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Information spillovers and cross monitoring between the stock market and loan market

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ABSTRACT

We explore information spillovers and cross-monitoring between the stock and loan markets, focusing on the roles of short sellers and banks. Using Regulation SHO that directly affects short-selling constraints in the stock market but is exogenous to the loan market, we find that only those firms without bank monitors exhibit significant stock price declines upon the announcement of SHO. We also document that while short interest increases following SHO, it increases far less for firms with bank monitors. Using bank and lending relationship characteristics, we find SHO returns increase in the bank's ability and incentive to monitor. Our exploration of equity ownership structure reveals that the presence of block holders and dedicated owners has little to no effect on our results, suggesting that bank monitors complement shareholder monitoring efforts.

1. Introduction

The costs and benefits of short-selling constraints are hotly debated in the regulatory community and the academic literature. The debate centers on the benefits of increased price discovery and information production versus the potential costs of manipulation. Prior academic work documents numerous effects of the relaxation of short-selling constraints that include stock liquidity improvements, enhanced price discovery, and more informative stock prices. Many of these effects arise because the negative private information possessed by short sellers is revealed through their trading and other indirect methods. Short sellers' incentive to uncover and reveal negative private information not only leaves prices more informationally efficient but may also influence manager decision-making, potentially acting as a disciplining mechanism given managers' decisions will take into account likely future actions by short sellers. Other stakeholders also influence managers and may act as complements or substitutes for the presence of short sellers.

We focus on one crucial stakeholder: bank lenders, who have been shown to influence firm decisions and performance (Chava and Roberts, 2008; Roberts and Sufi, 2009a; Nini et al., 2012). As debtholders, banks are more concerned with downside outcomes and engage in active monitoring to minimize these risks. The due diligence and monitoring conducted by banks to minimize their exposure to downside risk could spill over to the stock market and affect shareholder beliefs. Given their role as inside lenders, if banks already reveal information or reduce the likelihood that managers engage in self-interested policies through their monitoring, short-sellers will have a lower probability of uncovering new misdeeds that were not yet known to the stock market.

We examine whether the presence of a bank monitor mitigates anticipation of bearish trades by exploiting an exogenous event, the adoption of Regulation SHO. Short selling has been largely constrained in the U.S. The uptick rule that was established in 1935, for example, prohibits short sales when stock prices are declining, which imposes a significant cost on short sellers. In July 2004, the Security and Exchange Commission (SEC) announced Regulation SHO that removed the uptick rule restriction for a randomly selected group of firms (i.e., pilot group)

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representing one-third of the Russell 3000 firms listed on NYSE, NASDAQ, and AMEX. The other two-thirds of the Russell 3000 firms consist of the non-pilot group for which the uptick rule remained in effect. This sudden regulatory change provides a quasi-laboratory setting that exogenously shifts a firm's short-sale constraints but does not directly affect the loan market. Because the uptick rule was removed, Regulation SHO effectively reduced the cost of short selling, which should entice informed traders and result in improved price transparency. Moreover, Regulation SHO could put downward pressure on stock prices since there is an anticipation that pessimistic opinions can be incorporated into stock prices more easily. Consistent with this view, Grullon et al. (2015) document significant declines in the stock prices of SHO-affected firms around the revelation of Regulation SHO participation. Part of this decline in prices is argued to be driven by the anticipation that bearish traders could exploit the relaxation of short-selling constraints and trade against pilot stocks.[1]

We begin our analysis by exploring whether the stock market reaction to Regulation SHO depends on the firm's bank relationship. We find that the average cumulative abnormal return (CAR) for a Regulation SHO pilot firm that borrows from a U.S. commercial bank is an insignificant 0.04 %. In comparison, that for pilot firms lacking such a borrowing relationship is a significant −3.10 %. The two CARs are significantly different at the 1 % level. In contrast, we find that nonbank lenders have no effect on the CARs. Firms borrowing from nonbank lenders experience similar negative SHO CARs as those who do not have an outstanding loan. Furthermore, we document that only contemporaneous bank relationships have such spillover benefits to shareholders. The reaction to SHO announcement remains negative if a firm had a bank loan within one year prior to SHO but does not have a loan now. Taken together, our results suggest that having a bank monitor fully mitigates the lack of price discovery due to the uptick rule prior to the Reg SHO Pilot Program.

Since firms form bank relationships by passing a screening process, there could be potential matching that shapes existing firm-bank pairs. In other words, there is a possibility that our results simply reflect the fact that commercial banks lend to safer firms, and it is the firm's financial health that drives different SHO returns rather than bank relationships. We provide several pieces of evidence that are inconsistent with this alternative explanation. First, to alleviate the selection concern that firms with bank relationships can differ from firms without bank loans in observable characteristics, we perform a propensity score matching. This process leaves us a sample of matched firms with similar probabilities of obtaining bank loans and are indistinguishable in observable characteristics. Our analysis suggests that the effect of having a bank relationship on SHO returns persists in the matched sample. Second, by splitting firms into high-risk and low-risk firms, we find that our results are mainly driven by high-risk firms borrowing from low-risk banks. Third, we document that the effect of having a bank monitor on SHO returns is more pronounced in informationally opaque firms where bank monitoring is more valuable.

We further explore the characteristics of banks and lending relationships to examine whether the reduction in SHO returns is more pronounced in firms borrowing from banks with higher monitoring ability or incentive. We explore the degree of concentration of a bank's loan portfolio. We follow the literature (e.g., Acharya et al., 2006; Blickle et al., 2023) and construct the Herfindahl-Herschman index (HHI) of a bank's loan portfolio defined by industry sectors. We find that, while the positive effect of a bank monitor remains for less concentrated banks, the effect is significantly greater for banks with high loan portfolio concentration. Moreover, we show that firms with longer and stronger bank-borrower relationships experience a stronger effect of less negative SHO returns. The findings are consistent with the relationship lending literature (Bharath et al., 2011), which states that the bank's learning and more active monitoring role are through lending relationships.

Next, we show how actual short interest varies by bank relationship. We find that, on average, the short interest of pilot firms increases after Regulation SHO. The change in firms' short interest with bank relationship is positive, while it is significantly lower than the increase in the short interest of pilot firms with nonbank lenders and pilot firms without loans. Our patterns are consistent with stock return findings that Regulation SHO increases the average short-selling likelihood, while that for firms with bank relationships is lower.

While the above results show that having a bank monitor mitigates the negative announcement returns around Reg SHO, they do not address how the presence of shareholder monitors influences the results. We consider several shareholder types to investigate the role of shareholder monitoring around the SHO announcement, including dedicated institutional owners and block holders, as well as measures of stock ownership concentration. We then re-explore the influence of a bank monitor while controlling for the presence of shareholder monitors. We continue to find that bank monitors are associated with significantly less negative CARs. Moreover, we find that shareholder monitors have no direct effect on the abnormal announcement returns to Regulation SHO.

Our findings make important several contributions. First, our study documents novel evidence on information spillovers and cross-monitoring between the stock market and the syndicated loan market from the perspectives of short sellers and banks. The existing literature examines the informational role of bank lending to the equity market (James, 1987; Billett et al., 1995; and Ross, 2010) and information spillover from the equity market to bond markets (Kecskés et al., 2013). Our results highlight the significance of banks' screening and monitoring efforts on equity market price discovery in the context of short-selling.

Second, our study complements Ho et al. (2022), who use regulation SHO to show that relaxing short-selling constraints has real effects in the syndicated loan market. They argue that short sellers help reveal poor-quality firms, allowing syndicated lenders to avoid them and lend to a better pool of firms. This leads to borrowers with higher credit quality, better contract terms, and lower loan spreads. Thus, they demonstrate that stock market participants influence the loan market. Our study complements theirs by showing the reverse that is also true. Namely, the loan market, and in particular bank lenders, influence stock market participant behavior. Taken together, the two studies suggest that there is a bi-directional spillover of disciplinary mechanisms from the syndicated loan market to the stock market, and vice versa.

Third, we contribute to the literature that debates the effect of short-selling constraints on asset prices and the cost of capital (e.g., Miller, 1977; Chen et al., 2002; Diether et al., 2009; Boehmer et al., 2008; Beneish et al., 2015; Grullon et al., 2015; Chu et al., 2020). A key implication of this literature is that short-selling constraints impede stock price to fully reflect negative information. Our evidence suggests that bank information acquisition and monitoring reduces price inefficiency in the presence of short-selling constraints.

The rest of the paper is organized as follows. Section 2 discusses the institutional background of Regulation SHO and empirical predictions. Section 3 describes the data and variable construction. Section 4 presents the main results. Section 5 presents the underlying mechanism. Section 6 concludes.

2. Institutional background and empirical predictions

2.1. Institutional background of the Reg SHO pilot program

Short selling in the stock market has been largely constrained historically. Formally known as the Securities Exchange Act of 1934 Rule

[1] A recent paper argues that information leakage is not likely during the SHO Pilot list announcement (Litvak and Black, 2018). To address the concern, we provide additional anecdotal evidence and tests using alternative event windows in Section 2 and Internet Appendix A.

10a-1, the uptick rule requires short selling to be conducted at a price higher than the preceding trade. On October 28, 2003, the SEC initiated a proposal on the Regulation SHO Pilot Program that aimed at removing the uptick rule for a group of stocks. Implemented in May 2005 and expired on August 6, 2007, the pilot program used an experiment to evaluate whether completely removing the uptick rule would cause excessive short selling and stock price manipulation. It is close to a randomized controlled trial with the following sampling procedure: first, the SEC ranked all firms within the Russell 3000 by trading volume. Then they chose the middle firm from the top 3 ranked firms, the middle firm from the next three firms (ranked 4th, 5th, and 6th), resulting in the pilot firms being those ranked 2nd, 5th, 8th, …, 2999th. The SEC finalized this list on June 23, 2004, and announced it publicly on July 28, 2004.

There is ongoing debate in the academic community on whether there has been a leakage of the SHO pilot list prior to the public release date. Specifically, Grullon et al. (2015) document that abnormal returns show up on the window starting ten trading days before July 28, 2004. In contrast, Litvak and Black (2018) challenge the notion that there was leakage given the legal repercussions of leaking the pilot firm list. Prior to the formation of the list, the SEC requested public comment on their proposed process and had numerous discussions with market participants regarding their procedures. Therefore, it could be the case that those market participants had understood the pilot procedure before the public announcement. Indeed, the SEC reported having numerous discussions and meetings with market participants in the days leading up to the public announcement. For example, in an SEC memo filed on July 2, 2004, the SEC disclosed a meeting occurred with representatives from Citigroup Global Trading on June 30, 2004:

"On June 9, 2004, members from the Division of Market Regulation and Office of Economic Analysis engaged in a conference call meeting with Patricia Brigantic, John Malitzis, and Jim Martin, all with Citigroup Global Markets, to discuss costs associated with the proposed short sales rules. In brief, the call focused on the impact of costs associated with any additional programming and system changes necessary to comply with Regulation SHO." (SEC Memorandum 433, File S7–23–03, June 30, 2004).

While no evidence of improper information disclosure exists to our knowledge, it is plausible that various aspects of the selection procedure could have been inferred during the numerous meetings held at that time. Internet Appendix A lays out a detailed timeline of the critical events. To examine how this timing debate affects our conclusions, we conduct our analysis using various event windows. Specifically, our primary analysis is based on the original (−10,1) window, and we report test results using alternative windows in Internet Appendix B.

2.2. The role of bank relationships during Reg SHO announcement

Banks conduct due diligence and engage in costly monitoring of borrowing firms. Throughout a lending relationship, banks monitor borrowers by visiting corporate sites, imposing restrictive covenants, and creating internal credit reports. The soft information obtained during relationship lending can be useful in predicting loan failures, but it may also benefit other stakeholders, such as shareholders, who can learn from the banks' actions. For instance, studies have documented that the benefits of bank monitoring often spill over to shareholders in the form of positive loan announcement returns (James, 1987; Billett, Flannery, and Garfinkel, 1995; Ross, 2010). Addoum and Murfin (2020) demonstrate that secondary loan returns can predict future stock returns.

On the other hand, short sellers process and disseminate negative information about firms. Numerous studies have shown that informed short selling enhances price discovery, contributing to more informative stock prices (Miller, 1977; Diamond and Verrecchia, 1987; Bris et al., 2007; Engelberg et al., 2012; Berber and Pagano, 2013; Rapach et al., 2016). Short sellers improve price discovery not only by trading against the target stock but also by communicating their findings to the public. Profiting from short selling often depends on the credibility and reputation of short sellers and their ability to convince other market participants through strategic communication (Appel and Fos, 2024). If a firm is actively monitored by a bank focused on minimizing loan failure, it is less likely that additional misdeeds will be uncovered by short sellers. In other words, banks may have already taken actions to preempt negative consequences before any issues that might interest short sellers surface. As a result of this bank monitoring, short sellers may find it more difficult to realize financial gains by targeting these firms. When short-selling constraints are relaxed, having an outstanding banking relationship helps mitigate concerns that additional negative news will be uncovered by short sellers. Therefore, our first hypothesis, the bank monitoring hypothesis, argues that firms with a bank relationship experience less negative returns upon the announcement of the Regulation SHO Pilot Program.

Alternatively, short selling constraints could potentially restrict traders from causing (either unintentionally or via manipulation) overreactions to bad news (see Cohen et al., 2007). Such downward stock price overreactions could trigger actions by lenders, suppliers, or other stakeholders (e.g., via covenants or other reactive triggers) that may, in turn, lead to real negative consequences for the firm and other stakeholders (Brunnermeier and Oehmke, 2014; Liu, 2015). Bank borrowers can be more vulnerable in this context due to their higher financial leverage. In other words, stock prices may decline further when short-selling constraints are relaxed, especially for firms with access to bank loans. We term this view the financial leverage hypothesis, which predicts that pilot firms with outstanding bank relationships will experience more negative returns upon the announcement of the Reg SHO Pilot Program.

Additionally, it is important to discuss how bank relationships are determined and whether this affects our findings. It is plausible that banks select firms with better quality during the screening process. In other words, the firm characteristics that banks consider when approving loans may lead to a lower anticipation of short sales. In the empirical results section, we address this selection concern through a battery of robustness checks.

We further explore several important empirical predictions related to the bank monitoring hypothesis. Given that bank relationships mitigate borrower adverse selection and moral hazard (Boot and Thakor, 1994; Boot, 2000; Bharath et al., 2011), the effect of bank monitoring should be stronger among firms that require more investigation and monitoring effort. For example, Sufi (2007) shows that banks' skin in the game is higher for opaque firms syndicated loan arrangements. Bharath et al. (2011) demonstrate that bank relationships are particularly crucial for firms lacking alternative information producers. Therefore, we hypothesize that the spillover effect from banks to the stock market in the Reg SHO event will be more pronounced for firms with lower informational transparency.

The bank lending literature also highlights that bank monitoring outcomes depend on banks' incentive and ability to monitor borrowers. Banks with higher reputations are generally considered better monitors (Billett, Flannery and Garfinkel, 1995; Ross, 2010). Previous monitoring outcomes signal a bank' s monitoring effort and affect its future loan syndicates (Gopalan et al., 2011). In addition, since U.S. banks have diverse organizational structures, their different practices in specialization, risk management practice and portfolio composition may lead to varying monitoring approaches (Gustafson et al., 2021). For instance, small banks, which specialize in acquiring and processing soft information, may monitor their borrowers more actively compared to large banks that rely more on hard information (Berger and Black, 2011). Berger et al. (2005) show that the match between bank and firm size is an important predictor of loan performance. Furthermore, studies document that banks with industry expertise- measured by their loan portfolio industry concentration-tend to grant more loans and demonstrate higher monitoring efficiency (Acharya et al., 2006; Blickle et al.,

2023). Studies in the mortgage and industrial loan markets find mixed evidence regarding the effect of geographical diversification on loan performance (Loutskina and Strahan, 2011; Goetz et al., 2016). Given this ample empirical evidence, we expect stronger bank monitoring effects on SHO announcement returns when firms borrow from banks with higher monitoring quality.

Finally, banks learn a firm through lending relationships. Stronger banking relationships enable banks to monitor borrowing firms more closely and reduce the moral hazard associated with syndicated loans (Sufi, 2007; Bharath et al., 2011). Over time, a bank that repeatedly lends to a firm accumulates substantial information about the firm, which helps alleviate information asymmetries. Consequently, we expect that the effect of having a bank lender on SHO returns is more pronounced when the lending relationship is stronger and longer.

3. Data and variables

3.1. Sample construction

We construct our sample using the description in the SEC's first pilot order issued on July 28, 2004 (Securities Exchange Act Release No. 50,104). To identify pilot and non-pilot stocks, we start with the Russell 3000 index in June 2004 and exclude stocks that are not listed on the NYSE, AMEX, or NASDAQ NM, and stocks that go public or have spin-offs after April 30, 2004. Of the remaining 2952 stocks, we identify 986 pilot stocks according to the published list of the SEC's pilot order. The remaining 1966 stocks comprise the initial non-pilot sample. We then exclude financial, utilities, and non-U.S. firms and firms with average stock prices smaller than $5 or greater than $1000. This procedure results in 1518 stocks for the stock announcement return tests, of which 521 are pilot stocks, and 997 are non-pilot stocks.

3.2. Bank relationship variables

We construct measures to capture heterogeneity in bank relationships. We match Compustat firms with facility-level loan contract information in Dealscan around the announcement of Reg SHO, using the Compustat-Dealscan link created by Chava and Roberts (2008). We focus on the "lead arrangers" in the Dealscan lender file to classify banking relationships (Bharath et al., 2011).[2] Our primary variable, *BANKCUR*, is an indicator that equals one if a firm has an outstanding U.S. commercial bank relationship and zero otherwise. We focus on U.S. commercial banks because domestic banks, as informed lenders, provide effective certification and monitoring services to borrowers (Sufi, 2009). To further investigate the effects of non-bank institutions, we construct *LOANCUR*, an indicator that equals one if a firm has an outstanding loan contract and zero otherwise, and *NONBANK*, an indicator that equals one if the firm's primary lead arranger is a nonbank institutional investor, investment bank or a foreign bank and zero if the firm does not have an outstanding loan or has any loans with a lead arranger that is a U.S. commercial bank. NOLOANNOW is a dummy variable that equals one if a firm no longer has a bank loan but had one within a year prior to the implementation of Regulation SHO and zero otherwise.

We also construct three variables on relationship strength to measure a firm's dependence on the relationship bank. Following Bharath et al. (2011), we first examine firms' borrowing history in the five years prior to Regulation SHO. A firm is defined as having a prior relationship bank if this bank has been a lead arranger or sole lender for two or more deals. Then, we compute the percentage of the amount borrowed from this bank to the total amount the firm has borrowed in the past five years for each firm-bank pair. *STRONGRELAMT* is an indicator variable that equals one if a firm has a relationship lender and it borrows more than two-thirds of its loans from that lender in terms of the loan amount. The second variable, *STRONGRELDEAL*, is an indicator variable that equals one if a firm has a relationship lender and borrows more than two-thirds of its loans from that lender in terms of the number of deals. Because most loans in Dealscan are syndicated loans, we use the lead arranger in these cases. Taking account of bank mergers and information aggregation within financial conglomerates, we aggregate financial institutions to their parent companies and assign acquired firms to their acquirers at the effective date of the merger. Acquiring financial firms inherit both previous lead arranger-participant relationships and previous borrowing firm relationships of the acquired firm. Additionally, we construct a measure of relationship length. For each firm-bank pair, we compute the difference between the start date of firm's first loan with its current lender and the SHO date. The third variable, *Longrel (Shortrel)* is an indicator that equals one if the relationship length is longer (shorter) than the sample median for all borrowers.

[2] The lender can be either a sole lender or a lead arranger, as marked in the lender role in Dealscan.

3.3. Bank characteristics

We obtain information on bank characteristics from the BHCK series extracted from FR Y-9C filings. We use the total assets of a bank (BHCK2170) to measure bank size. We categorize a bank as small if its total assets are below the median of the empirical distribution. We then construct three variables based on bank balance sheet and credit rating. First, we collect information on non-performing loans (NPL) from the FR Y-9C filings and measure bank exposure to bad loans using the *NPL/Assets ratio*, which is the sum of loans past due 90 days or more (BHCK5525) and non-accrual loans (BHCK5526) divided by total assets (BHCK2170). We expect a bank to be riskier and less skillful in monitoring its portfolio firms if its fraction of non-performing loans is higher than the median. We also examine a bank's default likelihood by computing its Z-score using (ROA+(equity/assets))/SD(ROA) at the bank level. Following the bank reputation literature (Billett et al., 1995; Ross, 2010), we measure a bank's monitoring ability using its credit rating. We then create indicators for above and below the sample median Z-score, and for above and below the sample median bank credit rating (*A*+ and above vs A and below). Lastly, we follow the existing literature (e.g. Acharya et al., 2006; Goetz et al., 2013; Blickle et al., 2023) to construct the Herfindahl-Herschman index (HHI) of a bank's loan portfolio defined by either industry or geographic sectors.

3.4. Equity ownership structure variables

We construct variables on equity ownership structure using the 13f holdings data. First, following Bushee (1998)'s classification, we measure the ownership of dedicated and non-dedicated investors at the firm level. We define *Dedicated ownership* as the total percentage of shares owned by dedicated institutional investors, according to Bushee (1998)'s classification. We also construct a discrete variable, *Dedicated Indicator (5%)*, which equals one if the total percentage of shares owned by dedicated institutional investors is greater than or equal to 5% (top quintile) and zero otherwise. Second, we construct measures of ownership concentration using the *Herfindahl-Hirschman Index (HHI)* and *Top5 ownership*, taken from S14 summary data. Specifically, *Ownership HHI* is the Herfindahl-Hirschman Index calculated using all of a firm's institutional owners and their respective ownership stakes. *Top5 ownership* is the percentage of a firm's stock held by the five institutional holders with the largest stakes. Lastly, to investigate the role of blockholders around the SHO announcement, we construct a continuous measure, *Block ownership*, which is the percentage of shares owned by blockholders (from Thompson Reuters). We also include discrete measures: a *blockholder dummy* indicating the firm has one or more blockholders and an indicator of whether the firm's block ownership is among the top quintile of all firms.

3.5. Summary statistics

Table 1 provides summary statistics of the variables. Panel A shows descriptive statistics of our sample firms as of the most recent fiscal quarter end. An average firm has assets with a book value of 4.08 billion, book leverage of 20.3 %, asset tangibility of 26.9 %, an ROA of 3.3 %, and a market-to-book ratio of 2.148. Around 43.4 % of our sample firms have credit ratings. Panel B shows the summary statistics of stock announcement returns around Regulation SHO. The average CAR around the Regulation SHO announcement date is −0.67 %, and the median CAR is −0.10 %. Panel C presents the fraction of Russell 3000 firms with specific lending relationships as defined in Section 3.2 and 3.3, along with lender characteristics. In our sample, 65.8 % of firms have an outstanding loan at the time of SHO announcement; 52.2 % of firms have a borrowing relationship with a U.S. commercial bank, and 13.6 % of firms borrow from a nonbank lender (including investment banks, foreign banks and finance companies).

4. Main results

4.1. Bank monitors and CARs around the announcement of the Reg SHO pilot program

We first examine whether the Regulation SHO Pilot Program participating firms' abnormal stock reactions to the announcement of Regulation SHO depend on the firms' existing bank monitors. Following

Table 1
Summary statistics.

Panel A. Firm characteristics

Variable	N	Mean	SD	p25	p50	p75
Total assets	1518	4085.209	10,162.910	289.900	775.866	2627.769
Market to book	1518	2.148	1.613	1.128	1.609	2.567
Book leverage	1518	0.203	0.188	0.011	0.186	0.322
Institutional ownership	1518	0.701	0.220	0.572	0.739	0.859
Tangibility	1518	0.269	0.225	0.093	0.198	0.388
Profitability	1518	0.033	0.034	0.020	0.034	0.050
With credit rating	1518	0.434	0.496	0	0	1
Number of blockholders	1518	2.150	1.474	1	2	3
Block ownership	1518	0.185	0.173	0.074	0.160	0.261
Top5 institutional ownership	1518	0.287	0.205	0.204	0.268	0.336
Ownership HHI	1518	0.060	0.056	0.035	0.047	0.067
Dedicated ownership	1518	0.022	0.058	0	0	0.019

Panel B. Announcement returns

Variable	N	Mean	SD	P25	Median	P75
SHO announcement returns						
CAR(−10,1), in %	1518	−0.67	9.39	−4.69	−0.1	3.51

Panel C. Bank relationship variables

Variable	N	Mean	SD	p25	p50	p75
LOANCUR	1518	0.658	0.475	0	1	1
BANKCUR	1518	0.526	0.500	0	1	1
NONBANK	1518	0.132	0.339	0	0	0
NOLOANNOW	1518	0.027	0.162	0	0	0
NOLOAN	1518	0.342	0.474	0	0	1
STRONGAMT	1518	0.132	0.339	0	0	1
STRONGDEAL	1518	0.201	0.401	0	0	0
Log(bank assets)	999	19.518	1.989	19.517	20.522	20.762
HHI_State	999	2031.198	2280.290	744.739	1273.177	2069.497
HHI_Industry	999	1402.264	1770.208	673.168	844.58	1101.584
NPL/Assets	999	0.006	0.003	0.004	0.004	0.007
Bank Z-score	999	21.919	4.933	19.456	22.158	24.533
Bank credit rating	999	16.139	4.316	16	18	19
Relationship length	999	2244.452	1467.580	1082	1968	3172

Panel A shows summary statistics of firm characteristics for 1518 firms in the stock return tests. The sample is drawn from non-financial, non-utility firms from the June 2004 Russell 3000 Index and requires a firm to have non-missing financial information in Compustat. All continuous variables are winsorized at the 1th and 99th percentiles. Total assets is total assets (Compustat atq) in million dollars. Book leverage is total debt (dlcq+dlttq) divided by total assets (atq). Tangibility is net property, plant and equipment (ppent) divided by total assets (atq). Profitability is operating cash flow (oibdpq) divided by total assets (atq). Market-to-book ratio is the sum of market equity (prccq*cashoq), total debt (dlcq+dlttq) and deferred taxes and investment tax credit (txditcq) divided by total assets (atq). Block ownership is total shares owned by blockholders scaled by total shares outstanding. Top5 institutional ownership is the share ownership controlled by the five largest institutional investors. Ownership HHI is the Herfindahl-Herschman index of institutional ownership. Dedicated ownership is the percentage of shares controlled by dedicated investors based on the classification of Bushee (1998). Panel B shows market-adjusted stock returns around the Regulation SHO announcement day. Panel C shows the distribution of bank relationship characteristics. LOANCUR indicates whether a firm has an outstanding loan contract. BANKCUR is an indicator of whether a firm has an outstanding U.S. commercial bank relationship. NONBANK is an indicator of firms with loans originated by investment banks, foreign banks, nonbank institutional investors, and finance companies at the time of Regulation SHO announcement. NOLOANNOW is a dummy variable equal to one if a firm no longer has a bank loan but had one within a year prior to the implementation of Regulation SHO, and 0 otherwise. NOLOAN is an indicator that equals one if firm does not have any outstanding loan contracts. Log(bank assets) is the natural log of total assets (BHCK 2170) in million dollars. HHI_state is the Herfindahl-Herschman index of a bank's loan portfolio by state. HHI_industry is Herfindahl-Herschman index of a bank's loan portfolio by SIC-3 industry. NPL/Assets is the ratio of the sum of loans past due 90 days or more (BHCK5525) and non-accrual loans (BHCK5526) to total assets (BHCK2170). Bank zscore is (ROA+(equity/assets))/SD(ROA). STRONGRELAMT is an indicator that equals one if a firm has a relationship bank lender from which it borrows more than 2/3 loans in terms of the loan amount. STRONGRELDEAL is an indicator that equals one if a firm has a relationship bank lender from which it borrows more than 2/3 loans in terms of the number of loan deals. Relationship length is computed as days between current loan's origination date and the first loan with the lender. The rest of definitions can be found in Appendix A. All borrowing relationships are referred to sole lenders or lead arrangers in syndicated loans. All financial institutions are aggregated to their parent companies.

Table 2
Stock CARs around Regulation SHO announcement.

Panel A. Subsamples based on lender type

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Firms with loan contract					
	Without loan contract (LOANCUR=0)	With loan contract (LOANCUR=1)	With bank loan (BANKCUR=1)	With nonbank loan (NONBANK=1)	Diff. (1)-(2)	Diff. (1)-(3)	Diff. (3)-(4)	Diff (1)-(4)
Pilot	−3.35***	−0.41	0.04	−2.25**	−2.93***	−3.39***	2.29**	−1.10
T- Stat	(−4.47)	(−0.99)	(0.08)	(−2.25)	(−3.69)	(−4.09)	(2.18)	(−0.81)
Obs	175	346	278	68	521	453	346	243
Control	−0.71	0.19	−0.03	1.06	−0.91	−0.69	−1.08	−1.78
T- Stat	(−0.98)	(0.69)	(−0.09)	(1.60)	(−1.39)	(−0.98)	(−1.55)	(−1.43)
Obs	344	653	520	133	997	864	653	477
Diff (Pilot-Control)	−2.64**	−0.61	0.06	−3.31***	−2.03*	−2.70**	3.37***	0.68
T- Stat	(−2.53)	(−1.20)	(0.11)	(−2.76)	(−1.88)	(−2.36)	(2.73)	(0.34)
Obs	519	999	798	201	1518	1317	999	720

Panel B. Lender type and SHO announcement returns

	(1)	(2)	(3)	(4)
Pilot	−2.326***	−2.550***	−2.289**	−2.424**
	(0.873)	(0.825)	(1.060)	(1.003)
Pilot*LOANCUR	1.838*			
	(1.074)			
Pilot*BANKCUR		2.746***	2.485**	2.480**
		(0.999)	(1.200)	(1.145)
Pilot*NONBANK			−0.941	
			(1.608)	
Pilot*NOLOANNOW				−2.781
				(3.815)
LOANCUR	−0.319			
	(0.700)			
BANKCUR		−0.857	−0.588	−0.283
		(0.617)	(0.768)	(0.713)
NONBANK			0.817	
			(0.943)	
NOLOANNOW				−0.261
				(1.674)
Firm Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	1518	1518	1518	1518
Adjusted R-squared	0.031	0.031	0.034	0.018

This table presents cumulative abnormal stock returns around the Regulation SHO announcement date for firms with and without bank loan contracts. Panel A presents univariate tests on stock returns, while Panel B reports coefficient estimates from multivariate OLS regressions. The dependent variable is the 12-day market-adjusted abnormal return with a (−10, 1) event window around the Regulation SHO announcement day (from July 14 to July 29, 2004). Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. LOANCUR is an indicator of whether a firm has an outstanding loan contract. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. NONBANK is an indicator of firms with loans originated by investment banks, foreign banks, nonbank institutional investors, and finance companies at the time of Regulation SHO announcement. NOLOANNOW is a dummy variable equal to one if a firm no longer has a bank loan but had one within a year prior to the implementation of Regulation SHO, and 0 otherwise. The sample is drawn from non-financial, non-utility U.S. firms from the June 2004 Russell 3000 Index, and firms are required to be listed on NYSE, AMEX, or NASDAQ from 2002 to 2007 and have non-missing financial information in Compustat. All borrowing relationships refer to sole lenders or lead arrangers in syndicated loans. Two-tailed t-statistics are presented in the parentheses of Panel A, and robust standard errors are presented in the parentheses of Panel B and Panel C. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

Grullon et al. (2015), we compute the stock CAR as the market-adjusted return over a (−10, 1) event window for our main tests. We compare market-adjusted stock returns of the pilot and non-pilot firms based on whether the firms have existing loan contracts and whether the loan contract is with a bank (i.e., with a U.S. commercial bank, BANKCUR) or with a nonbank. Table 2 Panel A reports the univariate test results. In the first column, we observe that pilot firms without a loan contract exhibit a significant −3.35 % CAR around the Regulation SHO announcement. In contrast, pilot firms with an existing loan contract experience an insignificant CAR of −0.41 %. Parsing those pilot firms with loan contracts into those with and without a bank relationship illustrates the importance of having a bank monitor. The average CAR for the bank loan sample is 0.04 %, while that for the nonbank loan sample is a significant −2.25 %. Differences between the CARs, as shown in Column (5) to Column (8), confirm that the reaction to Regulation SHO is significantly negative for all pilot groups except those with a bank relationship. This observation suggests that the presence of a bank monitor helps SHO-affected firms offset the negative announcement effect of Regulation SHO. As a comparison, we do not observe significant CARs for non-pilot firms regardless of bank relationships. Row 3 of Panel A reports the difference in CARs between the pilot and non-pilot firms among subsamples. For firms with an existing bank relationship, pilot firms' stock returns do not show a significant difference from control firms. In contrast, pilot firms borrowing from nonbank lenders significantly underperform non-pilot firms by −3.31 %.

In Table 2 Panel B, we redo the analysis in a multivariate setting using the following model:

$$CAR_i = \alpha + \beta_1 Pilot_i + \beta_2 Pilot{*}BANKCUR_i + \beta_3 BANKCUR_i + Controls_i + \varepsilon_i, \quad (1)$$

where *i* indexes firm. *CAR* is the 12-day market-adjusted abnormal stock return. The key variable of interest is *Pilot*BANKCUR*, an indicator that equals one if the firm is in the pilot group and has an existing loan with a domestic commercial bank and zero otherwise. *Control* is a set of control variables that includes firm assets, market-to-book ratio, leverage, institutional ownership, and 1-digit SIC industry fixed effects. As we discussed earlier, given that banks screen and monitor their borrowers, we expect that stock price declines caused by market anticipation will be less for firms with existing bank monitors. Therefore, we expect β_2 to be positive while β_1 remains negative. This is because banks should have already produced valuable information and effectively monitored their borrowers, which is observed by equity market participants and priced into their stocks.

In Columns (1)-(3), we present results using the full sample of firms and explore whether the presence of a loan (*LOANCUR*) or a bank loan (*BANKCUR*) is associated with less negative stock price reactions to Reg SHO. In Column (1), we observe a positive and significant coefficient estimate on *Pilot*LOANCUR*, suggesting that pilot firms with loans react less negatively to Reg SHO. Columns (2) and (3) show that this mitigated reaction is mainly driven by firms with bank loans. Specifically, in Column (2), the coefficient estimate on *Pilot*BANKCUR* is positive and significant. Moreover, we notice that the having a bank monitor fully eliminate the negative price reactions of pilot stocks during Reg SHO announcement. In Column (3), when we include the effect of having a nonbank lender, the coefficient estimate on *Pilot*NONBANK* is negative and insignificant, but the coefficient estimate on *Pilot*BANKCUR* remains positive and significant. These results indicate that having a bank lender reduces the anticipation of future short-selling around Reg SHO announcements while having a nonbank lender does not provide the same benefit. In Column (4), we examine the reaction of firms with prior borrowing relationships but no outstanding loans during the SHO announcement. We show that the coefficient on *Pilot*BANKCUR* remains positive and significant, while the coefficient on *Pilot*NOLOANNOW* is negative −2.78 % and statistically insignificant.

In Internet Appendix B, we also test the model in Eq. (1) using alternative event windows to calculate CARs: (−15, 1), (−5, 1), (−3, 1), and (−1, 1). We find that the coefficient estimates on *Pilot*BANKCUR* corresponding to Column (4) are positive in all cases. This coefficient decreases in magnitude and significance as the event window shortens. Specifically, in our main test in Column (7) of Table 2 Panel A, the coefficient estimate is a significant 3.37. For the (−3, 1) window, we observe that the coefficient is 1.98 and significant at the 5 % level, while the coefficient for the (−1, 1) window is statistically insignificant. Taken as a whole, these results are consistent with our main findings and suggest that some of the information regarding pilot firms may have been anticipated.

Our results suggest that the stock price reaction of pilot firms to the SHO announcement depends on the firms' bank relationship. While short-selling constraints impede the price discovery of pilot firms prior to Reg SHO, firms with an existing bank relationship do not exhibit a negative stock price reaction. In contrast, firms lacking the screening and monitoring of an informed lender experience significant price declines upon the Regulation SHO announcement. Our findings are consistent with the literature arguing that banks' screening and monitoring have spillover benefits to shareholders (e.g., James, 1987).

4.2. Selection issues

While the above analysis includes a set of firm-level controls to alleviate the concern that certain characteristics drive differences in SHO announcement returns, it remains possible that firms originating loans with banks are fundamentally different from firms without bank loans, which could drive the observed differences in SHO announcement returns. To examine whether selection effects can explain our results, we match firms with bank loans to firms without bank loans based on the propensity to have a bank loan. This matching procedure yields a sample where both groups of firms have similar probabilities of originating a loan with a domestic commercial bank.

Panel A of Table 3 shows the Probit regression results on the predictability of having a bank loan based on observable firm characteristics, such as firm size, profitability, leverage, institutional ownership, and whether the firm has a credit rating or not. We then perform nearest neighbor matching (with replacement) to pair firms with bank loans to firms without bank loans, based on the closest propensity score. Column (2) of Panel A shows that after matching, observable firm characteristics no longer have predictive power on the probability of having a bank loan. In Panel B, we find no observable differences in firm characteristics between the post-matching samples, implying that differences in firm characteristics disappear when we control for the propensity to have a bank relationship and focus on the matched sample only. We then repeat the tests in Eq. (1) on the matched samples. If the results in Table 2 were driven by a few observations of firms with bank loans and higher credit quality, we should see no effects of having a bank relationship on SHO returns in propensity score regressions using the matched sample. However, if our results are driven by the fact of having a bank loan, the effects should persist in the matched sample. Columns (1) and (2) of Panel C present results using the nearest neighbor matching estimator. For each firm with a bank relationship, the algorithm chooses matching firms (with replacement) without a bank relationship but with the closest propensity scores. In Columns (3) and (4), we show results using kernel matching estimators, which match treated firms with the weight average of control firms. In these cases, more weight is given to firms without bank loans but with similar propensity scores to the treated firms. We find that the coefficient estimates on Pilot*BANKCUR remain positive and statistically significant in all matched samples. Our results suggest that the effect of bank relationship on SHO returns does not depend on observable characteristics that might affect the probabilities of obtaining a bank loan.

Table 3
Propensity score matching.

Panel A. Propensity score diagnostics		
	(1)	(2)
	Dependent variable: BANKCUR	
	Pre-match	Post-match
Log(Assets)	0.173***	0.016
	(0.034)	(0.040)
Market to book	−0.170***	−0.03
	(0.035)	(0.041)
Profitability	3.802**	0.220
	(1.532)	(1.953)
Book leverage	0.871***	0.075
	(0.243)	(0.321)
Tangibility	0.216	0.007
	(0.204)	(0.257)
Institutional ownership	0.429**	−0.047
	(0.177)	(0.230)
With credit rating	0.444***	0.177
	(0.109)	(0.130)
Industry FE	Yes	Yes
Observations	1518	1002
Adjusted R-squared	0.206	0.062

Panel B. Post matching characteristics				
Post matching firm characteristics	With bank relationship	Without bank relationship	Difference	t-stat
With credit rating	0.663	0.669	−0.006	−0.24
Log(Assets)	7.624	7.587	0.037	0.42
Market to book	1.620	1.716	−0.095	−1.56
Profitability	0.035	0.035	−0.001	−0.46
Book leverage	0.273	0.272	0.002	0.17
Tangibility	0.318	0.327	−0.008	−0.67
Institutional ownership	0.720	0.723	−0.003	−0.29

Panel C. Propensity score regressions				
	(1)	(2)	(3)	(4)
	Dependent variable: SHO CAR(−10,1)			
	Nearest neighbor (n = 1)	Nearest neighbor (n = 3)	Epanechnikov	Gaussian
Pilot	−2.419***	−2.305***	−2.026**	−1.974**
	(0.861)	(0.889)	(0.836)	(0.860)
Pilot*BANKCUR	2.382**	2.288**	2.049**	2.021**
	(1.041)	(1.057)	(1.014)	(1.031)
BANKCUR	−0.303	−0.717	−0.646	−0.542
	(0.623)	(0.566)	(0.578)	(0.605)
Log(Assets)	0.249	0.202	0.139	0.374*
	(0.220)	(0.190)	(0.183)	(0.200)
Market to book	−1.424***	−0.972***	−0.743***	−0.885***
	(0.246)	(0.203)	(0.207)	(0.225)
Profitability	30.680***	17.664**	13.295	10.641
	(10.481)	(8.607)	(8.847)	(9.465)
Book leverage	0.015	−1.440	−1.610	−3.219*
	(1.798)	(1.936)	(1.594)	(1.871)
Tangibility	0.326	1.819	1.998	1.030
	(1.363)	(1.306)	(1.222)	(1.230)
Institutional ownership	−0.127	1.873	2.582**	1.038
	(1.333)	(1.208)	(1.174)	(1.229)
With credit rating	−0.116	0.681	0.253	0.155
	(0.738)	(0.696)	(0.609)	(0.754)
Industry FE	Yes	Yes	Yes	Yes
Observations	1002	1215	1014	1014
Adjusted R-squared	0.052	0.072	0.057	0.067

Panel A presents propensity score diagnostics, computed using a Probit model. Panel B compares firm characteristics between firms with and without bank loans in the matched sample. Panel C reports coefficients from multivariate OLS regressions on propensity score-matched samples. Columns (1) and (2) utilize matched samples based on nearest neighbor matching, selecting n matched firms without bank loans with the closest propensity scores and using the arithmetic average of CARs for these firms. We use $n = 1$ in Column (1) and $n = 3$ in Column (2). Column (3) uses a matched sample based on Epanechnikov matching. Column (4) uses Gaussian matching. The dependent variable is the SHO announcement return over the (−10, 1) event window. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. Robust standard errors are presented in the parentheses of Panel A and Panel C. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

Table 4
Bank relationship, information asymmetry and SHO announcement returns.

Panel A. By whether the firm is in the S&P 500 Index				
	(1)	(2)	(3)	(4)
	Not in S&P500		S&P 500 Index constituents	
	OLS	PSM	OLS	PSM
Pilot	−2.712***	−2.703**	−0.992	−0.311
	(0.922)	(1.334)	(1.483)	(0.758)
Pilot*BANKCUR	3.325***	3.125**	0.420	0.909
	(1.185)	(1.537)	(1.653)	(1.440)
BANKCUR	−0.588	−0.406	−0.253	−0.526
	(0.718)	(1.049)	(1.016)	(1.325)
Firm controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	1177	604	341	332
Adjusted R-squared	0.025	0.136	0.072	0.011

Panel B. By accrual quality				
	(1)	(2)	(3)	(4)
	Low accrual quality		High accrual quality	
	OLS	PSM	OLS	PSM
Pilot	−2.978**	−2.553**	−1.739	−1.810
	(1.160)	(1.169)	(1.106)	(1.072)
Pilot*BANKCUR	3.413**	4.825***	1.712	1.299
	(1.429)	(1.526)	(1.278)	(1.398)
BANCUR	−0.564	−0.251	0.056	0.533
	(0.867)	(0.916)	(0.860)	(0.851)
Firm controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	687	528	683	424
Adjusted R-squared	0.039	0.012	0.026	0.168

This table shows how the effect of having an outstanding bank loan varies with the firm's information environment. S&P 500 Index constituents refers to whether the firm was included as a component of the S&P 500 index as of June 2004 (excluding finance and utility firms). High accrual quality refers to firms whose standard deviation of residual accruals is below the sample median. For each subsample, we present coefficient estimates on the OLS regression, and regression results on a matched sample based on propensity scores. The event window is (−10, 1) around the Regulation SHO announcement day (from July 14 to July 29, 2004). Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. Control variables include size, market-to-book ratio, book leverage, institutional ownership, and 1-digit SIC industry fixed effects. Robust standard errors are shown in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

5. Underlying mechanism: the role of bank monitoring

Our results so far sheds light on the effect of bank monitoring in mitigating negative stock price reactions during the announcement of Reg SHO. In this section, we examine the monitoring role of banks through their heterogeneous effects based on firms' information opacity, bank monitoring quality and strength of bank relationships.

5.1. Cross-sectional tests based on ex ante information opacity

In this subsection, we analyze whether and how the bank monitoring effect during Reg SHO varies with a firm's information environment. We split firms into subsamples of opaque and transparent firms based on

whether they are S&P 500 index constituents. If banks provide monitoring benefits that reduce the anticipation of short-selling, the effect will be stronger among opaque firms. In Panel A of Table 4, we find that both the Pilot indicator and the interaction term Pilot*BANKCUR remain statistically significant in the subsample of firms not in the S&P 500 index. Column (1) presents the OLS regression results and Column (2) shows the results on a propensity score matched sample. In Columns (3) and (4), we document that transparent firms, defined as those in the S&P 500 index, do not exhibit such effects during Reg SHO. In Panel B, we repeat the analysis using accrual quality as a proxy for information opacity (Dechow and Dichev, 2002; Billett and Yu, 2016). We define a firm as more opaque if its standard deviation of residual accruals is higher than the median of the empirical distribution. We then study the effects of bank monitoring by examining firms with high and low accrual quality separately. We find that the coefficient on Pilot*BANKCUR persists in the sample with lower accrual quality but turns statistically insignificant in the transparent firm sample.

5.2. Cross-sectional tests based on ex ante bank characteristics

In this subsection, we begin by investigating the effects of bank monitoring efforts on SHO returns by examining variations in bank risk and reputation. Bank risk indicates a bank's financial health based on its history of loan defaults or distance to bankruptcy. On the one hand, a bank's monitoring effort on its existing portfolio should result in fewer bad loans and higher-quality assets (Winton and Yerramilli, 2021). On the other hand, banks with higher risk or lower reputation might have stronger incentives to oversee existing loans. We create three variables to test this conjecture. First, we collect information on non-performing loans (NPL) from FR Y-9C filings and measure a bank's exposure to bad loans using the NPL/Assets ratio. We expect a bank to be riskier and have lower monitoring effort if its fraction of NPL is higher than the median. We then examine how SHO returns vary among firms without a bank loan, firms borrowing from riskier banks, and firms borrowing from less risky banks. Specifically, we estimate the following models:

$$\begin{aligned} CAR_i = \alpha + \ & \beta_1 Pilot_i + \beta_2 Pilot{*}BANKCUR{*}Lowrisk_i \\ & + \beta_3 Pilot{*}BANKCUR{*}Highrisk_i + \beta_4 BANKCUR{*}Lowrisk_i \\ & + \beta_5 BANKCUR{*}Highrisk_i + Controls_i + \varepsilon_i, \end{aligned} \tag{2}$$

$$\begin{aligned} CAR_i = \alpha + \ & \beta_1 Pilot_i + \beta_2 Pilot{*}BANKCUR{*}Lowrisk_i + \beta_3 Pilot{*}BANKCUR_i \\ & + +\beta_4 BANKCUR_i + \beta_5 BANKCUR{*}Lowrisk_i + Controls_i + \varepsilon_i, \end{aligned} \tag{3}$$

Where i indexes firm. The specification in Eq. (2) is an augmented model from Eq. (1) by expanding the BANKCUR variable into *BANKCUR*Highrisk* and *BANKCUR*Lowrisk* as we intend to explore the cross-sectional difference on firms with a bank relationship based on bank characteristics. In Eq. (3), β_3 represents the additional difference in pilot firms' reaction by firms borrowing from high-risk banks, and β_2 represents the additional difference in pilot firms' reaction by firms borrowing from low-risk banks compared with pilot firms borrowing from high-risk firms. In other words, β_2 in Eq. (3) tests whether pilot firms reactions to Reg SHO vary by bank risk.

Panel A of Table 5 shows that SHO returns are more positive when the lending bank has lower risk. Column (1) shows that the coefficient estimate on *Pilot*BANKCUR*Lowrisk* is 3.947% and is statistically significant at the 1% level. In contrast, the effect of having a bank loan becomes insignificant if the firm borrows from a risky bank. Column (2) documents that the differences between pilot firms borrowing from high-risk and low-risk banks are statistically significant at the 5% level.

Our results reveal that firms borrowing from high-risk and low-risk banks experience different SHO returns, implying that the stock market anticipates lower short-selling on the latter group during SHO implementation. Nevertheless, there is a potential concern that firms borrowing from low-risk banks may inherently have better credit quality. To address this concern, in Columns (3)-(6), we split the sample based on firm risk and re-examine the effect of bank risk on SHO returns on firms with higher and lower credit risk. We use the modified Z-score to evaluate the credit risk of firms. In Columns (3) and (4), we find that the effect of bank risk on SHO returns is more pronounced among high-risk firms. Column (6) reveals that the difference between firms borrowing from high-risk and low-risk banks is no longer significant among low-risk firms.

In Panels B and C, we repeat our tests using alternative measures of bank risk, including indicators for banks with Z-scores above and below the sample median, and indicators for banks with credit ratings above and below the sample median (*A*+ and above vs. A and below). In Panel B, we find that firms borrowing from banks with higher Z-scores experience significantly less negative stock returns, while the estimate on Pilot*BANKCUR*Lowzscore is insignificant. Additionally, the difference in bank risk is more pronounced in the sample of firms with higher credit risk. Similarly, the estimates in Panel C suggest that the monitoring benefit of a bank lender is mainly driven by banks with higher credit ratings and has a stronger impact on firms with higher risk.

We then explore whether SHO returns depend on the size of the lender. We measure bank size as the natural logarithm of the total assets of the bank holding company. To examine the role of small versus large banks on SHO announcement returns, we include a pilot indicator, an interaction term between the pilot indicator and BANKCUR, and a small bank indicator. We categorize a bank as small if its total assets are below the median of the empirical distribution. The key variable of interest is the triple interaction term *Pilot*BANKCUR*Smallbank*. In Columns (1) and (2) of Table 6, we see that the coefficient on this variable is highly positive and significant. The effect on firms borrowing from small banks is 4.035 and 2.296 for firms borrowing from large banks. The two coefficient estimates, however, are not statistically different from each other (t-stat=1.39).

Next, we split the sample based on firm size, with the presumption that monitoring is more important for smaller and more opaque borrowers. Columns (3)-(4) and (5)-(6) report estimates of the same specifications as in Columns (1) and (2), but for subsamples of small firms and large firms, respectively. We observe that the effect of a small bank monitor is very pronounced for small firms, whereas the effect of bank monitors, regardless of bank size, is muted for large firms. In other words, the effects of bank monitoring appear strongest when both the banks and the borrowing firms are small. When short-selling constraints are relaxed, the stock market anticipates that small banks will provide larger monitoring benefits to borrowers, which mitigates the negative stock return reaction to the Reg SHO announcement. Taken together, we show a larger monitoring benefit from smaller banks, especially when the borrower is smaller.

We next investigate whether a bank's loan portfolio concentration affects SHO announcement returns of borrowing firms. Following the existing literature, we construct the Herfindahl-Herschman index (HHI) of a bank's loan portfolio defined by either industry or geographic sectors. We examine whether SHO abnormal returns differ based on having a bank loan from a diversified bank versus a concentrated bank. Since banks collect information on borrowers through screening and monitoring, the information garnered from monitoring one borrower can be used to learn about similar borrowers, such as those in the same industry or region. In other words, banks with a higher loan portfolio concentration may have better monitoring outcomes. In Panel A of Table 7, we split banks based on the industry concentration of loan portfolios. Concentrated banks are those whose loan portfolio concentration is in the top quartile of the empirical distribution. The low HHI group includes firms in the middle and bottom quartiles. We document that pilot firms without a bank relationship experience a negative 2.549% return around the SHO announcement. In contrast, pilot firms borrowing from more concentrated banks see a 5.25% higher return, and those borrowing from less concentrated banks experience a 2.166% higher

Table 5
Bank risk and borrower SHO announcement returns.

Panel A. Non-performing loans

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		High-risk firms		Low-risk firms	
Pilot	−2.550***	−2.550***	−2.675***	−2.675***	−2.079*	−2.079*
	(0.825)	(0.825)	(0.839)	(0.839)	(1.154)	(1.154)
Pilot*BANKCUR*LowNPL	3.947***	2.469**	4.389***	3.653***	1.645	0.143
	(1.105)	(1.093)	(1.191)	(1.314)	(1.165)	(1.112)
Pilot*BANKCUR*HighNPL	1.478		0.736		1.502	
	(1.171)		(1.042)		(1.226)	
Pilot*BANKCUR		1.478		0.736		1.502
		(1.171)		(1.042)		(1.226)
BANKCUR		−1.050		−1.412		−0.501
		(0.668)		(1.046)		(0.782)
BANKCUR*Low NPL	−0.580	0.470	−0.797	0.615	−0.257	0.244
	(0.722)	(0.634)	(1.171)	(1.013)	(0.856)	(0.810)
BANKCUR*High NPL	−1.050		−1.412		−0.501	
	(0.668)		(1.046)		(0.782)	
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1518	1518	751	751	767	767
Adjusted R-squared	0.034	0.034	0.022	0.022	0.038	0.038

Panel B. Lenders' Z-score

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		High-risk firms		Low-risk firms	
Pilot	−2.549***	−2.549***	−2.793**	−2.793**	−2.191**	−2.191**
	(0.826)	(0.826)	(1.127)	(1.127)	(1.056)	(1.056)
Pilot*BANKCUR*Highrating	3.873***	2.384***	4.958***	3.083***	1.836	0.581
	(0.991)	(0.917)	(1.235)	(1.189)	(1.366)	(1.265)
Pilot*BANKCUR*Lowrating	1.489		1.875		1.255	
	(0.975)		(1.214)		(1.120)	
Pilot*BANKCUR		1.489		1.875		1.255
		(0.975)		(1.214)		(1.120)
BANKCUR		−0.612		−0.855		−0.409
		(1.176)		(1.268)		(0.929)
BANKCUR*Highrating	−0.898	−0.286	−1.328	−0.473	−0.581	−0.172
	(0.624)	(0.995)	(1.274)	(1.160)	(0.794)	(0.685)
BANKCUR*Lowrating	−0.612		−0.855		−0.409	
	(1.176)		(1.268)		(0.929)	
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1518	1518	751	751	767	767
Adjusted R-squared	0.034	0.034	0.022	0.022	0.038	0.038

Panel C. Lender credit rating

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		High-risk firms		Low-risk firms	
Pilot	−2.550***	−2.555***	−3.010***	−3.010***	−2.311**	−2.311**
	(0.825)	(0.828)	(0.974)	(0.974)	(1.005)	(1.005)
Pilot*BANKCUR*HighZscore	4.079***	2.454**	5.128***	3.843***	2.455	0.416
	(1.104)	(1.097)	(1.274)	(1.323)	(1.498)	(1.346)
Pilot*BANKCUR*LowZscore	1.620		1.285		2.039	
	(1.179)		(1.101)		(1.506)	
Pilot*BANKCUR		1.620		1.285		2.039
		(1.179)		(1.101)		(1.506)
BANKCUR		−0.787		−0.581		−0.976
		(0.675)		(1.064)		(0.961)
BANKCUR*HighZscore	−0.925	−0.138	−1.238	−0.657	−0.677	0.299
	(0.694)	(0.787)	(1.099)	(0.986)	(0.975)	(0.853)
BANKCUR*LowZscore	−0.787		−0.581		−0.976	
	(0.675)		(1.064)		(0.961)	
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1518	1518	751	751	767	767
Adjusted R-squared	0.034	0.034	0.022	0.022	0.038	0.038

This table presents regression coefficients of the SHO announcement returns on pilot treatment and bank risk. The dependent variable is the SHO announcement return over the (−10, 1) event window. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. Low NPL/Assets indicates whether the ratio of loans past due 90 days or more (BHCK5525) and non-accrual loans (BHCK5526) to total assets (BHCK2170) is lower than the median. High Z-score is an indicator that equals one if the bank's Z-score is above the median. We construct the Z-score using (ROA+(equity/assets))/SD(ROA). Highrating is an indicator that equals one if the bank is rated as $A+$ or above. High-risk (low-risk) firms are those whose modified Z-score is below (above) the median of the empirical distribution. All borrowing relationships refer to sole lenders or lead arrangers in syndicated loans. Robust standard errors are presented in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Table 6
Firm size and bank size effects on SHO announcement returns.

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Small firms		Large firms	
Pilot	−2.552***	−2.552***	−2.683**	−2.683**	−2.061*	−2.061*
	(0.826)	(0.826)	(1.115)	(1.115)	(1.053)	(1.053)
Pilot*BANKCUR*Smallbank	4.035***	1.739	5.835***	3.168	1.045	−0.683
	(1.383)	(1.252)	(2.081)	(2.323)	(1.576)	(1.346)
Pilot*BANKCUR*Largebank	2.296**		2.667		1.728	
	(1.041)		(1.972)		(1.238)	
Pilot*BANKCUR		2.296**		2.667		1.728
		(1.041)		(1.972)		(1.238)
BANKCUR		−0.507		−1.366		−0.106
		(0.601)		(1.060)		(0.679)
BANKCUR*Smallbank	−1.652*	−1.146	−1.839	−0.473	−1.091	−0.985
	(0.942)	(0.837)	(1.382)	(1.351)	(1.035)	(0.953)
BANKCUR*Largebank	−0.507		−1.366		−0.106	
	(0.601)		(1.060)		(0.679)	
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1518	1518	758	758	760	760
Adjusted R-squared	0.034	0.034	0.022	0.022	0.038	0.038

This table presents regression coefficients of the SHO announcement returns on pilot treatment and bank relationship. The dependent variable is the SHO announcement return over the (−10, 1) event window. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. Smallbank is an indicator that equals one if the total assets of the bank are below the median. Small firms are defined as firms whose total assets are below the sample median. All borrowing relationships refer to sole lenders or lead arrangers in syndicated loans. Robust standard errors are presented in the parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

return. The difference in SHO returns between firms borrowing from more concentrated banks and those borrowing from less concentrated banks is 3.085%, which is significant at the 5% level.

Panel B repeats the analysis using geographic HHI measures, using the borrower's state of incorporation. In this case, we find no significant difference between banks with high versus low geographic concentration in their loan portfolios. This lack of significance may be because state-specific information garnered from such concentration is less relevant when lending to publicly traded firms that likely operate across multiple geographic regions. Put differently, a bank's geographic focus may be more beneficial to smaller firms, which are prevalent within geographic sectors.

5.3. Heterogeneity of bank relationships

We further investigate whether the SHO announcement returns depend on the strength of bank relationships. We measure relationship strength following the methodology of Bharath et al. (2011), and we stratify the sample of firms with bank loans into those with relationship loans and those without. In Panel A of Table 8, we construct *STRONGRELAMT(NONRELAMT)*, an indicator that equals one if a firm has a (no) relationship bank lender from which it borrows more than two-thirds of its total loan amount. We then re-estimate Eq. (1) using the interaction term between *Pilot* and *BANKCUR*STRONGRELAMT(BANKCUR*NONRELAMT)*. The coefficient on *Pilot*BANKCUR*STRONGRELAMT* is a significant 3.33% and is statistically significant at the 1% level, while the coefficient on *Pilot*BANKCUR*NONRELAMT* is 2.093% and marginally significant. In Panel B, we perform a similar analysis using *STRONGRELDEAL(NONRELDEAL)*, an indicator that equals one if a firm has a (no) relationship bank lender from which it borrows more than two-thirds of its total number of deals. We find similar effects. Pilot firms with relationship bank loans appear to have a higher CAR compared to pilot firms with non-relationship bank loans.

In Panel C, we examine the effect of relationship length on SHO returns. We conjecture that longer bank relationships indicate better monitoring. To test this conjecture, we measure the borrower-bank relationship length as the difference between the start date of firm's first loan with its current lender and the SHO announcement date. We define *Longrel (Shortrel)* as an indicator that equals one if the relationship length is longer (shorter) than the sample median for all borrowers. In Column (1), we see that the coefficient on the interaction term *Pilot*BANKCUR*Longrel* is a positive 3.816% and statistically significant at the 1% level. In contrast, the coefficient on *Pilot*BANKCUR*Shortrel* is insignificant. Moreover, we see in Column (2) that the two coefficients are statistically different at the 5% level. These results are consistent with the conjecture that the firms with longer bank relationships benefit from better monitoring, potentially due to the information learned over the course of the relationship (Rajan,1992).

5.4. Effects of bank monitoring on short interest

We next explore whether changes in actual short interest following Regulation SHO vary across firms with different levels of bank relationships. Building on Grullon et al. (2015), we construct two measures of short interest. The first measure is relative short interest (in percentage points), computed as the ratio of the net short interest reported on the 15th of each month to the total shares outstanding at the beginning of each month. As an alternative, we use abnormal short interest, which accounts for the portion of the relative short interest that can be explained by firm characteristics and time trends. Specifically, we compute abnormal short interest using the following regression model:

$$\begin{aligned} \textit{Relative Short Interest}_{i,t} = {} & \alpha + \beta_1 \times \textit{Log}(\textit{Trading Volume})_{i,t} + \beta_2 \times \textit{Market} \\ & - \textit{to} - \textit{book}_{i,t} + \beta_3 \times \textit{Log}(\textit{Assets})_{i,t-1} + \beta_4 \\ & \times \textit{ROA}_{i,t-1} + \textit{Month}_t + \textit{Firm}_i + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

where i indexes firm, and t indexes calendar month. We obtain the residuals from Eq. (4) as firm i s' abnormal short interest.

We estimate the effect of Regulation SHO on firms' relative and abnormal short interest using data from 12 months before the Regulation SHO announcement to 9 months after the announcement (but before the Regulation SHO implementation). We use the following specification:

$$\begin{aligned} y_{i,t} = {} & \alpha + \beta_1 \textit{Pilot}_i{*}\textit{After}_t + \beta_2 \textit{Pilot}_i{*}\textit{After}_t{*}\textit{BANKCUR}_i + \beta_3 \\ & \times \textit{BANKCUR}_i{*}\textit{After}_t + \beta_4 \times \textit{Firm controls}_{i,t-1} + \textit{Month}_t + \textit{Firm}_i \\ & + \varepsilon_{i,t} \end{aligned} \tag{5}$$

Table 7
Bank loan portfolio concentration and borrower SHO announcement returns.

Panel A. Bank loan portfolio industry concentration		
	(1)	(2)
Pilot	−2.549***	−2.549***
	(0.825)	(0.825)
Pilot*BANKCUR*High HHI_Industry	5.250***	3.085**
	(1.613)	(1.489)
Pilot*BANKCUR*Low HHI_Industry	2.166**	
	(1.009)	
Pilot*BANKCUR		2.166**
		(1.009)
BANKCUR		−0.744
		(0.616)
BANKCUR*High HHI_Industry	−1.420	−0.676
	(1.002)	(0.901)
BANKCUR*Low HHI_Industry	−0.744	
	(0.616)	
Firm controls	Yes	Yes
Industry FE	Yes	Yes
Observations	1518	1518
Adjusted R-squared	0.030	0.030
Panel B. Bank loan portfolio geographical concentration		
	(1)	(2)
Pilot	−2.550***	−2.550***
	(0.826)	(0.826)
Pilot*BANKCUR*High HHI_State	3.232**	0.648
	(1.408)	(1.311)
Pilot*BANKCUR*Low HHI_State	2.584**	
	(1.050)	
Pilot*BANKCUR		2.584**
		(1.050)
BANKCUR		−0.747
		(0.620)
BANKCUR*High HHI_State	−1.203	−0.456
	(0.921)	(0.796)
BANKCUR*Low HHI_State	−0.747	
	(0.620)	
Firm controls	Yes	Yes
Industry FE	Yes	Yes
Observations	1518	1518
Adjusted R-squared	0.027	0.027

This table presents regression coefficients of the SHO announcement returns on pilot treatment and bank loan portfolio concentration. The dependent variable is the SHO announcement return over the (−10, 1) event window. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. High(Low) HHI is an indicator that equals one if the Herfindahl Index of loans across industries (states) is above (below) the top quartile of the empirical distribution. Robust standard errors are presented in the parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

where i indexes firm, and t indexes calendar month. $y_{i,t}$ represents the relative short interest and abnormal short interest. The estimation takes a Difference-in-Difference-in-Difference (DDD) approach. The first difference examines whether firms experience significant changes in short interest around the Regulation SHO announcement. The second difference compares whether the changes before and after the announcement differ between pilot and control firms. The third difference, denoted as β_2, estimates whether the effect of Reg SHO differs for firms with and without bank loans.

We report the regression coefficient estimates in Table 9. Column (1) presents the coefficient estimates for the relative short interest using Eq. (5). Consistent with the findings in Grullon et al. (2015), we find a significant positive effect of *Pilot*After* on firms' short interest. Moreover, the interaction term between *Pilot*After and BANKCUR* has a coefficient of −0.203, suggesting that the marginal effect of SHO on actual short interest is lower for firms with bank loans. In Column (2), we augment the model by replacing the *Pilot*After* and

Table 8
Bank relationship strength and borrower SHO announcement returns.

Panel A. Bank relationship strength (by loan amount)		
	(1)	(2)
Pilot	−2.547***	−2.547***
	(0.826)	(0.826)
Pilot*BANKCUR*STRONGAMT	3.328***	1.235
	(1.085)	(1.104)
Pilot*BANKCUR*NONRELAMT	2.093*	
	(1.202)	
Pilot*BANKCUR		2.093*
		(1.202)
BANKCUR		−0.602
		(0.682)
BANKCUR*STRONGRELAMT	−0.996	−0.394
	(0.680)	(0.625)
BANKCUR*NONRELAMT	−0.602	
	(0.682)	
Firm Controls	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	1518	1518
Adjusted R-squared	0.034	0.034
Panel B. Bank relationship strength (by number of deals)		
	(1)	(2)
Pilot	−2.549***	−2.549***
	(0.825)	(0.825)
Pilot*BANKCUR*STRONGRELDEAL	3.770***	2.010*
	(1.362)	(1.181)
Pilot*BANKCUR*NONRELDEAL	1.760*	
	(1.049)	
Pilot*BANKCUR		1.760*
		(1.049)
BANKCUR		−0.883
		(0.735)
BANKCUR*STRONGRELDEAL	−1.050	−0.167
	(0.826)	(0.758)
BANKCUR*NONRELDEAL	−0.883	
	(0.735)	
Firm Controls	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	1518	1518
Adjusted R-squared	0.033	0.033
Panel C. Relationship length		
	(1)	(2)
Pilot	−2.552***	−2.550***
	(0.826)	(0.825)
Pilot*BANKCUR*Longrel	3.816***	2.172**
	(1.093)	(1.083)
Pilot*BANKCUR*Shortrel	1.644	
	(1.175)	
Pilot*BANKCUR		1.644
		(1.175)
BANKCUR		−1.118
		(0.687)
BANKCUR*Longrel	−0.508	0.610
	(0.716)	(0.677)
BANKCUR*Shortrel	−1.118	
	(0.687)	
Firm controls	Yes	Yes
Industry FE	Yes	Yes
Observations	1518	1518
Adjusted R-squared	0.034	0.034

This table presents regression coefficients of the SHO announcement returns on pilot treatment and bank relationship. The dependent variable is the SHO announcement return over the (−10, 1) event window. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. STRONGRELAMT(NONRELAMT) is an indicator that equals one if a firm has a (no) relationship bank lender from which it borrows more than 2/3 of loans in terms of the loan amount. STRONGRELDEAL(NONRELDEAL) is an indicator that equals one if a firm has a (no) relationship bank lender from which it borrows more than 2/3 of loans in terms of the number of loan deals. Longrel

(Shortrel) as an indicator that equals one if the relationship length is longer (shorter) than the sample median for all borrowers. Robust standard errors are presented in the parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

Table 9
Short interest and lender type.

	(1)	(2)	(3)	(4)
	Relative short selling interest		Abnormal short selling interest	
Pilot*After	0.418***		0.415***	
	(0.083)		(0.082)	
Pilot*After*NOLOAN		0.373***		0.368***
		(0.095)		(0.095)
Pilot*After*BANKCUR	−0.203*	0.215**	−0.199*	0.216***
	(0.118)	(0.084)	(0.117)	(0.084)
Pilot*After*NONBANK		0.553***		0.554***
		(0.166)		(0.166)
After	0.281***		−0.121**	
	(0.050)		(0.050)	
BANKCUR*After	0.115*	0.395***	0.108	−0.013
	(0.069)	(0.051)	(0.069)	(0.051)
NOLOAN*After		0.304***		−0.096*
		(0.058)		(0.058)
NONBANK*After		0.219**		−0.188**
		(0.093)		(0.093)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Observations	31,878	31,878	31,878	31,878
Adjusted R-squared	0.820	0.820	0.838	0.838

This table presents the effect of the Regulation SHO program on firms' relative and abnormal short interest, with subsamples partitioned on firms' bank relationship at the time of the Regulation SHO announcement. The sample period was from one year before the announcement date (July 28, 2004) through nine months after the announcement (but before the implementation date). Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. After is a dummy variable that equals one if the observation falls within 9 months after the announcement (but before the Regulation SHO implementation). NOLOAN is an indicator on that equals one if the firm does not have any outstanding loan contracts. BANKCUR is an indicator of whether a firm has an outstanding U.S. commercial bank relationship. NONBANK is an indicator of firms with loans originated by investment banks, foreign banks, nonbank institutional investors, and finance companies at the time of Regulation SHO announcement. Columns (1)-(2) present the regression coefficient estimates based on Relative Monthly Short Interest, computed as the ratio of net short positions outstanding to shares outstanding at the beginning of each month. Columns (3)-(4) present the regression coefficient estimates based on Abnormal Monthly Short Interest, computed as the residual of a firm fixed effect regression of Relative Monthly Short Interest on firm fixed effects, calendar month fixed effects, market-to-book ratio, the logarithm of lagged total assets, lagged return on assets, trading volume. Robust standard errors are clustered at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

*Pilot*After*BANKCUR* indicators with interaction terms between *Pilot*After* and the *NOLOAN, BANKCUR* and *NONBANK* indicators, *where BANKCUR* captures firms with an outstanding U.S. commercial bank relationship, *NONBANK* represents firms borrowing from nonbank lenders, and *NOLOAN* captures firms without any outstanding loan contracts. These new interaction terms enable us to evaluate the average effect of SHO on short interest for firms without loans, with bank loans, and with nonbank loans separately. We find that firms with bank loans experience the smallest average increase in short interest, with a marginal effect of 0.21 percentage points. Firms with nonbank loans have an average increase of 0.55 percentage points. Columns (3) and (4) present coefficient estimates using abnormal short interest as the outcome variable. The key coefficients for these interaction terms remain statistically significant, and their economic magnitude is comparable to those in Columns (1) and (2). This suggests that all firms in the pilot group

Table 10
Ownership structure and SHO announcement returns.

Panel A. By investor type

	(1)	(2)
Pilot	−1.505	−2.025***
	(0.652)	(0.661)
Pilot*Dedicated ownership	2.820	
	(11.109)	
Dedicated ownership	−0.948	
	(5.273)	
Pilot*Dedicated Indicator(5%)		1.290
		(0.990)
Dedicated Indicator(5%)		0.134
		(0.603)
Industry FE	Yes	Yes
Firm controls	Yes	Yes
Observations	1518	1518
Adjusted R-squared	0.034	0.032

Panel B. By ownership concentration

	(1)	(2)	(3)	(4)
Pilot	−0.954	−1.583***	−1.716***	−1.136**
	(1.132)	(0.492)	(0.618)	(0.541)
Pilot*Ownership HHI	−10.547			
	(21.645)			
Ownership HHI	20.398			
	(23.614)			
Pilot*Ownership HHI (quintile)		1.542		
		(1.143)		
Ownership HHI(quintile)		−0.522		
		(0.640)		
Pilot*Top5 ownership			2.042	
			(1.437)	
Top5 ownership			0.407	
			(6.621)	
Pilot*Top5 Dummy				0.149
				(1.132)
Top 5 Dummy				−1.015
				(0.657)
Industry FE	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Observations	1518	1518	1518	1518
Adjusted R-squared	0.051	0.033	0.029	0.031

Panel C. By block ownership

	(1)	(2)	(3)
Pilot	−1.749***	−2.140***	−2.648**
	(0.561)	(0.609)	(1.266)
Pilot*Blockownership	1.908		
	(3.172)		
Blockownership	−1.622		
	(2.645)		
Pilot*Blockownership(quintile)		1.050	
		(1.139)	
Blockownership(quintile)		−0.969	
		(0.717)	
Pilot*Block Dummy			1.635
			(1.395)
Block Dummy			0.532
			(0.901)
Industry FE	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes
Observations	1518	1518	1518
Adjusted R-squared	0.019	0.020	0.031

This table presents regression coefficients of the SHO announcement returns on pilot treatment and ownership structure. The dependent variable is the SHO announcement return over the (−10, 1) event window. The sample is drawn from non-financial, non-utility U.S. firms from the June 2004 Russell 3000 Index, and firms are required to be listed on NYSE, AMEX, or NASDAQ, from 2002 to 2007 and have non-missing financial information in Compustat. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. Dedicated ownership is the total percentage of shares owned by dedicated institutional investors following Bushee's (1998) institutional

investor classification. Dedicated Indicator is an indicator that equals one if the total percentage of shares owned by dedicated institutional investors is greater than or equal to 5%. Ownership HHI is the Herfindahl Index of institutional concentration calculated based on the percentages of institutional holdings by all 13f institutions. Ownership HHI(quintile) is an indicator that equals one if the Herfindahl Index of institutional concentration is in the highest quintile. Top5 ownership is the total percentage of shares owned by the five largest institutional investors. Top5 Dummy is an indicator that equals one if the total percentage of shares owned by the five largest institutional investors is in the highest quintile. Block ownership is the percentage of shares owned by blockholders(shareholders holding more than 5% of ownership). Block ownership (quintile) is an indicator that equals one if block ownership is in the highest quintile. Block Dummy is an indicator that equals one if the company has an outside blockholder. Robust standard errors are presented in the parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

experience a significant increase in short interest following the SHO announcement, but the average increase is smaller for pilot firms with bank loans.

5.5. Equity ownership structure and SHO announcement returns

Our results thus far indicate that having an outstanding U.S. bank relationship reduces the likelihood of investors uncovering negative information about pilot firms. While our findings highlight the unique monitoring benefits provided by domestic commercial banks, many firms in our sample already have external and internal monitors (e.g., institutional investors and security analysts). This raises a question: does bank monitoring benefit shareholders exist beyond the monitoring role of institutional investors? In this section, we attempt to distinguish between the effect of bank monitoring and shareholder monitoring. We first investigate whether the monitoring benefits provided by various classes of stock owners affect SHO announcement returns similarly to bank monitors. Prior research suggests that institutional investors have different incentives to monitor their portfolio firms and differentially impact corporate governance (Dasgupta et al., 2021; Brav et al., 2024), which can potentially lead to different reactions around SHO implementation. To explore whether institutional investors have heterogeneous impacts on pilot firms, we follow Bushee (1998) to classify ownership into dedicated and non-dedicated at the firm level. Using the 13f holdings data, we define *Dedicated ownership* as the total percentage of shares owned by dedicated institutional investors. Panel A of Table 10 presents coefficient estimates of SHO announcement returns on dedicated ownership. In Column (1), we find that the coefficient on the interaction term *Pilot*Dedicated ownership* is positive but insignificantly different from zero. In Column (2), we replace *Dedicated ownership* with a discrete measure *Dedicated Indicator (5 %)*, an indicator that equals one if the total percentage of shares owned by dedicated institutional investors is greater than or equal to 5 % (top quintile) and zero otherwise. We again find the interaction term is positive but insignificant. Taken together, our results suggest that dedicated stock owners do not mitigate the negative stock market reaction to SHO.

In Panel B, we investigate whether SHO announcement returns vary by the influence of institutional investors through the lens of ownership concentration. Institutional investors have stronger incentives to monitor managers if the firm has higher ownership concentration (Hartzell and Starks, 2003; Chen et al., 2007). We measure ownership concentration in several ways, including the *Ownership HHI,* calculated using all of a firm's institutional owners and their respective ownership stakes, and *Top5 ownership*, the percentage of a firm's stock held by its five largest institutional holders. Column (1) shows that both the *Pilot* and *Pilot*Ownership HHI* yield insignificant estimates. In Columns (2), we repeat the test using the *Ownership HHI top quintile* indicator and find that the coefficient estimates on *Pilot* is negative and significant. However, the interaction term between *Pilot* and the *Ownership HHI top quintile indicator* is insignificant. Similarly, in Columns (3) and (4), we find that although pilot firms experience negative and significant announcement returns around SHO, the effect of *Top 5 ownership* remains statistically insignificant.

We continue our analysis by investigating whether and how blockholders affect SHO returns. Blockholders provide important monitoring benefits through traditional voice mechanisms or trading in the secondary market (Edmans and Manso, 2011; Edmans et al., 2013). In Panel C, we examine whether blockholders have a direct effect on SHO abnormal returns. To implement, we estimate regressions of SHO abnormal returns that include a continuous measure, *Block ownership*, which is the percentage of shares owned by blockholders, along with its interaction with the Pilot indicator. We also explore discrete measures, including a blockholder dummy indicating the presence of one or more blockholders and an indicator of whether the firm's block ownership is among the top quintile of all firms. We find that the coefficients on the relevant interaction terms are all positive but statistically insignificant.

In Table 11, we re-conduct our primary analysis while controlling for various equity ownership variables and their interactions with the Pilot indicator. This includes nine different ways (one per column) of measuring and controlling for ownership structure, such as investor heterogeneity, ownership concentration and block ownership measures. Our results show that the effect of bank monitoring on SHO abnormal returns remains robust after we take equity ownership into account.

6. Conclusion

This paper studies information spillovers and cross-monitoring between the stock and loan market from the perspective of short selling and bank relationships. Short sellers are sophisticated traders who enhance price discovery and managerial discipline. However, they have also been criticized and challenged by regulatory authorities and shareholders for predatory short-selling, which may cause overreactions and disagreement in the stock market. On the other hand, banks are inside lenders who specialize in screening and monitoring borrowers. The value of loans is sensitive to downside risk, and banks exert significant monitoring efforts to stave off firm distress. Empirically, we investigate the role of banks in the event of increased short-selling potential by examining the Reg SHO event, which relaxes short-selling constraints for a randomly selected group of firms.

Our evidence reveals that screening and monitoring services from banks reduce the anticipation of equity short selling in the stock market. While SHO pilot firms experience negative announcement returns on average, firms with bank loans do not experience abnormal returns during the SHO announcement. Moreover, the SHO announcement returns for pilot firms vary by the type and risk of the lender, as well as the strength of the borrowing relationship. Our analysis highlights the uniqueness of bank relationships in the price discovery process.

CRediT authorship contribution statement

Matthew T. Billett: Writing – original draft, Validation, Supervision, Methodology, Conceptualization. **Fangzhou Liu:** Writing –

Table 11
Ownership structure, bank relationship and SHO announcement returns.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pilot	−1.726	−1.745*	−3.165***	−3.349***	−2.770***	−2.221**	−2.697***	−2.917***	−2.955***
	(1.071)	(0.984)	(0.828)	(0.963)	(0.924)	(1.002)	(1.012)	(0.923)	(1.078)
Pilot*BANKCUR	2.376**	2.777***	2.928***	2.809***	2.751***	2.800***	2.736***	2.779***	3.319***
	(1.174)	(1.033)	(1.014)	(1.047)	(1.044)	(0.984)	(1.054)	(1.049)	(1.151)
BANKCUR	−0.753	−0.400	−0.815	−0.039	−0.966	−0.941	−1.027	−0.989	−1.117
	(0.719)	(0.615)	(0.601)	(0.625)	(0.619)	(0.591)	(0.629)	(0.622)	(0.680)
Pilot*Dedicated ownership	1.004								
	(11.561)								
Dedicated ownership	−1.217								
	(5.354)								
Pilot*Dedicated Indicator(5%)		1.512							
		(0.999)							
Dedicated Indicator(5%)		0.416							
		(0.598)							
Pilot*Top 5 ownership			1.853						
			(1.661)						
Top5 ownership			−0.753						
			(1.059)						
Pilot*Top5 ownership_dummy				2.142					
				(1.334)					
Top5 ownership				0.412					
				(0.885)					
Pilot*Ownership HHI(quintile)					1.840				
					(1.172)				
Ownership HHI(quintile)					−0.431				
					(0.720)				
Pilot*Ownership HHI						8.012			
						(25.587)			
Ownership HHI						23.052			
						(23.309)			
Pilot*Blockownership							1.150		
							(1.042)		
Blockownership							−0.850		
							(0.673)		
Pilot*Blockownership(quintile)								1.745	
								(1.185)	
Blockownership(quintile)								−0.256	
								(0.775)	
Pilot*Block Dummy									1.552
									(1.339)
Block Dummy									0.571
									(1.593)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1518	1518	1518	1518	1518	1518	1518	1518	1518
Adjusted R-squared	0.013	0.037	0.054	0.033	0.032	0.043	0.034	0.033	0.023

This table presents regression coefficients of the SHO announcement returns on pilot treatment and ownership structure. The dependent variable is the SHO announcement return over the (−10, 1) event window. The sample is drawn from non-financial, non-utility U.S. firms from the June 2004 Russell 3000 Index, and firms are required to be listed on NYSE, AMEX, or NASDAQ, from 2002 to 2007 and have non-missing financial information in Compustat. Pilot is an indicator that equals one if the company is in the pilot group of Reg SHO and 0 otherwise. BANKCUR indicates whether a firm has an outstanding U.S. commercial bank relationship. Dedicated ownership is the total percentage of shares owned by dedicated institutional investors following Bushee's (1998) institutional investor classification. Dedicated Indicator is an indicator that equals one if the total percentage of shares owned by dedicated institutional investors is greater than or equal to 5%. Ownership HHI is the Herfindahl Index of institutional concentration calculated based on the percentages of institutional holdings by all 13f institutions. Ownership HHI(quintile) is an indicator that equals one if the Herfindahl Index of institutional concentration is in the highest quintile. Top5 ownership is the total percentage of shares owned by the five largest institutional investors. Top5 Dummy is an indicator that equals one if the total percentage of shares owned by the five largest institutional investors is in the highest quintile. Block ownership is the percentage of shares owned by blockholders(shareholders holding more than 5% of ownership). Block ownership(quintile) is an indicator that equals one if block ownership is in the highest quintile. Block Dummy is an indicator that equals one if the company has an outside blockholder. Robust standard errors are presented in the parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels using two-tailed tests.

original draft, Validation, Methodology, Funding acquisition, Formal analysis. **Xuan Tian:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jbankfin.2024.107351.

Appendix A. Definition of main variables

LOANCUR	An indicator on whether a firm has an outstanding loan contract.
BANKCUR	An indicator on whether a firm has an outstanding U.S. commercial bank relationship.
NONBANK	An indicator on firms that has loans originated by investment banks, foreign banks, nonbank institutional investors and finance companies at the time of Regulation SHO announcement.
NOLOANNOW	An indicator that equals one if a firm has had a bank loan within one year prior to SHO but does not have a bank loan at the announcement of Reg SHO.
NOLOAN	An indicator on that equals one if firm does not have any outstanding loan contracts. (for tests on short interest)
Log(assets)	Natural log of total assets (Compustat atq) in million dollars.
Book Leverage	Total debt (dlcq+dlttq) divided by total assets (atq).
Tangibility	Net property, plant and equipment (ppent) divided by total assets (atq).
Profitability	Operating cash flow (oibdpq) divided by total assets (atq).
Market-to-book ratio	The sum of market equity (prccq*cashoq), total debt (dlcq+dlttq) and deferred taxes and investment tax credit (txditcq) divided by total assets (atq).
Firm Z-score	Modified Z-score: [3.3*Operating income(oiadpq)+1.2*Working capital(wcapq)+1.4*Retained earnings (req)+Sales (saleq)]/Total assets (atq)
Accrual quality	Standard deviation of 5 year-residual accrual following Dechow and Dichev(2002) and Billett and Yu(2016).
Log(bank assets)	Natural log of total assets (BHCK 2170) in million dollars.
HHI_state	Herfindahl-Herschman index of a bank's loan portfolio by state.
HHI_industry	Herfindahl-Herschman index of a bank's loan portfolio by SIC-3 industry.
NPL/Assets	The ratio of the sum of loans past due 90 days or more (BHCK5525) and non-accrual loans (BHCK5526) to total assets (BHCK2170)
Bank zscore	(ROA+(equity/assets))/SD(ROA)
Bank credit rating	Numerical scale of bank credit ratings, with AAA assigned with 22 and AA+ assigned with 21, and so forth.
Relationship length	Days between current loan's origination date and the first loan with the lender.
STRONGRELAMT	An indicator that equals one if a firm has a relationship bank lender from which it borrows more than 2/3 loans in terms of the loan amount.
STRONGRELDEAL	An indicator that equals one if a firm has a relationship bank lender from which it borrows more than 2/3 loans in terms of the number of loan deals.
Longrel	An indicator that equals one if days between current loan's origination date and the first loan with the lender is longer than the median of the empirical distribution.
Block ownership	Total shares owned by blockholders scaled by total shares outstanding.
Top5 institutional ownership	The share ownership controlled by the five largest institutional investors.
Ownership HHI	Herfindahl-Herschman index of institutional ownership
Dedicated ownership	Shares controlled by dedicated investors based on the classification of Bushee (1998).

Data availability

The authors do not have permission to share data.

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