Shareholder-Creditor Conflicts and Limits to Arbitrage: Evidence from the Equity Lending Market

YONGQIANG CHU   LUCA X. LIN   PEDRO SAFFI   JASON STURGESS*

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Abstract

We show that conflicts of interest between shareholders and creditors affect prices in financial markets through the equity lending market and short selling constraints. Using mergers between financial institutions as exogenous variation in the presence of dual holders, that is, institutions holding equity and debt of the same firm, we find that shareholders increase equity lending supply when they face lower conflicts, which reduces short sale constraints and limits to arbitrage and increases price efficiency. The decrease in short sale constraints is more pronounced in firms with ex-ante greater conflicts of interest between shareholders and creditors. Our findings suggest that agency problems due to shareholder-creditor conflicts have a real impact on market efficiency and asset prices.

Keywords: Limits to Arbitrage, Dual Holders, Shareholder-Creditor Conflicts, Short Selling, Equity Lending.

JEL Codes: G21, G30, G34

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*Chu: Belk College of Business and Childress Klein Center for Real Estate, University of North Carolina at Charlotte. Email: yongqiang.chu@uncc.edu. Lin: HEC Montreal. Email: luca.lin@hec.ca. Saffi: Judge Business School, University of Cambridge. Email: psaffi@jbs.cam.ac.uk. Sturgess: School of Economics and Finance, Queen Mary University of London. Email: j.sturgess@qmul.ac.uk.

1 Introduction

Conflicts of interest between shareholders and creditors can distort financial decision-making and real corporate policies, which adversely impacts the ability of firms to raise external finance and contribute to economic growth.[1] However, the rise of institutional investors in equity and debt markets as led to a rise in dual holdings – where a single investor holds both the debt and equity of a firm. The percentage of firms with such dual holders has increased significantly over the past thirty years. Anton and Lin (2020) show that the fraction of firms with a financial institution that holds a syndicated loan and equity increased from 5% in 1990 to 30% in 2012, mostly due to deregulation in the financial services industry. Banks have started to hold more equity through their affiliated asset managers since the repeal of the Glass-Steagall Act in 1999, and there has been a substantial increase of non-bank institutional lenders in the syndicated loan market over the same period (Ivashina and Sun, 2011; Lim et al., 2014). These dual holdings have been shown to align shareholder-creditor incentives and mitigate conflicts of interests.[2]

In this paper, we examine the rise of dual holdings from a different perspective. Specifically, we show that dual holdings that mitigate conflicts of interest increase incentives of shareholders to participate in the equity lending market, which decreases limits to arbitrage and enhances price efficiency.

Financial market efficiency depends on the degree of limits to arbitrage, which can impede the ability of investors to trade quickly and cheaply (Shleifer and Vishny (1997)). The limits to arbitrage we focus on are short sale constraints, including the ability to borrow stocks in the equity lending market. Duffie et al. (2002) emphasize that short sale constraints arise when lendable securities are difficult to locate. Miller (1977), Diamond and Verrecchia (1987), and

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[1]See Jensen and Meckling (1976), Myers (1977), and Smith and Warner (1979) for seminal theoretical studies, and Jiang et al. (2010) and Gilje (2016) for empirical evidence.

[2]Dual holdings reduce credit risk (Jiang et al. (2010) and Ferreira and Matos (2012)), investment distortion (Chava et al. (2017) and Anton and Lin (2020)), excessive payout (Chu (2018)), executive option compensation (Chen et al. (2019)), agency conflicts in mergers and acquisitions (Bodnaruk and Rossi (2016)), and lead to more efficient resolution of financial distress (Chu et al. (2020b)).

Lamont and Thaler (2003) show that prices may be biased or less efficient in the presence of short sale constraints. Empirically, stocks with greater short sale constraints or short sale risk exhibit greater arbitrage risk and, in turn, exhibit lower price-efficiency and slower correction of mispricing (Saffi and Sigurdsson (2011), Engelberg et al. (2018), and Chu et al. (2020a)).

The mechanism between conflicts of interest and price efficiency we describe builds on this theoretical and empirical evidence on equity lending and short selling. The result that ownership structure that combines heterogeneous preferences can create short sale constraints. In particular, Porras Prado et al. (2016) show that shareholders' heterogeneous preferences shape the incentives to withhold stock from the equity lending market. These arise because of concerns that short selling may lead to a decline in price, have negative feedback effects on corporate policies, or the risk of losing control. Dual holdings potentially mitigate these equity lending concerns by aligning investor interests and decreasing incentives of shareholders to retain shares, with implications for equity lending supply, short sales constraints, and limits to arbitrage.[3]

The results on the rise of dual holdings have implications not only for asset pricing, but also for the role of market prices in shaping corporate decisions. Consider two stocks – A and B – that are identical in every way except for their ownership structures. Specifically, stock A and stock B have identical fundamentals, but the dual holding ownership structure of A results in lower conflicts of interest between shareholders and creditors. Conflicts of interest in stock B can lead to distortions in financial decision-making that negatively affect firm values. These costs are ex-ante borne by equity holders, consistent with Fama and Jensen (1983), which should result in lower equity prices. However, these same conflicts in stock B can create limits to arbitrage in the equity lending market if investors are less likely to lend shares. These limits to arbitrage can result in weaker price efficiency and inflated prices. Consequently, conflicts of interests can dampen price efficiency and limit the disciplining effect of market prices in correcting behavior stemming from these same conflicts (Admati

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[3]Bodnaruk and Rossi (2016) and Keswani et al. (2021) show that dual holdings align voting preferences of shareholders with debt holders on corporate outcomes.

and Pleiderer (2007), Edmans and Manso (2011), and Massa et al. (2015)). The rise of dual holdings, therefore, mitigates conflicts of interest by not only aligning interests but also by enhancing price efficiency and the disciplining effect of market prices.

Empirical evidence on how conflicts of interests between shareholders and creditors affect financial market prices has been encumbered by several challenges. First, measuring the potential for conflicts of interest between equity and debt is difficult. Conflicts are typically observed ex-post only after inefficient outcomes are realized.[4] We use the presence of dual holdings as a proxy for aligned interests. Dual holders facilitate incentive alignment between the two parties as they internalize the conflict of interests, incorporating the preferences of both equity and debt to maximize the value of the whole firm instead of just equity value. Alternatively, the absence of dual holders indicates a greater propensity for conflicts of interest.

Second, researchers rarely observe the motives for investors' dual holdings. Institutional owners, which have a higher propensity to lend shares (D'Avolio (2002)), may recognize the benefit of dual holdings. Therefore, it is difficult to separate the treatment effect of dual holdings on equity lending and market outcomes from the selection effect of institutional ownership. We address these selection concerns by following Chu (2018) and exploit mergers of financial institutions that provide exogenous variation in dual holdings. The merging institutions each hold shares or debt in hundreds, if not thousands, of firms at any point in time. Therefore, the mergers are unlikely to be driven by factors related to any particular firm.

Third, institutional mergers that create dual holdings might also create changes in equity ownership structure that impacts equity lending. If so, our results could mis-attribute effects to dual holdings. We examine ownership structure around merger events and find no significant changes, and control for ownership structure in estimations. Finally, institutional merger waves might be correlated with aggregate market dynamics. We estimate specifications absorbing aggregate effects throughout to mitigate this concern.

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[4]Exceptions include studies that examine cross-country or time-series variation in legal institutions to examine how conflicts of interests affect firm outcomes. Favara et al. (2017) show that country-level debt enforcement law induces variation in conflict of interests. Becker and Strömberg (2012) exploit a Delaware bankruptcy ruling that changed the nature of corporate directors' fiduciary duties.

We start by providing preliminary evidence on dual holdings and equity lending in the universe of U.S. public firms. Dual holdings are measured as institutional investors that hold at least 1% of the firm's outstanding equity that also are creditors of at least one of the firm's existing loans at a fiscal-quarter's end. Over the sample period from 2006 to 2012, 27% of firms have a dual holder investor in at least one quarter. We find a positive association between equity lending supply and dual holdings. The presence of at least one dual holder in the firm is associated with a 4% increase in equity lending supply, on average. This effect strengthens as the intensity of dual holders increases. The results are robust to the inclusion of firm and time fixed effects that control for time-invariant firm characteristics and to aggregate shifts in the corporate control environment that may be correlated with the presence of a dual holder.

Next, we investigate how this association manifests. We start by focusing on how the baseline effect varies with the allocation of bargaining power inside the firm. On the one hand, if dual holdings mitigate conflicts of interest between debt and equity investors, the effect should be stronger in firms with greater creditor bargaining power. We proxy for the strength of creditor bargaining power by examining whether a firm has a credit rating (Alanis et al. (2018)). When a firm does not have an S&P credit rating, creditors tend to have more bargaining power over the manager or shareholders, since the firm lacks the flexibility to diversify away from said creditors and is subject to continuous creditor monitoring. Consistent with this, we find that the positive effect of dual holdings on equity lending supply is stronger in unrated firms. On the other hand, large shareholders should have fewer incentives to retain shares for control over management when shareholder-creditor conflicts are lower. We find that the effect of dual holdings on lending supply are even stronger in firms with more block owners. This supports the notion that large shareholders find less need to retain control when shareholder-creditor incentives are more aligned.

We examine the setting of mergers between financial institutions to generate plausibly exogenous variation in dual holders to establish causality. Our data tracks 36 merger events between 2007 and 2012, which create new dual holders in 72 treated firms. Dual holdings are defined as coming from a merging shareholder that holds at least 1% of the outstanding

shares of the firm in the quarter prior to the merger announcement and a merging creditor whose loans to the firm are still outstanding at the time of the merger and the lender's participation is greater than 10% of the loan at origination. Our empirical setting allows us to design a difference-in-differences methodology that estimates the treatment effect of dual holdings on equity lending market outcomes. Specifically, we identify the treatment effect of dual holdings by comparing the difference in outcome for the treated firms around the merger events with the difference in outcome for a control group around the same event. The control group for each treatment firm comprises the three closest non-dual holding firms based on four characteristics: size, market-to-book, leverage, and institutional ownership.

Using these mergers as quasi-natural experiments, we find that the lending supply increases for treated firms after the mergers. We then examine the dynamics of the effect of the mergers on lending supply, and find that the effect only appears after, but not before, the merger. This suggests that the results are unlikely to be driven by pre-existing differences between treated and control firms. To the extent these mergers are exogenous, the effect of dual holdings on the lending supply is likely to be causal. We also find that after the mergers, treated firms are less likely to recall loaned shares before shareholder voting, again consistent with the bargaining power channel.

We provide further evidence that dual holdings mitigate the conflicts of interest between debt and equity investors by examining how dual holdings affect shareholder preferences to exercise voting rights. Lending shares transfer cash flows and voting rights to the borrower, creating a trade-off between keeping voting rights and earning loan income. Aggarwal et al. (2015) show that equity lenders restrict supply around the record date to exercise voting rights, trading off the opportunity to vote and voice their opinions against the loss of loan income. We re-examine their main findings, but conditional on dual holdings. Our results indicate that shareholders recall voting rights less when the firm has dual holders, consistent with shareholders having less need to influence management through their voting rights when interests are aligned. The results complement those in Keswani et al. (2021), who show

that dual holdings align voting preferences. Overall, these results provide strong support to the bargaining power channel.

We examine how the rise of dual holding affects market efficiency through equity lending supply by examining measures of short sale costs and risk. We find evidence that lower shareholder-creditor conflicts benefit short sellers by improving the quality of equity lending supply, as evidenced by the increase in the treated firms' utilization ratio and equity loan tenure. Consistent with the notion that fewer short-sale constraints make arbitrage less costly, we find that the arbitrage risk of treated firms decreases after the mergers.

Finally, turning to price efficiency, treated firms' stocks are found to be less overpriced following mergers, based on results from specifications estimating the stock mispricing measure computed by Stambaugh et al. (2015) and abnormal returns. The negative return effect of dual holdings is consistent with the evidence that dual holdings increase price efficiency by decreasing short sale constraints. However, the negative return effect is inconsistent with the evidence that dual holdings improve real outcomes by mitigating conflicts of interests. One interpretation is that the reduction in short sales constraints leads to a larger decrease in returns than the positive impact that fewer shareholder-creditor conflicts has on real outcomes. Therefore, examining financial market outcomes in response to changes in conflicts of interests might be misleading. Overall, our identification strategy based on financial institutions' mergers suggests that dual holdings have a causal effect on the lending supply, which implications for arbitrage risk, short selling constraints, and stock prices.

Our paper makes several contributions. First, our paper contributes to the emerging literature on dual holdings. Prior studies in this area have shown that by aligning shareholder-creditor incentives, dual holders foster a reduction in credit risk (Jiang et al. (2010)), while also affecting loan contracting (Chava et al. (2017)), as well as real firm decisions (Chu (2018), Chen et al. (2019), and Anton and Lin (2020)). Our results indicate that dual holders can also have important implications for asset pricing by influencing limits to arbitrage. Second, we also contribute to the agency conflict literature (Jensen and Meckling (1976), Myers (1977), Smith and Warner (1979), Gilje (2016), Chu (2018), and Anton and Lin (2020)) using the presence

of dual holders as a reverse proxy for shareholder-creditor conflicts. We also shed light on a previously under-explored channel through which shareholders respond to such conflicts, i.e., restricting equity lending supply. Porras Prado et al. (2016) point out that there remains limited evidence on the sources of short-sale constraints, and show how a firm's equity ownership structure can affect such constraints. Our paper argues that agency conflicts resulting from the firm's capital structure composition can be another source of short-sale constraints. Our paper also complements the literature on how equity lending and short sale constraints affect corporate policies and managerial behavior. The absence of shorting costs may allow uninformed short sellers to distort prices and inefficiently reduce investments (Goldstein and Guembel (2008)), leading managers to change repurchase policies to support share prices against manipulative shorting (Campello et al., 2020). De Angelis et al. (2017) find that short sales constraints affect managerial compensation contracts. In this paper, we show that corporate policies can in turn affect the equity lending market.

2 Sample Construction

We obtain the equity lending data from Markit, which has daily information on equity lending from July 2006.[5] We match the Markit data with stock price information from CRSP, financial data from Compustat, and institutional ownership from the Thomson Reuters' 13F database. We define lending supply as the percentage of market capitalization available for lending, measured as the quarterly average of the daily lendable value, divided by the firm's quarterly average total market value. We define shorting demand as the quarterly average of daily values of shares on loan, divided by the quarterly average of the firm's total market value.

To identify dual holders, we follow the definition in Jiang et al. (2010).[6] We find institutional investors that hold at least 1% of the firm's outstanding equity that also are creditors of

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[5]Before July 2006, the information is only available at the weekly frequency since 2005, and at the quarterly frequency since 2002. As robustness tests, we also conduct both our baseline and difference-in-difference analyses on the sample starting from 2002, with similar or even stronger results.

[6]See also Chava et al. (2017), Chu (2018), and Anton and Lin (2020).

at least one of the firm's existing loans at a fiscal-quarter's end. Then, we manually match the asset managers' names in 13F to lender information from the DealScan LPC database. As in Jiang et al. (2010), we aggregate first-level subsidiaries under their parent institutions, while also checking for years when ownership changes due to mergers and acquisitions. Following Anton and Lin (2020), we define the dual holder's investment style using Bushee's institutional investor classification (Bushee (1998)). We keep dual holders with long investment horizons, i.e., those classified as quasi-indexers or dedicated. For transient or unclassified dual holders, we track their holdings over time to determine their engagement, and only keep those with a dual holding period of more than one year. Due to the significant amount of effort necessary for this matching procedure, our final sample period covers July 2006 to December 2012.

Table 1 presents the summary statistics for the key variables used in our analysis. The average sample firm has 17.65% of its market value available for lending and 4.13% being lent out. Dual holders are common, with 27% of firm-quarter observations having at least one dual holder present.

3 Baseline Analysis

3.1 Baseline Result - Dual Holdings and Equity Lending Supply

We start with preliminary evidence on how equity lending supply varies with the presence of a dual holder for 6,310 firms, using quarterly U.S. data from 2006 to 2012. The dependent variable is the average fraction of the firm's market capitalization available for lending during the fiscal quarter. We define an indicator variable, *Dualholder*, that equals one if the firm has at least one dual holder at the end of the previous fiscal quarter, and zero otherwise. In robustness tests, we also employ continuous measures, such as the number of dual holders and the percentage of shares held by dual holders, to gauge the intensity of dual holder presence. We begin by estimating the following equation:

$$Supply_{i,t} = \beta \times Dualholder_{i,t-1} + \delta'X_{i,t-1} + \gamma_i + \tau_t + \epsilon_{i,t}, \tag{1}$$

where i is the focal firm and t is the calendar quarter corresponding to the observation. X is a set of firm characteristics used in the previous literature (Kolasinski et al. (2013) and Porras Prado et al. (2016)), including total institutional ownership, market capitalization, an indicator variable indicating whether the stock price is less than \$5, the Amihud (2002) illiquidity measure, turnover, market-to-book, leverage, analyst coverage, and the stock return over the previous quarter. We include firm fixed effects (γ_i) to control for unobserved time-invariant firm characteristics and year-quarter fixed effects (τ_t) to control for time-varying common shocks. Standard errors are double-clustered at the firm and year-quarter level following Petersen (2009). The key coefficient of interest is β, which is predicted to be positive based on our hypothesis that the presence of dual holders reduces shareholders' incentives to retain control rights rather than supply the shares in the equity lending market.

Table 2 reports the results. Column (1) shows the results of regressing equity lending supply on firm control variables, controlling for year-quarter fixed effects. The result is similar to those in prior studies. For example, higher total institutional ownership is associated with higher equity lending supply, since institutional shareholders are more likely to lend out their shares than individual shareholders (Porras Prado et al. (2016)). Firms with lower stock prices, less liquid stocks, and lower share turnover have lower lending supply. Market-to-book and leverage are both negatively associated with lending supply, while analyst coverage and prior stock returns have positive coefficients.

Columns (2)-(4) show that there is a positive and significant association between the presence of dual holders and equity lending supply, as predicted by our hypothesis. After including the list of firm control variables in column (3), the coefficient for *Dualholder* remains positive and significant, but the economic magnitude becomes smaller. This association is also robust to the inclusion of firm-fixed and time-fixed effects, as reported in column (4). On average, firms with dual holders have 0.7 percentage points more lending supply available.

This result corresponds to an increase of 4%(=0.689/17.65) in lending supply for the average firm in the sample.

If dual holdings mitigate the conflicts of interest through better alignment of the interests of creditors and shareholders, the effect should be stronger when dual holders own more equity. To test this conjecture, we study two continuous measures that capture the size of dual holders' equity stakes. The first measure is the natural logarithm of one plus the number of dual holders in the firm, as of the prior fiscal quarter end. The second one uses the percentage of equity held by dual holders in the firm. Columns (5) and (6) of Table 2 show that the equity lending supply increases with the magnitude of dual holders' equity stake in the firm. For example, a one-percentage point increase of the equity held by dual holders from the mean (25%) is associated with a 2.6 percentage point increase in lending supply (or 14.7% of the sample mean).

Overall, our baseline results support the hypothesis that shareholder-creditor conflicts negatively affect equity lending supply. In the presence of dual holders, shareholders are more willing to lend their shares because shareholder-creditor conflicts are lower. These results suggest that shareholder-creditor conflicts could give rise to limits to arbitrage by creating short-sale constraints through lower lending supply.

3.2 Dual Holdings and Bargaining Power - Cross-Sectional Analysis

Conflicts of interest between creditors and shareholders depend on the allocation of bargaining power between stakeholders. Larger and more concentrated owners accrue greater bargaining power, which allows them to exert influence on firm decisions that can generate conflicts with other owners.

Specifically, creditor-friendly managers with greater bargaining power can pursue risk-reducing policies that forgo good growth opportunities and harm shareholders (Acharya et al. (2011), Hilscher and Şişli Ciamarra (2013), and Lin (2020)). Therefore, when the allocation of bargaining power is tilted towards creditors, shareholders should have greater incentives

to keep their shares rather than lend them in the equity lending market. By choosing not to participate in the equity lending market, shareholders retain the power to influence corporate decisions. Therefore, we should observe stronger effects of dual holdings on equity lending supply for firms with greater ex-ante conflicts, proxied by concentrated ownership.

To study how bargaining power affects the relation between dual holdings and lending supply, we examine two cases of concentrated power. First, we study the degree of bank dependence to measure creditor bargaining power (Diamond (1991) and Bolton and Scharfstein (1996)). If a firm relies more on bank debt, creditors have greater bargaining power because they face fewer coordination issues and the firm cannot easily diversify towards public debt. We define a firm as bank dependent if it does not have an S&P credit rating in the prior quarter (Sufi (2007)), which comprises 77% of our sample. Table 3 presents the results of these cross-sectional tests using estimation (1) with firm and year-quarter fixed effects. The results in column (1) show that the effect of dual holders on lending supply is stronger for unrated firms, which exhibit greater creditor bargaining power.

We then turn to examine shareholders' bargaining power. Blockholders, that have greater bargaining power than dispersed shareholders and often play a strong role in corporate governance, are more likely to retain shares to maintain control rights, especially in the presence of conflicts of interest, and lend out fewer shares (Porras Prado et al. (2016)). Therefore, we expect that a larger number of blockholders should decrease lending supply. In column (2) of Table 3 we include the number of shareholders holding at least 5% of the firm's outstanding shares and its interaction with dual holder presence. For ease of interpretation, we demean the blockholder presence measure. We find that firms with more blockholders indeed have lower equity lending supply. However, dual holders that act to align the shareholder-creditor interests should reduce incentives for blockholders to retain shares and withhold supply in the equity lending market, which explains the positive sign for the interaction term coefficient between dual holders and the number of blockholders.

In column (3), we provide further evidence by identifying blockholders who also are dual holders in the firm. We investigate whether these dual blockholders exhibit incentives to lend

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shares differently compared to non-dual blockholders, in line with the results presented in column (2). When a blockholder is also a dual holder, we expect them to internalize the moderating effect that their own dual holdings have on conflicts of interest. Therefore, unlike non-dual blockholders, dual ones should not withhold as much lending supply. In column (3), we show that although blockholders on average withhold supply, this effect is moderated when there are blockholders who are also dual holders. Furthermore, we show that the moderating effect of dual blockholders on lending supply increases as the presence of dual blockholders intensifies. Overall, the results in Table 3 provide support for the hypothesis that shareholders retain shares less to maintain control when shareholder-creditor conflicts are lower.

4   Mergers of Financial Institutions, Dual Holders, and Equity Lending Supply

This section exploits mergers of financial institutions as a setting to address endogeneity concerns. The inclusion of firm and time fixed effects in our baseline estimation can help mitigate concerns about omitted variable biases due to unobserved time-invariant firm characteristics or time-varying common shocks. However, there can still be time-varying firm characteristics that are correlated with the presence of dual holders affecting the firm's equity lending supply. There is also a reverse causality concern that investors can self-select into becoming dual holders of firms with higher equity lending supply.

Since the Gramm-Leach-Bliley Act in 1999, which repealed the restrictions on affiliations between banks and securities firms, mergers between financial institutions have become more common. Mergers of financial institutions are often driven by the consolidation in the industry in response to regulatory and technological shocks (Harford (2005)) or for competitive reasons such as market penetration (Jayaraman et al. (2002)). In addition, the merging institutions often lend to or hold shares of hundreds and even thousands of firms at each point

in time. Therefore, mergers of financial institutions create variation in dual ownership at the firm level that is arguably exogenous to the underlying firm characteristics and equity lending supply because the motive of the merger lies with the financial institutions, not a few particular firms in their portfolios.

To illustrate the setting, consider the merger of Bank of America and Merrill Lynch, announced in Q3 2008 and completed in Q1 2009. At the time of the merger announcement, Merrill Lynch was the lead lender (11.09% of the total) on a $767 million existing loan facility to S&P Global Inc, but did not own any shares of the company. At the same time, Bank of America held 1.1% of the firm's outstanding equity shares, but did not hold any debt. After the merger, the combined institution, Bank of America–Merrill Lynch, became a dual holder of S&P Global Inc, owning a significant amount of both debt and equity. Overall, this merger led to the emergence of new dual holdings in 25 firms in our sample, which provides support to the exclusion restriction condition that the appearance of a dual holder is independent of these firms' characteristics. Given the large number of firms in both institutions' portfolios, it is highly unlikely that the merger occurred based on the fundamentals of these 25 firms.

4.1 Merger Sample Construction

We follow prior studies that use mergers as a setting to identify exogenous variation in ownership (see Chu (2018), Anton and Lin (2020), and Chu et al. (2020b)). First, we construct our merger sample using mergers between financial firms from the SDC database on mergers and acquisitions. Lenders' information comes from the LPC DealScan database, and we match names to those of either the acquirer or the target in a merger. We then use institutional investors' information from Thomson Reuter's 13F database and match their names with any acquirer or target firms that was not matched in the previous step. For both lender and shareholder acquirers, we use the names of companies directly involved or the names of their parent companies to define dual holders. We further require that a firm does not have

any dual holders in the quarter prior to the merger, such that we have a cleaner measurement of dual holdings.

To identify treated firms in each merger, we find all firms with available equity lending data on the Markit database, whose loans from the merging lender are still outstanding at the time of the merger. We require the lender's participation to be greater than 10% of the loan at origination. Next, we require that the merging shareholder holds at least 1% of the outstanding shares of the firm in the quarter prior to the merger announcement. Finally, we exclude treated firms without data available on the four quarters before and the four quarters after the merger. The final sample includes 72 treated firms stemming from 36 mergers occurring between 2007 and 2012 (see Figure 1 for the time distribution of these mergers).

4.2   Difference-in-Differences Design

To estimate the causal effect of dual holdings on equity lending supply, we employ a difference-in-differences (DiD) design. We compare the 72 treated firms with a sample of matched control firms. The control sample is constructed as follows. First, we start with the universe of firms with available Markit data from the same period. Second, we exclude all firms that have ever been treated in any shareholder-lender merger. For example, if a firm was treated by a shareholder-lender merger and gained a dual holder in 1998, it is then excluded from the pool. Third, we include only those firms that have at least one loan outstanding at the time of the merger.

Next, we follow a similar procedure as in Hong and Kacperczyk (2010) and Chu (2018) and match control firms to treated firms if they are in the same quintiles sorted based on market capitalization, market-to-book, leverage, and institutional ownership in the quarter prior to the merger. We then rank the matched control firms for each treated firm based on the differences of the four variables. We compute the average rank across all four variables, and retain the three closest control firms for each treated firm, i.e., those with the three lowest overall ranks for each treated firm. Some treated firms can only be matched to one or two firms, hav-

ing fewer than three matches. On the other hand, some treated firms can be matched to more than three firms due to a tie in rankings for the third place. The results remain similar if we use a one-to-one match instead. We end up with 275 control firms for our DiD sample.

We present a comparison of firm characteristics between treated and control firms, measured at the end of the quarter immediately before the merger, in Table 4. The comparison shows that the two groups of firms are very similar. The differences in market value, asset size, stock return, turnover, volatility, and liquidity, growth opportunities (market-to-book), capital structure (leverage), information environment (analyst coverage) are all small and statistically insignificant. Key aspects of ownership structure, which have been shown to affect equity lending supply by Porras Prado et al. (2016), are also similar between treated and control firms. Overall, this comparison of firm characteristics suggests that the DiD estimates are unlikely to be biased by pre-existing differences between the treated and control firms, being similar and comparable.

Finally, we conduct a quarterly level analysis of equity lending supply around financial institutions' mergers, with an estimation window of eight quarters before the merger announcement and eight quarters after the merger completion. To ensure a clean identification, we discard the quarters between merger announcement and completion, including the announcement and completion quarters.

We estimate the difference-in-differences specification as follows:

$$Supply_{i,t} = \beta_1 Treat_{i,k} \times Post_{i,k,t} + \delta X_{i,t-1} + \alpha_{i,k} + \alpha_{t,k} + \epsilon_{i,k,t} \tag{2}$$

where $Supply$ measures the average percentage of firm i's market capitalization available for lending during quarter t. $Treat_{i,k}$ is an indicator variable that equals one if firm i is classified as treated in merger k, and zero otherwise. $Post_{i,k,t}$ is an indicator variable that equals one if the fiscal quarter t is after the quarter in which merger k completes. The DiD coefficient estimate β captures the treatment effect of dual holdings on equity lending supply. $X_{i,t-1}$ the same control variables used in the baseline analysis. $\alpha_{i,k}$ is the firm-merger fixed effects, which

control for unobservable merger-specific characteristics that might contaminate the identification. $\alpha_{t,k}$ is the within-merger year-quarter fixed effects, which subsumes the effect of the standalone *Post* variable. Standard errors are clustered at the firm-merger level.

4.3 Dual Holdings and Equity Lending Supply

In Table 5, we display the DiD estimation results of Equation (2). In both columns, the DiD coefficient estimates are positive and statistically significant regardless of the effect of other control variables. In column (2), we show that treated firms on average have 1.6% more shares available for lending after the merger period (i.e., *Treat* × *Post*). This is equivalent to a 6.4% (=1.628/25.38) increase relative to the sample average and higher than the 4% baseline result in column (1).

An identification concern in estimating Equation (2) is that the effects on lending supply might be due to the treatment affecting other ownership characteristics, which in turn would affect lending supply (Porras Prado et al. (2016)). To mitigate this concern, in Appendix Table A.2 we show that the treatment effects on total institutional ownership, the Herfindahl-Hirschman index of ownership concentration, the ownership by the largest five shareholders, and block ownership are not statistically significant. These tests suggest that our main DiD result is unlikely to be driven by changes in ownership structure other than dual holdings.

Next, we conduct a dynamic DiD analysis. We interact the *Treat* variable with quarter dummies for each quarters in our event study, controlling for the same variables and fixed effects as in Equation (2) of the main DiD analysis, estimated as follows:

$$Supply_{i,t} = \sum_{n=-8}^{n=8} \beta_n Treat_{i,k} \times Year_n + \alpha_{i,k} + \alpha_{t,k} + \epsilon_{i,k,t}. \tag{3}$$

Table 6 reports the results. Column (1) shows that there is no significant difference in lending supply between the treated and control firms before treatment, suggesting that our findings are not driven by non-parallel trends between the treated and control firms. Treatment has a significant negative effect on lending supply for treated firms starting in the sec-

ond quarter after the treatment. Figure 2 visually illustrates this dynamic treatment effect with plots of the estimated coefficients for all interaction terms between *Treat* and the event-quarter indicator variables. Column (2) shows that our results are similar after including the same control variables used in the main DiD analysis. In summary, estimations exploiting the shareholder-lender merger setting provide causal evidence on the effect of dual holdings on equity lending supply.

4.4 Quality of Equity Lending Supply

Lending shares transfer cash flows and voting rights to the borrower, creating a trade-off between keeping voting rights and earning loan income. Aggarwal et al. (2015) show that equity lenders restrict supply around the record date to exercise voting rights, trading off the opportunity to vote and voice their opinions against the loss of loan income.

While the presence of dual holders leads to higher equity lending supply, does it affect the quality of the supply and actually benefit short sellers? Some equity lenders may opportunistically recall shares or free-ride on the information provided by short sellers (Greppmair et al. (2020)). The evidence so far indicates that shareholders in firms with dual holders are less likely to recall their shares. Therefore, we expect to also see an increase in the quality of equity lending supply, as short sellers become more willing to borrow from such shareholders. Dual holders can attract short sellers with a longer investment horizon who are likely to be more informed, ultimately helping to improve market efficiency.

We use the DiD setting to analyze the effect on loan fees, partitioning the sample based on utilization as a proxy for high demand for shorting relative to lendable supply. Columns (1) of Table 7 shows that there is no significant change in lending fees following the appearance of a dual holder. As expected, we find an increase in the utilization of the treated firms' equity lending supply (column (2)). The utilization ratio increases by an average of 12% for the treated firms (2.23/17.86) relative to the sample average utilization ratio equal to 17.86%. The increase in lending supply and utilization, together with unchanged loan fees, implies that

financial mergers with dual holders lead to an increase in shorting demand in which short sellers do not face higher loan fees because lending supply has sufficiently increased. This additional shorting demand can make prices more efficient and reduce limits to arbitrage, consistent with the price channel story.

Finally, columns (3) of Table 7 shows the DiD estimation for share loan tenure, defined as the average number of days that the firm's equity loans have been open. If the equity lending supply in dual holding firms is preferred by short sellers due to the lower recall risk (Engelberg et al. (2018)), we expect that the equity loan tenure is longer in such firms. We find that, indeed, the equity loan tenure increases significantly in treated firms by 20% (=14.91/76.24) to the sample average. The combination of these two sets of results suggests that lower shareholder-creditor conflicts increase not only the quantity of the firm's equity lending supply, but also the quality of the supply, which is important for attracting informed, long-horizon short sellers.

5   Dual Holdings and Shareholder Voting

Aggarwal et al. (2015) show that institutional investors often restrict lending supply or recall loaned shares before the proxy voting record dates to exercise control rights.[7] When the likelihood of shareholder-creditor conflicts is high, shareholders should have more incentives to retain or recall their shares to maintain their control rights and to protect themselves from potential creditor appropriation. Therefore, in the presence of dual holders, shareholders should have lower incentives to retain or recall their shares because shareholder-creditor incentives are better aligned.

In column (1) of Table 8, we first replicate the result of Aggarwal et al. (2015) in the full sample of firms, running an event study with a window of (-30, 30) days around the record date of shareholder meetings, controlling for firm and year fixed effects. $RDATE$ is an indicator variable that equals one for the observation on the record date of the voting event; zero

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[7]Shareholders must hold the shares on the record date of the voting event to exercise voting rights.

otherwise. Equity lending supply decreases substantially on the record date of the voting event, as indicated by the negative coefficient of $RDATE$. In column (2), we show that the coefficient estimate on the interaction term between $RDATE$ and *Dualholder* is positive and statistically significant. As expected, shareholders in firms with dual holdings find less need to restrict lending supply or recall loaned shares on the record date. Equity lending supply is 16% higher for firms with at least one dual holder, consistent with the idea that shareholders feel less need to exercise voting rights when shareholder-creditor incentives are more aligned.

We then analyze shareholder voting preferences in the financial institution merger DiD setting. Specifically, we examine if dual holder treatment affects shareholders' decisions to restrict lendable shares before voting events. We estimate equity lending supply on a window of (-30, 30) days around the record date ($RDATE$) of shareholder meetings, but with firm-merger and year fixed effects. Firms held by financial institutions involved in the merger must have at least one voting event before and at least one after the merger to be included. As before, $RDATE$ is an indicator variable that equals one for the observation on the record date of the voting event; zero otherwise. Similar to the analysis presented in Table 5, *Treat* is an indicator variable equal to one if the firm has a dual holder after the merger (i.e., it is "treated"), and zero otherwise. *Post* is an indicator variable that equals one if the shareholder meeting's record date is after the quarter in which the merger completes, zero otherwise.

The results are presented in Table 9. The coefficients of interest are: *Treat* $\times$ *Post*, which estimates the difference-in-differences treatment effect of dual holdings on equity lending supply; $RDATE$, which estimates the record date recall; *Treat* $\times$ $RDATE$, which estimates the pre-treatment difference in record date recall across treatment and control firms; and finally *Treat* $\times$ *Post* $\times$ $RDATE$, which estimates the difference-in-difference-in-differences treatment effect of dual holdings on equity lending record date recall. The positive and significant coefficient *Treat* $\times$ *Post* identifies the positive treatment effect of dual holdings on equity lending supply, consistent with the baseline DiD result in Table 5. The negative and significant coefficient on $RDATE$ shows that shareholders on average recall shares on the voting record date, consistent with the result in Table 8. Further, there is no pre-treatment difference across treat-

ment and control firms. The coefficient for the triple interaction term $Treat \times Post \times RDATE$ is 0.51, which implies that shareholders in treated firms are 47% (=0.510/1.107) less likely to recall loaned shares or to restrict lending supply before voting events than shareholders in control firms.

Overall, our results show that shareholders in firms with dual holdings restrict lending supply or recall loaned shares less on the record date, consistent with shareholders valuing control less when shareholder-creditor conflicts are low.

6 Dual Holdings, Arbitrage Risk, and Stock Returns

Next, we examine if changes in equity lending supply driven by variation in dual holdings affect the risk that arbitrageurs face to correct mispricing and its impact on stock prices. When idiosyncratic volatility is higher, arbitrageurs' ability to exploit mispricing is limited, as it is more difficult to establish a hedging portfolio (Shleifer and Vishny (1997)). Therefore, if dual holdings cause a reduction in short sales constraints, we should also observe a reduction in arbitrage risk.

Following Wurgler and Zhuravskaya (2002), we measure arbitrage risk with idiosyncratic risk, defined as the mean squared error of residuals of daily stock returns from the Carhart (1997) four-factor model regression. We rank this arbitrage risk measure for each calendar quarter in our DiD sample and convert it to a score ranging from zero to one. We then estimate Equation (2) using the arbitrage risk score as the dependent variable, reporting our findings in column (1) of Table 10. $Treat \times Post$ has a negative and significant coefficient of -0.03, which indicates a 6.7% decrease in arbitrage risk relative to the sample average (the DiD sample mean arbitrage risk score is 0.45). First, institutional ownership is associated with lower arbitrage risk. Firms with larger market capitalization, prior stock returns, higher stock price, and turnover also have lower arbitrage risk, consistent with Porras Prado et al. (2016).

The lower arbitrage risk induced by the increase in lending supply observed in column 1 of Table 7 is expected to reduce stock mispricing and lower prices due to fewer short sales con-

straints faced by arbitrageurs. However, dual holdings also help to mitigate conflicts between shareholders and creditors, which should have a positive impact on stock prices. Therefore, the net change in stock prices depends on the magnitude of these two opposite effects.

We test this conjecture using a measure of stock mispricing and abnormal returns following the financial institutions' mergers DiD setting. The stock mispricing measure is developed by Stambaugh et al. (2015) and is computed using a stock's monthly average ranking across 11 anomaly variables every month, with score ranging between 0 and 100.[8]. Stocks with the highest values of the mispricing score are the most overpriced, whereas those with the lowest values are the most underpriced. We average the monthly score at the quarterly level and repeat the DiD analysis using this mispricing measure, reporting our results in column (2) of Table 10.[9] Column (2) indicates that shareholder-lender mergers lead to a significant decrease of 5.3% (=2.621/49.44) in the mispricing score relative to the 49.44 unconditional sample average. Treated firms' stocks are, on average, 5.3% less overpriced after a shareholder-lender mergers that creates a dual holder. It suggests that the relaxation of short-sale constraints induced by lower shareholder-creditor conflicts ultimately translates into more efficient asset pricing outcomes and less over-priced stocks.

Finally, in column (3) of Table 10 we examine if these outcomes are directly reflected in the firm's actual stock returns. We use the Beta Suite on WRDS to estimate monthly abnormal returns based on the Carhart (1997) model. In this specification, *Post* is equal to one in the month immediately after the merger completion and zero otherwise. The control variables *Log(Market Cap)*, *Price* < $5, *Amihud Illiquidity*, and *Turnover* are computed as the monthly average in the previous month. We also use year-month fixed effects instead of year-quarter fixed effect to capture time-invariant effects. As expected, the treated firms experience 1% lower abnormal return in months following the treatment. This is a substantial economic magnitude given that the sample average monthly abnormal return is 0.22%. Similar to the

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[8]We thank Robert Stambaugh for making the data on mispricing score available.

[9]We lose some observations after matching to the stocks in the sample of Stambaugh et al. (2015). They impose certain restrictions on non-missing values for the anomaly variables and exclude some low-price stocks to avoid market microstructure effects. We end up with 77% of the observations from the original baseline DiD sample. We repeat the DiD analysis on lending supply with this sample and obtain similar results.

mispricing score test, this result supports the hypothesis that the equity lending supply increase induced by a reduction in shareholder-creditor conflicts leads to lower abnormal returns. Overall, this final set of results indicate that agency conflicts induced by capital structure can not only affect limits to arbitrage, but also ultimately have a tangible impact on market efficiency and stock prices.

7 Robustness Checks for Baseline DiD Analysis

In this section, we conduct several robustness checks to address identification concerns over our baseline DiD analysis on equity lending supply. We present the results of these robustness tests in Table 11. Columns (1) and (2) use a more restrictive DiD sample with a 1-to-1 matching to select control firms, instead of the 1-to-3 matching approach in the baseline DiD sample, with all other selection criteria remaining the same. Columns (3) and (4) use a sample excluding mergers that occurred during the 2008-2009 financial crisis period. Lewellen and Lowry (2020) argue that the financial institution mergers occurred during the financial crisis may not satisfy the exclusion condition. The tests indicate that our baseline result are unlikely to be driven by these potential biases.

Some prior literature has argued that bank dual holders may have weaker incentives on the equity side, as they often do not have the direct cash-flow rights because they hold shares through their trust accounts. Jiang et al. (2010) show that while bank dual holders also have some effect on the firm's credit risk, the effect of non-bank dual holders is much stronger. Non-bank dual holders tend to better facilitate incentive alignment between the two parties. In columns (5) and (6), we use mergers in which the surviving institutions are non-commercial bank institutions as the treatment. Despite the significant drop in the number of observations, we still observe a strong treatment effect on equity lending supply.

Another concern over the relevance of the DiD could be related to the status of the loan stakes. DealScan only reports loan stakes each lender gets allocated at loan origination. One could argue that at the time of the shareholder-lender merger, the lender may have already

sold the loan stake in the secondary market, hence, there will be no incentive alignment because the merged institution does not hold any debt. Columns (7) and (8) use a DiD sample with treatment from mergers through loans that are revolver or term loan A. Credit lines and term loan As are unlikely to be sold after origination. Therefore, this sample should not be subject to the concern over sold loan stakes. The result is again consistent with the baseline result.

8 Conclusion

In this paper, we show how agency conflicts between shareholders and creditors affect asset pricing. We examine the role that dual holders — investors that simultaneously hold equity and debt of a firm — have on limits of arbitrage and stock mispricing through their ability to reduce short sales constraints. We argue that the presence of dual holders mitigates the potential for shareholder-creditor conflicts, decreasing shareholders' need to retain their shares to preserve their voting power and increasing their willingness to lend shares to short sellers. The presence of dual holders increases the lending supply of equity shares. This effect is more pronounced for firms with unrated and fewer blockholders. Exploiting plausibly exogenous variation in dual holdings generated by mergers between financial institutions that simultaneously become shareholders and lenders of a firm, we find that the increase in lending supply is likely causal.

Furthermore, we find consistent evidence that the presence of dual holders leads to fewer short sales constraints. Dual holdings improve the amount and the quality of lending supply, facilitating an increase in shorting demand without raising the cost to short. These changes decrease arbitrage risk, and reduces stock overvaluation. The net effect of a change in dual holdings after mergers between financial institutions on stock returns is negative, as the reduction in short sales constraints decreases prices by more than the mitigation of shareholder-creditor conflicts increases them. Overall, our results suggest that shareholder-creditor con-

flicts not only can distort corporate policies, but also affect short-sale constraints, market efficiency, and stock prices.

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9   Figures

Figure 1. Shareholder-Lender Merger Distribution.
This figure shows the distribution of shareholder-lender mergers used as treatments in the difference-in-difference analysis over the period of 2007 to 2012.
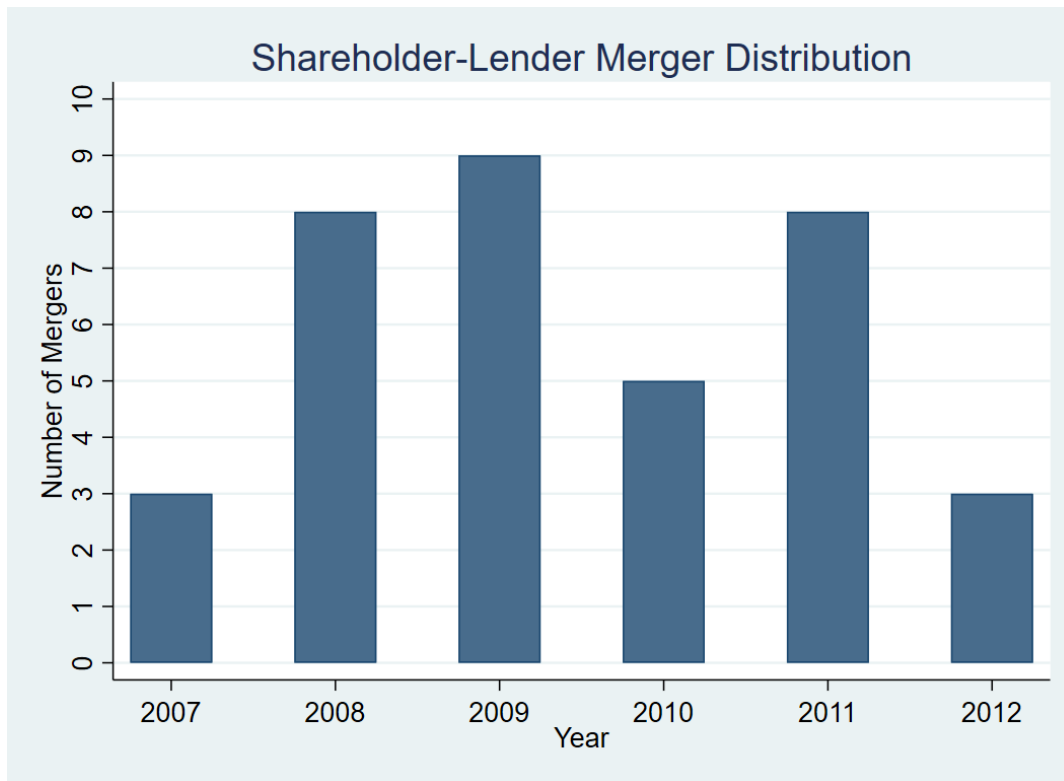
Figure 2. Dynamic Effects of Shareholder-Lender Mergers on Equity Lending Supply.
This figure plots the coefficients of Table 6 based on Equation (3). It shows the dynamic treatment effect of shareholder-lender mergers seven quarters before the merger announcement and eight quarters after the merger completion. The quarters between merger announcement and completion, including the announcement and completion quarters, are discarded in the analysis for each shareholder-lender merger.

Dynamic Treatment Effect on Equity Lending Supply
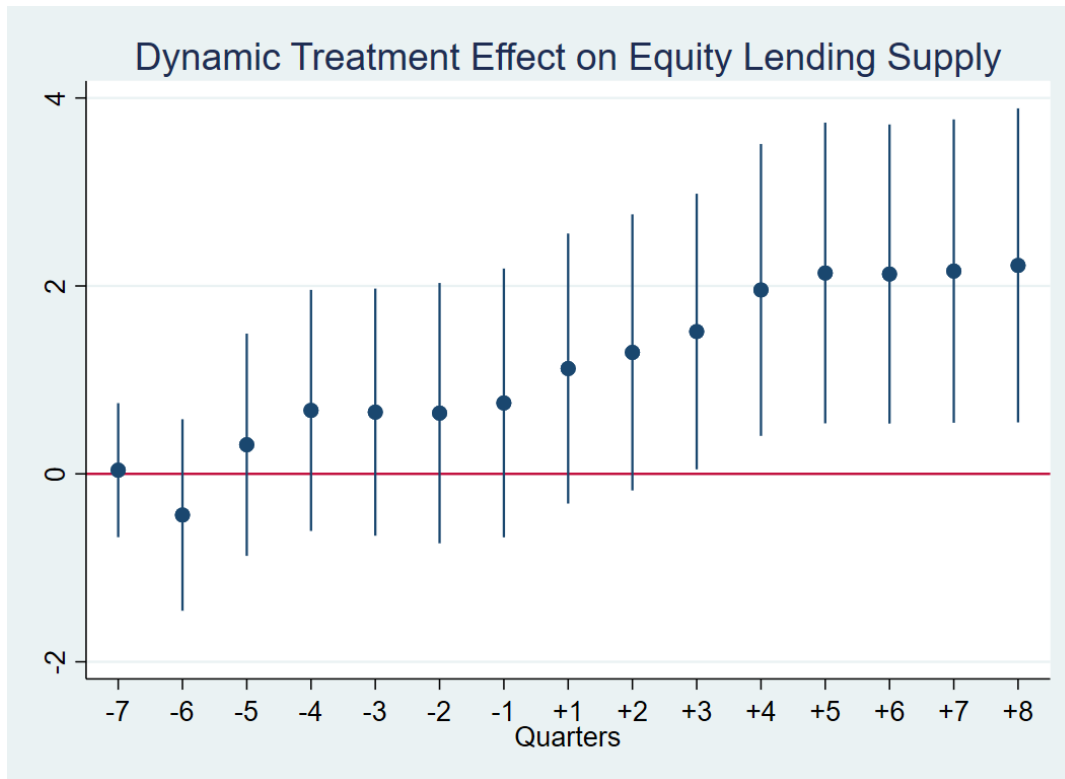
10 Tables

Table 1. Summary Statistics.
This table provides summary statistics of the variables used in the analyses. Detailed variable definitions are in Appendix A.1

Variable	N	Mean	SD	Min	25th	Median	75th	Max
Equity Lending Variables:								
Lending Supply (%)	111,386	17.65	12.53	0.00	5.77	17.65	27.68	45.70
Shorting Demand (%)	111,386	4.13	5.38	0.00	0.39	2.05	5.65	26.37
Ownership Variables:								
Dualholder	111,546	0.27	0.44	0.00	0.00	0.00	1.00	1.00
Number of Dualholders	111,546	0.82	1.69	0.00	0.00	0.00	1.00	8.00
Equity in Dualholding	111,546	0.04	0.11	0.00	0.00	0.00	0.02	0.39
Institutional Ownership	111,546	0.54	0.32	0.00	0.24	0.58	0.83	1.00
Ownership HHI	111,546	0.15	0.19	0.02	0.04	0.07	0.18	0.99
Firm Control Variables:								
Log(Market Cap)	111,335	19.91	1.97	13.75	18.50	19.83	21.22	27.12
Price<$5	111,546	0.21	0.41	0.00	0.00	0.00	0.00	1.00
Amihud Illiquidity	111,311	2.46	11.23	0.00	0.00	0.01	0.13	88.88
Turnover	111,336	0.84	0.86	0.02	0.24	0.60	1.10	4.81
Prior Stock Return	111,311	0.01	0.25	-0.60	-0.13	0.00	0.13	0.99
Market-to-Book	111,189	1.47	1.51	0.10	0.64	1.03	1.70	9.52
Leverage	111,275	0.21	0.22	0.00	0.02	0.15	0.33	0.94
Number of Analysts	111,546	6.40	6.81	0.00	1.00	4.00	10.00	30.00

Table 2. Dual Holder Presence and Equity Lending Supply.

This table estimates how dual holders affect equity lending supply. All control variables are lagged one quarter. Detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at the firm and year-quarter level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

| | Equity Lending Supply (%) | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)
Dualholder		10.08***	1.252***	0.689***		
		(28.70)	(4.792)	(5.000)		
Log (1 + Number of Dualholders)					0.939***	
					(6.964)	
Log (1 + Equity in Dualholding)						4.301***
						(4.969)
Institutional Ownership	24.06***		23.74***	9.136***	9.118***	9.125***
	(14.26)		(14.23)	(7.827)	(7.856)	(7.857)
Log (Market Cap)	0.072		-0.025	1.276***	1.252***	1.272***
	(0.780)		(-0.262)	(12.28)	(12.11)	(12.17)
Price<$5	-1.415***		-1.451***	-0.510***	-0.520***	-0.511***
	(-6.091)		(-6.253)	(-3.391)	(-3.449)	(-3.376)
Amihud Illiquidity	-0.034***		-0.037***	0.001	0.001	0.002
	(-5.779)		(-6.425)	(0.436)	(0.414)	(0.460)
Turnover	1.190***		1.203***	0.624***	0.617***	0.615***
	(7.128)		(7.218)	(6.501)	(6.492)	(6.509)
Market-to-Book	-0.423***		-0.387***	-0.131**	-0.124**	-0.131**
	(-4.727)		(-4.141)	(-2.450)	(-2.342)	(-2.475)
Leverage	-2.752***		-2.968***	-0.646	-0.670	-0.646
	(-7.174)		(-7.585)	(-1.638)	(-1.704)	(-1.641)
Analyst Coverage	1.725***		1.717***	1.324***	1.317***	1.332***
	(6.633)		(6.544)	(12.04)	(11.96)	(12.13)
Prior Stock Return	0.423		0.398	-0.118	-0.116	-0.118
	(1.098)		(1.041)	(-0.923)	(-0.904)	(-0.924)
N	110,217	110,618	110,217	110,700	110,700	110,700
Industry FE	Yes	Yes	Yes	No	No	No
Firm FE	No	No	No	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.716	0.300	0.717	0.918	0.918	0.918

Table 3. Dual Holdings and Equity Lending - Creditor Bargaining Power and Shareholder Control Incentive.

This table estimates how equity lending supply is affected by dual holders and measures of creditor bargaining power. *Unrated* is an indicator variable that equals one if the firm did not have an S&P credit rating in the prior fiscal quarter, zero otherwise. A firm is considered bank dependent if it is unrated and thus subject to more continuous creditor monitoring. *# of Block Owners* indicates the number of shareholders in the firm with at least 5% of its outstanding shares. A stronger block owner presence in the firm indicates more shareholders with incentives to remain in control over management, absent incentive alignment fostered by dual holders. *# of Block Dualholders* indicates the number of dual holders in the firm with at least 5%, instead of just 1%, of its outstanding shares. Both variable are scaled such that their average is equal to zero. The same list of control variables from Table 2 are included. All control variables are lagged one quarter. Detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at the firm and year-quarter level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Lending Supply (%)		
	(1)	(2)	(3)
Dualholder	0.171	0.407***	
	(0.688)	(3.171)	
Dualholder×Unrated	**0.693****		
	(2.559)		
Unrated	-0.421		
	(-1.559)		
Dualholder×Log (1 + # of Block Owners)		**0.991****	
		(5.217)	
Log (1 + # of Block Owners)		-0.812***	-0.523***
		(-6.189)	(-4.604)
Log (1 + # of Block Dualholders)×Log(1 + # of Block Owners)			**1.072****
			(5.189)
Log (1 + # of Block Dualholders)			0.715***
			(4.335)
N	110,700	110,700	110,700
Control	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
Adj. R-squared	0.918	0.918	0.918

Table 4. Pre-Treatment Comparison of Key Characteristics Between Treatment and Control Firms.

This table presents the comparison of key firm characteristics between treatment and control firms in the quarter prior to the treatment. Detailed variable definitions are in Appendix A.1.

Variables	Treatment	Control	Difference	P-Value
Log(Market Cap)	21.54	21.50	0.04	0.827
Log(Total Assets)	8.22	8.22	0.01	0.966
Turnover	1.28	1.29	-0.01	0.917
Amihud	0.04	0.06	-0.02	0.362
Price<$5	0.07	0.08	0.00	0.916
Market-to-Book	1.12	1.14	-0.02	0.788
Leverage	0.32	0.32	0.00	0.911
Analyst Coverage	2.21	2.21	-0.01	0.947
Stock Return (Prior Quarter)	0.006	0.004	0.002	0.907
Stock Return Volatility	0.032	0.033	-0.001	0.743
Institutional Ownership	0.75	0.77	-0.02	0.514
Top 5 Ownership	0.02	0.02	0.00	0.868
Ownership HHI	0.07	0.08	-0.01	0.294
Number of Blockholders	2.37	2.61	-0.24	0.172
Equity Lending Supply (%)	25.12	26.64	-1.52	0.184

Table 5. Difference-in-Difference Estimation Using Mergers of Financial Institutions.

This table presents the difference-in-difference (DiD) regression using Equation (2). A firm is defined as being part of the treatment group if one of its shareholders, with at least 1% of its equity, merges with one of its syndicated loan lenders, and it does not have any dual holder in the quarter prior to the merger announcement. *Treat* is an indicator variable that equals one if the firm has at least one dual holder in the prior fiscal quarter end, zero otherwise. *Post* is an indicator variable that equals one for the eight quarters after the merger completion quarter, zero otherwise. For each treated firm, up to three control firms are selected based on matching in the same quintiles of firm market value, market-to-book, institutional ownership, and leverage. We also require that the control firms to have never been affected by any shareholder-lender merger and have at least one loan outstanding at the time of the event. All control variables are lagged one quarter. Detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. The Post variable is subsumed by the within-merger year-quarter fixed effect. Standard errors are clustered at the firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Equity Lending Supply (%)	
	(1)	(2)
Treat×Post	1.441***	1.628***
	(2.964)	(3.646)
Institutional Ownership		5.658***
		(6.280)
Log (Market Cap)		0.383
		(0.984)
Price<$5		-2.406***
		(-4.130)
Amihud Illiquidity		0.015
		(0.022)
Turnover		0.372**
		(2.043)
Market-to-Book		-0.532
		(-1.520)
Leverage		1.625
		(0.915)
Analyst Coverage		1.618***
		(4.106)
Prior Stock Return		0.377
		(1.515)
N	7,538	7,530
Firm×Merger FE	Yes	Yes
Year-Quarter FE	Yes	Yes
Adj. R-squared	0.871	0.882

Table 6. Dynamic Treatment Effect on Equity Lending Supply.

This table presents the dynamic difference-in-difference (DiD) of lending supply using Equation (1). *Treat* is an indicator variable that equals one if the firm has at least one dual holder in the prior fiscal quarter end, zero otherwise. The same list of controls from Table 5 are included. All control variables are lagged one quarter. Detailed variable definitions are in Appendix A.1. All non-log control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at the firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Equity Lending Supply (%)	
	(1)	(2)
Treat×T-7	0.040	0.064
	(0.108)	(0.181)
Treat×T-6	-0.450	-0.416
	(-0.867)	(-0.832)
Treat×T-5	0.257	0.216
	(0.428)	(0.378)
Treat×T-4	0.658	0.545
	(1.006)	(0.884)
Treat×T-3	0.660	0.598
	(0.985)	(0.946)
Treat×T-2	0.641	0.617
	(0.900)	(0.922)
Treat×T-1	0.745	0.858
	(1.022)	(1.294)
Treat×T+1	1.102	1.235*
	(1.508)	(1.902)
Treat×T+2	1.231*	1.436**
	(1.649)	(2.168)
Treat×T+3	1.503**	1.641**
	(2.013)	(2.510)
Treat×T+4	1.948**	2.029***
	(2.468)	(2.918)
Treat×T+5	2.122***	2.181***
	(2.605)	(3.014)
Treat×T+6	2.111***	2.235***
	(2.604)	(3.087)
Treat×T+7	2.147***	2.353***
	(2.617)	(3.096)
Treat×T+8	2.169**	2.507***
	(2.547)	(3.207)
Controls	No	Yes
N	7,538	7,530
Firm×Merger FE	Yes	Yes
Year-Quarter FE	Yes	Yes
Adj. R-squared	0.871	0.882

Table 7. Difference-in-Difference Result on Lending Supply Quality.

This table presents the difference-in-difference (DiD) regression of lending fee, lendable supply utilization, and share loan tenure. Fee is the 30-day value weighted lending fee reported by Markit at each fiscal quarter end. Utilization is the quarterly average of daily percentage of lendable supply utilized. Share loan tenure is the quarterly average number of days that equity loans have been open. All firm control variables are lagged one quarter. Detailed variable definitions are in Appendix A.1. Fee is winsorized at the 5% and 95% levels, while utilization and loan tenure are winsorized at the 1% and 99% levels. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Fee	Utilization	Share Loan Tenure
	(1)	(2)	(3)
Treat×Post	**1.951**	**2.226***	**14.91***
	(0.726)	**(1.679)**	**(2.821)**
Institutional Ownership	-3.594	9.454***	19.58***
	(-0.796)	(3.809)	(2.712)
Log (Market Cap)	0.923	-1.090	-3.987
	(0.365)	(-0.900)	(-1.005)
Price<$5	14.26***	3.263	-1.940
	(2.986)	(1.542)	(-0.176)
Amihud Illiquidity	6.683	-2.155	26.17
	(0.933)	(-1.230)	(1.588)
Turnover	6.014***	6.901***	-10.95***
	(4.181)	(11.37)	(-5.467)
Market-to-Book	-4.376**	-2.399**	-8.871**
	(-2.119)	(-2.308)	(-2.561)
Leverage	22.12***	19.21***	17.67
	(2.851)	(4.206)	(1.144)
Analyst Coverage	0.656	0.761	-8.474*
	(0.346)	(0.830)	(-1.763)
Prior Stock Return	-7.461***	-2.616***	-0.901
	(-3.373)	(-3.028)	(-0.273)
N	7,384	7,479	3,679
Firm×Merger FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
Adj. R-squared	0.568	0.677	0.612

Table 8. Dual Holdings and Equity Lending - Equity Lending Supply Around Voting Events.

This table presents estimates of lending supply for a (-30, +30) day window around each voting event's record date. *RDATE* is an indicator variable that equals one if the observation is on the voting record date, zero otherwise. *Fee* is contemporaneous, while all other control variables are lagged one quarter. *Short-Term Momentum* and *Long-Term Momentum* are defined as the cumulative returns in the previous 5 and 252 days period, respectively. Other detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at the firm level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Lending Supply (%)	
	(1)	(2)
RDATE	**-1.631*****	**-1.737*****
	(-44.18)	**(-37.50)**
RDATE×Dualholder		**0.277*****
		(3.833)
Dualholder		0.315
		(0.982)
Fee	-0.001**	-0.001**
	(-2.573)	(-2.554)
Institutional Ownership	22.08***	22.05***
	(25.75)	(25.76)
Institutional Ownership Concentration	-25.52***	-25.48***
	(-9.904)	(-9.884)
Index Fund Ownership	7.032***	7.014***
	(4.589)	(4.585)
Log (Market Cap)	1.010***	1.009***
	(4.755)	(4.751)
Book-to-Market	0.264*	0.267*
	(1.701)	(1.719)
Turnover	0.075**	0.075**
	(2.459)	(2.447)
Spread	-0.114***	-0.113***
	(-2.850)	(-2.837)
Price<$5	0.566***	0.557***
	(2.720)	(2.682)
Governance Index	2.261	2.244
	(1.168)	(1.159)
Short Term Momentum	-0.020***	-0.020***
	(-13.13)	(-13.15)
Long Term Momentum	0.004**	0.004**
	(2.190)	(2.181)
N	438,712	438,712
Firm FE	Yes	Yes
Year FE	Yes	Yes
Adj. R-squared	0.907	0.907

Table 9. Difference-in-Difference Result on Equity Lending Supply Around Voting Events.
This table presents estimates of lending supply for a (-30, +30) day window around each voting event's record date. in a difference-in-difference-difference (DDD) setting. *RDATE* is an indicator variable that equals one if the observation is on the voting record date. *Treat* is an indicator variable that equals one if the firm has at least one dual holder in the prior fiscal quarter end, zero otherwise. *Post* is an indicator variable that equals one if the record date takes place within eight quarters after the merger completion quarter, zero otherwise. We regress equity lending supply on *RDATE* for a (-30, +30) day window around each voting event, interacting *RDATE* with the *Treat* and *Post* variables. Control variables are lagged by one quarter, being the same ones used by Aggarwal et al. (2015) and in Appendix 8. Standard errors are clustered at firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Equity Lending Supply (%)
Treat×Post	2.158***
	(4.383)
RDATE	-1.107***
	(-9.414)
Treat×RDATE	-0.141
	(-0.504)
Treat×Post×RDATE	**0.510***
	(1.749)
Controls	Yes
N	79,562
Firm×Merger FE	Yes
Year FE	Yes
Adj. R-squared	0.823

Table 10. Difference-in-Difference Result on Arbitrage Risk, Overpricing, and Abnormal Return.

This table presents the difference-in-difference (DiD) regression of arbitrage risk, overpricing, and monthly abnormal return. Arbitrage risk is idiosynrcatic volatility rank-transformed for each calendar quarter and converted into a score from zero to one. Mispricing score is from Stambaugh et al. (2015), computed with a range of 0 to 100 on a monthly basis using the firm's stock's rankings on 11 anomaly variables. Stocks with the highest values of the mispricing score are the most overpriced whereas those with the lowest values are the most underpriced. The monthly values are averaged at the quarter level. Monthly abnormal returns are calculated with the WRDS Beta Suite using the Fama-French 3 factors plus momentum model. In the regression of monthly abnormal return, we retain T0 of the treatment, i.e. the merger announcement and completion quarters, as well as any quarter in between, if any. All firm control variables are lagged one quarter. In the regression of monthly abnormal return, Log(Market Cap), Price<$5, Amihud Illiquidity, and Turnover are at the monthly average level from the previous month. Column (3) uses within merger calendar-month fixed effect instead of year-quarter fixed effect. Detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Arbitrage Risk	Mispricing Score	Monthly Ab. Return
	(1)	(2)	(3)
Treat×Post	**-0.030****	**-2.621****	**-0.010****
	(-2.124)	**(-2.576)**	**(-2.302)**
Institutional Ownership	-0.047*	-0.393	0.017**
	(-1.887)	(-0.251)	(2.069)
Log (Market Cap)	-0.139***	-0.089	-0.066***
	(-11.06)	(-0.097)	(-13.96)
Price<$5	0.057***	2.363**	-0.001
	(2.760)	(2.062)	(-0.093)
Amihud Illiquidity	0.027	7.551	-0.001
	(1.086)	(0.481)	(-1.018)
Turnover	0.059***	1.245***	-0.024**
	(10.22)	(3.298)	(-2.482)
Market-to-Book	0.067***	-3.691***	-0.002
	(7.381)	(-5.747)	(-0.403)
Leverage	-0.012	20.54***	-0.039**
	(-0.250)	(5.935)	(-2.267)
Analyst Coverage	-0.003	3.036***	-0.010**
	(-0.280)	(3.820)	(-2.513)
Prior Stock Return	-0.068***	-6.388***	-0.013*
	(-6.469)	(-11.53)	(-1.759)
N	7,479	5,774	22,547
Firm×Merger FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	No
Calendar-Month FE	No	No	Yes
Adj. R-squared	0.662	0.646	0.052

Table 11. Robustness Checks for Baseline DiD Analysis.

This table presents the robustness checks for the baseline difference-in-difference (DiD) regression of equity lending supply. Columns (1) and (2) use a DiD sample selecting control firms with 1-to-1 cohort matching instead of 1-to-3 in the baseline sample, with all other standards remaining the same. Columns (3) and (4) use a sample excluding treatments from shareholder-lender mergers that occurred during 2008 to 2009, a crisis period that some have argued could lead to confounding factors such as crisis-related responses Lewellen and Lowry (2020). Columns (5) and (6) use a sample involving treatments from only mergers conducted by non-bank institutions, as some have argued that bank dual holders' incentives on the equity side may not be as strong since they often do not have the direct cash flow rights Jiang et al. (2010). Columns (7) and (8) use a sample of treatments from mergers through credit lines (revolver loans) or term loan A, which are unlikely to be sold in the secondary market. All firm control variables are lagged one quarter. Detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Equity Lending Supply (%)							
	1-to-1 Matching for Control Firms		Exclude 2008-2009 Mergers		NonBank Merger Treatment		Merger via Revolver/Term Loan A	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	1.655***	1.738***	2.746**	2.552**	2.232**	2.270**	1.479***	1.889***
	(2.677)	(3.056)	(2.324)	(2.260)	(2.344)	(2.407)	(2.870)	(4.038)
Institutional Ownership		5.200***		1.730		1.536		6.253***
		(4.682)		(1.086)		(1.206)		(6.821)
Log (Market Cap)		1.164**		0.626		2.180**		0.537
		(2.222)		(0.603)		(2.293)		(1.425)
Dummy_P<$5		-1.496**		-2.132		-3.673***		-1.419**
		(-2.183)		(-1.527)		(-2.746)		(-2.541)
Amihud Illiquidity		-1.048		-28.06		19.92**		-0.350
		(-0.646)		(-1.225)		(2.103)		(-0.581)
Turnover		0.511***		0.022		0.219		0.406**
		(2.732)		(0.071)		(0.723)		(2.223)
Market-to-Book		-0.449		-1.671		-1.380**		-0.474
		(-1.043)		(-1.479)		(-2.589)		(-1.382)
Leverage		2.222		-1.040		0.522		-0.482
		(0.926)		(-0.212)		(0.148)		(-0.287)
Analyst Coverage		1.704***		2.556***		0.341		1.407***
		(3.087)		(3.496)		(0.366)		(3.578)
Prior Stock Return		0.043		1.185*		-0.041		0.404
		(0.151)		(1.834)		(-0.077)		(1.479)
N	4,006	4,003	1,615	1,612	1,636	1,633	6,419	6,412
Firm×Merger FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.866	0.882	0.891	0.898	0.873	0.883	0.884	0.894

A Appendix

Table A.1. Variable Definitions.

Variables	Description
Lending Supply	The quarterly average percentage of the firm's daily market capitalization available for lending, as reported by Markit.
Shares on Loan	The quarterly average value on loan as of the firm's market capitalization, as reported by Markit.
Dualholder	Indicator variable that equals one if the firm has at least one dual holder in the prior fiscal quarter end.
Price<$5	Indicator variable that equals one if the firm's quarterly average stock price is lower than $5.
Amihud Illiquidity	The average absolute return over dollar volume within a quarter.
Turnover	The average daily stock turnover within a quarter (x100).
Log (Market Cap)	The logarithm of the firm's quarterly average market capitalization.
Leverage	The sum of debt in current liabilities and long term debt divided by total assets.
Market-to-Book	The sum of debt in current liabilities, long term debts, preferred stocks, deferred taxes, and market value, divided by total assets.
Analyst Coverage	The logarithm of one plus the number of analysts covering the firm's stock.
Cash	Cash and marketable securities divided by total assets.
Prior Stock Return	The cumulative daily return of the firm's stock within the fiscal quarter.
Institutional Ownership	Percentage of shares outstanding held by institutional investors.
RDATE	Indicator variable that equals one if the observation occurs on the day in which a voting event happens.
Arbitrage Risk	Mean squared error of residuals (RMSEs) from Carhart (1997) four-factor model using daily stock returns within a quarter. It is rank-transformed for each calendar quarter and converted into a score from 0 to 1.
Mispricing Score	Mispricing measure developed by Stambaugh et al. (2015) based on 11 anomaly variables. Stocks with the highest value are the most overpriced, vice versa.

Table A.2. Other Ownership Changes Following DiD Treatment.

This table presents the difference-in-difference (DiD) regression of other ownership structure. The dependent variable is total institutional ownership (%) in columns (1) and (2), institutional ownership HHI in columns (3) and (4), ownership by the top 5 largest institutional shareholders in columns (5) and (6), and ownership held by blockholders in columns (7) and (8). The list of control variables in the baseline DiD regression from Table 5 are included. Detailed variable definitions are in Appendix A.1. All non-log continuous control variables are winsorized at the 1% and 99% levels. Standard errors are clustered at the firm×merger level. T-statistics are displayed in parentheses. ***, **, and * indicate p-values of 1%, 5%, and 10%, respectively.

	Institutional Ownership		Ownership HHI		Top 5 Ownership		Block Ownership	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	-0.017	-0.006	0.008	0.005	-0.001	-0.001	-0.001	-0.000
	(-0.798)	(-0.920)	(1.091)	(0.853)	(-0.424)	(-0.592)	(-0.324)	(-0.333)
N	7,512	7,504	7,512	7,504	7,512	7,504	7,512	7,504
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm×Merger FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.753	0.908	0.789	0.839	0.692	0.785	0.664	0.738