STRATEGIC BORROWING FROM PASSIVE INVESTORS

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Abstract

We find that short-sellers manage risks by strategically borrowing shares in stocks with significant ownership by passive investors. This practice increases securities lending demand for stocks with substantial passive ownership, resulting in improved price efficiency, higher lending fees, and increased short interest in these stocks. Consistent with the risk mitigation motive, these stocks show reduced risks of unexpected fee hikes and loan recall, longer loan durations, and attract more informed short-sellers. These effects are particularly pronounced in hard-to-borrow stocks where short-sale constraints are binding. Our study suggests that passive investing helps alleviate short-sale constraints by reducing the risks associated with stock borrowing.

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1. Introduction

In recent decades, there has been a substantial rise in assets managed by passive investors, including index mutual funds and ETFs. For instance, passive management accounted for 15% of total assets in U.S. mutual funds in 2007, which significantly increased to 43% by the end of 2021.[1] This shift towards passive management has been particularly pronounced in the U.S. equity markets, where over 53% of mutual fund assets were managed passively in 2021.[2] Given this significant trend in the asset management industry, a fundamental question arises: what is the impact of the rise of passive investing on asset prices?

While the existing literature does not provide a unanimous consensus on the effects of passive investing, the prevailing viewpoint suggests that it primarily introduces price inefficiencies. Theoretical studies indicate that passive investing diminishes the inclusion of asset-specific information in prices (Bond and Garcia, 2022; Garleanu and Pedersen, 2022; Baruch and Zhang, 2018), reduces the efforts exerted by active managers (Brown and Davies, 2017), and leads to increased return volatility (Basak and Pavlova, 2013), and comovement (Barberis, Shleifer, and Wurgler, 2005). Empirical evidence supports some of these concerns, showing that passive investing amplifies stock return volatility and comovement while reducing information acquisition efforts.[3]

The primary contribution of this paper is to propose and examine a novel channel through which the rise of passive investing can enhance price efficiency. We call it the "strategic borrowing channel." The strategic borrowing channel posits that short sellers prefer borrowing from passive investors for two primary reasons. First, passive investors typically maintain long-term positions, reducing the likelihood of share recalls or increases in loan fees. Second, passive investors are less inclined to trade against short sellers for informational reasons. As a result, short interest is higher, and prices are more efficient.

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[1] See the 2018 and 2022 Investment Company Fact Books available at www.icifactbook.org.

[2] One of the potential reasons for this shift is that investors in index funds pay significantly smaller fees, and many active mutual funds do not generate significantly higher net-of-fee returns for their investors than comparable passive funds (Jensen, 1968; Carhart, 1997; Sharpe, 1991, French, 2008; Fama and French, 2010; Lewellen, 2011).

[3] See Israeli, Lee and Sridharan (2017), Ben-David, Franzoni and Moussawi (2018), Coles, Heath and Ringgenberg (2022), Glosten, Nallareddy and Zou (2020), and Sammon (2022).

More specifically, the adoption of an index-replicating strategy with limited discretion over asset allocation positions passive investors as "safer" stock lenders for several reasons. First, they are less likely to impose unexpected lending limitations or recall their shares (D'Avolio, 2002), thereby reducing the risks associated with fee variation and share recalls (Engelberg, Reed, and Ringgenberg, 2018). Second, passive investors are unlikely to exploit the information gained from security lending and replicate short-selling strategies (Honkanen, 2021; Greppmair et al., 2023). This effect diminishes the "information leakage" risk faced by short-sellers when borrowing from active investors. The reduction in these dynamic risks drives up the demand for stocks with high passive ownership, thereby increasing short-selling activity and bolstering price efficiency. The strategic borrowing channel complements the traditional lending supply channel by showcasing an upsurge in demand by short-sellers when passive investors expand their lending supply.[4]

We investigate this new channel by examining the effects of ownership by different institutions on stock prices and lending outcomes. Our empirical tests utilize a large and comprehensive dataset encompassing all U.S. stocks, which is detailed in Section 3. In Section 4, we present our methodology, which incorporates two key features. The first feature involves a simultaneous comparison of three types of investors: passive mutual funds, active mutual funds, and non-mutual funds.[5] This approach enables a direct comparison within the same econometric framework, ensuring an "apples-to-apples" evaluation of institutions. The second feature entails comparing the effects between hard-to-borrow or "special" stocks and easy-to-borrow or "general collateral" (GC) stocks, since lending market conditions generate more pronounced effects on lending fees and prices for special stocks (Blocher, Reed, and Van Wesep, 2013).

Section 5 delves into examining the impact of passive ownership on stock price efficiency. The underlying theory suggests that short-sale constraints can influence stock prices in various ways. Firstly, short-sale constraints can impede the speed of adjustment to negative information without biasing prices (Diamond and Verrecchia (1987)).[6] Building upon the research of Bris,

[4] See Nagel (2005), Asquith, Pathak, and Ritter (2005) and Prado, Saffi, and Sturgess (2016) for the evidence on the effects of lending supply.

[5] We refer to passive mutual fund ownership as the combined ownership of index mutual funds and index ETFs. A similar classification is used for active ownership. Non-mutual fund institutional ownership is defined as the cumulative ownership of other institutional investors such as pension funds, banks, insurance companies, and endowments.

[6] Diamond and Verecchia (1987) assume complete arbitrage by rational investors who take into account the effect of short-sale constraints on stock prices when forming their expectations.

Goetzmann, and Zhu (2007) and Saffi and Sigurdson (2011), we employ differences in the conditional cross-autocorrelations of stock returns with lagged market returns as a measure of the speed of adjustment to news. Secondly, Xu's (2007) model predicts that when investors disagree on information precision, short-sale constraints can increase return skewness. Consequently, we directly examine the effects on skewness, as in Xu (2007) and Chang, Cheng, and Yu (2007). Thirdly, in the presence of divergent beliefs, short-sale constraints may introduce an upward bias in prices and diminish subsequent returns (Miller, 1977; Chen, Hong, and Stein, 2002). To capture the extent of overvaluation, we adopt Nagel's (2005) approach and utilize the value premium.

Our findings reveal that heightened passive ownership is linked to improved price efficiency across all measures. In contrast, active and non-mutual fund ownership show no significant correlation with price efficiency. As predicted, these results are particularly evident in special stocks. Importantly, the unique impacts of passive ownership cannot be solely attributed to fluctuations in lending supply. The lending supply channel suggests that an increase in ownership by any institutional investor can alleviate short-sale constraints, as all investors lend shares. Therefore, solely based on this channel, we would anticipate a positive correlation between any type of institutional ownership and price efficiency.[7]

In Section 6, we conduct a direct comparison of the effects of institutional ownership on security lending outcomes to further differentiate between demand and supply effects. Overall, our findings reveal that all institutional investors engage in lending special stocks, with only modest economic differences in their relative contributions to lending supply. Among general collateral stocks, the effects of ownership by different institutional investors also exhibit similarities. These results corroborate our conclusions from the price efficiency tests, confirming that the variation in lending supply across institutional investors alone cannot fully account for the observed effects on stock prices.

To identify changes in demand, we examine lending fees and short interest. In these tests, we draw upon the insights of Cohen, Diether, and Malloy (2007), who distinguish between supply and demand shocks by observing the joint variation in equilibrium price (lending fees) and quantity

[7] If passive investors lend more shares than active investors, then the active ownership is still expected to improve price efficiency, while having a smaller economic effect.

(short interest). If increased passive ownership is associated with both higher fees and short interest, it indicates an increase in shorting demand.

Consistent with this rationale, our analysis demonstrates that increased passive ownership is linked to higher lending fees for special stocks, while ownership by other types of institutional investors is associated with lower lending fees. Additionally, we find that passive institutional ownership has almost twice the effect on short interest compared to non-passive institutional ownership. These results suggest that increased passive ownership is connected to a substantial surge in lending demand, thereby helping to explain the evidence of improved price efficiency. Furthermore, we observe no impact of institutional ownership on lending fees for general collateral stocks, which suggests that these stocks experience low demand and high supply.

Section 7 delves into an examination of why stocks with higher passive ownership experience high demand. We specifically evaluate two key types of benefits for short-sellers: 1) reduced risks associated with loan recalls and variation in lending fees; and 2) diminished risks of information leakage, whereby lenders can gain insights from short-sellers' demand and mimic their trades.

Drawing upon the approach by Engelberg, Reed, and Ringgenberg (2018), we initially investigate the relationship between passive ownership, variation in lending fees (referred to as "fee risk"), and variation in loan utilization. Given that high variation in utilization is associated with an increased likelihood of being unable to re-establish a security loan, we term it "recall risk".[8] In line with our hypothesis, we find that an increase in passive ownership is associated with reduced fee and recall risks. Moreover, higher passive ownership exhibits a correlation with longer stock loan durations, suggesting that the mitigation of dynamic risks enables short-sellers to maintain their positions for extended periods. On the other hand, ownership by other institutional investors exerts no effect on short-selling risks or loan duration, consistent with our earlier findings on lending outcomes and price efficiency.

[8] These dynamic short-selling risks emerge in various theoretical models. For instance, in Duffie, Garleanu, and Pedersen (2002), both fees and share availability fluctuate over time in tandem with investor beliefs. D'Avolio and Perold (2003) directly demonstrate that short-sellers are more inclined to trade when the probability of future share availability is high.

Regarding the risk of information leakage, the strategic borrowing channel suggests that short-sellers possessing particularly valuable private information may prefer to borrow stocks with high passive ownership. This choice stems from the desire of short-sellers to prevent the disclosure of their private information to lenders, such as active funds, who incorporate this information into their trading strategies (Honkanen, 2021; Greppmair et al., 2023). To test this implication, we exploit the well-established predictability of short interest for future returns, focusing on stocks with varying levels of passive ownership.[9] Our findings reveal that passive ownership significantly enhances the predictive power of short interest, aligning with the notion that shorts in stocks with high passive ownership are more informed. For example, for stocks with low passive ownership, a one-standard deviation increase in short interest corresponds to a future stock return of -4.92% over a 360-day period. In contrast, for stocks with high passive ownership, the negative future return nearly doubles to -7.93%.

To ensure the robustness of our findings, we incorporate stock and quarter fixed effects, as well as time-varying control variables, in all our specifications. This approach enables us to estimate the effects of institutional ownership by utilizing within-stock variation and effectively controlling for all time-invariant unobservable factors. We deliberately avoid methodologies that rely on the reconstitution of Russell indices to estimate the effect of passive ownership. These methodologies have limitations in terms of comparing investor categories (passive, active, and non-mutual fund) and are based on small samples of selected mid-cap stocks. Moreover, these samples lack the necessary representation of specials, which makes it challenging to meaningfully compare special and GC stocks. Such a comparison is crucial for our study, since short-sales constraints are binding among specials.[10]

While our approach does not share these limitations, we acknowledge that our estimates may still be subject to bias stemming from unobserved time-varying confounding factors. To address this concern, in Section 8, we assess the sensitivity of our results to unobserved

[9] See, for example, Figlewski (1981), Hemang et al. (2002), Jones and Lamont (2002), Geczy, Musto and Reed (2002), Ofek, Richardson and Whitelaw (2004), Cohen, Diether and Malloy (2007), Diether, Lee and Werner (2009), Boehmer, Huszar and Jordan (2010), Engelberg, Reed and Ringgenberg (2012, 2018) and Muravyev, Pearson and Pollet (2022).

[10] The methodologies based on the reconstitution of the Russell indices have also been subject to growing controversies and criticisms. See, for example, Wei and Young (2022), Appel, Gormley and Keim (2022), Glossner (2022), and Heath et al. (2023).

confounders. We employ an innovative methodology based on Oster (2019) to mitigate the potential impact of these confounders. Across all outcomes, we find that the omitted variable bias, if it exists, is not significant enough to cause our estimates to change sign or substantially diminish in magnitude.

In our concluding remarks in Section 9, we assert that the recent shift towards passive investing has the potential to facilitate short-selling and contribute to improved price efficiency. This is achieved not only by increasing lending supply but also by mitigating the distinct dynamic risks faced by short-selling arbitrageurs. However, it is important to note a caveat. While our findings demonstrate improvements in measures of price efficiency associated with short-selling, they do not imply a positive net effect on information production. It is possible that index funds, for example, may have weaker incentives to engage in information production and monitoring, potentially leading to a decline in overall information production (Israeli, Lee, and Sridharan, 2017; Iliev, Kalodimos, and Lowry, 2021; Heath et al., 2022; Sammon, 2022). Thus, our contribution is more modest, focusing on a specific aspect of information production by short-sellers. We demonstrate that passive investing, by facilitating short-selling demand, complements the efforts of arbitrageurs and increases the amount of information incorporated in stock prices.

2. Relevant Literature

Our study focuses on the implications of the recent rise in passive investing for short-selling, with a particular emphasis on the novel effects of strategic borrowing. We generate new evidence on the demand-driven effects, aligning with the significance of shifts in lending demand for security prices (Cohen, Dietner, and Malloy, 2007; Blocher, Reed, and Van Wesep, 2013) and lending fees (Kolasinski, Reed, and Ringgenberg, 2013). In doing so, we complement existing research on institutional ownership's impact on security lending supply (Prado, Saffi, and Sturgess, 2016; Evans, Ferreira, and Prado, 2017), lending fees (D'Avolio, 2002), stock prices influenced by short-sale constraints (Nagel, 2005; Asquith, Pathak, and Ritter, 2005; Coles, Heath, and Ringgenberg, 2022), the relationship between lending supply and stock prices (Saffi and Sigursson, 2011), and short covering (Bhojraj and Zhao, 2022).

Moreover, our study adds to the growing body of literature exploring the impacts of dynamic short-selling risks, a concept theoretically highlighted by D'Avolio and Perold (2003) and Atmaz, Basak, and Ruan (2023), and empirically investigated by Engelberg, Reed, and Ringgenberg (2018). Our analysis introduces fresh evidence suggesting that arbitrageurs can alleviate these risks by borrowing shares in stocks with substantial passive ownership, albeit at the expense of higher lending fees.

Our results further emphasize the increased predictive capability of short interest for future returns within stocks characterized by higher passive ownership. The results indicate that more informed short sellers choose to borrow shares with significant passive ownership, possibly as a strategy to avoid the risks associated with revealing their private information to active investors. This tendency aligns with the practice of actively-managed funds utilizing the equity lending market to discern short-selling demand and adjust their trading strategies accordingly, as noted by Honkanen (2021) and Greppmair et al. (2023).[11]

3. Data and Variables

This section outlines the construction of our dataset and variables, along with the presentation of summary statistics. We gather data from seven sources. Specifically, we utilize the CRSP Mutual Fund database for mutual fund data, Thomson Reuters Holdings S12 and S34 databases for institutional holdings data, IHS-Markit for security lending data, and CRSP and Compustat for accounting and pricing data.

3.1 Fund Holdings

We adopt a similar procedure to Iliev and Lowry (2015) and Appel, Gormley, and Keim (2016, 2018) to construct our dataset. Initially, we utilize the CRSP Mutual Fund database to

[11] Several studies have examined the effects of passive ownership in other contexts. Security lending by indexers is profitable to fund families and affects fund holdings (Blocher and Whaley, 2016), but this practice leads to distortions in asset allocation, impacting fund returns (Johnson and Weitzner, 2020). Passive investing can also improve price efficiency through other complementary channels such as liquidity (Lee, 2021). Additionally, passive investing has been shown to affect product market competition (Azar, Schmalz and Tecu, 2018), crash risk (Chang, Lin and Ma, 2016), corporate governance mechanisms and firm value (Mullins, 2014; Schmidt and Fahlenbrach, 2017; Borochin and Yang, 2017; Appel, Gormley and Keim, 2016, 2018).

classify domestic equity funds as either passive or active. Funds identified as index funds by CRSP are classified as passive, while the remaining funds are classified as active.

Next, we match the fund classifications to the quarterly holdings data from Thomson Reuters Mutual Fund Holdings S12 database. We calculate stock ownership for each fund type by aggregating the holdings of all passive and active funds for each stock-quarter observation. Fund holdings are expressed as the proportion of shares held by the fund relative to the total number of shares outstanding. The number of shares outstanding for each stock-quarter is determined using information from the CRSP stock file.

To obtain the holdings of 13F institutional investors, we utilize the Thomson Reuters Institutional Ownership S34 database. We work with the updated and regenerated versions of both the S12 and S34 datasets, which include corrections for errors previously identified by researchers such as Ben-David et al. (2021).[12] In our primary tests, we retain observations where the number of shares held by institutions exceeds the number of shares outstanding in the CRSP. It is worth noting that total institutional ownership may exceed 100% of shares outstanding due to legitimate reasons, some of which are relevant in our analysis.[13] Our results remain largely unchanged when following a conventional filtering approach, as suggested by Frazzini (2006) and Brav, Jiang, and Li (2018), where observations with total institutional ownership exceeding 100% of shares outstanding are dropped.

We calculate non-mutual fund ownership by taking the difference between total institutional ownership and the ownership of passive and active mutual funds. This measure captures the ownership of other institutional investors, including pension funds, banks, insurance companies, and endowments.

[12] See https://wrds-www.wharton.upenn.edu/documents/952/S12_and_S34_Regenerated_Data_2010-2016.pdf for details.

[13] For example, institutional investor A can lend shares (declared in her 13F filing) to a short-seller, who sells them to institutional investor B. In turn, institutional investor B may also declare the same shares in her 13F filing. Consequently, the stocks which are sold short more often are more likely to have higher institutional ownership relative to the total shares outstanding. Omitting these stocks may lead to a selection bias.

3.2 Security Lending Data

We source our security lending data from IHS-Markit, which provides a comprehensive daily dataset covering the majority of U.S. stocks from 2007 to 2017. This dataset includes essential indicators of security lending. We focus on four key variables:

1. "Active Lendable Quantity": This variable represents the measure of lending supply.

2. "Quantity on Loan": This variable captures the level of short interest.

3. "Indicative Fee": This variable indicates the lending fees.[14]

4. "Average Tenure": This variable measures the average duration of outstanding loans for a given stock on a particular date.

To incorporate this data into our analysis, we merge the IHS-Markit dataset with the daily CRSP stock file. We only retain U.S. common stocks (identified by share codes 10 and 11) for consistency. For each daily observation of a stock, we calculate lending supply and short interest as proportions of shares available for lending (obtained from IHS-Markit) relative to the total number of outstanding shares (obtained from CRSP). These calculations are then averaged within each stock-quarter to align with the quarterly holdings data. Similarly, we compute average lending fees and loan durations by averaging the daily Markit data within each stock-quarter observation.

3.3 Price Impact Measures and Accounting Data

Given our focus on the impact of passive ownership on stock prices through its influence on short-selling activities, we adopt measures of price efficiency commonly used in the literature on shorting. The first measure we employ is based on the difference between the downside and upside cross-autocorrelations of market returns and stock returns, as suggested by Hou and Moskowitz (2005). This measure has also been utilized by Bris, Goetzmann, and Zhu (2007) and Saffi and Sigurdsson (2011) to capture the effects of short-sale constraints on the speed of price

[14] As in Muravyev, Pearson, and Pollet (2022) we use “Indicative Fees” which are the fees paid by short-sellers to prime brokers. Muravyev, Pearson, and Pollet (2022) argue that these fees are much greater than the fees received by either the custodian or the ultimate lender, which are frequently used in the literature.

adjustments to new information, consistent with the predictions of Diamond and Verrecchia (1987).[15]

To construct the measure, we use the following procedure. For each stock-quarter pair we first calculate the downside and the upside cross-autocorrelations using daily stock returns and lagged market return as follows:

$$\rho_{i,t}^{-} = corr\left(r_{i,d,t}, r_{d-1,t}^{M-}\right), \quad \rho_{i,t}^{+} = corr\left(r_{i,d,t}, r_{d-1,t}^{M+}\right), \quad (1)$$

where $r_{i,d,t}$ is the return on stock *i* in quarter *t* on day *d,* and $r_{d-1,t}^{M-}$ ($r_{d-1,t}^{M+}$) is the market return on day *d-1* in quarter *t* conditional on the market return being negative (positive). We follow Hou and Moskowitz (2005) by using the CRSP value-weighted stock market index to obtain daily market returns. As correlations are bounded by -1 and 1, we apply the $\ln\left[(1+\rho)/(1-\rho)\right]$ transformation to all the measures of cross-autocorrelations. In line with the literature, an increased correlation of stock returns with past negative market returns $\rho_{i,t}^{-}$ can be interpreted as an increased delay in price response to negative information and reduced price efficiency. As short-selling is not expected to affect the speed of incorporation of positive information in prices measured by $\rho_{i,t}^{+}$, we focus on the difference between the upside and the downside autocorrelations $\rho_{i,t}^{Diff}$ to evaluate the asymmetry in price adjustment:

$$\rho_{i,t}^{Diff} = \rho_{i,t}^{-} - \rho_{i,t}^{+}. \quad (2)$$

Our second measure of price effects focuses on the skewness of stock returns. Following the approach of Bris, Goetzman, and Zhu (2007), we apply a log-transformation to returns and calculate the skewness of daily returns within each stock-quarter observation.[16] This measure has been examined by Bris, Goetzman, and Zhu (2007), Xu (2007), Chang, Cheng, and Yu (2007), and Saffi and Sigurdsson (2011), who find that increased short-selling is associated with reduced

[15] The theory in Diamond and Verrecchia (1987) predicts that short-sale constraints delay the adjustment of prices to bad news without biasing prices. In their noisy rational expectations model, it is common knowledge that negative information is not reflected in the order flow. Since price is a conditional expectation of the value of the asset, it is unbiased because rational agents take the short-sale constraints into account when forming their expectations. However, prices will not immediately reflect new information because agents with negative information cannot trade.

[16] Our results hold if we do not log-transform the daily returns.

skewness in stock returns. Consistent with these studies, we interpret the reduction in skewness as evidence of the impact of increased short-selling activity on stock prices.

Our third measure of price impact is the value premium. Miller (1977) and Chen, Hong, and Stein (2002) highlight that short-sale constraints can result in overpricing. Nagel (2005) suggests that the value premium can capture these overpricing effects. Following Nagel (2005), we estimate regressions of annual future stock returns on the interaction between institutional ownership and market-to-book ratios. We include separate interactions for each type of institutional ownership to differentiate the effects of passive and non-passive investors on the value premium. Consistent with Nagel (2005), a lower value premium can arise from increased short-selling by arbitrageurs.

3.4 Short-Selling Risks

To capture the uncertainty related to short-sale constraints, we follow the approach of Engelberg, Reed, and Ringgenberg (2018) and construct variables that reflect this uncertainty. Specifically, we define two measures: fee risk and recall risk.

Fee risk is calculated as the natural logarithm of the variance of daily lending fees for each stock-quarter observation. This measure captures the risk of potential increases in lending fees in the future, which can reduce the profitability of short-sellers or force them to close their positions, as described by D'Avolio (2002).

Recall risk is defined as the natural logarithm of the variance of daily "utilization," which represents the ratio of short interest to lending supply, within each quarter. This measure captures the variation in the relative availability of shares for short-selling. A large variation in share availability can be associated with significant reductions in lending supply, increasing the likelihood of loan recalls.

Finally, we merge the holdings data, security lending data, stock price data, and accounting data to create our final dataset. This comprehensive dataset comprises approximately 5,700 stocks and covers the period from 2007 to 2017.

3.5 Summary Statistics

Table 1 presents the summary statistics for our sample. On average, passive funds own 6% of the shares outstanding for the typical U.S. stock. In comparison, active funds have an average ownership level of 11%, while non-mutual fund ownership stands at 45%. These estimates are consistent with findings from other recent studies conducted over similar time periods.[17] Despite the increasing popularity of passive funds, they still hold a significantly smaller proportion of shares relative to other institutional investors.

*** Table 1***

Examining the security lending data, we find that a substantial portion of the lending supply is not utilized by short-sellers. The average supply of lendable shares is 19%, while the average short interest is only 3%. However, lending fees exhibit a high degree of variability. The average fee is 1.69%, but the median fee is much lower at 0.39%.[18] These results align with previous research by D'Avolio (2002) and Asquith, Pathak, and Ritter (2005), which demonstrate that borrowing is generally not challenging for most stocks, but certain stocks can present difficulties for short-selling due to limited availability. The average loan duration is 80.5 days, with a median duration of 63.5 days. This suggests that short-selling tends to be a medium-term trading activity, with many short positions being closed within a span of 2-3 months.

3.6 Special and General Collateral Stocks

Blocher, Reed, and Van Wesep (2013) emphasize the importance of examining the distinctions between easy-to-borrow and hard-to-borrow stocks. Their theoretical model presents two distinct market equilibria, each with significant implications for the effects of lending conditions on stock prices and lending fees.

In the case of easy-to-borrow stocks categorized as general collateral (GC) stocks, the lending supply significantly exceeds the lending demand. Consequently, the presence of short-sale

[17] For example, the average passive ownership equals 10% in the 2007-2013 sample of Appel, Gormley and Keim (2018), 5.5% in the 2007-2016 sample of Coles, Heath and Ringgerberg (2022), and 6% in the 2000-2015 sample of Ben-David, Franzoni and Moussawi (2018).

[18] In the case of cash collateral, the lending fee is calculated as the difference between returns on reinvested collateral (typically, the fed fund rate) and the rebate received by the borrower.

constraints is negligible, and minor changes in supply or demand do not have a substantial impact on stock prices or lending fees.

On the other hand, the hard-to-borrow stocks, referred to as special stocks, exhibit a lower supply relative to the demand, resulting in higher lending fees. In this scenario, even slight changes in supply or demand can influence stock prices through their effects on the equilibrium amount of short-selling and lending fees. Given these dynamics, our analysis focuses on the disparities between special and GC stocks, anticipating that the effects of passive ownership will be more pronounced among special stocks.

To identify special stocks, we adopt a common approach used in the literature, defining a stock as special if its lending fee falls within the top 10% of the fee distribution for a given quarter. This method of using fee distribution as a criterion for identifying specials has been widely employed in previous studies, such as those by D'Avolio (2002), Blocher, Reed, and Wesep (2013), and Kolasinski, Reed, and Ringgenberg (2013). In Section 8.1 of our analysis, we demonstrate the robustness of our results by considering alternative definitions of specials based on a proprietary borrowing cost metric provided by IHS-Market.

Figure 1 illustrates the time-series of fees for special and GC stocks, revealing a notable increase in the minimum and average lending fees for special stocks over the past decades. This finding highlights substantial time variation in the fees associated with the most expensive-to-borrow stocks. Consequently, relying on fixed cutoffs (e.g., 1% or 2%) to classify stocks as hard-to-borrow may result in an inadequate representation, as it could lead to an insufficient or excessive number of stocks being categorized as such. In contrast, the average fees for GC stocks exhibit minimal variation over time and consistently remain at low levels.

Figure 1

To further investigate the characteristics of special and GC stocks, Table 2 provides a comparison between the two groups. Specials tend to have lower institutional ownership across all types, suggesting that the lending supply for these stocks is more likely to be constrained compared to GC stocks. Specifically, the fraction of shares available for borrowing is only 6% for specials, while it is 20% for GC stocks. The short interest for special stocks also stands at 6%, indicating that short-selling activity is limited by the availability of shares and that short-sale constraints are

likely binding. For GC stocks, the equity loan market demonstrates slackness, as the fraction of shares borrowed amounts to only 3%, which is significantly lower than the lending supply. Furthermore, the average lending fee for specials reaches 12%, while it is 1% for GC stocks, reflecting the relatively low supply and high demand for hard-to-borrow stocks. Hard-to-borrow stocks also exhibit substantially higher fee and recall risks, along with lower price efficiency, as compared to GC stocks.

Table 2

4. Methodology

In this section, we outline our regression model which examines the relationship between institutional ownership and various outcomes. The model specification is as follows:

$$y_{i,t} = \alpha_i + \alpha_t + \beta_1 \cdot Passive_{i,t} + \beta_2 \cdot Active_{i,t} + \beta_3 \cdot NonMF_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $y_{i,t}$ is an outcome for stock *i* in quarter *t*, $Passive_{i,t}$ is the level of passive fund ownership of stock *i* in quarter *t*, $Active_{i,t}$ is the level of active mutual fund ownership of stock *i* in quarter *t*, $NonMF_{i,t}$ is the ownership by non-mutual fund institutions of stock *i* in quarter *t*, α_i are stock fixed effects, α_t are quarter fixed effects, and $X_{i,t}$ is a vector of stock-specific control variables such as the natural logarithm of the stock's market capitalization, the natural logarithm of the firm's book value of assets, market-to-book ratio, and bid-ask spreads.

The regression is conducted separately for special and GC stocks, and the standard errors are double-clustered by stock and quarter to account for potential dependencies within these groups. We standardize all variables to facilitate the assessment of economic magnitudes. All the regression coefficients indicate the change in the outcome variable, measured in standard deviations, corresponding to a one standard deviation increase in the predictor variable.

The coefficients on institutional ownership variables in these tests represent the changes in outcome variables that can be linked to fluctuations in institutional ownership. These changes cannot be attributed to disparities in observable stock characteristics like size, relative valuation, or liquidity. Moreover, by incorporating time fixed effects, we account for the influence of unobserved market sentiment fluctuations that impact all stocks. Additionally, accounting for stock

fixed effects enables us to estimate the effect using within-stock variation, thus encompassing the impact of all persistent stock-specific unobservable factors.

Most of our tests revolve around evaluating two hypotheses across multiple outcomes. Our first hypothesis examines the distinct impact of passive ownership on a specific outcome, compared to other types of institutional ownership *within* a given set of stocks (i.e., special or GC). Hence, our null hypothesis assumes that the coefficient β_1 is equal to either β_2 or β_3. Rejecting this null hypothesis suggests a significant difference in the effect of passive ownership compared to other types of institutional ownership.

The second hypothesis focuses on differentiating the effects of a particular ownership type *between* special and GC stocks. In these tests, our null hypothesis posits that the coefficient of a given ownership type $(\beta_1, \beta_2, \beta_3)$ for special stocks is equal to the corresponding coefficient for GC stocks. Comparing special and GC stocks is important not only because the short-sales constraints are concentrated among specials, but also because it offers an additional advantage in terms of identification. One concern in our analysis is that different funds may choose to invest in different stocks, potentially introducing bias if this choice is related to some unobserved variable. While passive funds have less discretion in their holdings, many funds are structured as "sampling" rather than fully replicating funds. Consequently, they have the flexibility to exclude certain stocks based on unobservable criteria. However, for an omitted variable to bias our results in this setting, the omitted variable would need to be correlated with the outcome variable, correlated with ownership by passive funds, and correlated with whether the stock is GC or special. Consequently, our specification comparing GC to special stocks introduces an additional identification restriction that makes omitted variable bias less likely.

5. Comparative Effects of Passive Fund Ownership on Stock Price Efficiency

5.1 Graphical Evidence on Difference in Cross-Autocorrelations and Skewness

To begin our analysis, we rely on graphical evidence. Firstly, we residualize both price efficiency and passive ownership using the regression specification outlined in Equation (3). Subsequently, we employ binned scatterplots with 20 bins of passive fund ownership, illustrating the average measures of stock price efficiency for each bin, separately for special and GC stocks.

The top graphs of Figure 2 depict the fundamental relationship between passive fund ownership and the difference in cross-autocorrelations. As passive ownership increases, the decline in cross-autocorrelation difference is more pronounced for specials compared to GC stocks. This finding suggests that specials with a high level of passive fund ownership demonstrate a more rapid pace of price discovery. Furthermore, special stocks exhibit a higher average difference in cross-autocorrelation compared to general collateral stocks.

Figure 2

The bottom panel of Figure 2 illustrates the relationship between passive ownership and skewness. An uptick in passive ownership is linked to a reduction in skewness, with this trend being more noticeable for special stocks. This observation aligns with the idea that increased short-selling has a more pronounced effect on prices. Furthermore, special stocks demonstrate a higher average skewness compared to GC stocks. The collective evidence indicates that passive ownership is associated with improved price efficiency, as indicated by well-established measures reflecting the impact of short-selling on stock prices.

5.2 Regression Tests for Difference Cross-Autocorrelations and Skewness

Table 3 provides comprehensive regression results, highlighting significant variations in the effects of different institutions. Overall, the findings corroborate those depicted in Figure 2, suggesting that increased passive ownership contributes to enhanced price efficiency. Conversely, other forms of institutional ownership demonstrate no discernible impact on the baseline measures of price efficiency.

Panel A, specifically column (1), demonstrates that an increase in passive fund ownership leads to a reduction in the difference in cross-autocorrelations for specials. However, columns (2) and (3) reveal that active fund ownership and non-mutual fund ownership do not yield economically or statistically significant effects. These results remain robust after incorporating control variables in column (3). The p-value tests for differences between coefficients confirm the distinct effect of passive ownership on price efficiency, as the differences in coefficients are statistically significant at the 1% level. Columns (4) to (6) demonstrate that institutional ownership has no impact on the difference in cross-autocorrelations for GC stocks. Notably, the final column

highlights that the effect of passive ownership is more pronounced for specials, aligning with the evidence presented in Figure 2, which suggests that short-selling activity in GC stocks is less likely to be constrained by lending market conditions.

*** Table 3***

In Appendix Tables A1 and A2, we provide additional evidence that further supports our notion of the decline in the difference in cross-autocorrelations being driven specifically by a decrease in negative cross-autocorrelations. Notably, there is no discernible effect on positive cross-autocorrelations. This supplementary evidence strengthens the argument that the impact of passive ownership on price efficiency operates primarily through short-selling activity driven by negative information.

Moving on to Panel B of Table 3, we present the estimated effects of passive fund ownership on the skewness of stock returns. The regression results align with our previous findings regarding cross-autocorrelations. Among specials, higher passive ownership is associated with lower skewness, while active and non-mutual fund ownership have no discernible effects on skewness (columns (1) to (3)). Columns (4) to (6) further demonstrate that the effect of passive ownership on skewness is significantly weaker for GC stocks.

5.3 Effects on Value Premium

For our final price efficiency test, we draw inspiration from Nagel (2005), who demonstrates that ownership by two prominent security lenders, namely the Vanguard S&P 500 Index Fund and Dimensional Fund Advisors, is associated with a reduced value premium. Nagel (2005) links the security lending activities of these institutional investors to short-sellers being able to exploit known price anomalies. Following Nagel (2005), we adopt a similar approach by transforming return predictors into decile ranks each quarter and scaling them to fall within the interval of 0 and 1. Our dependent variable is the return over four quarters from t+1 to t+4, which we regress on quarter t stock characteristics, quarter fixed effects, and stock fixed effects.

Table 4 presents the results separately for specials (columns (1) and (2)) and GC stocks (columns (3) and (4)). In column (1), we observe a negative and significant coefficient on the

market-to-book ratio (*M/B*), confirming the presence of the value premium. To further explore this relationship, we interact the market-to-book ratio with the different types of institutional ownership, as presented in column (2). In this specification, the coefficient on the market-to-book ratio suggests that if a stock is moved into the lowest ownership decile across all investor types, the difference in returns between the top and bottom market-to-book deciles is 65% per year.[19] However, if we consider the highest decile of passive fund ownership while holding ownerships by other funds constant, the value effect becomes substantially diminished, reduced by 62%.[20] Ownership by active mutual funds or non-mutual fund institutional investors does not exert a significant negative effect on the value premium within the sample of special stocks. Consistent with our findings on other measures of the price impact of short-sale constraints, we observe that the effect of passive fund ownership on the value premium is three times smaller for GC stocks.

*** Table 4***

In summary, the results presented in Tables 2-4 consistently demonstrate significant differences in the effects of various institutional investors on stock prices. Specifically, only increases in passive ownership are associated with enhanced price efficiency among short-sale constrained, special stocks, leading to faster incorporation of negative information into stock prices and reducing the likelihood of substantial negative returns and the value premium. Additionally, our results indicate that the effects of passive ownership on stock prices cannot be solely attributed to variations in lending supply. If improved price efficiency by passive investors was solely driven by making more shares available for borrowing relative to other institutional investors, we would expect to observe comparatively smaller effects for non-passive investors. However, since increased ownership by non-passive investors is unrelated to the effects of short-selling on stock prices, the lending supply channel alone cannot fully account for our findings.

[19] Since our regression specifications include stock fixed effects, we interpret the economic magnitude of the coefficient as moving the same stock from the extreme growth decile to the extreme value decile, and conversely.

[20] Note that passive ownership has two distinct effects on stock returns. Firstly, it diminishes the value premium by significantly increasing the returns on stocks with high market-to-book ratios (M/B) by 65%. Our focus, inspired by Nagel (2005), centers on this particular effect as we aim to investigate how passive ownership influences future returns within the category of stocks with exceptionally high prices relative to their fundamentals (i.e., high M/B). However, passive ownership itself exhibits a negative correlation with future returns, as evidenced by the coefficient of -60% for *Passive* in column (2). This finding aligns with the conclusions of Nagel (2005) and Asquith, Pathak, and Ritter (2005), who observe that stocks with higher institutional ownership, regardless of the type, tend to demonstrate lower future returns. Consequently, when a stock is transitioned into the highest decile of passive fund ownership, these two effects almost offset each other, resulting in a near cancellation.

6. Comparative Effects of Passive Fund Ownership on Security Lending Outcomes

6.1 Effects on Lending Supply

In this section, we directly examine the effects of institutional ownership on lending outcomes. We start with the effects of passive fund ownership on lending supply. Figure 3 provides the baseline graphical evidence, revealing a positive correlation between increased passive ownership and increased lending supply. This finding is consistent with previous studies such as D'Avolio (2002), Prado, Saffi, and Sturgess (2016), and Evans, Ferreira, and Prado (2017). However, the slope for special stocks is comparatively lower than that for GC stocks, indicating that the impact of passive ownership on the lending supply of specials is much weaker.

Figure 3

Table 5 presents the regression results, confirming that increased ownership by any of the three institutional investor types is associated with higher lending supply. The economic magnitudes of the effects are relatively similar across investor types but considerably larger for GC stocks. Specifically, a one standard deviation increase in passive/active/non-mutual fund ownership is associated with a lending supply increase of 0.22/0.15/0.15 standard deviation for specials and 0.32/0.20/0.20 for GC stocks. Although passive ownership exhibits slightly stronger effects on the lending supply of special stocks, the difference in coefficients between passive and non-mutual fund ownership is only weakly statistically significant.

Table 5

The absence of major differences in the economic magnitude of the effects of institutional investor types on lending supply supports the notion that the variation in lending supply alone cannot account for our earlier findings on price efficiency. While there are no substantial disparities in the impact of institutional investors on the lending supply for special stocks, the significant differences in price efficiency improvements remain evident.

6.2 Effects on Lending Fees and Short Interest

We next examine the effects of passive fund ownership on lending fees and short interest, using the intuition from Cohen, Diether, and Malloy (2007) to distinguish between supply and demand shocks. If increased passive ownership is associated with both increased fees and short interest, it indicates an increase in shorting demand.

The graphical results on lending fees in the top graphs of Figure 4 demonstrate a strong positive correlation between passive fund ownership and lending fees for special stocks, while the relation appears flat for GC stocks. This finding suggests that increased passive ownership is associated with higher demand from short-sellers for hard-to-borrow stocks. Supporting this result, the bottom graphs show that passive ownership is linked to increased short interest for both types of stocks, with a significantly larger effect observed for specials.

Figure 4

Table 6 confirms the graphical relations shown in Figure 4. In column (1), a one-standard deviation increase in passive ownership leads to a 0.17 standard deviation increase in lending fees for specials, aligning with the increased demand. Conversely, the effects of active and non-mutual fund ownership on fees are negative, indicating that these effects are largely driven by changes in lending supply. For GC stocks, passive ownership has a negligible effect on lending fees, and other ownership types show no significant effects (column (2)). The differences between ownership types are statistically significant within the specifications, suggesting that passive investors have a distinct impact on fees.

Table 6

Next, we analyze the effects on short interest. In column (3), a one-standard deviation increase in passive ownership corresponds to a 0.64 standard deviation increase in the fraction of shares borrowed. Comparatively, the effects of active and non-mutual fund ownership are weaker, measuring 0.33 and 0.35 standard deviations, respectively. In column (4), an increase of one standard deviation in passive ownership results in a 0.15 standard deviation increase in shares borrowed for GC stocks. Additionally, the last column indicates that the effect of passive ownership on short interest for special stocks is significantly larger than its effects on GC stocks, while no differences are observed across the samples for other institutional investors.

In summary, the evidence on lending outcomes in Tables 5 and 6 aligns with the strategic borrowing channel. Stocks with high passive ownership do not exhibit a substantially larger lending supply, but they have higher lending fees and significantly higher short interest. These results suggest that the improvements in price efficiency associated with increased passive ownership are driven by increased demand from short-sellers, rather than the effects of lending supply alone.

7. Comparative Effect of Passive Fund Ownership on Short-Selling Risks

7.1 Effects on Fee Risk and Recall Risk

We next analyze the factors that drive short-seller demand for stocks with higher passive ownership, specifically examining whether increased passive ownership is associated with reduced short-selling risks for specials. We follow the approach of Engelberg, Reed, and Ringgenberg (2018) who find that short-selling activity and price efficiency are reduced when dynamic short-selling risks are high. To conduct our analysis, we use fee and recall risks as independent variables.

The results in Table 7 confirm that stocks with higher passive ownership exhibit lower dynamic short-selling risks. An increase of one standard deviation in passive ownership is associated with a 0.07 standard deviation reduction in fee risk (column (2)). Active fund ownership has no significant effects on fee risk, while non-mutual fund ownership is associated with increased fee risk. These results remain robust when control variables are included, and the differences in the coefficients are statistically significant at the 1% level (column (3)). We also find that specials with higher passive ownership have lower recall risk, with a one standard deviation increase in passive ownership reducing recall risk by 0.23 standard deviations (column (4)). The effects of other types of institutional ownership on recall risk are much smaller (columns (5) and (6)), and the differences between the effects of institutional investor types are statistically significant.

Table 7

These findings suggest that stocks held by passive investors are highly sought after by short-sellers due to the reduced dynamic short-selling risks. Our results contribute to the literature

on the risk of short-selling by highlighting that these risks are notably low in stocks with high passive ownership. Additionally, Appendix Table A3 provides evidence that these results remain robust when employing the alternative risk measure defined by Engelberg, Reed, and Ringgenberg (2018).[21]

7.2 Effect of Passive Fund Ownership on Stock Loan Duration

We next analyze the relationship between institutional ownership and loan duration, providing the results in Table 8. We observe that short-sellers borrow stocks with high passive ownership for longer periods, which is consistent with the earlier findings on reduced dynamic risks. A one-standard deviation increase in passive ownership is associated with a 0.12 standard deviation increase in loan duration, while the effects of other types of ownership are statistically insignificant. These findings suggest that borrowing shares with high passive ownership allows short-sellers to keep their positions open for a longer time period. This further supports the notion that short-sellers find borrowing these shares advantageous.

*** Table 8***

7.3 Effect on Predictability of Short Interest for Future Stock Returns

Next, we explore the impact of passive ownership on the predictability of short interest for stock returns. The underlying notion is that short-sellers may lean towards borrowing shares with significant passive ownership to reduce the risk of information leakage to lenders who might mimic their trades. We delve into cross-sectional variations in stocks, assessing whether predictability rises with the degree of passive ownership, suggesting the presence of more informed short-sellers. Table 9 presents the regression results of future stock returns on short interest and its interactions with high levels of passive fund ownership for special stocks. The variable $Return_{t,t+K}$ represents the cumulative future return (in percentage points) over K days,

[21] Our tests in the Appendix follow Engelberg, Reed and Ringgenberg (2018) who use a large set of variables to construct a measure of short-selling risk. While some data used in that paper is unavailable to us (for example, fees on new loans), we match their specification as close as possible using all our data.

from day t to t+K. Columns (1) to (10) display the results for different values of K ranging from 15 to 360 days. The variable "*High Passive*" is a dummy variable that equals one if the ratio of passive ownership to total institutional ownership is above the median, and zero otherwise. The coefficients indicate the change in future returns associated with a one standard deviation change in short interest.

Consistent with our hypothesis, we find that short interest predicts more negative returns in stocks with high passive ownership. For stocks with low passive ownership, a one standard deviation increase in short interest is associated with future stock returns of -2.59% over 90 days and an even more negative -4.92% over 360 days. In contrast, in stocks where passive fund ownership is above the median, the negative future returns increase by 69 basis points over 90 days and 3.01% over 360 days. These results support our hypothesis and suggest that the higher demand for stocks with high passive ownership partly stems from better-informed short sellers who may seek to minimize the risk of information leakage to active investors.

*** Table 9***

8. Robustness Tests

8.1 Alternative Definition of Specialness

We first address concerns about the potential endogeneity of the specialness classification based on lending fees by examining the robustness of our results to an alternative definition of specialness. Instead of relying on lending fees, we utilize a proprietary metric called Daily Cost of Borrowing Score (DCBS) provided by IHS-Markit. The DCBS ranges from 1 to 10 and represents the cost of borrowing a security, with 1 being the cheapest and 10 being the most expensive. We define a stock as special if its DCBS falls within the top 10% of the distribution in a given quarter, following the approach used by Prado, Saffi, and Sturgess (2016).

*** Table 10***

Table 10 presents the comparative effects of passive ownership across various outcomes using this alternative definition of specialness for special stocks. The results demonstrate that the findings remain both quantitatively and qualitatively similar to our baseline results. Passive

ownership continues to be associated with improved price efficiency (columns (1) and (2)), higher lending supply, short interest, and lending fees (columns (3) - (5)), longer loan duration (column (6)), and lower short-selling risks (columns (7) and (8)). Furthermore, the effects of passive ownership remain significantly larger than those of other types of institutional ownership. These results indicate that our findings are not solely driven by the standard fee-based definition of specialness and remain robust when using an alternative definition based on DCBS. Additionally, in Appendix Table A4, we show that all the main results remain unchanged when specialness is defined based on lagged lending fees instead of contemporaneous fees.

8.2 Sensitivity to Unobserved Confounders

To address concerns about potential omitted variable bias and assess the robustness of our results, we employ a methodology derived from Oster (2019). The methodology relies on two key assumptions. The first assumption is the relative degree of selection on observed and unobserved variables, denoted as δ. We assume equal selection on observables and unobservables, setting $\delta = 1$. Oster (2019) suggests that this value can be an appropriate upper bound for δ in many empirical cases.[22] The second assumption is the fraction of the outcome that would be explained if the full set of unobservables were observed, denoted as R_{max}. We assume $R_{max} = 1$, which is a highly conservative assumption, as it implies that the outcome's variance would be fully explained if all unobservables were controlled for.[23]

By applying Oster's methodology with these assumptions, we calculate a consistent estimate of the effect adjusted for omitted variable bias. This allows us to construct the identified set, which captures all the values of the effect bounded between the estimates from the original model and Oster's consistent estimate. Analyzing the identified set helps us evaluate the robustness of our results to omitted variable bias. If the set does not include zero, it suggests that the omitted

[22] This assumption was first made by the influential paper of Altonji, Elder and Table (2005).

[23] For example, in cases where there is a measurement error in outcome, controlling for unobservables will not account for all of the outcome variance ($R_{max} < 1$). As a result, unobservables are expected to introduce a smaller bias than under the assumption of $R_{max} = 1$.

variable bias is not large enough to affect the sign of the coefficient, and it indicates that the true effect is unlikely to be equal to zero.

*** Table 11***

Table 11 presents our results. Column (1) displays the baseline effect obtained by regressing the outcome variable solely on passive ownership, without incorporating any control variables or fixed effects. These baseline estimates may suffer from bias due to the omission of relevant variables, potentially leading to either positive or negative biases.

Column (2) presents the estimates for our comprehensive fixed effects model, which includes all the control variables from Tables 3-9. Introducing these controls generally reduces the magnitude of the effect. This suggests that omitting the observed controls in the specification tends to result in a positive bias, thereby leading to an overestimation of the baseline effects.

Moving on to column (3), we find Oster's estimates. In several cases, these estimates surpass those obtained in column (2), implying that the bias resulting from the exclusion of unobserved variables can also be negative. Consequently, the effects of passive ownership may be underestimated.

In column (4), we provide the identified sets for the coefficient on passive ownership. This set encompasses all the values from columns (1)-(3) and represents the widest range of plausible values. Notably, in column (5), we observe that this set never includes zero for any of the outcome variables. This suggests that our estimates are highly unlikely to change sign or become zero when the regression specification incorporates the unobserved confounding variables.

8.3 Driscoll and Kraay (1998) Standard Errors

We also employ an alternative clustering procedure proposed by Driscoll and Kraay (1998). Unlike our main analysis where standard errors are double-clustered by stock and quarter, the Driscoll and Kraay procedure assumes a heteroscedastic error structure that is autocorrelated up to a specific time lag and potentially correlated across stocks. To determine the optimal lag length,

we follow Hoechle's (2007) approach, which results in the selection of three lags for most of our specifications. [24]

In Appendix Table A5, we present the results for special stocks across our main outcome variables using the Driscoll and Kraay (1998) clustering procedure. Notably, this alternative approach does not substantially impact the statistical significance of our estimates. In the majority of cases, the standard errors obtained through the Driscoll and Kraay method are slightly smaller compared to the double-clustered standard errors utilized in our main analysis. As a result, this slight reduction in standard errors enhances the levels of significance to some extent.

8.4 Time-varying Effects

To investigate the time-varying effects of passive ownership, we delve into the possibility that these effects may be more pronounced in recent periods characterized by rapid growth in passive investing. To test this hypothesis, we introduce an indicator variable that takes the value of one if the sample year falls between 2007 and 2012. This indicator is then interacted with the three institutional ownership variables, enabling us to capture the dynamic effects of passive investing and effectively split the sample into two distinct sub-periods: 2007-2012 and 2013-2017.

The results, as presented in Table A6, shed light on these time-varying effects. Specifically, the coefficient on *Passive* can be interpreted as the effect of passive ownership during the more recent sample period of 2013-2017. The coefficients on *Passive* exhibit similar signs and levels of significance as those found in the main results, indicating that the effect of passive ownership persists in the recent years.

Furthermore, we examine the coefficients on the interaction term, which represent the marginal effects during the earlier sample period. For certain variables such as *Difference in cross-autocorrelations*, *Short interest*, and *Duration*, the coefficients on the interaction term turn out to be statistically insignificant. This suggests that there is no discernible effect during the earlier period.

[24] The optimal lag length as a function of the total number of time periods is given by: $m(T) = \left\lfloor 4\left(\frac{T}{100}\right)^{2/9} \right\rfloor$.

Notably, for variables like *Lending Supply, Lending Fee, and Recall Risk,* the coefficients on the interaction term exhibit the opposite sign compared to the coefficients on *Passive*. These results indicate that the effects of passive ownership are concentrated primarily in the later sample years.

In summary, the findings from Table A6 support the notion of time-varying effects of passive ownership. The coefficients on *Passive* demonstrate consistent signs and significance, affirming the presence of an effect in the more recent years. On the other hand, the coefficients on the interaction term either lack statistical significance or display opposing signs, suggesting that the effects are predominantly concentrated in the later sample period.

9. Conclusions

Our findings have several implications. Firstly, they contribute to the ongoing debate surrounding the impact of passive investing on market efficiency. Prior research has argued that the rise of passive investing can lead to less efficient prices, as passive investors typically do not actively incorporate security-specific information into their investment decisions, potentially creating price pressure. However, our study reveals that passive investors complement the information-seeking efforts of short-sellers. While we do not settle the broader discussion on the aggregate effects of passive investing on information production, we provide evidence of a specific channel through which passive investing enhances the incorporation of information into stock prices.

Secondly, the improvement in price efficiency resulting from passive investing cannot be solely attributed to an increase in lending supply. Interestingly, both active mutual funds and non-mutual fund investors participate in lending special stocks without contributing to enhanced price efficiency. Instead, the improved price efficiency can be primarily attributed to the increased demand from short-sellers, underscoring the significance of the demand channel in driving the positive effects of passive investing on price efficiency.

Lastly, our study emphasizes the importance of incorporating security lending activity into theoretical models of passive and active investing. Existing advancements in this area primarily focus on price pressure and information acquisition, overlooking the impact of passive investing on short-sale constraints. Additionally, theories of security lending often fail to explicitly consider

the effects of lender heterogeneity, despite our findings highlighting the critical role played by differences between lenders. By incorporating these effects into theories of asset management and security lending, we can gain a more comprehensive understanding of the overall impact of passive investing on financial markets.

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Figure 1: Lending Fees over Time

This figure presents the dynamics of lending fees for 2007-2017 on a quarterly interval, separately for special stocks and general collateral stocks (GC). Lending fees are annual fees for borrowing shares. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as *GC,* otherwise. *Minimum Fee – Specials* is the minimum lending fee for the stock to be considered as a special stock in a given quarter. *Average fee* is calculated as the simple arithmetic average across stocks for each group.

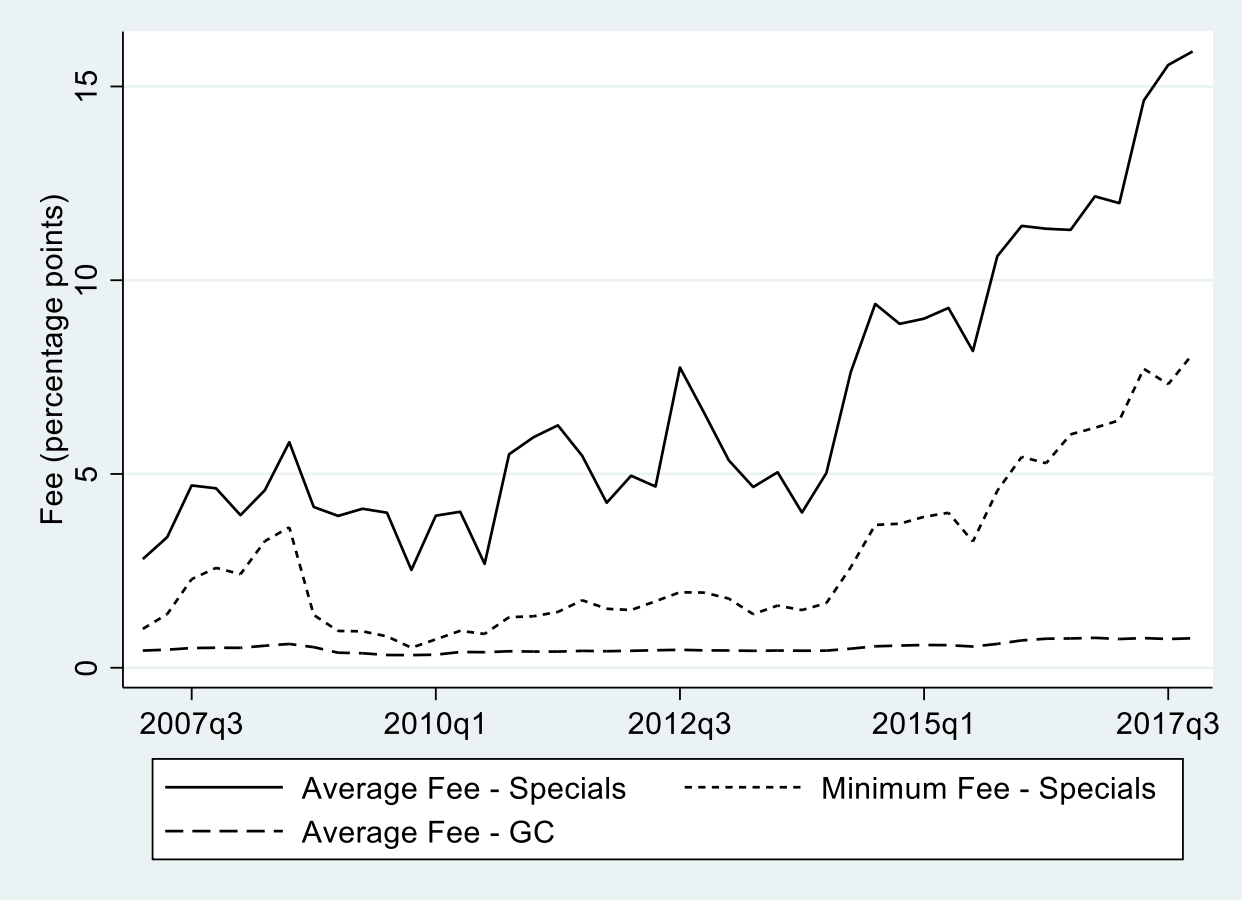

Figure 2: Relationship between Passive Fund Ownership, Difference in Cross-Autocorrelations and Skewness

This figure presents the relationships between passive fund ownership, cross-autocorrelations and skewness of daily returns, separately for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC otherwise. The figure uses binned-scatter plots with 20 bins of passive fund ownership. *Passive* represent a fraction of shares held by passive mutual fund. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. All the variables are residualized on a set of control variables such as *Log(market)*, *Log(book)*, *M/B* and *Bid-ask*, as well as stock and quarter fixed effects. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price.

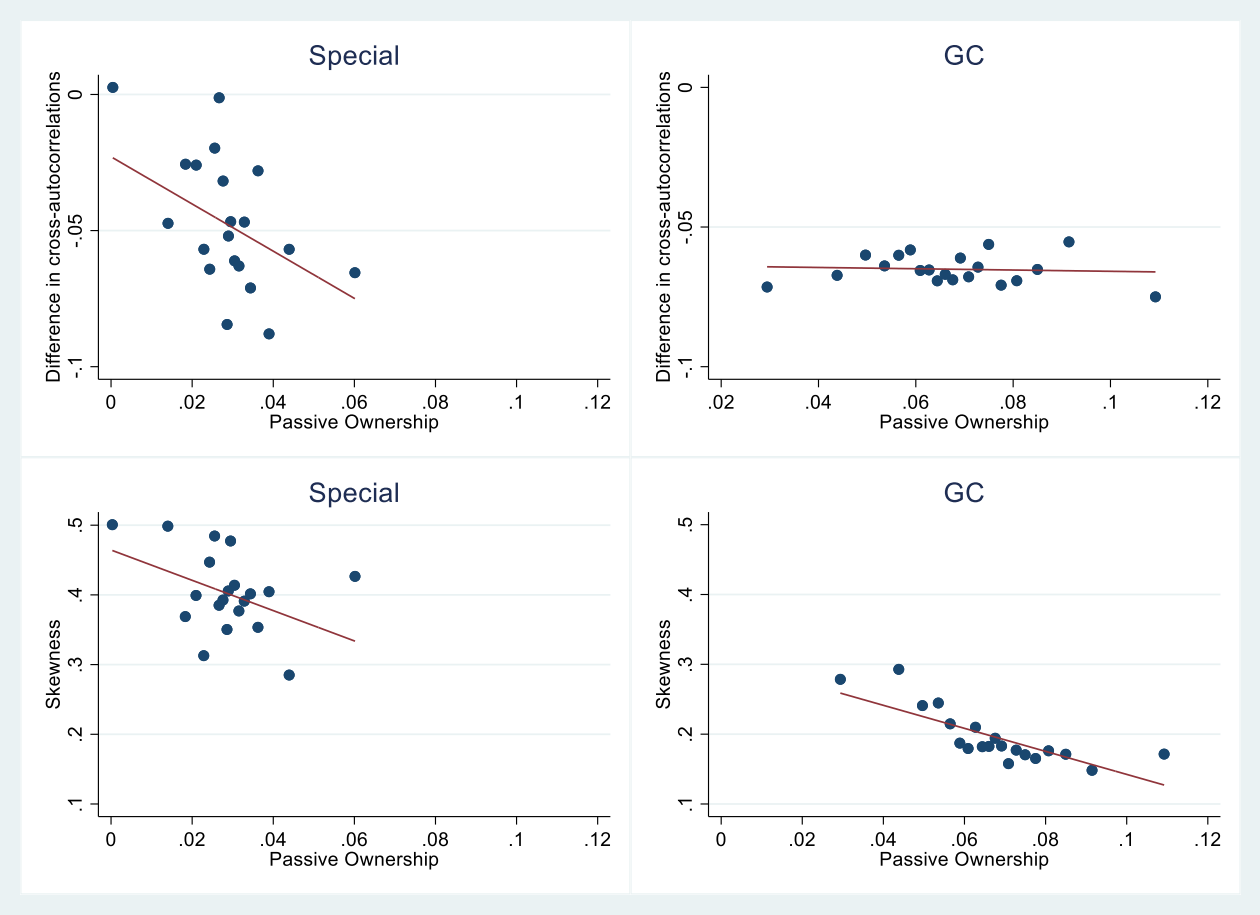

Figure 3: Relationship between Passive Fund Ownership and Lending Supply

This figure presents the relationships between passive fund ownership and security lending supply, separately for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The figure uses binned-scatter plots with 20 bins of passive fund ownership. *Passive* represent the fraction of shares held by passive mutual fund. *Lending fees* are annual fees for borrowing shares. *Lending supply* is the fraction of shares available for borrowing. All the variables are residualized on a set of control variables such as *Log(market)*, *Log(book)*, *M/B* and *Bid-ask*, as well as stock and quarter fixed effects. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price.

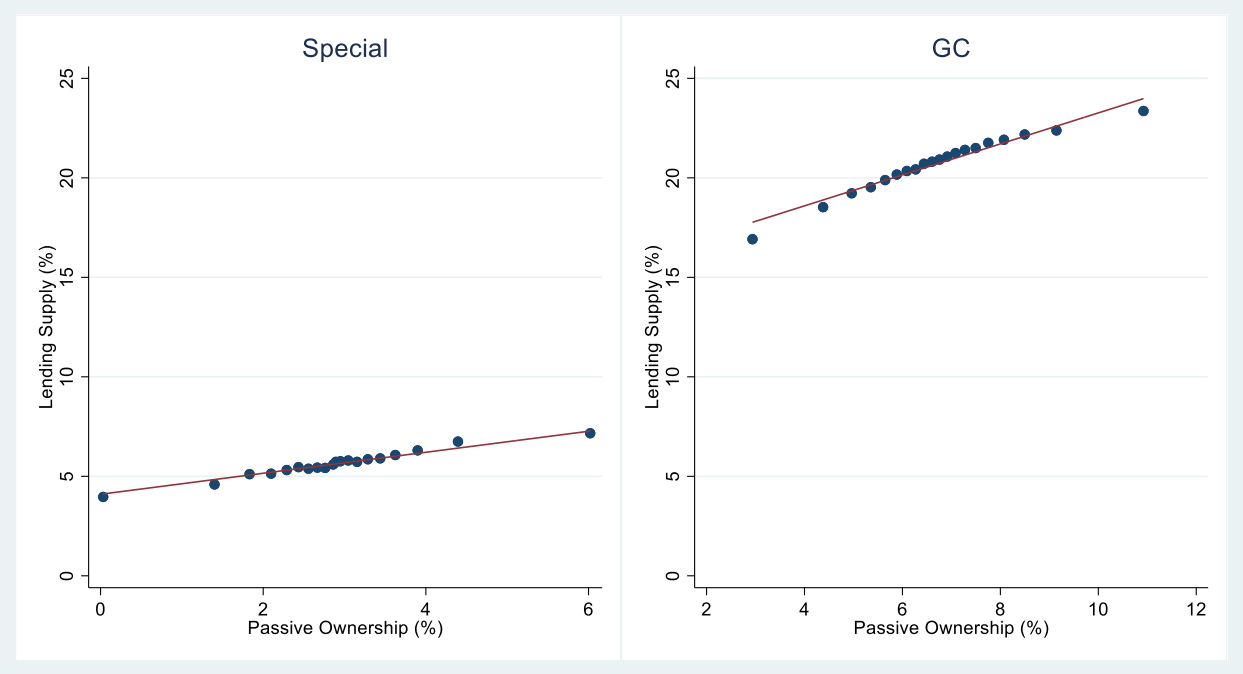

Figure 4: Relationship between Passive Fund Ownership and Lending Outcomes

This figure presents the relationships between passive fund ownership and security lending outcomes, separately for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The figure uses binned-scatter plots with 20 bins of passive fund ownership. *Passive,* represent the fraction of shares held by passive mutual fund. *Lending fees* are annual fees for borrowing shares. *Short interest* is the fraction of shares borrowed. All the variables are residualized on a set of control variables such as *Log(market)*, *Log(book)*, *M/B* and *Bid-ask*, as well as stock and quarter fixed effects. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price.

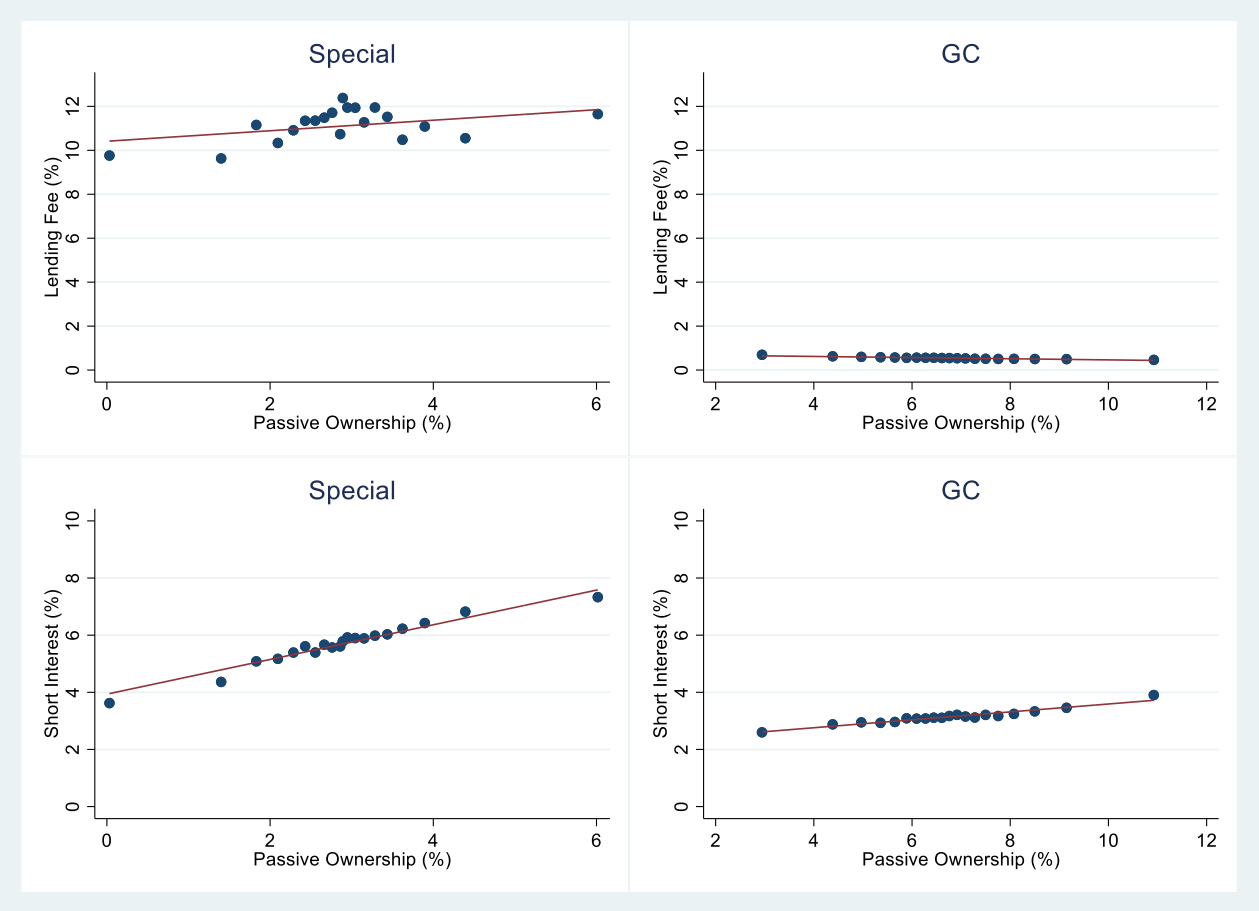

Table 1: Summary Statistics

This table presents summary statistics for the 2007-2017 quarterly panel of stocks. Ownership variables are calculated using end-of-the-quarter ownership data as reported by Thomson Reuters Mutual Fund Holding database. Fund classifications are based on CRSP Mutual Fund database. Security lending variables are from Markit and are calculated as daily averages within each stock-quarter observation unless mentioned otherwise. Price impact and control variables are calculated using CRSP and Compustat. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price.

	N	Mean	SD	Median	Min.	Max.
Ownership variables						
Passive (fraction)	121,405	0.06	0.05	0.06	0.00	0.55
Active (fraction)	121,405	0.11	0.09	0.10	0.00	0.87
Non-mutual (fraction)	121,109	0.45	0.20	0.48	0.00	0.99
Security lending outcomes						
Lending supply (fraction)	121,383	0.19	0.11	0.20	0.00	0.42
Short interest (fraction)	121,326	0.03	0.04	0.02	0.00	0.24
Lending fee (%)	121,307	1.69	5.93	0.39	0.25	114.60
Loan duration (days)	121,326	80.53	67.86	63.52	3.17	463.86
Fee risk	105,599	-13.79	3.02	-14.74	-17.53	-0.76
Recall risk	121,067	-6.91	3.21	-7.44	-34.99	18.63
Price impact variables						
Difference in cross-autocorrelations	121,209	-0.06	0.57	-0.05	-13.14	15.15
Skewness	121,289	0.24	1.32	0.19	-7.34	7.78
Control variables						
Log(market)	121,305	20.37	1.95	20.20	13.61	27.48
Log(book)	112,549	19.71	1.83	19.53	6.91	26.59
M/B	113,533	3.00	3.82	1.83	0.30	27.29
Bid-ask (fraction)	121,305	0.01	0.01	0.00	0.00	0.31

Table 2: Differences between Special and General Collateral Stocks

This table presents the results from the differences-in-means tests between special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column reports the *p*-values of the tests. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all the open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively.

	Mean *Special*	Mean *GC*	Difference	*p*-value
Ownership variables				
Passive (fraction)	0.03	0.07	-0.04***	0.00
Active (fraction)	0.04	0.12	-0.08***	0.00
Non-mutual (fraction)	0.26	0.47	-0.21***	0.00
Security lending variables				
Lending supply (fraction)	0.06	0.20	-0.14***	0.00
Short interest (fraction)	0.06	0.03	0.03***	0.00
Lending fee (%)	11.85	0.56	11.29***	0.00
Duration (days)	81.09	80.51	0.57	0.25
Fee Risk	-8.22	-14.50	6.29***	0.00
Recall Risk	-2.68	-7.28	4.70***	0.00
Price impact variables				
Difference in cross-autocorrelations	-0.04	-0.07	0.03***	0.00
Skewness	0.44	0.22	0.23***	0.00
Control variables				
Log(market)	18.80	20.55	-1.75***	0.00
Log(book)	18.09	19.87	-1.79***	0.00
M/B	4.02	2.90	1.02***	0.00
Bid-ask (fraction)	0.01	0.00	0.01***	0.00

Table 3: Effect of Institutional Ownership Type on Difference in Cross-Autocorrelations and Skewness

This table reports the results from regressing difference in cross-autocorrelations and skewness on ownership of institutional investors. The results are separately reported for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column reports the differences in the coefficients between columns (3) and (6). The *p*-values for the differences between the coefficients within columns (3) and (6) are reported at the bottom. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

Panel A:	y = *Difference in cross-autocorrelations*						
	(1)	(2)	(3)	(4)	(5)	(6)	(3) – (6)
	Special	*Special*	*Special*	*GC*	*GC*	*GC*	*Special v. GC*
Passive	-0.08**	-0.09***	-0.08**	-0.01	-0.01	-0.00	-0.08**
	(0.03)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	
Active		0.00	0.03		0.00	0.01	0.02
		(0.03)	(0.03)		(0.01)	(0.01)	
Non-mutual		0.01	0.04		-0.03**	-0.02	0.06*
		(0.03)	(0.03)		(0.01)	(0.01)	
Log(Market)			-0.19***			-0.12*	
			(0.07)			(0.07)	
Log(Book)			0.11			0.07	
			(0.07)			(0.06)	
M/B			0.03			0.02	
			(0.02)			(0.02)	
Bid-ask			0.00			0.02	
			(0.03)			(0.03)	
	p-values of tests for differences between coefficients						
H_o: *Passive = Active*			0.01			0.54	
H_o: *Passive = Non-mutual*			0.01			0.49	
Observations	11,582	11,526	9,804	108,865	108,698	101,782	
R^2	0.23	0.23	0.23	0.21	0.21	0.21	
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	

Panel B:	y = *Skewness*						
	(1)	(2)	(3)	(4)	(5)	(6)	(3) – (6)
	Special	*Special*	*Special*	*GC*	*GC*	*GC*	*Special v. GC*
Passive	-0.16***	-0.15***	-0.15**	-0.06***	-0.06***	-0.06***	-0.09***
	(0.03)	(0.04)	(0.03)	(0.01)	(0.01)	(0.01)	
Active		-0.03	0.03		-0.03**	-0.02	0.05
		(0.03)	(0.04)		(0.01)	(0.02)	
Non-mutual		-0.03	0.02		0.03**	0.04***	-0.02
		(0.03)	(0.02)		(0.01)	(0.01)	
Log(Market)			-0.13*			-0.03	
			(0.07)			(0.04)	
Log(Book)			-0.13**			-0.13***	
			(0.06)			(0.04)	
M/B			-0.02			0.01	
			(0.02)			(0.01)	
Bid-ask			0.03**			0.05***	
			(0.01)			(0.01)	
	p-values of tests for differences between coefficients						
H_o: *Passive = Active*			0.00			0.07	
H_o: *Passive = Non-mutual*			0.00			0.00	
Observations	11,582	11,526	9,804	108,865	108,698	101,782	
R^2	0.19	0.19	0.20	0.08	0.08	0.08	
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	

Table 4: Effect of Institutional Ownership Type on the Value Premium

This table reports the results from regressing annual future stock returns on ownership of institutional investors and its interactions with market-to-book ratios. The results are separately reported for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column reports the differences in the coefficients between columns (3) and (6). The *p*-values for the differences between the coefficients within columns (3) and (6) are reported at the bottom. $Annual\ Return_{t,t+1}$ is the annual future return in percentage points. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. As in Nagel (2005), all variables are transformed into decile ranks each quarter and scaled such that their values fall into interval between 0 and 1. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

y = $Annual\ Return_{t,t+1}$ (in percentage points)					
	(1)	(2)	(3)	(4)	(2) – (4)
	Special	*Special*	*GC*	*GC*	*Special v. GC*
Passive	-22.08**	-60.65***	-8.25**	-19.16***	
	(10.20)	(19.63)	(3.08)	(5.19)	
Active	-14.81	-22.51	-5.51***	-9.24*	
	(11.64)	(18.48)	(2.03)	(4.95)	
Non-mutual	-19.52*	10.19	-3.64	-11.87**	
	(10.23)	(17.10)	(2.42)	(5.84)	
M/B	-59.13***	-65.28***	-39.10***	-61.59***	
	(13.26)	(15.83)	(7.37)	(11.88)	
Passive × *M/B*		62.05***		19.70**	42.35**
		(16.45)		(8.03)	
Active × *M/B*		12.29		5.87	6.42
		(9.00)		(8.45)	
Non-mutual × *M/B*		-50.06**		15.10*	-65.16***
		(23.70)		(8.80)	
p-values of tests for differences between coefficients					
H_o: *Passive* × *M/B* = *Active* × *M/B*		0.00		0.30	
H_o: *Passive* × *M/B* = *Non-mutual* × *M/B*		0.00		0.73	
Observations	9,808	9,808	101,805	101,805	
R^2	0.49	0.49	0.38	0.38	
Controls	Yes	Yes	Yes	Yes	
Quarter FE	Yes	Yes	Yes	Yes	
Stock FE	Yes	Yes	Yes	Yes	

Table 5: Effect of Institutional Ownership Type on Lending Supply

This table reports the results from regressing lending supply on ownership of institutional investors. The results are separately reported for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column reports the differences in the coefficients between columns (3) and (6). The *p*-values for the differences between the coefficients within columns (3) and (6) are reported at the bottom. *Lending supply* is the fraction of shares available for borrowing. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Lending supply*						
	(1)	(2)	(3)	(4)	(5)	(6)	(3) – (6)
	Special	*Special*	*Special*	*GC*	*GC*	*GC*	*Special v. GC*
Passive	0.32***	0.24***	0.22***	0.38***	0.34***	0.32***	-0.10***
	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	
Active		0.15***	0.15***		0.21***	0.20***	-0.05***
		(0.02)	(0.01)		(0.01)	(0.01)	
Non-mutual		0.15***	0.15***		0.31***	0.30***	-0.15***
		(0.02)	(0.02)		(0.02)	(0.02)	
Log(Market)			-0.01			-0.02	
			(0.03)			(0.02)	
Log(Book)			0.12***			0.22***	
			(0.03)			(0.02)	
M/B			0.02**			0.05***	
			(0.01)			(0.01)	
Bid-ask			-0.01			-0.03***	
			(0.00)			(0.01)	
p-values of tests for differences between coefficients							
H_o: *Passive = Active*			0.02			0.00	
H_o: *Passive = Non-mutual*			0.09			0.51	
Observations	11,565	11,512	9,793	108,862	108,697	101,781	
R^2	0.86	0.88	0.90	0.86	0.89	0.89	
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	

Table 6: Effect of Institutional Ownership Type on Loan Outcomes (Lending Fees and Short Interest)

This table reports the results from regressing lending fees and short interest on ownership of institutional investors. The results are separately reported for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column for each variable reports the differences between the coefficients for special and general collateral stocks, respectively. The *p*-values for the differences between the coefficients within the columns are reported at the bottom. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Lending fee*			y = *Short interest*		
	(1)	(2)	(1) – (2)	(3)	(4)	(3) - (4)
	Special	*GC*	*Special vs. GC*	*Special*	*GC*	*Special v. GC*
Passive	0.17**	-0.02***	0.19***	0.64***	0.15***	0.49***
	(0.08)	(0.00)		(0.06)	(0.02)	
Active	-0.13**	0.00	-0.13**	0.33***	0.28***	0.05
	(0.06)	(0.00)		(0.05)	(0.01)	
Non-mutual	-0.37***	-0.00	-0.37***	0.35***	0.43***	-0.08
	(0.10)	(0.00)		(0.06)	(0.02)	
	p-values of tests for differences between coefficients					
H_o: *Passive = Active*	0.01	0.00		0.00	0.00	
H_o: *Passive = Non-mutual*	0.00	0.00		0.00	0.00	
Observations	9,804	101,728		9,804	101,745	
R^2	0.56	0.58		0.89	0.61	
Control variables	Yes	Yes		Yes	Yes	
Quarter FE	Yes	Yes		Yes	Yes	
Stock FE	Yes	Yes		Yes	Yes	

Table 7: Effect of Institutional Ownership Type on Short-Selling Risks for Specials

This table reports the results from regressing the measures of dynamic short-selling risks on ownership of institutional investors for special stocks. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. The *p*-values for the differences between the coefficients within columns (3) and (6) are reported at the bottom. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is a ratio of the firm's stock market capitalization to book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Fee risk*			y = *Recall risk*		
	(1)	(2)	(3)	(4)	(5)	(6)
Passive	-0.07***	-0.07***	-0.08***	-0.23***	-0.21***	-0.20***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.05)
Active		-0.02	-0.01		-0.04*	-0.03
		(0.02)	(0.02)		(0.02)	(0.02)
Non-mutual		0.06**	0.06*		-0.06**	-0.07**
		(0.03)	(0.03)		(0.02)	(0.03)
Log(Market)			0.14**			-0.01
			(0.06)			(0.08)
Log(Book)			0.02			-0.05
			(0.05)			(0.07)
M/B			0.02			-0.01
			(0.02)			(0.02)
Bid-ask			-0.01			0.04**
			(0.01)			(0.02)
	p-values of tests for differences between coefficients					
H_o: *Passive = Active*			0.01			0.00
H_o: *Passive = Non-mutual*			0.00			0.02
Observations	11,509	11,446	9,712	11,451	11,394	9,661
R^2	0.43	0.43	0.44	0.55	0.55	0.56
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Effect of Institutional Ownership Type on Loan Duration for Specials

This table reports the results from regressing loan duration on ownership of institutional investors for special stocks. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. The *p*-values for the differences between the coefficients within column (3) are reported at the bottom. *Loan duration* is the average number of days from start date to present for all open loans. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Loan duration*		
	(1)	(2)	(3)
Passive	0.11***	0.11***	0.12***
	(0.04)	(0.04)	(0.04)
Active		-0.03	0.03
		(0.03)	(0.03)
Non-mutual		-0.04	0.02
		(0.03)	(0.03)
Log(Market)			-0.49***
			(0.11)
Log(Book)			-0.11
			(0.07)
M/B			-0.03
			(0.02)
Bid-ask			0.02
			(0.02)
p-values of tests for differences between coefficients			
H_o: *Passive = Active*			0.09
H_o: *Passive = Non-mutual*			0.04
Observations	11,633	11,565	9,813
R^2	0.58	0.58	0.60
Quarter FE	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes

Table 9: Relation between Passive Fund Ownership and the Effects of Short Interest on Stock Returns for Specials

This table reports the results from regressing future stock returns on short interest and its interactions with high levels of passive fund ownership for special stocks. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. $Return_{t,t+K}$ is the cumulative future return (in percentage points) over K days, from day *t* to day *t+K*, in percentage points. *Short interest* is the fraction of shares borrowed. *High Passive* is a dummy variable that equals one if the ratio of passive ownership to the total institutional ownership is above the median. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and day are in parentheses.

y = $Return_{t,t+K}$ (in percentage points)					
K (days) =	15	30	45	60	90
	(1)	(2)	(3)	(4)	(5)
Short Interest	-0.19	-0.30*	-1.51***	-2.07***	-2.59***
	(0.11)	(0.16)	(0.33)	(0.37)	(0.46)
High Passive	-0.37*	-0.56**	-1.93***	-3.05***	-4.60***
	(0.22)	(0.28)	(0.58)	(0.73)	(0.94)
High Passive × *Short Interest*	-0.09	-0.16	-0.31**	-0.44**	-0.69*
	(0.10)	(0.14)	(0.15)	(0.21)	(0.38)
Observations	578,457	576,867	567,390	562,510	546,854
R^2	0.16	0.17	0.27	0.30	0.36
Control variables	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes

y = $Return_{t,t+K}$ (in percentage points)					
K (days) =	120	150	180	240	360
	(6)	(7)	(8)	(9)	(10)
Short Interest	-3.02***	-2.92***	-3.06***	-3.44***	-4.92***
	(0.50)	(0.50)	(0.55)	(0.72)	(0.83)
High Passive	-4.50***	-3.49***	-2.80**	-2.17**	-4.13***
	(1.01)	(1.08)	(1.16)	(0.98)	(1.17)
High Passive × *Short Interest*	-1.44***	-2.18***	-2.85***	-3.41***	-3.01***
	(0.48)	(0.61)	(0.74)	(0.83)	(0.83)
Observations	530,947	515,281	500,414	471,248	418,468
R^2	0.41	0.45	0.47	0.52	0.65
Control variables	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes

Table 10: Robustness to Alternative Measure of Specialness Based on DCBS

This table reports the results from regressing multiple outcome variables on ownership of institutional investors for special stocks. A stock is defined as special in a given quarter if its Daily Cost of Borrowing Score (DCBS) is in the top decile of the DCBS distribution across stocks. The *p*-values for the differences between the coefficients are reported at the bottom. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Difference in cross-autocorrelations	*Skewness*	*Lending supply*	*Short interest*	*Lending fee*	*Loan duration*	*Fee risk*	*Recall risk*
Passive	-0.06**	-0.09**	0.23***	0.65***	0.16**	0.12***	-0.06**	-0.19***
	(0.03)	(0.04)	(0.03)	(0.06)	(0.08)	(0.04)	(0.03)	(0.05)
Active	0.03	0.02	0.15***	0.36***	-0.13*	0.03	0.01	-0.04**
	(0.03)	(0.03)	(0.01)	(0.04)	(0.06)	(0.03)	(0.02)	(0.02)
Non-mutual	0.03	0.01	0.14***	0.35***	-0.38***	0.06**	0.08***	-0.08**
	(0.03)	(0.01)	(0.02)	(0.05)	(0.10)	(0.03)	(0.02)	(0.03)
	p-values of tests for differences between coefficients							
H_o: *Passive = Active*	0.04	0.07	0.01	0.00	0.02	0.08	0.09	0.01
H_o: *Passive = Non-mutual*	0.04	0.05	0.04	0.00	0.00	0.24	0.00	0.08
Observations	9,657	9,657	9,646	9,657	9,657	9,657	9,561	9,506
R^2	0.23	0.20	0.90	0.88	0.55	0.61	0.45	0.56
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: Robustness to Sensitivity to Unobserved Confounders

This table reports the coefficients from regressing multiple outcome variables on passive ownership for special stocks. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. Column (1) reports the baseline estimate without controls or fixed effects. Column (2) reports the estimates from the specifications with the full set of control variables and fixed effects from Tables 3-9. Column (3) reports the estimates from Oster (2019) procedure under the assumptions of equal selection on observables and unobservables ($\delta = 1$), and the ability of unobservables to fully explain the outcome variance ($R_{max} = 1$). Column (4) reports the identified set, the largest set that includes the values from columns (1)-(3). Column (5) indicates if the identified set from column (4) includes zero. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Passive* represent fractions of shares held by passive mutual funds. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	Coefficient on *Passive*				
	(1)	(2)	(3)	(4)	(5)
Independent Variable	Baseline effect	Controlled effect	Oster estimate	Identified set	Includes zero?
Difference in cross-autocorrelations	-0.08**	-0.08**	-0.09	[-0.08, -0.09]	No
	(0.03)	(0.03)			
Skewness	-0.18***	-0.15**	-0.11	[-0.11, -0.18]	No
	(0.03)	(0.03)			
Lending supply	0.58***	0.22***	0.97	[0.22, 0.97]	No
	(0.02)	(0.03)			
Short interest	1.57***	0.64***	2.48	[0.64, 2.48]	No
	(0.05)	(0.06)			
Lending fee	0.08	0.17**	0.04	[0.04, 0.17]	No
	(0.07)	(0.08)			
Loan duration	0.16***	0.12***	0.21	[0.12, 0.21]	No
	(0.03)	(0.04)			
Fee risk	-0.04	-0.08***	-0.10	[-0.04, -0.10]	No
	(0.03)	(0.02)			
Recall risk	-0.46***	-0.20***	-0.62	[-0.20, -0.62]	No
	(0.03)	(0.05)			

Online Appendix to "Strategic Borrowing from Passive Investors"

A. Alternative Measure of Short-Selling Risk

In this section, we describe the construction of the alternative measure of short-selling risk based on Engelberg, Reed and Ringgenberg (2018). We follow their methodology and estimate the regression of the form:

$$Var(Fee)_{i,t+1} = \alpha_i + \beta_1 \cdot Var(Fee)_{i,t} + \beta_2 \cdot VarUtil_{i,t} + \beta_3 \cdot TailFee_{i,t} + \beta_4 \cdot TailUtil_{i,t} +$$

$$+\gamma X_{i,t} + \varepsilon_{i,t},$$

where α_i are stock fixed effects, $Var(Fee)_{i,t}$ is the natural logarithm of the variance of loan fee for stock i in quarter t, $VarUtil_{i,t}$ is the natural logarithm of the variance of loan supply to short interest, $TailFee_{i,t}$ and $TailUtil_{i,t}$ are the 99th percentiles of a normal distribution based on the mean fee and its variance in quarter t-1, and $X_{i,t}$ is the vector of the stock characteristics used in our main analysis. We label the predicted value of the model as $ShortRisk_{i,t}$ which represents the estimate of future short-selling risk based on the information available in the current quarter.

We next repeat our tests from Section 4.4 and give the results in Table A3. In line with our main results from Table 7, a one-standard deviation increase in passive ownership is associated with 0.07 standard deviations reduction in short-selling risk (column (3)). Active mutual fund ownership is unrelated to the risk measure from Engelberg, Reed and Ringgenberg (2018), while non-mutual fund ownership is associated with increased risk.

Table A1: Effect of Institutional Ownership Type on Negative Cross-Autocorrelation

This table reports the results from regressing negative cross-autocorrelation on ownership of institutional investors. The results are separately reported for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column reports the differences in the coefficients between columns (3) and (6). The *p*-values for the differences between the coefficients within columns (3) and (6) are reported at the bottom. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Negative cross-autocorrelation* is the negative correlation of daily stock returns with lagged negative market returns in a given quarter. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Negative cross-autocorrelation*						
	(1)	(2)	(3)	(4)	(5)	(6)	(3) – (6)
	Special	*Special*	*Special*	*GC*	*GC*	*GC*	*Special v. GC*
Passive	-0.11***	-0.10***	-0.09**	-0.02	-0.02	-0.01	-0.08**
	(0.03)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	
Active		-0.01	0.01		0.00	0.02	-0.01
		(0.03)	(0.03)		(0.01)	(0.01)	
Non-mutual		-0.00	0.04		-0.05***	-0.03**	0.07*
		(0.03)	(0.03)		(0.01)	(0.01)	
Log(Market)			-0.17***			-0.19***	
			(0.07)			(0.06)	
Log(Book)			0.14*			0.06	
			(0.07)			(0.06)	
M/B			0.06***			0.01	
			(0.02)			(0.01)	
Bid-ask			0.03			0.04**	
			(0.03)			(0.02)	
	p-values of tests for differences between coefficients						
H_o: *Passive = Active*			0.02			0.43	
H_o: *Passive = Non-mutual*			0.01			0.42	
Observations	11,582	11,525	9,801	108,862	108,695	101,778	
R^2	0.27	0.27	0.27	0.27	0.27	0.27	
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	

Table A2: Effect of Institutional Ownership Type on Positive Cross-Autocorrelation

This table reports the results from positive cross-autocorrelation on ownership of institutional investors. The results are separately reported for special stocks and general collateral stocks (GC). A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks, and as GC, otherwise. The last column reports the differences in the coefficients between columns (3) and (6). The *p*-values for the differences between the coefficients within columns (3) and (6) are reported at the bottom. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Positive cross-autocorrelation* is the positive correlation of daily stock returns with lagged positive market returns in a given quarter. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to the firm's book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Positive cross-autocorrelation*						
	(1)	(2)	(3)	(4)	(5)	(6)	(3) – (6)
	Special	*Special*	*Special*	*GC*	*GC*	*GC*	*Special v. GC*
Passive	-0.00	-0.01	-0.00	-0.01	-0.01	-0.00	-0.01
	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	
Active		-0.02	-0.03		-0.01	0.00	-0.03
		(0.03)	(0.04)		(0.01)	(0.01)	
Non-mutual		-0.01	-0.01		-0.02*	-0.00	-0.01
		(0.03)	(0.03)		(0.01)	(0.01)	
Log(Market)			0.08			-0.05	
			(0.08)			(0.07)	
Log(Book)			0.01			-0.04	
			(0.07)			(0.04)	
M/B			0.02			-0.01	
			(0.02)			(0.01)	
Bid-ask			0.03			0.01	
			(0.02)			(0.03)	
	p-values of tests for differences between coefficients						
H_o: *Passive = Active*			0.01			0.54	
H_o: *Passive = Non-mutual*			0.01			0.49	
Observations	11,582	11,526	9,804	108,865	108,698	101,782	
R^2	0.23	0.23	0.23	0.21	0.21	0.21	
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	

Table A3: Alternative Measure of Short-Selling Risk

This table reports the results from regressing the measure of short-selling risk on ownership of institutional investors for special stocks. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. The *p*-values for the differences between the coefficients within column (3) are reported at the bottom. *Short risk* is the measure of short-selling risk, estimated as described in Appendix Section A.1. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. *Log(market)* is the natural logarithm of the firm's stock market capitalization. *Log(book)* is the natural logarithm of the firm's book value of equity at the end of the quarter. *M/B* is the ratio of the firm's stock market capitalization to book assets. *Bid-ask* is the closing bid-ask spread scaled by stock price. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	y = *Short risk*		
	(1)	(2)	(3)
Passive	0.01	-0.05	-0.07**
	(0.04)	(0.04)	(0.04)
Active		-0.06*	-0.05
		(0.03)	(0.03)
Non-mutual		0.21***	0.18***
		(0.04)	(0.05)
Log(Market)			0.04
			(0.07)
Log(Book)			-0.23***
			(0.07)
M/B			0.01
			(0.03)
Bid-ask			0.01
			(0.03)
p-values of tests for differences between coefficients			
H_o: *Passive = Active*			0.01
H_o: *Passive = Non-mutual*			0.00
Observations	6,058	6,051	6,051
R^2	0.56	0.56	0.57
Control variables	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes

Table A4: Robustness to Alternative Measure of Specialness Based on Lagged Lending Fees

This table reports the results from regressing multiple outcome variables on ownership of institutional investors for special stocks. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks in the previous quarter. The *p*-values for the differences between the coefficients are reported at the bottom. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Difference in cross-autocorrelations	*Skewness*	*Lending supply*	*Short interest*	*Lending fee*	*Loan duration*	*Fee risk*	*Recall risk*
Passive	-0.08**	-0.11**	0.22***	0.62***	0.21**	0.12***	-0.05*	-0.19***
	(0.03)	(0.05)	(0.03)	(0.06)	(0.09)	(0.04)	(0.03)	(0.04)
Active	-0.02	0.06	0.14***	0.31***	-0.13**	0.02	0.05	-0.03
	(0.04)	(0.04)	(0.01)	(0.05)	(0.06)	(0.03)	(0.04)	(0.02)
Non-mutual	0.02	0.02	0.15***	0.36***	-0.32***	0.05	0.08***	-0.04
	(0.03)	(0.04)	(0.02)	(0.06)	(0.11)	(0.03)	(0.02)	(0.03)
p-values of tests for differences between coefficients								
H_o: *Passive = Active*	0.20	0.00	0.01	0.00	0.01	0.10	0.03	0.00
H_o: *Passive = Non-mutual*	0.04	0.07	0.06	0.01	0.00	0.27	0.01	0.01
Observations	8,736	8,736	8,736	8,724	8,730	8,730	8,649	8,649
R^2	0.23	0.19	0.89	0.87	0.55	0.61	0.42	0.55
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A5: Robustness to Driscoll and Kraay (1998) Standard Errors

This table reports the results from regressing multiple outcome variables on ownership of institutional investors for special stocks. The standard errors are calculated using Driscoll and Kraay (1998) procedure. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. The *p*-values for the differences between the coefficients are reported at the bottom. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Driscoll and Kraay (1998) standard errors with a 3-quarter lag (t=3) are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Difference in cross-autocorrelations	*Skewness*	*Lending supply*	*Short interest*	*Lending fee*	*Loan duration*	*Fee risk*	*Recall risk*
Passive	-0.08***	-0.15***	0.22***	0.64***	0.17***	0.12***	-0.08***	-0.20***
	(0.02)	(0.04)	(0.02)	(0.05)	(0.06)	(0.03)	(0.02)	(0.05)
Active	0.03	0.03	0.15***	0.33***	-0.13***	0.03	-0.01	-0.03***
	(0.02)	(0.03)	(0.01)	(0.04)	(0.04)	(0.02)	(0.02)	(0.01)
Non-mutual	0.04	0.02	0.15***	0.35***	-0.37***	0.02	0.06*	-0.07***
	(0.03)	(0.03)	(0.02)	(0.06)	(0.08)	(0.02)	(0.03)	(0.02)
p-values of tests for differences between coefficients								
H_o: *Passive = Active*	0.00	0.02	0.00	0.00	0.00	0.06	0.03	0.00
H_o: *Passive = Non-mutual*	0.00	0.02	0.05	0.00	0.00	0.12	0.03	0.01
Observations	9,801	9,801	9,791	9,801	9,801	9,801	9,709	9,668
Within R^2	0.07	0.02	0.33	0.33	0.04	0.07	0.05	0.04
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A6: Time-variation of the Effects of Institutional Ownership

This table reports the results from regressing multiple outcome variables on ownership of institutional investors for special stocks. $1_{year<2013}$ is the indicator variable that equals one for the period of 2007-2012. A stock is defined as special in a given quarter if its lending fee is in the top decile of the fee distribution across stocks. *Lending supply* is the fraction of shares available for borrowing. *Short interest* is the fraction of shares borrowed. *Lending fee* is the annual fee for borrowing shares. *Loan duration* is the average number of days from start date to present for all open loans. *Fee risk* is the natural logarithm of variance of lending fees in a given quarter. *Recall risk* is the natural logarithm of variance of short interest-to-lending supply ratio in a given quarter. *Difference in cross-autocorrelations* is the difference between the correlation of daily stock returns with lagged negative market returns and the correlation of daily stock returns with lagged positive market returns in a given quarter. *Skewness* is the skewness of the distribution of daily log returns in a given quarter. *Passive, Active* and *Non-mutual* represent fractions of shares held by passive mutual funds, actively managed mutual funds and non-mutual funds, respectively. All the variables, except returns, are standardized such that the coefficients represent a change in standard deviations of the dependent variable as a result of a one standard deviation change in the independent variable. *, **, and *** denote statistical significance at the 10%, the 5%, and the 1% levels, respectively. Standard errors double-clustered by stock and quarter are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Difference in cross-autocorrelations	*Skewness*	*Lending supply*	*Short interest*	*Lending fee*	*Loan duration*	*Fee risk*	*Recall risk*
Passive	-0.09**	-0.05	0.26***	0.27**	0.79***	0.16***	-0.06	-0.27***
	(0.05)	(0.05)	(0.03)	(0.12)	(0.07)	(0.05)	(0.04)	(0.05)
Active	0.04	0.05	0.15***	-0.13	0.33***	0.03	-0.03	-0.04
	(0.05)	(0.06)	(0.02)	(0.10)	(0.06)	(0.04)	(0.04)	(0.03)
Non-mutual	0.05	-0.03	0.11***	-0.38***	0.26***	0.05	0.04	-0.07*
	(0.03)	(0.05)	(0.02)	(0.12)	(0.05)	(0.04)	(0.03)	(0.04)
Passive $\times$ $1_{year<2013}$	0.04	-0.06	-0.06**	-0.17	-0.22***	-0.07	-0.02	0.14**
	(0.05)	(0.05)	(0.03)	(0.13)	(0.08)	(0.05)	(0.04)	(0.06)
Active $\times$ $1_{year<2013}$	-0.02	-0.03	-0.00	0.02	0.03	0.01	0.03	-0.00
	(0.05)	(0.07)	(0.02)	(0.10)	(0.05)	(0.04)	(0.04)	(0.04)
Non-mutual $\times$ $1_{year<2013}$	-0.02	0.02	0.06**	0.04	0.15**	0.01	0.07**	0.00
	(0.03)	(0.04)	(0.03)	(0.11)	(0.07)	(0.05)	(0.03)	(0.03)
Observations	9,801	9,810	9,799	9,810	9,810	9,810	9,709	9,658
R^2	0.23	0.20	0.90	0.55	0.89	0.60	0.44	0.56
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes