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Securities lending and information acquisition

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Non-technical summary

Research Question

Securities lending plays a pivotal role in financial markets by matching investors with long positions, such as mutual funds, pension funds, and exchange-traded funds, to short sellers who wish to borrow securities. As short selling is an important channel through which negative information is incorporated into stock prices, borrowing demand from short sellers is a signal for potential underperformance of a stock. Given this negative signal, we ask why institutional investors retain their long positions and continue to lend the security.

Contribution

Using portfolio-level information of German mutual funds, we show that equity lenders access private information through their contract with a short seller. They observe a more precise and timelier signal about short sellers' preferences through their presence in the equity lending market. This information acquisition channel provides a motive for equity lending. Our results suggest that stock lenders use the information from the equity lending market for making informed portfolio decisions.

Results

We document that actively managed funds adjust their positions in stocks for which they observe private short demand signals in the securities lending market more strongly than to non-lenders holding the same stock. We further show that private short demand signals allow fund managers to front-run publicly disclosed short positions. The short demand signal allows funds to avoid future negative returns: They exit positions before the negative information is fully incorporated into the price, thereby leaving "losses on the table". In sum, our results highlight a new motive for securities lending and that the securities lending market provides a channel for information aggregation in stock markets.

Nichttechnische Zusammenfassung

Fragestellung

Die Wertpapierleihe spielt an den Finanzmärkten eine zentrale Rolle. Sie bringt Anleger mit Long-Positionen, wie etwa Investmentfonds, Pensionsfonds und börsengehandelte Fonds, mit Leerverkäufern, die Wertpapiere leihen möchten, zusammen. Da Leerverkäufe ein wichtiger Kanal sind, über den negative Informationen in die Aktienkurse einfließen, ist die Nachfrage von Leerverkäufern im Wertpapierleihmarkt ein Signal für eine potenzielle Underperformance einer Aktie. Angesichts dieses negativen Signals stellt sich die Frage, warum institutionelle Anleger ihre Long-Positionen beibehalten und das Wertpapier weiterhin verleihen.

Beitrag

Anhand von Portfolioinformationen deutscher Investmentfonds zeigen wir, dass Verleiher einer Aktie durch die Interaktion mit Leerverkäufern am Wertpapierleihmarkt private Informationen erhalten. Sie beobachten ein präziseres und zeitigeres Signal über die Präferenzen von Leerverkäufern durch ihre Präsenz in der Wertpapierleihe. Dieser Informationsbeschaffungskanal ist ein Motiv für die Wertpapierleihe. Unsere Ergebnisse deuten darauf hin, dass die Verleiher die Informationen aus dem Wertpapierleihmarkt für fundierte Portfolioentscheidungen nutzen.

Ergebnisse

Wir zeigen, dass aktiv gemanagte Fonds ihre Positionen in Aktien, für die sie private Leerverkaufs-Nachfragesignale am Wertpapierleihmarkt beobachten, stärker anpassen als Fonds, die denselben Bestand halten, die Aktie jedoch nicht verleihen. Weiterhin zeigen wir, dass private Leerverkaufssignale es Fondsmanagern ermöglichen, bereits vor der Veröffentlichung von großen Leerverkaufs-Positionen zu agieren. Das private Leerverkaufssignal ermöglicht es den Fonds, zukünftige negative Renditen zu vermeiden: Sie schließen Positionen, bevor die negativen Informationen vollständig in den Preis eingeflossen sind, und lassen so „Verluste auf dem Tisch“. Insgesamt zeigen unsere Ergebnisse einerseits ein neues Motiv für die Wertpapierleihe und andererseits, dass der Wertpapierleihmarkt einen Kanal für die Informationsaggregation an den Aktienmärkten bietet.

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Abstract

Using microdata on stock-level lending positions from German mutual funds, we show that active funds use the equity lending market to obtain information about short sale demand. Funds reduce long positions in response to these demand signals, which allows fund managers to front-run public disclosure of big short positions and avoid future losses. Fund managers exploit this information advantage across funds they manage, but do not share it within their fund family, consistent with short demand signals providing an information advantage. Our results suggest a new motive for securities lending and an information aggregation role for the equity lending market.

Keywords: Equity lending markets, mutual funds, short sales, short interest, price revelation, public disclosure.

JEL classification: G10, G12, G14, G18.

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1 Introduction

Securities lending plays a pivotal role in financial markets, matching investors with long positions to short sellers who wish to borrow securities. These short sellers, often sophisticated entities, like hedge funds, arbitrageurs, and activists, hold informed negative perspectives about a stock.[1] Lenders, primarily large institutional investors such as mutual funds, pension funds, index funds, and exchange-traded funds, earn fees by lending their shares. If the borrowing demand from short sellers signals potential stock underperformance, why would institutional investors retain their long positions and continue to lend the security?

In this paper, we show that mutual funds that lend securities to short sellers use demand information from the equity lending market for portfolio decisions. This suggests that securities lending acts as an information conduit between funds and informed short sellers. Short selling is an important channel through which negative price information is incorporated into stock prices. The superior forecasting ability of short sellers can be explained by better analysis of public information (Engelberg et al. (2012) and Porras Prado et al. (2016)) and short sellers' ability to uncover private negative information (Karpoff and Lou (2010) and Boehmer et al. (2020)). Aggarwal et al. (2015) and Porras Prado et al. (2016) show that lending transactions reflect the preferences of both equity lenders and short sellers.

Through their contract with a short seller, equity lenders can access private information not revealed in prices or even in stock-level short interest.[2] Specifically, lenders observe a more precise and timely signal about short sellers' preferences than non-lenders because they observe the composition of shorting demand, fees associated with short-selling, excess demand, and supply for lending stocks. This information acquisition channel provides a motive for equity lending that is complementary to lending fees, which provide an increasingly important source of income for funds, especially when fund managers face portfolio restrictions (Evans et al. (2017)).

[1] An extensive literature shows that short selling predicts lower abnormal stock returns consistent with short sellers being sophisticated and their short-selling decisions predicting future underperformance, including Asquith and Meulbroek (1995), Jones and Lamont (2002), Asquith et al. (2005), Boehme et al. (2006), Cohen et al. (2007), Diether et al. (2009), Rapach et al. (2016)), Boehmer et al. (2020).

[2] Blocher et al. (2013) show that short interest is not a sufficient statistic for measuring investors' beliefs because the equity lending market exhibits both search costs and slack supply.

Our analysis presents new evidence on the role of securities lending in information acquisition. First, active fund lenders adjust their positions in response to observing private short demand signals in the securities lending market relative to non-lenders holding the same stock. Second, using the timing of regulatory disclosure on large short positions, we show that private short demand signals allow fund managers to front-run public disclosure of short positions. These short demand signals allow funds to avoid future negative returns by leaving "losses on the table" relative to non-lending funds. Third, fund managers exploit the short demand signals across the funds they manage but do not share this information with competing funds in the same fund family. This is consistent with short demand signals providing a competitive advantage. We find no effect on passive funds. Taken together, the results highlight a new motive for securities lending and suggest that the securities lending market provides a channel for information aggregation in securities markets.

To study securities lending and information acquisition, we use unique data on equity lending by German mutual funds from the Investment Funds Statistic (IFS) of the Deutsche Bundesbank. Since September 2009, all investment companies domiciled in Germany must report general fund information and portfolio holdings monthly to the IFS. In December 2014, the reporting requirements were extended to include information about securities lending activity. For each security, funds must report the nominal value of each equity lending transaction in their portfolio. This granular data allows us to study the securities lending behavior of mutual funds, in particular, monthly fund-stock-time portfolio and lending positions. We combine this microdata with Morningstar fund information, stock information from Datastream, and security lending market data from Markit.

Our setting comprises 320 mutual funds domiciled in Germany, including 267 active and 53 passive funds, with €157 billion in assets under management. On average, 70% of passive funds and 25% of active funds lend stocks, consistent with evidence that active funds are less likely to supply stocks to the US equity lending market (Porras Prado et al. (2016)). However, the majority (63%) of lending positions are from active funds. The typical fund that lends securities lends 3.8% of its assets under management.

A unique feature of our data is that we can distinguish between private short demand signals, based on individual fund lending, and public signals, based on aggregate equity lending data. We define the private short demand signal a fund receives as the quantity of stock it has on loan in each period. In contrast, the public short demand signal is the aggregate on loan quantity. Aggregate short selling demand is available with some delay. This includes short interest, brokers' data on special lists, and borrowing costs provided to institutional investors with substantial trading volume. IHS Markit shares aggregate lending market information on a reciprocal basis with participating clients.

At the fund-stock level, active funds lend out 1.7% of their stocks, while passive funds lend 2.9%. On average, when a fund lends out a stock, the loaned amount constitutes 55% of its total position in that stock. The decision to lend a stock is persistent within a fund, and equity lending supply for a specific stock is concentrated in a few funds, consistent with the US evidence presented by Dong and Zhu (2022) using SEC N-PORT data. Two-thirds of the fund-stock lending positions have non-zero values in the preceding month. Only one-third are new equity lending supply contracts.[3] Therefore, the ability to measure the quantity on loan for each stock from each fund and how this quantity changes through time is critical for examining the transmission of short demand signals in the equity lending market.

We overcome several challenges related to identifying information acquisition in the equity lending market. First, we observe lenders and non-lenders and whether each fund can trade on information (e.g., active and passive funds). Second, the microdata reports fund-stock-time portfolio and lending positions monthly. This allows us to identify changes in portfolio allocation and lending positions within a fund, mitigating the selection concern that a fund's decision to lend securities may be correlated with its investment strategy and information acquisition at the fund level. Third, by observing the loaned quantity for each stock across funds, we can identify the private short demand signal separately from the aggregate signal. Therefore, we can identify the causal effect of information acquisition in the equity lending market. The completeness and frequency of the German mutual fund microdata provide an advantage over

[3]In an AR(1) estimation of lending supply at the fund-stock level, the AR(1) coefficient is 0.61 for active funds and 0.72 for passive funds.

data that contain simpler lending indicators, including the U.S. N-Q and N-CSRN-CSR filings, because these data do not reflect lending supply variation at the intensive margin.[4]

We start by examining changes in fund-stock portfolio holdings as a function of private short demand signals in the equity lending market. Active lenders are, on average, more likely to reduce positions in response to both public and private short demand signals from the securities lending market. In our primary estimations, we show that active funds reduce positions by 25% when they experience a one standard deviation increase in the private short demand signal for a stock they lend. Conversely, passive funds, lacking the discretionary authority to respond to such signals, appear unaffected.

Next, we examine if funds exploit private short demand signals to adjust their portfolio allocations before the public announcement of large short positions. Starting on November 1, 2012, European Union regulators standardized the disclosure of large short sale positions across stock exchanges in the European Union (EU). All short positions larger than 0.5% of the market capitalization for any stock traded on European exchanges must be reported to the market on the next trading day.[5] These public disclosure events are informative insomuch as they predict negative returns (Jank and Smajlbegovic (2015)). Therefore, disclosure of large short sales positions provides an ideal setting to identify trading on private information acquisition through securities lending separately from trading on public information.

We find that active fund lenders front-run public disclosures of large short sale positions when observing a private short demand signal, avoiding future losses. Lenders that front-run the disclosure avoid future losses associated with large short positions. This result highlights that funds receive an earlier and more precise signal about the dispersion of investor beliefs and informed negative sentiment through equity lending.

We also investigate the possibility that information spillover influences portfolio decisions within mutual fund families. We find evidence of spillover effects at the fund manager level; short

[4]In the U.S., the SEC quarterly N-Q and semi-annual N-CSRN-CSR filings include lending at the extensive margin only (i.e., whether a stock has been lent in the period or not) and N-SAR filings report lending at the stock level. The exception is the new N-PORT data, which includes the value of stock on loan at the quarterly level and is available from 2019 only.

[5]Before this date, the United Kingdom, France, and Spain already enforced disclosure requirements for large short sale positions for a wide array of stocks (Jones et al. (2016)).

demand signals received at a single fund explain portfolio decisions across all funds managed by the same manager. We find less evidence that the short demand signal is shared among managers within a family. Single funds respond to signals received at the fund family level but only when the fund is an active lender and receives its own short demand signal. Therefore, any spillover effect is limited to funds that acquire information through their own lending and have information to share, consistent with the within-family competition documented by Kempf and Ruenzi (2008) and Evans et al. (2020). This implies that the short demand signals in lending markets provide valuable information and facilitate information acquisition.

Finally, we examine the impact on fund returns and show that active funds exposed to private short demand signals are better at timing the closure of long positions. Active lenders time their exits *before* the full price impact of increased short selling. In contrast, active non-lenders exit relatively later and incur greater losses. On average, stocks with top-quintile shorting demand exhibit average abnormal 12-month returns of -14%. To reduce these losses, active lenders successfully time exits of high shorting demand stocks, earning pre-exit returns that are 4.7% higher than active non-lenders and avoiding post-exit abnormal returns of -5.1%. The pattern of pre-exit positive and post-exit negative relative returns represents losses that active lenders avoid relative to a comparable fund that does not lend. We label this pattern "losses-left-on-the-table." Active funds that lend shares have a better market timing ability than those that do not, consistent with information acquisition in the securities lending market. However, the effect on overall fund-level performance is more modest, most likely due to the small proportion of highly shorted stocks in the typical mutual fund's portfolio.

Our paper highlights that securities lending is a channel for information acquisition. The results are consistent with evidence that prices alone do not reflect dispersion in investor beliefs and that there is a disconnect between long and short markets (Blocher et al. (2013) and Kolasinski et al. (2013)). Information is conveyed from informed to uninformed investors not only through prices and trades in the long market but also through the equity lending market. We show that when active funds lend shares to short sellers, these funds exploit the information acquired through lending to their advantage. Thus, our results speak directly to how the flow of information is incorporated into prices in financial markets.

The information acquisition motive complements existing explanations for securities lending. D'Avolio (2002) and Nagel (2005) show that institutional investors and passive funds, in particular, supply securities to the lending market in exchange for a fee. Evans et al. (2017) find that lending fees are an increasingly important source of income for mutual funds and that fees drive the decision to lend, especially when fund managers face limited discretion in portfolio decisions. Aggarwal et al. (2015) show that investors trade off lending income with the potential risks of losing control through transferring securities to the equity lending market.[6] Porras Prado et al. (2016) show that mutual funds internalize the potential negative price impact when lending shares to short sellers.

Three papers are related to the contributions of our paper. Dong and Zhu (2022) examine the U.S. equity lending market structure and finds that a few lenders drive supply, with implications for short sale risk and market efficiency. Their results complement our paper, which provides new micro-evidence on the importance of equity lending. Honkanen (2020) uses U.S. mutual fund data on portfolio-level equity lending from SEC N-Q and N-CSR filings to study how active and passive lenders behave in the securities lending market and the impact on the allocation of loans, short sale risk, and fee structure. Palia and Sokolinski (2021) present similar arguments using stock-level data and focus on how short sellers strategically borrow from passive investors to mitigate short sale risks. Our main contribution relative to these last two papers is that our microdata includes loan quantities at the fund-stock-time level. This level of analysis allows us to identify (i) the causal effect of receiving a private short demand signal on portfolio allocation and exits, (ii) the information usage across funds and fund families, and (iii) how fund managers use these signals to front-run market disclosure and avoid losses.

Our paper highlights an alternative mechanism that emphasizes the complementary roles of short sellers and active lenders.[7] First, we find that active lender funds act on short demand signals. Consistent with this, the proportion of active fund lenders declines by 25%, moving

[6] This trade-off is illustrated by, for example, BlackRock's decision to offer investors both regular funds, in which stock can be lent, and non-lending funds, in which it cannot.

[7] Two recent papers provide theoretical motivation for complementarities in information and trading across market participants. Goldstein and Yang (2015) show that complementarities between information acquisition and trading amplify the effect of exogenous changes in the underlying information environment. Cvijanović et al. (2019) show that complementarities in information acquisition and trading improve governance via exit.

from the bottom to the top quintile of shorting demand. Second, the price to borrow stocks is no higher for active lender funds after we control for shorting demand, which is inconsistent with higher shorting risk from loan supply fragility. Third, abnormal returns after large short disclosures are concentrated in stocks where active funds have exited. The evidence is consistent with the complementary trading mechanism proposed by Goldstein and Yang (2015), in which short sellers rationally "leak" information to uninformed investors, who trade in a complementary pattern (Indjejikian et al. (2014)). Overall, the results highlight the importance of information acquisition in both the long and short markets to the overall efficiency of financial markets.

2 Institutional Details and Data

The framework that guides securities lending activities by German mutual funds is similar to the regulatory framework faced by US funds. As laid out in §§200 to 202 of the KAGB (Kapitalanlagegesetzbuch), open-end investment funds can engage in securities lending transactions under the following conditions: (1) the volume of securities lending transactions with a specific counter-party must not exceed 10% of a fund's net asset value; (2) funds must receive collateral that is equivalent to at least 100% of the loan value (depending on counter-party risk); (3) the collateral must be invested in high-quality sovereign debt, short-term money market funds, or repurchase agreements (repos); (4) funds must receive remuneration that reflects current market conditions; and (5) funds must be able to terminate the loan at any point in time.

In addition to these rules, fund families also impose restrictions on the maximum amount of a fund's portfolio that can be lent out at any point in time. Moreover, fund families can contract external securities lending agents or use in-house securities lending desks to pool their lending business across funds. While some German fund families have third-party lending agents, most employ in-house lending desks. In either case, securities lending revenues are usually split up between the fund, which effectively lends the security, and the lending agent. A report by Voicu and Prache (2019) on European UCITS ETFs shows that the revenue split between the lending fund and lending agent can range from around 50%–50% to up to 95%–5%.

Our data on German mutual funds comes from the Investment Funds Statistics (IFS) of the Deutsche Bundesbank, covering December 2014 through December 2018. Since September 2009, all investment companies domiciled in Germany have been required to report general fund information, as well as information on their portfolio holdings, to the IFS. The data is collected every month and provides detailed end-of-month, security-by-security information about the portfolio of a fund. More specifically, a fund reports the ISIN, the number of shares held, as well as the nominal and the market value of each holding.[8]

In December 2014, the Bundesbank introduced a major change in the reporting of funds' securities lending activities. For each security in the portfolio, each fund must report the end-of-month nominal value of a position that is held in a lending transaction.[9] Since the IFS data is collected on a share class level, we merge the data with Morningstar fund information and aggregate the data to the fund level, matching the share classes' ISINs to the fund identifier provided by Morningstar. For funds with multiple share classes, we calculate fund returns and expenses as asset-weighted averages across share classes. For assets under management, fund flows, and fund holdings, we aggregate across all share classes. Fund age is based on the inception date of the oldest share class. The initial IFS-Morningstar matched sample consists of 2044 funds from 58 fund families.

Next, we apply several filters. First, we exclude closed-end funds and alternative investment funds. Second, we delete non-equity, sector, and emerging market funds based on their Morningstar fund category. Third, we only keep funds older than three years and that have more than $10 million assets under management (AUM)to mitigate potential incubation biases (Evans, 2010). Our final sample has 320 German open-end equity mutual funds from 36 fund families. According to the IFS, 267 funds are actively managed, and 53 are passively managed. The investment focus of these funds is rather broad, as shown in Table 1. In terms of investment focus, 92 funds have a global focus, 135 funds are European, and 58 funds focus on German

[8] Dötsch et al. (2018) provide a general description of the data and the variables collected for the Investment Fund Statistics.

[9] Similar to information on portfolio holdings, the information on securities lending positions is reported at the security-fund-level and thus constant across all share classes of an individual fund.

equity. Relative to their AUM, 41% of the sample funds' AUM are invested with a focus on global equity markets, 25% with a focus on European equities, and 32% on German equities.

For the subsequent analysis, we combine the IFS mutual fund data with stock information from Datastream, security lending data from IHS Markit, and the Fama-French risk factors from Kenneth French's data library.[10] Furthermore, we restrict our sample to holdings of securities identified as common or preferred equity (excluding 2% of the sample observations) and to securities traded in the 23 developed markets as listed in Fama and French (2012) (excluding another 2% of the sample observations). Additionally, we drop an observation if the reporting date of the holding in the IFS data exceeds the stock's delisting date in Datastream (affecting less than 0.5% of all observations). We drop fund-month pairs from the sample if a fund closes all positions in a given month because we assume the fund is liquidated (affecting less than 0.5% of all observations).

We then use the holdings data to calculate two variables that capture the monthly trading activity of a fund. $PosChange_{i,j,t}$ is the percentage change in the number of shares of stock i held by fund j in month t.[11] The number of shares outstanding is adjusted for stock splits to ensure that the position changes are not driven by market value adjustments. In terms of the securities lending activity of a fund, we compute $sh\_sec\_lend_{i,j,t}$, defined as the fraction of a particular portfolio position in stock i lent by fund j in month t.

Table 2 provides summary statistics on the security lending behavior of German investment funds. A third of all funds participate in securities lending in our sample period. The share of securities lenders is lower for actively managed funds (26%) compared to passive funds (70%). Investment funds typically lend only a small fraction of their portfolio. The fraction on loan to the total AUM is equal to 3.8% on average. These figures are comparable to recent figures on mutual funds' securities lending practices in the U.S. (Porras Prado et al. (2016)). According to the Investment Company Institute (ICI), among the 500 largest U.S. mutual funds in 2004,

[10] Following Ferreira et al. (2018), we estimate four-factor alphas using regional factors based on a fund's investment region and use world factors in the case of global funds.

[11] We winsorize the variable at the 99.5% level.

37.6% engage in securities lending, with 2.28% of their AUM on loan (Grohowski and Collins, 2014).

Table 3 displays summary statistics for the monthly fund-security panel data. On Panel A, we find that 2% of a fund's positions are lent out in a given month and 5% are lent out over the past twelve months. The relative frequency with which funds exit a position is 4%. Panel B of Table 3 shows stock characteristics. As a proxy for aggregated shorting demand, we use the amount of securities on loan scaled by the total market capitalization of that security ($OnLoan$), which is provided by IHS Markit. For the stocks held by German investment funds, total shorting demand has a mean of 2.5% and a median of 1%. Panel C and Panel D of Table 3 report fund-level and fund family-level characteristics. In our sample, 85% of the observations originate from active funds and the remaining 15% from passive funds. Overall, 20% of the observations are from active and passive funds that participated in the securities lending market in a given month. Finally, 17% of observations are from fund families with at least one fund participating in the securities lending market in a given month.

Lending funds benefit from accessing private information and can earn lending fees, but choosing to participate in the equity lending market also incurs some costs. In the Appendix Table A.2, we examine how the propensity to lend by a fund is related to fund-level and family-level characteristics. We create an indicator variable equal to one if a fund does equity lending, and zero otherwise. Then, we estimate this lending indicator variable on a set of lender characteristics using the mean value over time for each fund. We find that passive funds are more likely to lend and consistent with a fixed cost of lending and economies of scale, that larger funds and those belonging to larger fund families are also more likely to lend.

3 Portfolio Holdings and Short Demand Signals

3.1 Empirical strategy

We examine how short selling demand signals in the equity lending market affect mutual fund portfolio allocation. Consider the following general characterization of mutual fund holdings,

where $\delta Y(i,j,t)$, is the change in holding for fund j holding stock i at time t:

$$Y_{i,j,t} = Y\left(Y_{i,j}, Y_{i,t}, Y_{j,t}, \phi_{i,j,t}\right) \tag{1}$$

Mutual fund holdings are an equilibrium outcome at time t, determined by the following components: a fund-stock time-invariant component, $Y_{i,j}$, which reflects a fund's time-invariant preferences for an individual stock based on a fund's investment philosophy or style towards a specific stock; a common stock-time component, $Y_{i,t}$, which reflects a common signal about stock fundamentals (including aggregate short selling demand) and explains the demand for a stock across funds; a fund-time component, $Y_{j,t}$, which reflects a fund's investment style including passive or active, portfolio breadth, and governance across stocks in its portfolio; and a fund-stock-time specific component, $\phi_{i,j,t}$.

The fund-stock-time specific component, $\phi_{i,j,t}$, captures fund j's specific demand for stock i at time t that is not explained by the components $Y_{i,j}$, $Y_{i,t}$, and $Y_{j,t}$. Our focus is on how a fund j's specific demand for stock i, $\phi_{i,j,t}$, changes when the fund receives the private short selling demand signal, $OnLoan_{i,j,t}$, acquired through the lending market on stock i at time t.

For example, consider a fund j that is active in the equity lending market and lends out a certain amount $OnLoan_{i,j,t-1}$ of stock i at time $t-1$. This amount provides the fund with a private signal of short selling demand that can affect portfolio allocation at time t. Importantly, this information is not a public signal that reflects the demand for a stock by all funds, like the information contained in short interest or index re-balancing, because it would be captured in the component $Y_{i,t}$.[12]

Our empirical specification identifies the effect of a private short demand signal that a lender receives in the equity lending market on the lenders' subsequent portfolio decisions. In a saturated fixed effect estimation, we estimate changes in fund-stock portfolio holdings as a function of a fund's lending activity, including fund-stock, stock-time, and fund-time-fixed effects ($\alpha_{i,j}$, $\alpha_{j,t}$, and $\alpha_{i,t}$). These fixed effects absorb public stock-time price signals common to

[12] A measure of aggregate short selling demand is available to institutional investors. Brokers often provide data on special lists and borrowing costs to institutional investors with substantial trading volume. Markit reciprocally shares lending market information with participating clients.

all investors, fund-time information and investment decisions common to all stocks in a fund's portfolio, and fund-stock time-invariant expertise.

To identify the effect of the private signal, $OnLoan_{i,j,t-1}$, on portfolio allocation, we estimate:

$$Y_{i,j,t} = \alpha_{i,j} + \alpha_{i,t} + \alpha_{j,t} + \beta_1 OnLoan_{i,j,t-1} + \mathbf{X}'_{i,j,t-1}\gamma_1 + \epsilon_{i,j,t}, \quad (2)$$

where $Y_{i,j,t}$ is a fund's change in portfolio allocation in stock i at time t (i.e., $PosChange_{i,j,t}$). The variable $OnLoan_{i,j,t-1}$ captures the magnitude of short-selling demand for stock i owned by fund j at time $t-1$ and is measured as the dollar value of shares on loan by fund j divided by market capitalization of stock i. $\mathbf{X}_{i,j,t-1}$ is a matrix of controls measured at the fund-stock-time level that could explain portfolio holdings, including the lagged position market value as a fraction of the fund market value, ($PosWeight$), and $ILLIQ$, a measure of the relative liquidity of a holding within a portfolio (Amihud (2002)).[13] Standard errors are clustered at the fund-time level.

The coefficient β_1 in equation 2 identifies the effect of a short demand signal received by fund j on stock i at time t on fund j's portfolio allocation. We predict that β_1 should be negative if lenders act on the private short selling demand information resulting from thier participation in the equity lending market. The counterfactual is funds that do not participate in security lending for stock i and therefore do not receive a private signal. Again, any effect due to information contained in aggregate $OnLoan_{i,t}$ is absorbed by $\alpha_{i,t}$.

Next, we examine the ability of active funds to act on short selling demand signals relative to passive funds. We estimate:

$$\begin{aligned} Y_{i,j,t} = {} & \alpha_{i,j} + \alpha_{i,t} + \alpha_{j,t} + \beta_1 OnLoan_{i,j,t-1} + \beta_2 OnLoan_{i,j,t-1} \times Active_j \\ & + \beta_3 OnLoan_{i,t-1} \times Active_j + \mathbf{X}'_{i,j,t-1}\gamma_1 + \epsilon_{i,j,t}, \end{aligned} \quad (3)$$

where $Active_j$ is an indicator variable equal to one for active funds and zero otherwise. The coefficient β_1 represents the portfolio change for passive funds that have lent stock i at time t.

[13] More details on the definition of the variables is given in Table A.1.

We expect β_1 to be zero since passive funds have no discretion to act on information signals. β_2 represents the portfolio change for active funds that have lent stock i relative to active funds not participating in the lending market. We predict that β_2 should be negative if active lenders act on the private short selling demand signal.

The coefficient β_3 captures the allocation response of actively managed funds to the public aggregate signal of short selling demand.[14] We predict β_3 to be negative if the aggregate short selling demand signal, $OnLoan_{i,t-1}$, is informative and includes a public component received by all funds. Further, we expect β_2 to continue to be negative if the private signal includes short demand information not captured in the public aggregate signal.

Equstimation 3 is central to our paper's results. Identifying the effect of the private short demand signal on portfolio allocation decisions allows us to explore a new economic motive for equity lending, namely information acquisition. In further tests, we implement similar estimations to explore how mutual funds use this private information signal on short demand to front-run disclosure of short positions, generate lower losses, and examine how the information is used in portfolio decisions within mutual fund families and by managers across funds.

In summary, our empirical strategy identifies the effect of short selling demand signals on portfolio allocation by exploiting the microdata on mutual fund holdings and lending in a saturated fixed effect estimation that absorbs fund-stock, fund-time, and stock-time effects.

3.2 Main Results

We first examine how receiving a short selling demand signal in the equity lending market affects portfolio decisions. In Column 1 of Table 4 we present results estimating equation 2 for all mutual funds, where the dependent variable is *%-Position Change*. The negative coefficient estimated for β_1 on $OnLoan_{i,j,t}$ shows that, on average, mutual funds reduce their position in response to increased demand for shares in the equity lending market.

Next, in column 2 we examine the differential effect for passive and active funds based on estimating equation 3. The coefficient β_1 on $OnLoan_{i,j,t}$ is insignificant from zero, showing that

[14] Aggregate short selling demand for stock i, $OnLoan_{i,t-1}$, is the sum of $OnLoan_{i,j,t-1}$ across funds at time $t-1$.

passive funds do not reduce positions in response to receiving a short selling signal relative to funds that do not lend. The result is consistent with passive funds not having the discretion to act on short demand signals. As expected, the portfolio allocation effect shown in column 1 is entirely explained by active funds, which have the discretion to act on private short demand information. The negative and significant coefficient for $Active \times OnLoan_{i,j,t}$ is equal to -0.3468, implying that a one standard deviation increase in $OnLoan_{i,j,t-1}$ reduces a position by 0.35 percentage points.

In addition to the private signal observed by a fund on its own lending portfolio, public signals of aggregate short selling demand are available with some delay from exchanges. This includes short interest, brokers' data on special lists, and borrowing costs provided to institutional investors with substantial trading volume. Additionally, IHS Markit shares aggregate lending market information on a reciprocal basis with participating clients. As highlighted in the Introduction, a large literature documents that the public signal predicts negative returns. Therefore, a potential selection concern in the estimation in column 2 is that the private signal of short demand, $OnLoan_{i,j,t}$, captures the effect of active funds responding to the aggregate public signal of short demand $OnLoan_{i,t}$.

In column 3, we include the interactions $Active \times OnLoan_{i,j,t}$ and $Active \times OnLoan_{i,t}$ to examine the effect of private and public short demand signals on portfolio allocation. If aggregate shorting demand predicts future negative returns, then active funds with the discretion to reallocate portfolio holdings should respond to the public signal whether they lend the stock or not. If the private short signal, observable only to those investors that participate in equity lending, is price-informative, then we should expect a differential response across active lenders and active non-lenders that is proportionate to the fund's private short demand signal. In contrast, if there is no benefit from the private short demand signal, there should not be any difference in trading activity across funds that own the stock and lend it relative to those funds that own the stock but do not lend it.

We show that the coefficient β_3 in column 3 is negative and significant, consistent with active lenders reducing their holdings in response to a public short selling demand signal. The

magnitude of -0.3048 implies that a standard deviation increase in aggregate short selling activity $OnLoan_{i,t-1}$ reduces stock positions of active funds by 0.3 percentage points.

Importantly, coefficient β_2 is negative and significant, implying that the private short demand effect in column 2 continues to hold. Active lenders that observe a private signal exhibit a portfolio response twice as large as active lenders that receive the public signal only. The result in column 3 of Table 4 mitigates the selection concern that the private short demand signal is a proxy for aggregate demand. The results in column 3 show that the private short demand signal, observable only to those investors participating in the equity lending market, captures price-sensitive information not captured in a public aggregate signal, such as short interest, consistent with Blocher et al. (2013).

We provide additional results on how funds respond to short selling demand signals by presenting estimation results for equation 3 separately for active and passive funds. As shown in the results in Table 4, active and passive funds have fundamental differences in portfolio allocation decisions. For instance, the main objective of passive funds is to replicate their underlying benchmarks, minimizing a fund's tracking error. Alternatively, active funds have the discretion to select stocks and act on short demand information acquired through equity lending.

Estimating equation 3 by fund type (active or passive) is equivalent to allowing fund-type interactions with all control variables and fixed effects to absorb conflating effects across fund types. The counterfactual fund is a fund of the same type that does not lend the stock and therefore does not receive a private short selling demand signal. The advantage is that the saturated fixed effect structure in equation (3) absorbs all common information shocks, including the aggregate short selling demand signal. We can therefore make a more precise inference by isolating the component $\phi_{i,j,t}$ in equation 1, which allows us to identify the effect of a private signal of short selling demand on stock i acquired by fund j in the equity lending market.

The results are presented in Table 5. As in Table 4, the dependent variable is *%-Position Change*, with all other variables defined as before. In column 1, we examine results for actively managed funds. The coefficient β_1 on $OnLoan_{i,j,t-1}$ is analogous to β_2 in Table 4. The results

in columns 1 and 3 show that active funds decrease their position in stocks that they lend and receive a private short demand signal; passive funds do not.

In column 2, we examine whether the allocation response to a private short demand signal is amplified by the level of aggregate short demand. The results in column 3 of Table 4 show that the private demand signal is informative over and above the public signal. The aggregate effect of the public signal on active funds is absorbed by the security-time-fixed effect in Table 5. Therefore, the coefficient β_2 on the interaction $OnLoan_{i,j,t-1} \times OnLoan_{i,t-1}$ captures whether there is a complementary effect of the public and private signals. This effect could arise if the two signals contain complementary information. For example, the public signal could contain an aggregate signal of short demand while the private signal could include a more precise measure of short demand preference, including the borrower's identity. We find that there is a complementary effect. Active lenders receiving a private short demand signal reduce holdings more when aggregate short demand is greater

In columns 3 and 4 of Table 5, we focus on changes in portfolio holdings for passively managed funds only. In contrast to active funds, we find short selling demand signals do not explain portfolio decisions for passive lender funds, relative to passive non-lender funds. This is consistent with the fact that passive funds invest in stocks to replicate their underlying benchmark, and we do not expect them to use equity lending information to change their portfolios.

In summary, the results in Section 3.2 present evidence that active funds that participate in equity lending make portfolio decisions conditional on the short selling demand signals received from the equity lending market. We show that active lenders decrease holdings in response to short selling demand relative both to passive lenders, who do not have the discretion to change holdings, and to active non-lenders, who observe only the publicly shared signal on short selling demand. Further, we rule out that the private short demand signal is simply capturing information contained in aggregate short demand signals. The private signal provides additional price information that complements the public aggregate signal. The results are

consistent with active lenders acquiring private information in the equity lending market that allows them to make more informed portfolio decisions.

3.3 Large Short Position Public Disclosures

To disentangle the effects of information acquired from participating in the securities lending market from information inferred from public signals, we study the timing of fund managers' portfolio allocation decisions around the public disclosure of large short sale positions.

Article 9 of Regulation (EU) No 236/2012 requires that large short sale positions in the European Union (EU) are disclosed publicly. Since November 1st, 2012, any net short position larger than 0.5% of the market capitalization of the company shorted has to be disclosed on the next trading day to the public. Above the disclosure threshold of 0.5%, further disclosures are obligatory at increments of 0.1% (e.g., 0.6%, 0.7%, etc.) and when the position falls below the 0.5% disclosure threshold. The disclosure requirement applies to all investors, irrespective of their origin. Disclosure is standardized across all European countries and contains the name of the investor, the date of the short position, identifying information on the shorted stock, and the magnitude of the position reported as a percentage of the shorted firm's market capitalization. The regulation and relevant data are described in more detail in Jank and Smajlbegovic (2015), Jones et al. (2016), and Jank et al. (2020). In terms of representativeness, publicly disclosed short positions are more frequently observable for large and very liquid stocks (Jank et al., 2020), which is also the case for our sample.

We collect the short position disclosures from the web pages of the national competent authorities of the EU. These public disclosure events are informative in the sense that they predict negative returns (Jank and Smajlbegovic (2015)) but do not fully reveal private information about the structure of shorting demand below the disclosure threshold (Jank et al. (2020)). We focus on new disclosure events, defined as those in which stocks have not disclosed any public short positions in the previous six months.[15]

[15]The six-month period between the last reported public short position and the new disclosure makes it more likely that the new disclosure represents an informative public price signal instead of a follow-on disclosure, which is less informative (Jones et al. (2016)).

To understand the timing of fund managers' portfolio allocation decisions around the disclosure we study active funds' portfolio adjustments in the months around the disclosure of large short positions in the following regression framework:

$$\begin{aligned} Y_{i,j,t} &= a_0 + \beta_1 OnLoan_{i,j,t-1} + \beta_2 OnLoan_{i,j,t-1} \times OnLoan_{i,t-1} + \\ &\quad \beta_3 Disclosure_{i,t+1} \times OnLoan_{i,j,t-1} + \beta_4 Disclosure_{i,t} \times OnLoan_{i,j,t-1} + \\ &\quad \beta_5 Disclosure_{i,t-1} \times OnLoan_{i,j,t-1} + \mathbf{X}'_{i,j,t-1}\gamma + \alpha_{i,t} + \alpha_{j,t} + \alpha_{i,j} + \epsilon_{i,j,t} \end{aligned} \quad (4)$$

where $Disclosure_{i,t}$ is an indicator variable equal to one if there is a new short position disclosure in month t for stock i and zero otherwise. Similarly, $Disclosure_{i,t+1}$ is an indicator variable equal to one if there is a new short position disclosure in month $t+1$ (i.e., in the future), and $Disclosure_{i,t-1}$ is an indicator variable equal to one if there is a new short position disclosure in month $t-1$ (i.e., in the past). The fixed effect framework adsorbs common effects of the disclosure on portfolio allocation. We hypothesize that mutual fund managers can better time position re-allocation around disclosure when they observe private signals of shorting demand in the securities lending market. Therefore, our focus is on how the fund's private signal of demand $OnLoan_{i,j,t-1}$ interacts with the disclosure timing of a large short position.

The coefficients β_1 and β_2, examined in columns 1 and 2 of Table 5, represent the effect of a private shorting demand signal on portfolio allocation. If observing private short demand signals allows mutual funds to improve the timing of portfolio decisions by anticipating large short positions, then we expect active lenders to front-run public disclosure. Therefore, the main coefficient of interest in this regression is β_3. This coefficient measures how security lenders adjust their stock positions in the month before a large public short sale disclosure relative to non-lenders holding that stock. In contrast, we expect β_4 and β_5 to be zero because active lenders have no information advantage over non-lenders post-disclosure.

Our results are presented in Table 6. Column 1 shows that securities lenders reduce their holdings of a stock in the month prior to a large position disclosure. The $Disclosure_{i,t+1} \times OnLoan_{i,j,t-1}$ coefficient is equal to -0.4397 and almost 50% larger than the coefficient estimated

for $OnLoan_{i,j,t-1}$. This result implies that mutual fund lenders not only respond to the private signal of sorting demand in their own lending but they are able to observe and respond to large short demand positions before these are publicly disclosed. The result is consistent with lending funds acquiring private information on the structure of security lending beyond their own contract, which allows them to front-run the market. As expected, the coefficients β_4 and β_5 are zero, showing that lenders' private information about the big short position becomes valueless once the position has been disclosed publicly. In column 2, we control for the aggregate short selling amount, finding similar results. These results suggest that fund managers can acquire valuable information through security lending, which allows them to anticipate large negative trades. Lenders produce their own private information rather than just reacting to the public signal of a large short sale position.

3.4 Information Usage across Funds and Fund Families

The results so far show that active funds that lent a stock in the past are more likely to reduce or close their position compared to non-lenders when shorting demand is high in that stock. This suggests that fund managers value the information in shorting demand signals and closely monitor shorting demand for the stocks they lend. In this section, we examine how portable this information is across funds with different fund managers within a fund family and across funds with the same fund manager.

3.5 Fund Family Information Flows

The typical equity lending arrangement of mutual funds (e.g., DWS Invest German Equities LC) of a given fund family (e.g., DWS Group) is that all holdings are pooled at the fund-family level and then lent out according to demand. Fund managers receive information from the fund family's lending desk about their fund's equity loans. We should therefore naturally question the extent to which security lenders share shorting demand information with other fund managers in the same fund family. To study this question, we first augment the regression model for active funds in the following way:

$$
\begin{aligned}
Y_{i,j,t} \quad = \quad & \beta_1 OnLoan_{i,j,t-1} + \beta_2 OnLoan_{i,f\neq j,t-1} + \beta_3 OnLoan_{i,j,t-1} \times OnLoan_{i,f\neq j,t-1} \\
& + \mathbf{X}'_{i,j,t-1}\gamma + \alpha_{i,t} + \alpha_{j,t} + \alpha_{i,j} + \epsilon_{i,j,t}
\end{aligned} \tag{5}
$$

where $OnLoan_{i,j,t-1}$ captures the magnitude of stock lending in stock i by fund j at time $t-1$, and $OnLoan_{i,f\neq j,t-1}$ captures the fraction of the portfolio position in stock i lent by other funds in the fund family f in month $t-1$.

We report our results in Table 7, with column 1 repeating the same results shown in column 1 of Table 5. In column 2, we find a negative relation between the amount lent out of stock i aggregated at the fund-family level for all other funds in the family; the coefficient is equal to -0.166 and statistically significant at the 1% level. This is consistent with contemporaneous work by Honkanen (2020) and Dong and Zhu (2022), which also show that family-level stock lending affects holdings. However, once we control for fund-level stock lending in column 3, there is no evidence that non-lending funds change their holdings based on information gathered by lending funds within the same fund family. The estimated coefficient is close to zero (i.e., -0.0109) and is no longer significant. Instead, j's lending of stock i drives most of the variation in portfolio holdings: the β_1 coefficient for $OnLoan_{i,j,t-1}$ is equal to -0.2991. In column 4, we find that a fund only responds to signals received by family-level lending when the fund is an active lender and receives its own short demand signal. The interaction term is negative and significant at the 10% level. Therefore, any spillover effect is limited to funds that acquire information through their own lending and have information to share, consistent with the within-family competition documented by Kempf and Ruenzi (2008) and Evans et al. (2020).

3.6 Fund Manager Information Flows

If managers compete within a fund family, then we should observe a manager using shorting demand signals for portfolio allocation across all the funds they manage. To investigate this possibility, we create three variables to capture the effect of lending stocks across funds managed

by the same manager: (i) $OnLoan_{i,m,t-1}$ is the fraction of stock i lent by all funds managed by manager m; (ii) $OnLoan_{i,m,j,t-1}$ is the fraction of stock i lent by manager m for fund j in month $t-1$; and (iii) $OnLoan_{i,k\neq j,t-1}$ is the fraction of stock i being lent by manager m for all her other funds $k \neq j$ in month $t-1$. We use these variables to estimate the following equation:

$$\begin{aligned} Y_{i,j,t} &= \beta_1 OnLoan_{i,m,t-1} + \beta_2 OnLoan_{i,m,j,t-1} + \beta_3 OnLoan_{i,k\neq j,t-1} + \\ &\quad \mathbf{X}'_{i,j,t-1}\gamma + \alpha_{i,t} + \alpha_{j,t} + \alpha_{i,j} + \epsilon_{i,j,t} \end{aligned} \tag{6}$$

Results are shown in Table 8. In column 1 we find that a manager is more likely to reduce the holding of a given stock if it is lent by any fund managed by the manager. In column 2 we split this variable between the amount of stock i lent in fund j managed by manager m (i.e., $OnLoan_{i,m,j,t-1}$) and the amount lent of that stock across all other funds managed by the same manager (i.e., $OnLoan_{i,k\neq j,t-1}$). Both effects are negative and statistically significant. For example, the -0.0779 coefficient on β_3 in column 2 shows that we still observe a reduction in the holdings of a stock in a given fund if this stock has been lent out by another fund managed by the same portfolio manager, but this effect is much lower than the -0.2293 found for lending the stock in fund j. These results are consistent with fund managers using shorting demand information derived from equity lending across their managed portfolios.

The results on the flow of information within a fund family and a fund manager provide further evidence that shorting demand signals are important for mutual fund portfolio allocation. Mutual fund managers use signals from one fund to inform portfolio allocation in other funds they manage but do not share these signals with competing managers within the same fund family.

4 Stock Returns

4.1 Returns after Position Exits

Our results show that lending shares affect the decision to hold a particular stock. A natural extension of our analysis is to examine if lending also affects returns on investment. First, we examine whether being an equity lender increases the probability of exiting a stock position in the future with an indicator variable equal to one if a fund has closed its position on a stock in month *t+j* and zero otherwise. Then, we estimate a regression to see how an indicator variable, $D(OnLoan_{i,j,t-13,t-1})$, equal to one if the fund lent the stock in the previous 12 months up to month *t-1* and zero otherwise, is related to whether a fund has closed a position or not. We control for the percentile rank of a portfolio position sorted on Amihud's (2002) illiquidity measure and for the fraction of the stock's position in the fund's portfolio in month *t-1*.

In Figure 1, we report the coefficients of $D(OnLoan_{i,j,t-13,t-1})$ using all stock exits in Panel A; Panel B includes only the exits of heavily shorted stocks, defined as those in the top quintile of short interest demand (*On Loan*) in month *t-1*. We find that being an equity lender increases the probability of exiting a position for active funds but not for passive funds. In Panel B, we obtain similar results, but the estimated coefficients are almost twice as large when the focus is on highly shorted stocks. When equity lenders are active rather than passive lenders, they change their portfolio decisions, an effect that is amplified for highly shorted portfolio stocks.

Next, we examine if lending shares have an impact on the timing ability of active lenders and how lending shares affect the returns of position exits by a fund. We collect all position exits of actively managed funds that have lent any stock in the year before the exit and partition the exits into two groups: stocks lent at any point in the year before the exit and stocks not lent in the year before the exit. We analyze all cases in which a fund closes a position, as well as a sub-sample of highly-shorted stocks, defined as those in the highest quintile of *OnLoan* one month before the exit across all events.

We set an event window of 12 months around a position's exit at t=0.[16] For each event, we compute the monthly abnormal stock return based on the Carhart four-factor model.[17] We compute the pre-exit abnormal returns from time $t+j$ until the end of the month before an exit $(CARt+j, t-1)$ and the post-exit abnormal returns from the end of the exit month up to 12 months after the position exit $(CARt, t+j)$. A negative return before the exit (e.g., from $t=-12$ to $t=0$) can be interpreted as the loss that the fund would have avoided by closing the position 12 months before the actual exit $(CARt-12, t-1)$. Similarly, a negative cumulative return after the exit month (e.g., from t to $t+12$) can be interpreted as the additional losses that the fund would have faced by closing the position at $t+12$. To ensure that post-exit returns indeed represent returns the fund has "left on the table," we drop all cases in which a fund buys the stock again within the 12 months after the exit.

The final sample contains 45,291 observations in the event time. We estimate the following event-time regression to examine abnormal returns associated with the position exits of active lenders:

$$Ab.Ret_{i,j,\tau} = \sum_{\tau=-12}^{12} \beta_{1,\tau} \times D_\tau + \sum_{\tau=-12}^{12} \beta_{2,\tau} \times D_\tau \times SecLend_{i,j} + \alpha_i + \alpha_j + \alpha_t + \epsilon_{i,j,\tau} \quad (7)$$

The dependent variable is the abnormal return of stock i, exited by fund j at time $\tau = 0$. D_τ is a set of event-time indicator variables, and $SecLend$ is an indicator variable equal to one if the fund has lent the stock in the 12 months prior to the exit. α_i, α_j, and α_t are stock, fund, and time-fixed effects, respectively.

Figure 2 shows the cumulative abnormal returns from $t-12$ up to $t=-1$ before the exit and from t up to $t+12$ after the exit based on the estimated coefficients. The solid line displays results for active funds that lent the stock in the 12 months before the exit; the dashed line shows active funds that did not lend during these 12 months. Both lines indicate that the abnormal returns of heavily shorted stocks amount to approximately -16% in the 12 months

[16] Since the IFS data contains end-of-month holdings, the exit can occur at any point between $t=-1$ and $t=0$. We conservatively assume the exit takes place at $t=0$.

[17] We use region-specific factors for the risk adjustment. We follow Fama and French (2012) to assign a region to each stock and compute the parameters for the risk adjustment 13 months before each exit to avoid an overlap with the event window.

surrounding a fund exit. However, active lenders can time their exits in the stocks they have lent such that a significant part of the decline in abnormal returns occurs only after the exit. More specifically, abnormal returns for highly shorted stocks that were lent decline by about -9% until the exit and continue to decline by another -7% following the exit. These declines suggest that the fund can close the position before the negative information is fully incorporated into the stock price and leave "losses on the table" by selling at the time the fund does. In contrast, post-exit abnormal returns for stocks that have not been lent by the fund are not statistically significant but equal to -13.6% in the 12 months before the exit.

Table 9 reports the coefficient estimates depicted in Figure 2. In Panel A, we show results for all exits by a fund, split between stocks that were lent (L) in the past 12 months relative to those not lent (NL). Column 3 displays the difference in abnormal returns between these two groups. While in a few months we observe a statistically significant difference (e.g., at *t+3* the difference is equal to -1.11%), there is no meaningful economic difference in returns between lending a share or not, both in the twelve months before and after the exit.

In Panel B, we focus only on exits of highly shorted stocks, those for which we would expect the trading signal observed by lending shares to be the most useful when aggregate shorting demand is high. The pre-exit 12-month abnormal return between previously lent stocks and those not previously lent is equal to 4.66%. This means that stocks in the highest quintile of short interest that are not lent by a fund have lower abnormal returns in the 12 months before they are sold than stocks that are lent by a fund. Examining the performance after the exit, we find that the relative cumulative returns are also significantly lower, up to -6.79% at $t + 10$, for stocks that were previously lent by a fund. This pattern of relatively lower pre-exit and lower post-exit returns is consistent with funds being able to front-run price decreases with the help of information they acquire from participating in the lending market. In turn, this front-running abiity prevents further losses relative to those funds that have not lent the stock.

To further investigate whether the position exits by funds that lend high short-interest stocks exhibit different abnormal returns than exits by non-lending funds, we run the following

regression:

$$\begin{aligned} Ab.Ret_{i,j,t} &= \beta_0 + \beta_1 D(OnLoan_{i,j,t-13,t-1}) + \beta_2 OnLoan_{i,t-1} + \\ &\quad \beta_3 D(OnLoan_{i,j,t-13,t-1}) \times OnLoan_{i,t-1} + \mathbf{X}'_{j,t-1}\gamma + \alpha_j + \alpha_{j,t} + \epsilon_{i,j,t}, \end{aligned} \tag{8}$$

$Ab.Ret_{i,j,t}$ is the abnormal stock return of stock i in the six or twelve months following a position exit by fund j. $D(OnLoan_{i,j,t-13,t-1})$ is an indicator variable equal to one if the fund has lent the stock in the year before the exit and zero otherwise. $OnLoan_{i,t-1}$ is the aggregate fraction lent out of stock i in the previous month. $X_{j,t-1}$ is a vector of fund characteristics measured one month before the exit. We control for fund size, age, flows, expense ratio, alpha, R^2, portfolio turnover, and fund-family size. We also include security-fixed effects (α_i) and fund-time-fixed effects ($\alpha_{j,t}$).

If actively managed funds can better time position closures due to information acquired from participating in the securities lending market after increases in shorting demand, we expect β_3 to be negative. Table 10 shows that this is indeed the case. In columns 1–2, the dependent variable is the six-month abnormal return. In all specifications, we find a negative coefficient for the interaction between $D(OnLoan_{i,j,t-13,t-1})$ and $OnLoan$. After a fund closes a position held on a previously lent stock, abnormal returns in the next six months become more negative as the shorting demand for the stock increases. In columns 3–4, we replace our dependent variable with the 12-month abnormal return to examine whether the negative abnormal performance persists. Again, all specifications yield a negative coefficient for β_3, which is somewhat larger compared to the coefficients in columns 1–2. For example, a one standard deviation difference in shorting demand forecasts a -3.54% lower abnormal return in the 12 months after exiting for stocks that have been lent out by a fund. In summary, there is no evidence of a reversal in abnormal returns.

4.2 Stock Returns Following Disclosure of Large Short Positions

Finally, we investigate how stock returns are affected by the actions of active funds that exit and large short sellers. In Table 11, we examine stock returns following the disclosure of a new large short position and condition it on the number of active mutual funds that exited the position in the previous month (*#(Active Funds Exiting)*). In columns 1–6, we use one-month and three-month post-disclosure returns ($Ret_{t+1,t+2}$ and $Ret_{t+1,t+4}$), while in columns 7–12 we employ abnormal returns using the Carhart four-factor model. We include security and time fixed effects, with standard errors clustered at the security level.

Our main finding is that stocks with a higher number of active funds that close their positions before the large short announcement underperform in the three months after the large short disclosure. The size of the new large short positions disclosed at time t, *%Big Short*, is statistically significant only for raw returns. However, the interaction of large shorts with active fund exits is negative and statistically significant for both raw and abnormal returns. This is consistent with the strategic trading complementarity argument by Goldstein and Yang (2015). Exits by active mutual funds amplify the magnitude of the informational signal contained in the large short selling disclosure. Similar to past literature (e.g., Asquith et al. (2005) and Richardson et al. (2017)), the aggregate short selling demand (*On Loan*) forecasts lower future returns.

5 Conclusion

Using unique microdata on German mutual fund holdings and equity loans, we provide evidence that securities lending is a mechanism for information acquisition and a channel used by informed investors to gather information about future stock returns. We show that mutual funds make portfolio allocation decisions conditional on information acquired from participating in the equity lending market. Active funds that supply shares to short sellers reduce their holdings and increase the likelihood of closing a position in response to increases in the shorting

demand. These effects are observed for active funds but not for passive funds, consistent with investors actively exploiting changes in shorting demand.

Informed exits by funds that have lent shares appear to front-run negative price revelations contained in shorting demand. Active lenders minimize losses when selling highly shorted stocks and earn positive abnormal returns relative to active funds that do not lend stocks. Using the mandatory disclosure of large short positions in European stock markets, we find a tendency toward underperformance for stocks with a higher number of positions closed by active lenders before the disclosure of a new large short position.

Our results can be better understood through the lens of short sellers and active lenders having complementary roles in information acquisition and trading in a manner that improves price informativeness (Goldstein and Yang (2015)). Selling activity by short sellers and lending funds incorporate private information into prices. This new perspective is important given the ongoing debate on how financial technology may destroy incentives for information production and decrease price information to understand the overall efficiency of financial markets.

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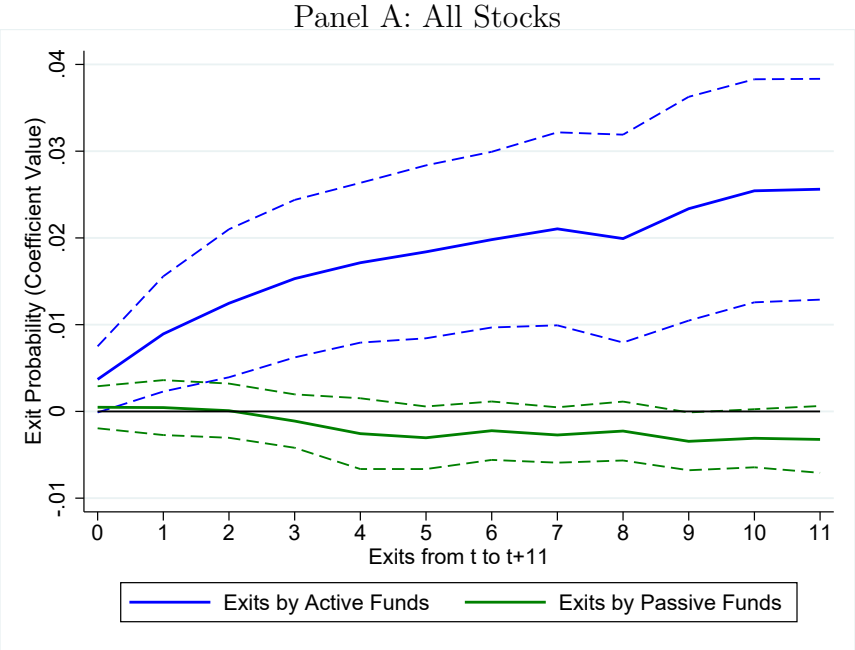
Figure 1.
Position Exit Probabilities as a Function of Lending Stock
This figure displays the impact of a fund being an equity lender at time t on the probability of exiting a stock in the following 12 months. The figure is based on a regression of an indicator variable equal to one if a fund has closed its position on a stock in month $t+j$ as a function of an indicator variable equal to one if the fund lent the stock in the previous 12 months up to month *t-1*, controlling for the percentile rank of portfolio position sorted on Amihud's (2002) illiquidity measure and the fraction of the stock's position in the fund's portfolio in month *t-1*. We split the sample between active funds (blue lines) and passive funds (black lines), using dashed lines for the 95% confidence intervals. The top figure shows coefficients for all stocks, while the bottom figure only uses heavily shorted stocks, defined as those in the top quintile of short interest demand (*On Loan*) in month *t-1*.



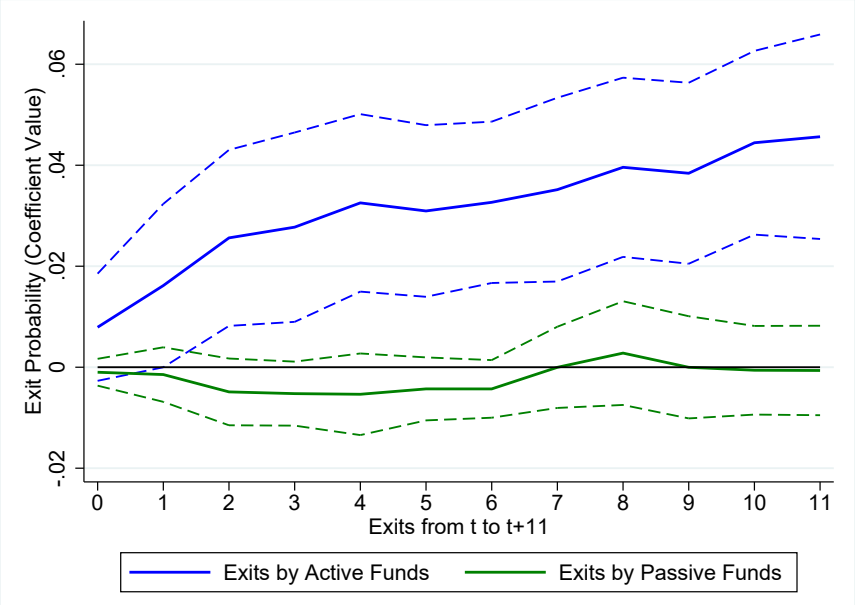


Figure 2.
Position Exits of Active Lenders: Abnormal Stock Returns
This figure displays abnormal stock returns from 12 months before to 12 months after position exits in event time. The figure is based on the coefficient estimates shown in Table 9. The sample consists of all stock exits of active lenders in heavily shorted stocks, i.e. stocks which are in the highest quintile of short selling demand (*OnLoan*) one month prior to the exit. The single solid line shows abnormal returns for position closures of stocks that have been lent by the fund in the year prior to the exit (Table 9, Column 1). The dashed line shows abnormal returns for position closures of stocks that have not been lent by the fund in the year prior to the exit (Table 9, Column 2). Abnormal returns are calculated based on the Carhart four-factor model, using regional risk factors.

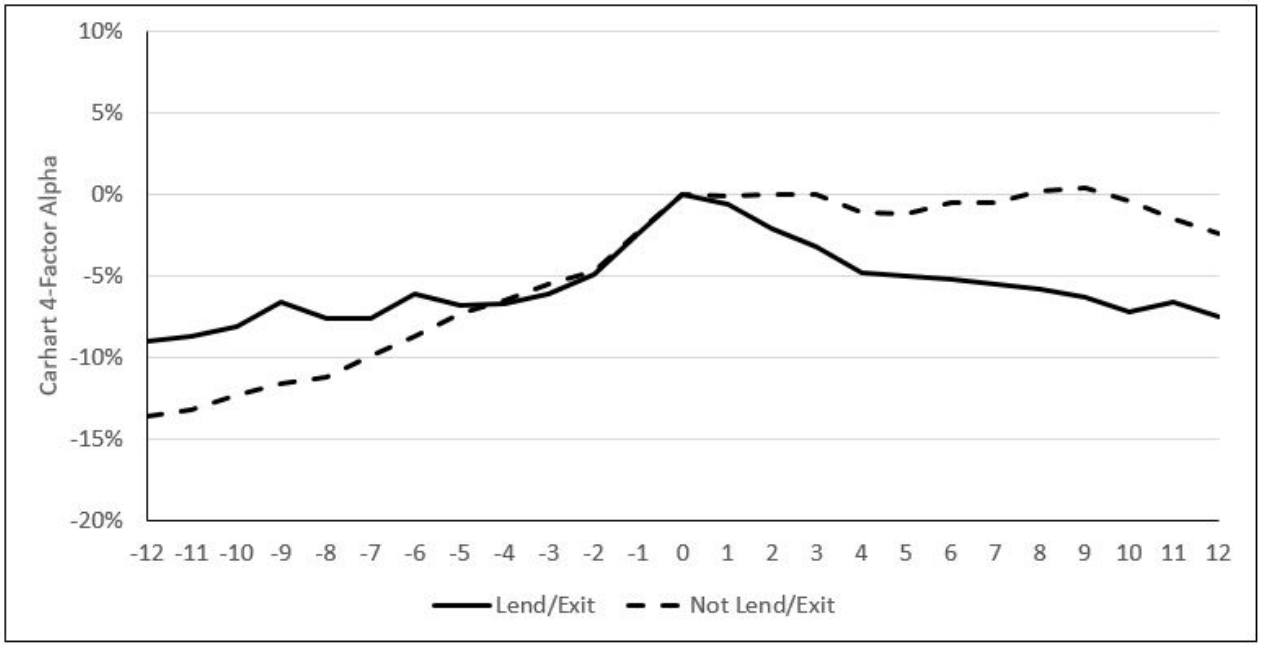


Table 1
Descriptive Statistics: German Mutual Funds - Investment Focus
This table reports descriptive statistics of the sample of German mutual funds used in the analysis. Data on fund portfolio holdings are from the Bundesbank's Investment Funds Statistics database. Other fund information is from Morningstar.

Investment Focus	*Number of Funds*	*AUM (in billion EUR)*
Global	92	63.78
Europe	135	38.37
Germany	58	49.40
Other	35	5.20
ALL	**320**	**156.75**

Table 2
Descriptive Statistics: German Mutual Funds - Securities Lending Behavior
This table reports descriptive statistics of the sample of German mutual funds used in the analysis. Data on fund portfolio holdings are from the Bundesbank's Investment Funds Statistics database. Other fund information is from Morningstar.

Panel A: Fund-Level Lending	Obs	% of Funds Lending
All Funds	320	32.81%
Active Funds	267	25.47%
Passive Funds	53	69.81%

Panel B: Portfolio-Level and Position-Level Lending	Obs	Mean	Median	St. Dev.	25th Pct.	75th Pct.
% of AUM Lent	2,563	3.80%	2.43%	4.50%	0.94%	5.12%
% of Position MV Lent	21,572	55.39%	57.44%	36.20%	17.64%	92.77%

Table 3
Descriptive Statistics
This table reports monthly descriptive statistics of the main variables used in the analysis. Data on fund portfolio holdings and equity lending activities is from the Bundesbank's Investment Funds Statistics database. Stock data is from Datastream. Markit provides equity market lending data. Fund information is from Morningstar. The variable definitions are in Appendix A.

Variable	Mean	Median	St. Dev.	25th Pct.	75th Pct.	Obs.
Panel A: Portfolio Variables						
Position Change (in %)	-2.97	0.00	25.16	0.00	0.00	1,136,013
Position Weight (in %)	1.10	0.63	1.40	0.23	1.45	1,181,876
D(Position Exit)	0.04	-	0.19	-	-	1,182,413
D(On Loan)	0.02	-	0.14	-	-	1,182,413
D(On Loan (past 12 months))	0.05	-	0.19	-	-	1,182,413
Panel B: Stock Variables						
On Loan (% of Market Cap.)	2.52	0.38	3.94	1.06	2.86	191,624
Lending Supply (% of Market Cap.)	17.89	9.72	10.14	17.21	25.34	191,547
Short Fee (bps p.a.)	75.98	11.68	265.53	19.09	28.95	185,704
Return (in %)	0.48	0.38	9.25	-4.40	5.27	195,588
Carhart four-factor Alpha (in %)	-0.02	-0.08	8.84	-4.28	4.14	184,481
D(Disclosed Short Position)	0.20	-	0.40	-	-	196,279
Panel C: Fund Variables						
D(Active Fund)	0.85	-	0.36	-	-	13,029
D(Fund Lends)	0.20	-	0.40	-	-	13,029
Gross Return (in %)	0.41	0.67	3.99	-1.91	3.04	12,897
Net Return (in %)	0.29	0.56	3.98	-2.02	2.91	12,897
Gross Alpha Carhart four-factor) (in %)	-0.02	0.00	1.60	-0.87	0.84	12,858
Net Alpha (Carhart four-factor) (in %)	-0.13	-0.11	1.60	-0.98	0.73	12,858
Fund R^2 (in %)	86.49	88.96	10.49	82.75	93.88	12,858
Fund Costs (excl. Transaction Fees) (in %)	1.36	1.46	0.69	0.96	1.72	12,897
Net Asset Value (in billion €)	0.56	0.10	1.58	0.03	0.34	13,029
Fund Flows (in % of AUM)	0.59	-0.05	28.85	-0.62	0.50	13,014
Fund Age (in years)	18.61	16.25	13.08	9.75	21.58	13,029
Fund Turnover (in %)	4.48	1.94	8.21	0.08	5.44	13,018
Panel D: Fund Family Variables						
D(Family Lends)	0.17	-	0.37	-	-	1,545
Family Net Asset Value (in billion €)	45.73	12.38	71.97	3.47	49.89	1,545

Table 4
Equity Lending and Changes in Portfolio Positions: OLS-FE Regressions
This table reports regressions of changes in portfolio position in month t as a function of a dummy equal to one for actively managed funds ($Active_j$), stock lending in stock i by fund j in month *t-1* ($OnLoan_{i,j,t-1}$), and aggregate stock lending in stock i in month *t-1* ($OnLoan_{i,t-1}$). The variable definitions are in Appendix A. We report t-statistics based on standard errors clustered at the fund level in brackets. All regressions have security-time, fund-time, and security-fund fixed effects.

	Dependent Variable		
	%-Position Changes		
Variable	(1)	(2)	(3)
$OnLoan_{i,j,t-1}$	-0.2069***	0.0197	0.0046
	(-4.23)	(1.11)	(0.26)
$Active_j * OnLoan_{i,j,t-1}$		-0.3468***	-0.3287***
		(-5.70)	(-5.38)
$Active_j * OnLoan_{i,t-1}$			-0.3048***
			(-3.23)
$Adj.R^2$	0.2417	0.2418	0.2418
N	1,008,344	1,008,344	1,008,344
Controls	Yes	Yes	Yes
Security×Time FE	Yes	Yes	Yes
Fund×Time FE	Yes	Yes	Yes
Fund×Security FE	Yes	Yes	Yes

Table 5
Equity Lending, Changes in Portfolio Positions: Sample Split by Management Type
This table reports regressions of changes in portfolio position in month t as a function of stock lending in stock i by fund j in month *t-1* ($OnLoan_{i,j,t-1}$) and aggregate stock lending in stock i in month *t-1* ($OnLoan_{i,t-1}$). The sample is split into active and passive funds. Columns 1 and 2 report results for active funds. Columns 3 and 4 report results for passive funds. The variable definitions are in Appendix A. We report t-statistics based on standard errors clustered at the fund level in brackets. All regressions have security-time fund, fund-time, and security-fund fixed effects.

	Dependent Variable			
	%-Position Changes			
	Active Funds		**Passive Funds**	
Variable	(1)	(2)	(3)	(4)
$OnLoan_{i,j,t-1}$	-0.3038***	-0.2720***	-0.0064	0.0057
	(-5.61)	(-5.29)	(-0.46)	(0.28)
$OnLoan_{i,j,t-1} \times OnLoan_{i,t-1}$		-0.0526**		-0.0111
		(-2.36)		(-0.89)
$Adj.R^2$	0.167	0.167	0.9275	0.9275
N	748,028	748,028	245,206	245,206
Controls	Yes	Yes	Yes	Yes
Security×Time FE	Yes	Yes	Yes	Yes
Fund×Time FE	Yes	Yes	Yes	Yes
Fund×Security FE	Yes	Yes	Yes	Yes

Table 6
Equity Lending and Large Short Position Disclosures
This table reports regressions of changes in portfolio position in month t as a function of observing the disclosure of a large short position in month *t+1*, *t*, or *t-1*, stock lending in stock i by fund j in month *t-1* ($OnLoan_{i,j,t-1}$), and aggregate stock lending in stock i in month *t-1* ($OnLoan_{i,t-1}$). The sample is limited to portfolio holdings of actively managed funds. The variable definitions are in Appendix A. We report t-statistics based on standard errors clustered at the fund level in brackets. All regressions have security-time, fund-time, and security-fund fixed effects.

	Dependent Variable	
	%-Position Changes	
Variable	(1)	(2)
$OnLoan_{i,j,t-1}$	-0.3008***	-0.2684***
	(-5.54)	(-5.21)
$OnLoan_{i,j,t-1} \times OnLoan_{i,t-1}$		-0.0531**
		(-2.38)
$Disclosure_{i,t+1} \times OnLoan_{i,j,t-1}$	-0.4397*	-0.4516*
	(-1.79)	(-1.82)
$Disclosure_{i,t} \times OnLoan_{i,j,t-1}$	0.2650	0.2508
	(0.51)	(0.49)
$Disclosure_{i,t-1} \times OnLoan_{i,j,t-1}$	-0.1379	-0.1556
	(-0.44)	(-0.50)
$Adj.R^2$	0.167	0.167
N	748,028	748,028
Controls	Yes	Yes
Security×Time FE	Yes	Yes
Fund×Time FE	Yes	Yes
Fund×Security FE	Yes	Yes

Table 7
Equity Lending and Information Spillover Within Fund Families: OLS-FE Regressions
This table reports regressions of changes in portfolio position in month t as a function of stock lending by fund j in stock i in month *t-1* ($OnLoan_{i,j,t-1}$) and stock lending in stock i by all other funds in the fund family ($f \neq j$) in month *t-1* ($OnLoan_{i,f\neq j,t-1}$). The sample is limited to actively managed funds. The variable definitions are in Appendix A. We report t-statistics based on standard errors clustered at the fund level in brackets. All regressions have security-time, fund-time, and security-fund fixed effects.

	Dependent Variable			
	%-Position Changes			
Variable	(1)	(2)	(3)	(4)
$OnLoan_{i,j,t-1}$	-0.3038***		-0.2991***	-0.2097***
	(-5.61)		(-5.00)	(-2.68)
$OnLoan_{i,f\neq j,t-1}$		-0.1660***	-0.0109	0.0103
		(-4.06)	(-0.26)	(0.24)
$OnLoan_{i,j,t-1} \times OnLoan_{i,f\neq j,t-1}$				-0.0175*
				(-1.92)
$Adj.R^2$	0.167	0.167	0.167	0.167
N	748,028	748,028	748,028	748,028
Controls	Yes	Yes	Yes	Yes
Security×Time FE	Yes	Yes	Yes	Yes
Fund×Time FE	Yes	Yes	Yes	Yes
Fund×Security FE	Yes	Yes	Yes	Yes

Table 8
Equity Lending and Information Spillover By Fund Managers
This table reports regressions of changes in portfolio position of stock i by fund j in month t as a function of total lending in stock i across all funds managed by manager m in month *t-1* ($OnLoan_{i,m,t-1}$). In column 2 we split lending of stock i by manager m's fund j in month *t-1* ($OnLoan_{i,m,j,t-1}$) and the lending of stock i across manager m 's other funds $k \neq j$ ($OnLoan_{i,m,k\neq j,t-1}$) in month *t-1*. The variable definitions are in Appendix A. The sample is limited to actively managed funds. We report t-statistics based on standard errors clustered at the manager levels in brackets. All regressions have security-time, fund-time, fund-security, manager-time, and manager-security fixed effects.

	Dependent Variable	
	%-Position Changes	
Variable	(1)	(2)
$OnLoan_{i,m,t-1}$	-0.2179***	
	(-3.54)	
$OnLoan_{i,m,j,t-1}$		-0.2293***
		(-4.12)
$OnLoan_{i,m,k\neq j,t-1}$		-0.0779***
		(-2.82)
$Adj.R^2$	0.4264	0.4264
N	735,203	735,203
Controls	Yes	Yes
Security×Time FE	Yes	Yes
Fund×Time FE	Yes	Yes
Fund×Security FE	Yes	Yes
Manager×Time FE	Yes	Yes
Manager×Security FE	Yes	Yes

Table 9
Position Exits of Active Lenders: Abnormal Stock Returns
This table presents the cumulative abnormal returns (CAR) around position exits by active lenders, measured in event time. Pre-exit returns are computed every month from *t-12* to the end of the exit's month (i.e., $CAR_{t-j,t}$ where j ranging between 12 and 1), while post-exit returns are calculated from the end of the month the position is closed to up to 12 months after the position exit (i.e., $CARt, t+j$). Based on Equation 7, abnormal stock returns are modelled as a function of a set of event-time dummies and $D(Onloan_{i,j})$, an indicator variable equal to one if a fund j is a lender of stock i in the past 12 months, zero otherwise. All regressions include security, fund, and time-fixed effects. Abnormal returns are calculated based on the Carhart four-factor model. In Panel A, the sample is based on all position exits of active lenders for all stocks, while Panel B only includes stocks in the highest quintile of short interest in the month before the exit. *Lent* shows estimates of abnormal returns for stocks that are lent by actively managed funds in the 12 months preceding the exit, while *Not Lent* for stocks that not lent in the 12 months preceding the exit. *L–NL* shows the difference in abnormal returns. T-statistics are based on standard errors clustered at the security level and given in brackets.

	Panel A: All Stocks			Panel B: High SIR Stocks		
CAR	Lent (L)	Not Lent (NL)	L–NL	Lent (L)	Not Lent (NL)	L–NL
$CAR_{t-12,t}$	-0.0428***	-0.0556***	0.0127	-0.0897***	-0.1362***	0.0466*
	(-3.60)	(-9.58)	(1.08)	(-3.57)	(-10.12)	(1.81)
$CAR_{t-11,t}$	-0.0503***	-0.0587***	0.0084	-0.0873***	-0.1324***	0.0451*
	(-4.53)	(-10.81)	(0.75)	(-3.79)	(-10.27)	(1.89)
$CAR_{t-10,t}$	-0.0531***	-0.0594***	0.0063	-0.0813***	-0.1227***	0.0414*
	(-5.04)	(-11.91)	(0.60)	(-3.60)	(-10.17)	(1.80)
$CAR_{t-9,t}$	-0.0486***	-0.0594***	0.0109	-0.0662***	-0.1164***	0.0503**
	(-5.05)	(-12.55)	(1.12)	(-3.19)	(-9.86)	(2.35)
$CAR_{t-8,t}$	-0.0564***	-0.0605***	0.0041	-0.0761***	-0.1118***	0.0357*
	(-6.25)	(-13.95)	(0.45)	(-3.93)	(-10.35)	(1.80)
$CAR_{t-7,t}$	-0.0599***	-0.0583***	-0.0017	-0.0758***	-0.0989***	0.0231
	(-7.20)	(-14.61)	(-0.20)	(-4.17)	(-9.62)	(1.24)
$CAR_{t-6,t}$	-0.0518***	-0.0549***	0.0031	-0.0614***	-0.0876***	0.0261
	(-6.78)	(-15.57)	(0.40)	(-3.70)	(-9.76)	(1.55)
$CAR_{t-5,t}$	-0.0566***	-0.0499***	-0.0067	-0.0679***	-0.0734***	0.0056
	(-8.69)	(-15.75)	(-0.99)	(-5.18)	(-8.97)	(0.41)
$CAR_{t-4,t}$	-0.0559***	-0.0455***	-0.0104*	-0.0672***	-0.0650***	-0.0022
	(-9.52)	(-16.97)	(-1.73)	(-5.71)	(-9.02)	(-0.18)
$CAR_{t-3,t}$	-0.0497***	-0.0404***	-0.0093*	-0.0611***	-0.0550***	-0.0061
	(-9.50)	(-17.47)	(-1.73)	(-5.78)	(-8.36)	(-0.54)
$CAR_{t-2,t}$	-0.0433***	-0.0328***	-0.0105**	-0.0496***	-0.0475***	-0.0021
	(-10.43)	(-18.11)	(-2.43)	(-5.95)	(-8.72)	(-0.23)
$CAR_{t-1,t}$	-0.0231***	-0.0191***	-0.0040	-0.0239***	-0.0229***	-0.0010
	(-8.13)	(-15.15)	(-1.31)	(-4.29)	(-5.61)	(-0.15)
$CAR_{t,t+1}$	-0.0049*	-0.0030***	-0.0020	-0.0066	-0.0007	-0.0059
	(-1.67)	(-2.59)	(-0.63)	(-1.07)	(-0.20)	(-0.87)
$CAR_{t+1,t+2}$	-0.0125***	-0.0058***	-0.0066	-0.0210**	0.0002	-0.0211**
	(-2.94)	(-3.17)	(-1.49)	(-2.39)	(0.03)	(-2.06)
$CAR_{t+1,t+3}$	-0.0188***	-0.0077***	-0.0111**	-0.0326***	0.0001	-0.0327***
	(-3.49)	(-3.22)	(-1.98)	(-2.96)	(0.02)	(-2.59)
$CAR_{t+1,t+4}$	-0.0267***	-0.0117***	-0.0150**	-0.0480***	-0.0111	-0.0369**
	(-3.99)	(-4.04)	(-2.19)	(-3.69)	(-1.21)	(-2.50)
$CAR_{t+1,t+5}$	-0.0274***	-0.0130***	-0.0145*	-0.0504***	-0.0118	-0.0386**
	(-3.52)	(-3.71)	(-1.83)	(-3.25)	(-1.13)	(-2.27)
$CAR_{t+1,t+6}$	-0.0274***	-0.0133***	-0.0141	-0.0517***	-0.0055	-0.0463**
	(-3.02)	(-3.20)	(-1.51)	(-2.89)	(-0.45)	(-2.30)
$CAR_{t+1,t+7}$	-0.0315***	-0.0154***	-0.0162	-0.0548***	-0.0047	-0.0501**
	(-3.17)	(-3.43)	(-1.58)	(-2.87)	(-0.39)	(-2.39)
$CAR_{t+1,t+8}$	-0.0385***	-0.0161***	-0.0224**	-0.0582***	0.0020	-0.0603***
	(-3.57)	(-3.25)	(-2.02)	(-2.80)	(0.16)	(-2.63)
$CAR_{t+1,t+9}$	-0.0448***	-0.0170***	-0.0277**	-0.0629***	0.0038	-0.0666***
	(-3.98)	(-3.19)	(-2.40)	(-2.97)	(0.29)	(-2.89)
$CAR_{t+1,t+10}$	-0.0469***	-0.0208***	-0.0261**	-0.0719***	-0.0040	-0.0679***
	(-3.84)	(-3.58)	(-2.09)	(-3.10)	(-0.28)	(-2.70)
$CAR_{t+1,t+11}$	-0.0452***	-0.0237***	-0.0216	-0.0662***	-0.0156	-0.0505*
	(-3.45)	(-3.76)	(-1.63)	(-2.66)	(-1.00)	(-1.88)
$CAR_{t+1,t+12}$	-0.0505***	-0.0286***	-0.0219	-0.0751***	-0.0242	-0.0508*
	(-3.59)	(-4.27)	(-1.54)	(-2.76)	(-1.41)	(-1.73)

Table 10
Position Exits of Active Lenders: OLS-FE Regressions
This table reports regressions of cumulative 6-month and 12-month abnormal returns following position closures of active lenders as a function of security loan demand in the month prior to the closure, stock lending of fund j in stock i over the last 12 months prior to the closure ($OnLoan_{i,j,t-13,t-1}$), and $D(Onloan_{i,j,t-13,t-1})$ an indicator variable equal to one if a fund j is a lender of stock i in the past 12 months, zero otherwise. The variable definitions can be found in Appendix A. All regressions include security and fund-time-fixed effects. All variables are measured one month prior to the position exit in month t, i.e. at $t-1$ (we define $t=0$ as the time at which the position is being closed). We report t-statistics based on standard errors clustered at the security level in brackets.

	Dependent Variable			
	Cumulative 6-Month Alpha		**Cumulative 12-Month Alpha**	
Variable	(1)	(2)	(3)	(4)
$D(Onloan_{i,j,t-13,t-1})$	0.3874	0.4600	0.0479	1.0797
	(0.43)	(0.46)	(0.04)	(0.67)
$OnLoan_{i,t-1}$	3.3891***	0.4237	3.2796**	0.6907
	(4.25)	(0.77)	(2.12)	(0.75)
$D(Onloan_{i,j,t-13,t-1}) \times OnLoan_{i,t-1}$	-1.8495**	-3.5126***	-3.5368***	-4.1454**
	(-2.02)	(-2.94)	(-2.89)	(-2.52)
$Adj.R^2$	0.434	0.082	0.555	0.077
N	6,888	7,445	5,195	5,741
Security FE	Yes	No	Yes	No
Fund×Time FE	Yes	Yes	Yes	Yes

Table 11
Stock Returns after Large Short Disclosures: Exits by Active Funds
This table reports regressions of stock returns in the months following the disclosure of large short positions. Abnormal returns are calculated based on the Carhart four-factor model. The main explanatory variables are the number of active funds closing a position in the stock in the month prior to the disclosure (*#(Active Funds Exiting)*) and the total short positions as a fraction of market capitalization disclosed by all large short sellers of a stock in month t (*%Big Short*). As control variables, we include the logarithm of market capitalization (*Log(Market Cap)*), the logarithm of Amihud's (2002) illiquidity measure (*Log(Amihud)*), the aggregate short interest (*On Loan*), lending supply (as % of market capitalization) (*Lending Supply*), the logarithm of lending fees (*Log(Lending Fee)*), and the cumulative return over the past 12 months ($Return_{t-12,t-1}$). The variable definitions are in Appendix A. We report t-statistics based on standard errors clustered at the security level in brackets. All regressions have security and time-fixed effects.

	All Firms											
	$\text{Ret}_{t+1,t+2}$			$\text{Ret}_{t+1,t+4}$			$\text{Alpha}_{t+1,t+2}$			$\text{Alpha}_{t+1,t+4}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
%BigShort$_t$	-0.2106***	-0.2092***	-0.1979***	-0.5440***	-0.5409***	-0.5167**	-0.0416	-0.0406	-0.0278	-0.0604	-0.0582	-0.0328
	(-2.77)	(-2.75)	(-2.59)	(-2.60)	(-2.59)	(-2.48)	(-0.54)	(-0.53)	(-0.37)	(-0.29)	(-0.28)	(-0.16)
#(Active Funds Exiting)$_{t-1}$		-0.0799***	-0.0706***		-0.1754***	-0.1552***		-0.0597**	-0.0490**		-0.1226***	-0.1014**
		(-3.36)	(-2.96)		(-4.27)	(-3.87)		(-2.49)	(-2.05)		(-2.86)	(-2.41)
#(Active Funds Exiting)$_{t-1}\times$ *%Big Short*$_t$			-0.0316*			-0.0680*			-0.0359*			-0.0713*
			(-1.78)			(-1.76)			(-1.85)			(-1.80)
OnLoan$_{t-1}$	-0.1717**	-0.1710**	-0.1705**	-0.5030***	-0.5015***	-0.5003***	-0.1679**	-0.1675**	-0.1668**	-0.4216**	-0.4206**	-0.4193**
	(-2.32)	(-2.31)	(-2.30)	(-2.74)	(-2.74)	(-2.73)	(-2.37)	(-2.36)	(-2.35)	(-2.37)	(-2.36)	(-2.35)
Adj. R^2	0.217	0.217	0.217	0.298	0.298	0.298	0.039	0.039	0.039	0.153	0.153	0.153
N	129,102	129,102	129,102	129,102	129,102	129,102	129,102	129,102	129,102	129,102	129,102	129,102
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix

Table A.1
Variable Definition

Variable Name	Description
$D(OnLoan_{i,j,t-13,t-1})$	Dummy: Fund j has lent stock i in the past 12 months
$OnLoan_{i,j,t-1}$	Fraction of portfolio position in stock i being lent by fund j in month $t-1$
$OnLoan_{i,f\neq j,t-1}$	Fraction of portfolio position in stock i being lent by other funds in the fund family ($f \neq j$) in month $t-1$
$OnLoan_{i,m,t-1}$	Fraction of portfolio position in stock i being lent by manager m in month $t-1$
$OnLoan_{i,m,j,t-1}$	Fraction of stock i being lent by manager m's fund j in month $t-1$
$OnLoan_{i,k\neq j,t-1}$	Fraction of stock i being lent by manager m but not from fund k's portfolio in month $t-1$
$PosWeight_{i,j,t}$	Position Market Value divided by Sum of Position Market Values
$ILLIQ_{i,j,t}$	Percentile rank of portfolio position sorted on Amihud's (2002) illiquidity measure
$OnLoan_{i,t-1}$	Monthly average fraction of market capitalization effectively lent out in stock i in month $t-1$
$Disclosure_{i,t}$	Dummy: Public short position disclosure conditional on no publicly disclosed short position in the past 6 months
$BigShort_{i,t}$	Total short positions as a fraction of market capitalization disclosed by all large short sellers of a stock in month t
$Active_j$	Dummy: Fund j classified as an active fund (no index fund, no ETF) according to IFS
$Return_{i,t}$	Stock Monthly Raw Return
$Alpha_{i,t}$	Carhart four-factor Abnormal Return

Table A.2
Decision to Lend Shares & Fund and Family-level Characteristics
This table reports regressions of indicator variable (*D(Lending)*) equal to one if a fund does equity lending and zero otherwise as a function of average fund and fund-family characteristics. *D(Active)* is an indicator variable equal to one if the fund is active, and zero if passive. *Family NAV* is the fund family's total net asset value (NAV), *Fund NAV* is the fund's NAV, *Relative Flow* is the monthly net flow relative to the benchmark, *Expense Ratio* is the fund's expenses, *4-factor Alpha* is the fund's alpha using the Fama-French 4-factor model, *Portfolio Turnover* measures the portfolio turnover, *Portfolio Utilization* is the ratio of short interest to lending supply across stocks. All variables are averaged throughout time. We report t-statistics based on robust standard errors in brackets.

	D(Lending)
D(Active)	-0.4580***
	(-5.18)
Ln(Family NAV)	0.0561***
	-4.88
Ln(Fund NAV)	0.1018***
	-7.11
Ln(Age)	0.0397
	-1.29
Relative Flow	0.3863*
	-1.67
Expense Ratio	3.5729
	-0.72
4-factor Alpha	-2.5435
	(-0.25)
Portfolio Turnover	-0.0034
	(-1.00)
Portfolio Utilization	-0.0091
	(-1.51)
Constant	-1.5055***
	(-5.51)
Adj. R^2	0.316
N	317