

Short-Selling Profitability, Market Power, and Asset Pricing Anomalies ^{*}

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Abstract

We propose a novel measure of short-selling profitability (SSP) that captures a stock's price sensitivity to recent short-selling activity, reflecting short sellers' information advantage before lending costs. Consistent with the finding that short interest predicts lower future returns, we find that this relation is significantly stronger for stocks with high SSP. Moreover, stock lenders with market power charge higher lending fees to extract a portion of these profits, strengthening the positive correlation between SSP and lending fees. Although short-selling costs reduce anomaly profitability by about half on average, anomalies remain significant among high-SSP stocks, particularly when lenders lack market power. These results highlight how short-selling costs and lending market structure jointly influence the persistence of return anomalies.

Keywords: Short-selling fees, Stock lending market, Short Interest, Anomalies

JEL Classifications: G12, G23

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1. Introduction

Stock market anomalies are often viewed as evidence of mispricing that should be eliminated by arbitrage. However, a large literature documents their persistence and attributes it to short-selling costs.¹ This interpretation builds on the premise that short sellers are informed traders, consistent with the evidence that short interest negatively predicts future returns at both the market and firm levels (e.g., [Engelberg, Reed, and Ringgenberg, 2012](#); [Rapach, Ringgenberg, and Zhou, 2016](#); [Chen, Da, and Huang, 2022](#)), indicating that short sellers anticipate future price declines.² When they target overvalued stocks, lenders charge lending fees that reduce short sellers' after-fee returns and impede price correction (e.g., [Saffi and Sigurdsson, 2011](#); [Beneish, Lee, and Nichols, 2015](#); [Schultz, 2024](#); [Muravyev, Pearson, and Pollet, 2025](#)). Moreover, in lending markets with search frictions and concentrated supply, lenders may exercise market power and appropriate a portion of short sellers' expected profits through higher fees (e.g., [Duffie, Garleanu, and Pedersen, 2002](#); [Kolasinski, Reed, and Ringgenberg, 2013](#); [Chen, Kaniel, and Opp, 2025](#)). These observations raise several important questions: How large are the profits generated by short sellers' information advantage? How are these profits shared between short sellers and stock lenders? And what are the implications for the after-fee performance of stock market anomalies?

Addressing these questions requires a framework that links short sellers' information advantage to conditions in the stock lending market and equilibrium asset prices. [Blocher,](#)

¹See, among others, [Jones and Lamont \(2002\)](#), [Lamont \(2004\)](#), [Nagel \(2005\)](#), [Beneish, Lee, and Nichols \(2015\)](#), [Ljungqvist and Qian \(2016\)](#), [Schultz \(2023\)](#), and [Engelberg, Evans, Leonard, Reed, and Ringgenberg \(2025\)](#).

²A large literature documents the informational content of short selling, showing that short interest reflects negative signals about future returns. At the market level, [Rapach, Ringgenberg, and Zhou \(2016\)](#) show that short interest robustly predicts lower market returns both in-sample and out-of-sample, and [Chen, Da, and Huang \(2022\)](#) confirm a negative relation. At the stock level, numerous studies find that increases in short interest predict subsequent underperformance (e.g., [Brent, Morse, and Stice, 1990](#); [D'Avolio, 2002](#); [Chen and Singal, 2003](#); [Lamont and Stein, 2004](#); [Asquith, Pathak, and Ritter, 2005](#); [Boehmer, Huszar, and Jordan, 2010](#); [Kolasinski, Reed, and Ringgenberg, 2013](#); [Drechsler and Drechsler, 2014](#); [Ben-David, Drake, and Roulstone, 2015](#); [Beneish, Lee, and Nichols, 2015](#)). Importantly, prior work attributes this predictive power to short sellers' information advantage, showing that short sellers are skilled at processing value-relevant information (e.g., [Engelberg, Reed, and Ringgenberg, 2012](#), [Huszár, Tan, and Zhang, 2017](#); [Sun and Yin, 2017](#); [Purnanandam and Seyhun, 2018](#) and [Boehmer, Jones, Wu, and Zhang, 2020](#)).

Reed, and Van Wesepe (2013) develop a model, showing that the supply and demand for shorting affect equity prices through lending market conditions. To operationalize this mechanism, we construct a firm-level measure of short-selling profitability (SSP) that captures the sensitivity of stock returns to recent abnormal short interest and thus reflects short sellers' expected pre-fee profits. By combining SSP with stock-level lending fees, we quantify how information rents are allocated between short sellers and lenders, examine whether this allocation varies with lender market power, and assess whether anomaly returns remain economically and statistically significant after accounting for short-selling costs, particularly for stocks where short sellers have stronger information advantage.

We estimate SSP by regressing excess stock returns on lagged abnormal short interest. Abnormal short interest is defined as the difference between a stock's short interest ratio (SIR) and its average over the past 12 months. SSP is measured as the negative of the coefficient on abnormal short interest. Because higher abnormal short interest predicts lower subsequent returns, the estimated coefficient is typically negative; multiplying by -1 ensures that a larger value of SSP corresponds to stronger expected price declines. Economically, SSP measures the sensitivity of future returns to information-driven changes in short interest. A higher SSP indicates that increases in short interest are followed by larger price declines, reflecting stronger information advantage and greater expected pre-fee profitability for short sellers.

We document three stylized facts that clarify the economic interpretation of SSP and its implications for asset pricing. First, prior literature shows that short-selling activity negatively predicts future stock returns, indicating that short sellers are informed about future price movements (e.g., Engelberg, Reed, and Ringgenberg, 2012; Rapach, Ringgenberg, and Zhou, 2016; Chen, Da, and Huang, 2022). In the stock lending market, loans facilitate short selling and increase short interest as short positions accumulate. When short sellers are informed, profitable short-selling reflects the effective use of value-relevant information. SSP captures this information advantage by measuring the sensitivity of future stock returns to abnormal short interest. Under this interpretation, stocks should exhibit stronger subsequent

price declines following increases in short-selling activity, particularly for high-SSP stocks. Section 4.2 provides evidence consistent with this prediction. Second, SSP is persistent over time, allowing stock lenders to extract a portion of short sellers' expected profits. In a non-competitive stock lending market, lenders with market power appropriate part of the profits generated by short sellers in the form of lending fees (Chen, Kaniel, and Opp, 2025). When setting fees, lenders incorporate information about short sellers' pre-fee profitability and capture part of the information rents. Section 4.2 documents strong out-of-sample persistence in SSP. These findings imply that stocks whose returns respond more negatively to short-selling activity (i.e., high-SSP stocks) provide larger pre-fee profits to short sellers. Anticipating this, lenders charge higher fees, thereby increasing short-selling costs and affecting equilibrium asset prices. Third, stock lenders have market power to set lending fees. Duffie, Garleanu, and Pedersen (2002) develop a search-based model in which search frictions grant stock lenders bargaining power, resulting in higher lending fees for hard-to-locate securities. Empirically, Kolasinski, Reed, and Ringgenberg (2013) show that lending fees increase with borrowing demand, particularly when lending supply is concentrated. Moreover, Chen, Kaniel, and Opp (2025) document that the two largest lenders jointly control between 50% and 85% of total lendable shares, indicating substantial market power.

To further clarify the economic content of SSP, we examine its relation to firm characteristics and stock lending market variables. SSP is higher for smaller firms, less liquid stocks, and those with greater return volatility, commonly associated with higher information asymmetry. These results are consistent with the interpretation that short sellers possess information advantage that is more valuable in opaque environments. In addition, SSP is related to lending market conditions, including lender concentration, loan utilization, and loan tenure. Together, these results indicate that SSP captures cross-sectional variation in short-selling profitability that is linked to both firm characteristics and lending market conditions.

We next investigate whether the bargaining interaction between stock lenders and short sellers is related to short-selling costs. If SSP captures short sellers' expected pre-fee

profitability, then higher SSP implies greater expected gains from short selling. Thus, lending fees should increase with SSP, reflecting lenders' ability to appropriate part of short sellers' expected profits. Using the monthly average lending fee across stock loan transactions as our primary measure of borrowing costs, we find a strong positive relation between SSP and lending fees, even after controlling for firm characteristics and stock lending market variables that influence borrowing costs. This relation remains robust when using alternative proxies for short-selling fees. We further show that this relation varies with lender market power. In more concentrated lending markets, where competitive pressure is weaker, the positive association between SSP and lending fees is significantly stronger, whereas it is weaker and economically smaller in less concentrated markets. This cross-sectional asymmetry supports the view that lending fees incorporate short sellers' information advantage and reflect lenders' ability to extract informational rents.

Given that SSP captures short sellers' information advantage and is positively related to short-selling fees, it should also have implications for the profitability of stock market anomalies. [Muravyev, Pearson, and Pollet \(2025\)](#) show that once short-selling fees are incorporated, aggregate anomaly return spreads become statistically insignificant, implying that a large portion of anomaly profits arises from the short legs of trading strategies targeting stocks with high borrowing costs. Their finding highlights the important role of borrowing costs in determining the net profitability of anomalies. Building on this insight, we argue that anomalies should be more pronounced among high-SSP stocks, where short sellers can better identify mispricing. Although lenders charge higher fees on these stocks to extract part of these profits, they cannot fully appropriate the informational rents. Therefore, after-fee anomaly returns should remain economically significant for high-SSP stocks. In contrast, for low-SSP stocks, where short sellers possess weaker information advantage and expected pre-fee profitability is lower, borrowing costs are more likely to eliminate anomaly returns.

In light of the importance of short-selling fees for anomaly performance, we quantify how anomaly profits are divided between lenders and short sellers by analyzing the before-fee

and after-fee performance of 151 stock market anomalies. Incorporating short-selling fees reduces average anomaly profitability by approximately 53%, indicating that more than half of the pre-fee profits are captured by stock lenders through lending fees. However, this reduction does not fully eliminate anomaly returns, particularly among high-SSP stocks. For these stocks, abnormal returns remain statistically and economically significant even after accounting for borrowing costs. These findings suggest that short sellers' information advantage allows them to exploit persistent mispricing despite lenders' rent extraction. Overall, these results indicate that although stock lenders capture a sizable share of the rents generated by short sellers, they do not fully offset short sellers' information advantage. Therefore, short-selling costs are economically important but do not solely determine cross-sectional variation in anomaly returns.

Finally, we examine how short sellers' information advantage and lenders' market power jointly affect the distribution of anomaly profits, given that lenders' ability to appropriate short sellers' informational rents depends on their bargaining strength. Within both high- and low-SSP portfolios, we further divide stocks into two groups based on whether lenders have high or low market power. When the lending market is concentrated among a small number of lenders, these lenders can extract a larger share of informational rents by charging higher lending fees; when lender market power is limited, short sellers retain a larger portion of their profits. Consistent with this analysis, we find that after-fee anomaly returns remain strongly significant among high-SSP stocks with low lender market power, where lenders capture only a small share of short sellers' profits. Specifically, when short sellers have an information advantage and lenders lack market power, only about 26% of anomaly profits are appropriated by lenders. Overall, these results demonstrate that the after-fee profitability of anomalies depends jointly on short sellers' information advantage and the market power of stock lenders.

Our study makes three contributions to the literature. First, we propose a novel, firm-level measure of short sellers' information advantage based on pre-fee short-selling profitability

(SSP). The existing literature documents that short interest negatively predicts future returns and interprets this relation as evidence of informed trading by short sellers (e.g., [Engelberg, Reed, and Ringgenberg, 2012](#); [Kolasinski, Reed, and Ringgenberg, 2013](#); [Rapach, Ringgenberg, and Zhou, 2016](#); [Huszár, Tan, and Zhang, 2017](#); [Sun and Yin, 2017](#); [Purnanandam and Seyhun, 2018](#); [Boehmer, Jones, Wu, and Zhang, 2020](#)). We complement this literature by transforming return predictability into a direct and economically interpretable measure of expected pre-fee short-selling profits. SSP measures the sensitivity of future stock returns to abnormal short interest and thus captures cross-sectional variation in short sellers' information advantage. Although prior studies document that short sellers are informed, they do not quantify how much informational rents are generated by short sellers before borrowing costs. By constructing a persistent, firm-specific measure of pre-fee short-selling profitability, we provide a proxy for short sellers' expected informational gains and create a foundation for examining how these gains are shared between short sellers and stock lenders.

Second, we introduce SSP as a new dimension related to stock-level short-selling fees. Previous research links lending fees to analyst disagreement ([D'Avolio, 2002](#); [Atmaz, Basak, and Ruan, 2024](#); [Banerjee and Smith, 2025](#)), elastic demand ([Henderson, Jostova, and Philipov, 2025](#)), information asymmetry ([Nezafat and Schroder, 2022](#)), institutional ownership ([Diether and Werner, 2011](#); [Beneish, Lee, and Nichols, 2015](#); [Porras Prado, Saffi, and Sturgess, 2016](#); [Honkanen, 2020](#); [Sikorskaya, 2023](#); [Palia and Sokolinski, 2024](#)), liquidity premium ([Diether and Werner, 2011](#); [Saffi and Sigurdsson, 2011](#); [Porras Prado, Saffi, and Sturgess, 2016](#)), matching costs ([Gârleanu, Panageas, and Zheng, 2021](#)), search costs ([Duffie, Garleanu, and Pedersen, 2002](#)), and short interest ([Beneish, Lee, and Nichols, 2015](#)). We add to this literature by showing that short-selling costs are higher for stocks with high SSP, even after controlling for these determinants. Moreover, we demonstrate that this relation is affected by lenders' market power. When lending supply is more concentrated, lenders possess greater market power and can extract larger information rents through higher lending fees (e.g., [Kolasinski, Reed, and Ringgenberg, 2013](#); [Chen, Kaniel, and Opp, 2025](#)). Consistent with this intuition,

we show that the positive correlation between SSP and lending fees is significantly stronger in stocks with high market power.

Third, we advance the literature connecting the stock lending market and the equity market by examining how short-selling costs affect stock market anomalies. Prior studies show that short-sale constraints contribute to anomaly persistence (Nagel, 2005; Stambaugh, Yu, and Yuan, 2012) and that lending fees are related to anomaly returns (Engelberg, Evans, Leonard, Reed, and Ringgenberg, 2025). More recently, Muravyev, Pearson, and Pollet (2025) document that many anomaly returns become statistically insignificant after short-selling fees are included. Building on this evidence, we find that the impact of borrowing costs on anomaly returns varies with SSP. While short-selling fees reduce anomaly returns substantially on average, anomalies remain economically and statistically significant for high-SSP stocks. In contrast, anomaly returns disappear for low-SSP stocks once borrowing costs are incorporated. Furthermore, consistent with the studies on market power in the stock lending market (Duffie, Garleanu, and Pedersen, 2002; Kolasinski, Reed, and Ringgenberg, 2013; Chen, Kaniel, and Opp, 2025), we show that lender market power influences the distribution of anomaly profits between stock lenders and short sellers. When lenders have greater market power, they extract a larger portion of pre-fee profits, weakening after-fee anomaly returns. When lenders lack market power, short sellers retain a larger share of informational rents, allowing anomalies to remain profitable after fees. By documenting the joint roles of short sellers' information advantage and lender market power, our study strengthens the link between the stock lending market and equity pricing, consistent with the equilibrium framework of Blocher, Reed, and Van Wesep (2013).

The remainder of the paper is organized as follows. Section 2 develops our hypotheses. Section 3 describes the data and empirical methodology. Section 4 presents the main results, focusing on how short-selling profitability relates to firm characteristics, lending market variables, lending fees, and stock market anomalies. Section 5 concludes. The Internet Appendix provides detailed definitions of all variables.

2. Hypothesis Development

This section develops testable hypotheses linking the after-fee profitability of asset pricing anomalies to short sellers' information advantage and to stock lenders' market power. A short sale involves two parties: a stock lender, who supplies shares in exchange for a lending fee, and a short seller, who borrows shares to speculate on overvaluation or to hedge other positions.³ Upon loan expiration, the short seller earns the price decline net of the lending fee, making the fee a friction that constrains short-selling profitability. Following [Chen, Kaniel, and Opp \(2025\)](#), we analyze a lending market in which stock lenders possess market power and can extract a portion of short sellers' expected profits ([Kolasinski, Reed, and Ringgenberg, 2013](#)). Such market power arises when the supply of lendable shares is constrained, often due to regulatory restrictions.⁴

Short-selling profitability (SSP), our key variable, captures short sellers' information advantage by measuring how strongly recent short interest predicts negative future pre-fee returns. Existing studies show that short sellers are informed traders: short interest is negatively related to subsequent returns at both the market and firm levels ([Engelberg, Reed, and Ringgenberg, 2012](#); [Rapach, Ringgenberg, and Zhou, 2016](#); [Chen, Da, and Huang, 2022](#)). Formally, SSP reflects the sensitivity of a stock's future return to changes in abnormal short interest. Stocks with high SSP experience larger price declines following increases in short interest, indicating stronger short-seller information. Short sellers are more willing to pay lending fees when expected price declines are larger. Therefore, borrowing demand is likely to be greater in high-SSP stocks. In contrast, for low-SSP stocks, where expected price declines are small, short sellers have little incentive to borrow shares or pay lending fees. Therefore, SSP summarizes the extent to which short sellers possess information about future price declines.

³Directional short sellers seek returns net of lending fee, whereas others primarily short for hedging purposes. For example, equity market-neutral funds take equal-and-opposite long and short positions (see [Getmansky, Lee, and Lo, 2015](#)).

⁴For example, the U.S. Investment Company Act of 1940 requires a 300% asset-coverage ratio for mutual fund borrowings, limiting the quantity of shares that funds can make available for lending.

We use SSP to connect the stock market and the lending market. If SSP is persistent at the stock level, the return predictability associated with short selling should be concentrated among high-SSP stocks, where short sellers have consistently demonstrated a superior ability to identify overvaluation. Because SSP is estimated from past data, this hypothesis concerns out-of-sample return predictability: stocks sorted on *ex ante* SSP should exhibit stronger subsequent short-interest predictability. Thus, short interest should strongly and reliably predict future returns for high-SSP stocks, while exhibiting little or no predictive power for low-SSP stocks. This leads to our first hypothesis:

Hypothesis 1 *Stock-level short interest negatively predicts future stock returns; this predictive effect is stronger among high-SSP stocks than among low-SSP stocks.*

Under Hypothesis 1, SSP captures the expected pre-fee profitability of short selling and thus reflects short sellers' information advantage in exploiting the short leg of anomalies. SSP thus provides a basis for analyzing how lending fees are determined and how anomaly profits are divided between short sellers and stock lenders. In the lending market, fees represent information rents. Lenders set borrowing fees to appropriate a share of short sellers' expected pre-fee profits. We refer to this share as the split ratio, defined as the fraction of pre-fee profits captured by lenders through lending fees, with the remainder accruing to short sellers. This implies that lending fees should increase in short sellers' expected pre-fee alpha.

Two forces determine the split ratio. First, higher SSP implies larger expected pre-fee profits. Even if lenders cannot fully extract information rents, they can charge higher fees on high-SSP stocks because short sellers expecting greater price declines are willing to pay more. Thus, lending fees should increase with SSP. Second, the extent to which lenders convert expected pre-fee profitability into higher fees depends on their market power. When a small number of lenders dominate the supply of lendable shares, they can impose higher fees and capture a larger share of informational rents, increasing the split ratio. In contrast, competitive lending markets limit rent extraction and weaken the fee response to SSP. This results in our second hypothesis:

Hypothesis 2 *Stocks with higher SSP have higher short-selling fees, and this positive relation is stronger when stock lenders have greater market power.*

We next analyze the implications of SSP for the profitability of stock market anomalies. The existing literature shows that anomaly returns mainly originate from the short-leg of long-short portfolios (Stambaugh, Yu, and Yuan, 2015). More recently, Muravyev, Pearson, and Pollet (2025) document that most anomalies become unprofitable after accounting for short-selling fees.⁵ Nevertheless, lenders do not fully appropriate pre-fee profits. Chen, Kaniel, and Opp (2025) estimate an average split ratio of 0.54, indicating that short sellers retain a substantial share of expected pre-fee profits.

Our framework highlights cross-sectional heterogeneity in short sellers' information advantage. Because SSP proxies for this advantage, anomalies should be more pronounced among high-SSP stocks, where short sellers are better able to identify and exploit mispricing. Therefore, these stocks have larger pre-fee long-short returns and lenders charge higher fees to capture part of this alpha. However, because lenders cannot perfectly observe or verify short sellers' private information, they cannot fully extract informational rents, especially for high-SSP stocks. Thus, if SSP reflects expected pre-fee profitability, after-fee anomaly returns should increase with SSP. This generates our following hypothesis.

Hypothesis 3.1 *The after-fee profitability of trading a comprehensive set of stock market anomalies remains significant for high-SSP stocks, reflecting the information advantage of short sellers. However, for low-SSP stocks where short sellers have limited information advantage, the after-fee profitability of exploiting stock market anomalies becomes insignificant.*

Finally, we analyze how short sellers' information advantage and lenders' market power jointly determine the distribution of anomaly profits. In our framework, lending fees arise from a bargaining process between short sellers and stock lenders, with the split ratio summarizing how expected pre-fee profits are allocated. Holding SSP fixed, greater lender market power increases the split ratio by allowing lenders to extract a larger share of informational rents.

⁵See Table 3 in Muravyev, Pearson, and Pollet (2025) for a detailed analysis of anomaly performance.

Thus, within a given SSP group, after-fee anomaly profitability depends on the degree of lender concentration. For high-SSP stocks, expected pre-fee alpha is large. When lender market power is low, lenders cannot fully appropriate these rents, and after-fee returns remain sizable. When market power is high, lenders capture a larger share of these rents, reducing after-fee profitability. For low-SSP stocks, expected pre-fee profits are limited. High market power can eliminate most after-fee returns, whereas low market power leaves slightly more to short sellers but still results in modest after-fee profits. This leads to the following hypothesis:

Hypothesis 3.2 *Holding stock-level SSP constant, the after-fee profitability of trading stock market anomalies is higher when lenders' market power is low.*

In summary, our hypotheses provide an integrated framework connecting short sellers' information advantage, lenders' market power, and the persistence of asset pricing anomalies in after-fee returns.

3. Data and Methodology

3.1. Construction of Short-Selling Profitability Measure

We obtain monthly stock returns from CRSP and collect monthly stock-level short interest and firm characteristics from Compustat. Following [Chen, Da, and Huang \(2022\)](#), we calculate the short interest ratio (SIR) as the number of shares in uncovered short-sale positions divided by total shares outstanding. We exclude firms in the utility (SIC codes 4900-4999) and financial (SIC codes 6000-6999) sectors and retain only common stocks listed on the NYSE, NASDAQ, or AMEX. We further require that stocks have non-missing observations of the FIS short-selling fee to be included in the sample.⁶

We estimate short-selling profitability (SSP) using rolling 36-month regressions, requiring at least 24 monthly observations for each stock. In particular, we regress excess stock returns

⁶We observe that some stocks have SIR value exceeding 100%. Excluding stocks with SIR greater than 100% does not affect our empirical results.

on lagged abnormal short interest:⁷

$$ExRet_{it} = \alpha_{it} + \delta_{it} \text{ abnSIR}_{it-1} + \varepsilon_{it}, \quad (1)$$

$$SSP_{it} = -\delta_{it}, \quad (2)$$

where $ExRet_{it}$ denotes the excess return of stock i over the risk-free rate in month t , and abnSIR_{it-1} represents abnormal short interest in month $t-1$. We define SSP as the negative of the coefficient δ_{it} , so that higher SSP corresponds to stronger expected price declines following increases in short interest prior to lending fees. Following [Karpoff and Lou \(2010\)](#) and [Chen, Da, and Huang \(2022\)](#), abnormal short interest is measured as the difference between a stock’s SIR in month $t-1$ and its average SIR over the past 12 months, from month $t-13$ to $t-2$.⁸ To mitigate the impact of outliers, we winsorize SSP at the 1% level each month and standardize it using the monthly cross-sectional standard deviation. Table 1 reports summary statistics. SSP has a mean of 0.03 and a median of 0.00.

[Insert Table 1 here]

Figure 1 plots the monthly cross-sectional average SSP from 2005 to 2021. The market-level average SSP decreases sharply during recessions, particularly from September 2007 to January 2009 coinciding with the global financial crisis. This period also corresponds to a downturn in the S&P 500 index, which reached its trough in March 2009. Over the full sample, the market-wide average SSP is positive in most months, indicating that increases in short interest are generally followed by lower stock returns in the subsequent month. This pattern is consistent with [Rapach, Ringgenberg, and Zhou \(2016\)](#).

[Insert Figure 1 here]

⁷Our main results are robust to estimating SSP with additional controls for market factors, liquidity, information environment, and market sentiment.

⁸This adjustment captures incremental short-selling activity that is more likely to reflect short sellers’ response to new negative information. Since many short positions are initiated for hedging rather than informational purposes, using abnormal short interest helps isolate the information-driven component of short-selling activity captured by SSP. Thus, the lead-lag coefficient δ_{it} measures the sensitivity of future returns to information-driven changes in short interest, ensuring that SSP is conceptually consistent with the literature on short-selling informativeness.

3.2. *Short-Selling Fee Measures and Other Data*

We consider three measures of short-selling costs: the FIS short-selling fee, the Markit Daily Cost of Borrowing Score (DCBS), and the option-implied short-selling fee. The first measure is obtained from the FIS Astec Analytics Short Lending Data, which includes daily security-level information on average lending fees and the market value of stock loans from January 2005 to December 2021. This dataset has been widely used in recent studies (e.g., [Dixon, Fox, and Kelley, 2021](#); [Schultz, 2024](#); [Engelberg, Evans, Leonard, Reed, and Ringgenberg, 2025](#)). The FIS data reports the retail fees charged by stock lenders to brokerages, with brokers requiring cash collateral for all U.S. dollar-denominated stock loans. Following [Dixon, Fox, and Kelley \(2021\)](#) and [Muravyev, Pearson, and Pollet \(2022\)](#), we define the daily stock-level short-selling fee as the difference between the Federal Funds Rate (FFR) and the average rebate rate on collateralized loans across all transactions on that day. To align with the portfolio rebalancing arrangement of the anomaly portfolio, we use the month-end fee as a proxy for short-selling costs. Consistent with [Muravyev, Pearson, and Pollet \(2022\)](#), we require stocks to have at least four daily observations of short-selling fees in a given month.

Following [Muravyev, Pearson, and Pollet \(2025\)](#), we assume that short sellers pay 100% of the short-selling fee when borrowing short-leg stocks.⁹ However, since stock lenders typically cannot lend all available shares, long-leg stockholders generally receive less than the full short-selling fee. Consistent with [Muravyev, Pearson, and Pollet \(2025\)](#), we assume that long-leg investors receive 70% of the fee, reflecting the proportion of shares actually lent in the market.¹⁰ These filters generate a final sample of 400,571 monthly SSP-fee observations.

Our second short-selling cost measure is DCBS, obtained from IHS Markit. DCBS is a standard proxy for the expensiveness of borrowing stocks ([Beneish, Lee, and Nichols, 2015](#);

⁹Our results are robust to a markup of up to 15%, where short sellers pay 115% of the fee.

¹⁰In unreported analyses, we find that using stricter outlier filters generates even more statistically significant results. For instance, we restrict the sample to observations with FIS short-selling fees between 0% and 100% to mitigate the influence of outliers, and the findings remain qualitatively unchanged.

Schultz, 2023; Palia and Sokolinski, 2024), and covers a broad cross-section of stocks. The score varies from 1 to 10, with higher values indicating greater borrowing costs. We calculate monthly fees as the monthly average of daily DCBS scores, requiring at least four daily observations. The final sample includes 345,458 monthly DCBS observations from 2007 to 2021, merged with our SSP estimates.

The third measure is the option-implied short-selling fee, proxied by put-call disparity following Ofek, Richardson, and Whitelaw (2004) and Engelberg, Reed, and Ringgenberg (2018). For each stock, the implied fee is calculated as the percentage difference between the synthetic stock price, computed from call and put prices adjusted for the discounted strike price, and the spot stock price.¹¹

Table 1 reports summary statistics for all three fee measures. The average FIS short-selling fee is 2.96% per year, with half of stocks having fees below 0.57%. For comparison, Engelberg, Evans, Leonard, Reed, and Ringgenberg (2025) report a mean of 1.30% and a median of 0.59%, which is expected given their exclusion of stocks below the 5th percentile of the NYSE size breakpoints. DCBS scores in our sample have a mean of 1.46 and a median of 1.00, comparable to the mean of 1.64 and median of 1.00 in Beneish, Lee, and Nichols (2015), and the mean of 2.00 and median of 1.00 in Schultz (2023) for FIS short-selling fees. Taken together with our FIS short-selling fee results, these comparisons suggest that borrowing costs are generally low for most stocks. The average option-implied short-selling fee is 9.00% per year, which is notably higher than the FIS short-selling fee of 2.96% per year. This difference reflects the greater illiquidity of the options market and the more limited data coverage of option-implied fees. Despite differences in the magnitude and coverage, the three

¹¹Options written on individual stocks are American style, which requires accounting for the early exercise premium when estimating put-call disparity (Ofek, Richardson, and Whitelaw, 2004). To mitigate this issue, we restrict the sample to options with three-month maturities, as short-maturity options have lower expected dividends, reducing the likelihood of early exercise. For each pair of put and call options with the same strike price, we construct a tradable synthetic short position as the ask price of the put option minus the bid price of the call option plus the discounted value of the strike price. The option-implied fee can proxy the actual cost of short-selling as it incorporates the liquidity cost of trading options. Since the number of observations of the option-implied fee is relatively small compared to the other fee measures, we do not use it as the main measure of short-selling costs.

fee measures are highly correlated. For example, the correlation between the FIS fee and the option-implied fee is 37.64% with a p -value of 0.00.¹²

To identify SSP as a distinct dimension of short-selling costs, we control for various firm characteristics, which are shown to affect short-selling fees. We obtain data on beta, size, book-to-market ratio, momentum, illiquidity, firm age, institutional ownership, investor disagreement, volatility, coskewness, and lottery demand from the Open Source Asset Pricing website.¹³ Table 1 reports summary statistics for these firm characteristics, and Appendix Table A1 provides detailed variable definitions.

4. Empirical Analysis

In this section, we present our main empirical findings. First, we examine how SSP relates to firm characteristics and stock lending market conditions. Second, we provide out-of-sample evidence that SSP is persistent. Stocks classified as high SSP based on historical data continue to exhibit a strong negative relation between abnormal short interest and subsequent returns, whereas this relation is absent among low-SSP stocks. Third, we examine the relationship between SSP and short-selling costs at the stock level, and investigate how lenders' market power influences this relationship. Finally, we show that stock market anomalies remain statistically profitable among high-SSP stocks even after adjusting for short-selling fees. This effect is particularly pronounced among stocks where lenders have limited market power. In contrast, after accounting for short-selling fees, anomaly returns become insignificant for low-SSP stocks, where short sellers are less informed.

¹²In unreported results, we find that the correlation coefficients among the three measures of short-selling fees are significantly positive. The FIS short-selling fee is strongly and positively correlated with the natural logarithm of the monthly DCBS and the option-implied short-selling fee. Due to license restrictions, we cannot report the correlation table, but we ensure the consistency of the short-selling cost proxies.

¹³We are grateful to Andrew Chen and Tom Zimmermann for publicly sharing their data at <https://www.openassetpricing.com/data/>.

4.1. *Short-Selling Profitability, Firm Characteristics, and Lending Variables*

We begin by analyzing how SSP relates to firm characteristics and stock-lending market variables. This analysis is important for two reasons. First, it helps clarify the economic content of SSP by identifying the types of firms and lending environments in which short-selling profitability is more pronounced. Second, it provides a foundation for our subsequent analysis of how SSP relates to short-selling fees and anomaly performance, thereby strengthening the link between SSP and the cross-section of asset prices.

Table 2 reports stock-level panel regression results of SSP on firm characteristics controlling for firm, time, and industry fixed effects. Column (2) shows that SSP is negatively related to firm size, implying that the return sensitivity to abnormal short-interest is stronger for smaller firms. This result suggests that short sellers have greater information advantage in small stocks. Columns (3) and (4) show that firms with lower book-to-market ratios and weaker recent performance exhibit lower future returns following increases in short interest. Column (6) presents a multivariate specification that includes additional controls for illiquidity, volatility, lottery demand, firm age, and analyst forecast dispersion. SSP remains significantly related to several firm characteristics.

[Insert Table 2 here]

We next turn to stock-lending market variables, including the utilization of loanable shares, lender concentration (a proxy for lenders' market power), the average tenure of stock loans, and the short interest ratio. Because these variables affect short-selling costs (Beneish, Lee, and Nichols, 2015), they are also expected to be associated with SSP. Column (7) shows that SSP is higher for stocks with lower utilization, greater lender concentration, and longer loan tenures. Column (8) includes both firm characteristics and lending variables, and the results remain qualitatively unchanged. Notably, the coefficient on short interest ratio (SIR) is negative, implying that stocks with lower SIR have higher SSP. One possible explanation is that short squeezes can generate positive returns following increases in short-selling activity,

leading to negative SSP. Since short sellers typically trade through margin accounts and take positions opposite to retail investors, rising prices may force them to cover positions, causing short interest to decline even as prices increase.¹⁴

Overall, Table 2 shows that SSP is correlated with several firm characteristics and stock lending market variables. Interestingly, all variables together explain only 24.75% of the variation of SSP, implying that SSP measures unique information that is not contained in common firm and stock lending market variables. To ensure that our subsequent analyses of short-selling fees and anomaly results are not driven by these correlations, we conduct a robustness check. In particular, we regress SSP on the firm characteristics and lending market variables in Table 2 and use the residual as an alternative measure of SSP in subsequent tests. The residual measure is highly correlated with the original SSP, with a correlation of 94%. While the results are not tabulated, all main findings reported in the following sections remain qualitatively unchanged.

4.2. *Persistence in Short-Selling Profitability*

This section examines the out-of-sample persistence of SSP at the stock level, which is important for two reasons. First, stock lenders set short-selling fees based on expected short-selling profits and therefore can capture a portion of the gains earned by short sellers. For lenders to extract profits using historical information about short sellers' information advantage, SSP must be persistent out of sample. Second, if SSP is persistent, certain stocks will consistently be expensive to short, providing a potential explanation for long-lived anomaly returns through the channel of short-selling costs.

To test the persistence of SSP, we analyze whether abnormal short interest continues to predict future stock returns out of sample and whether this predictability varies with SSP. Previous literature shows that short interest negatively predicts cross-sectional stock

¹⁴A notable example is the GameStop short squeeze in January 2021, where coordinated buying by retail investors led to a sharp increase in GameStop's stock price, forcing short sellers to cover their positions by purchasing shares, which further amplified the price surge.

returns (e.g., [Engelberg, Reed, and Ringgenberg, 2012](#); [Rapach, Ringgenberg, and Zhou, 2016](#); [Chen, Da, and Huang, 2022](#)), consistent with the idea that short sellers have an information advantage. Since SSP is defined as the negative coefficient from regressing stock returns on abnormal short interest, a persistent SSP implies that the predictive power of short interest should be stronger among high-SSP stocks (Hypothesis 1). We test this prediction by sorting stocks each month into high-SSP and low-SSP groups using NYSE breakpoints based on SSP estimates. Within each SSP group, we further sort stocks into quintiles based on lagged abnormal short interest and calculate equal-weighted portfolio returns for each quintile. We then calculate the return spread between the lowest and highest abnormal short interest quintiles for the full sample and within each SSP subsample.

Panel A of Table 3 reports the pre-fee portfolio results. Columns (1) and (2) present full-sample results. Abnormal short interest increases monotonically across quintiles, from -0.0370 in the lowest quintile to 0.0360 in the highest (column (1)). Correspondingly, average portfolio returns decrease from 1.6024% to 1.0089%, generating a statistically significant long (low)-short (high) spread of 0.5935% ($t - stat = 2.54$) (column (2)). The rows labeled CAPM Alpha, FF3 Alpha, FF5 Alpha, and FF6 Alpha report risk-adjusted returns estimated using the CAPM, [Fama and French \(1993\)](#) three-factor, [Fama and French \(2015\)](#) five-factor, and [Fama and French \(2018\)](#) six-factor models, respectively. The negative relation between abnormal short interest and future returns remains robust across all models. Overall, these results corroborate extensive prior evidence documenting that short interest negatively predicts the cross-section of stock returns (e.g., [Asquith, Pathak, and Ritter, 2005](#); [Boehmer, Huszar, and Jordan, 2010](#); [Engelberg, Reed, and Ringgenberg, 2012](#); [Rapach, Ringgenberg, and Zhou, 2016](#); [Chen, Da, and Huang, 2022](#)).

We next examine whether this return predictability differs across SSP groups. Hypothesis 1 indicates that if SSP captures short sellers' information advantage, the negative relation between abnormal short interest and expected stock returns should be pronounced among high-SSP stocks. To test this prediction, we split the sample into high-SSP and low-SSP

stocks and repeat the portfolio analysis in column (2). Columns (4) and (6) confirm this prediction. For high-SSP stocks, average returns decline from 1.7744% in the lowest abnormal short interest quintile to 0.9538% in the highest, generating a highly significant spread of 0.8206% ($t\text{-stat}=3.40$). In contrast, the corresponding spread for low-SSP stocks is 0.3545% and statistically insignificant ($t\text{-stat}=1.14$). Risk-adjusted alphas show a similar pattern.¹⁵

As a robustness check, Panel B of Table 3 presents DGTW characteristics-adjusted portfolio returns (Daniel, Grinblatt, Titman, and Wermers, 1997). Consistent with Panel A of Table 3, abnormal short interest negatively predicts future returns in the full sample, and the effect remains statistically significant only among high-SSP stocks. Taken together, these findings provide out-of-sample evidence that SSP is persistent at the stock level and that it captures short sellers' information advantage.

[Insert Table 3 here]

4.3. *Short-Selling Profitability and Short-Selling Fees*

Stock lenders use short-selling fees to extract a portion of the arbitrage profits earned by short sellers from trading anomalies. Because SSP captures pre-fee short-selling profitability, the correlation between short-selling fees and SSP provides insight into how these profits are divided between stock lenders and short sellers. Thus, we expect a significantly positive relationship between short-selling fees and SSP, suggesting that lenders extract a large share of pre-fee anomaly profits through their market power in the lending market.

To test this prediction, we examine three well-known measures of short-selling costs: the FIS short-selling fee, the Markit DCBS, and option-implied short-selling fees. The construction of these three fee measures is described in Section 3.2. We conduct panel regressions of each fee measure on SSP, controlling for time, firm, and industry fixed effects to account for unobserved heterogeneity. Our baseline specification focuses on the monthly

¹⁵In unreported tables, we show that the findings presented in Panel A of Table 3 remain robust after accounting for short-selling fees.

FIS short-selling fee.¹⁶ In addition to SSP, we control for lending market variables, as well as established determinants of lending fees identified in literature. These variables include beta, firm size (Diether and Werner, 2011; Saffi and Sigurdsson, 2011; Beneish, Lee, and Nichols, 2015; Porras Prado, Saffi, and Sturgess, 2016), book-to-market ratio (Saffi and Sigurdsson, 2011; Beneish, Lee, and Nichols, 2015), momentum (Diether and Werner, 2011; Beneish, Lee, and Nichols, 2015), disagreement (Diether and Werner, 2011; Atmaz, Basak, and Ruan, 2024), firm age, illiquidity (Diether and Werner, 2011; Saffi and Sigurdsson, 2011; Porras Prado, Saffi, and Sturgess, 2016), volatility (Beneish, Lee, and Nichols, 2015), and institutional ownership (Diether and Werner, 2011; Beneish, Lee, and Nichols, 2015; Sikorskaya, 2023; Palia and Sokolinski, 2024).

Panel A of Table 4 reports the results. We find a positive and statistically significant relation between the FIS short-selling fee and SSP. In column (1), the coefficient of SSP is 0.1213 ($t - stat=2.26$), indicating that stocks with higher SSP have higher short-selling costs. Column (2) shows that this relationship remains robust after controlling for firm age, illiquidity, volatility, and institutional ownership, with the coefficient of SSP remaining at 0.1143 ($t - stat=2.05$). The signs of the control variables are consistent with the existing literature. Since SSP is standardized, these estimates suggest that a one-standard-deviation increase in SSP is associated with an approximately 0.12% increase in short-selling fees.

We next examine whether stock lenders' market power affects this relationship. Columns (3)-(6) divide the sample by lender concentration, our proxy for market power. This measure captures the extent to which a small number of lenders dominate the supply of lendable shares, with higher values representing greater market power.¹⁷ We classify stocks as high (low) market power if their lender concentration is above (below) the previous month's cross-sectional median. The result shows that the positive relation between short-selling

¹⁶To mitigate the impact of outliers, we conduct robustness checks using FIS fees winsorized at the 1% level in each tail and SSP estimates adjusted using a Bayesian shrinkage factor. Our conclusions remain unchanged.

¹⁷The Markit database defines this variable as “a value between 0 and 1 to measure the distribution of lender value on loan. A very small number indicates a large number of lenders with low value on the loan, and 1 indicates a single lender with all the loan value. A value of 0 means no value on the loan.”

fees and SSP is statistically significant only in the high-market power subsample, whereas it is economically small and statistically insignificant in the low-market power subsample. These findings support Hypothesis 2: short-selling fees increase with SSP, and this effect is amplified when lenders have greater market power. The significantly positive coefficients on SSP imply that lenders can extract a large portion of anomaly profits through the fees they charge. This result suggests that lenders set fees in response to short sellers' information advantage, resulting in a positive empirical correlation between SSP and short-selling fees. Furthermore, this relationship is more pronounced for stocks in which lenders have stronger market power. In contrast, when their market power is weaker, lenders capture a smaller share of short-selling profits, leaving more of the gains to short sellers.

Panels B and C of Table 4 provide additional robustness using alternative fee measures. Panel B replaces the FIS fee with the logarithm of the monthly average DCBS score. Columns (1)-(2) show a consistently positive and significant relationship between SSP and short-selling fees. Columns (3)-(6) further demonstrate that this relationship is more pronounced when lenders have greater market power. Panel C uses the option-implied short-selling fee. Although using option data reduces the sample size compared to the baseline analysis, the results remain consistent: the coefficients on SSP are still statistically significant in columns (1)-(2).¹⁸ Columns (3)-(6) again show that the relationship between SSP and short-selling fees is stronger under greater lender market power.

[Insert Table 4 here]

To further validate the role of market power, we employ two alternative proxies. First, we use the combined market share of the top two stock lenders. The Markit database reports the market shares of the two largest stock lenders for each stock, allowing us to construct a direct

¹⁸To investigate the robustness of these findings, we employ an alternative methodology in Table 4. Following Beneish, Lee, and Nichols (2015), Porras Prado, Saffi, and Sturgess (2016), and Palia and Sokolinski (2024), we construct a "specialness" dummy variable to identify stocks expensive to borrow. A stock is classified as special if its monthly average DCBS exceeds 4, and is assigned a value of 1; otherwise, it is assigned a value of 0. We perform Probit regressions, regressing this dummy variable on SSP with the same set of control variables. While the results are not tabulated, the results demonstrate that the coefficients on SSP remain positively significant, consistent with the Hypothesis 2.

proxy for lender dominance by summing these shares. Second, following [Chen, Kaniel, and Opp \(2025\)](#), we use the utilization ratio of available stock loans, defined as the percentage of shares on loan relative to the total lendable shares, as an alternative measure of lender market power. We apply the same methodology as in [Table 4](#) and report the results in [Table 5](#). Columns (1) and (2) of [Table 5](#) also show a positive correlation between SSP and the FIS short-selling fee for the combined market share measure. For instance, the coefficient on SSP in column (1) is 0.1789 ($t\text{-stat}=2.27$), indicating that lenders with greater market power can charge higher fees. Consistent with the baseline results in [Table 4](#), this relationship becomes statistically insignificant in the low-market power subsample, as shown in columns (3)–(4). The results are qualitatively similar when we proxy lender market power using the utilization ratio of available stock loans: SSP remains positively related to fees only in the high-market power subsample.

[Insert [Table 5](#) here]

In summary, we document a robust positive relation between SSP and short-selling fees across multiple measures of short-selling costs and lender market power. This relationship is stronger when lenders have greater market power, providing consistent support for [Hypothesis 2](#). Our findings also refine the conventional interpretation of short-sale constraints. Previous research often uses short-selling fees as a proxy for short-sale constraints ([Asquith, Pathak, and Ritter, 2005](#)). In contrast, we show that borrowing costs are closely related to short-selling profitability. Short sellers may target high-fee stocks because these stocks offer greater pre-fee short-selling profits, implying that high fees do not necessarily indicate binding short-sale constraints. Instead, high borrowing costs can be offset by the expected gains from short-selling as prices decline.

4.4. *Short-Selling Fees and Anomaly Performance*

4.4.1. *SSP and the After-fee Performance of Anomalies*

We extend [Muravyev, Pearson, and Pollet \(2025\)](#) by examining whether short sellers' information advantage, proxied by SSP, affects the relation between short-selling costs and the performance of a comprehensive set of stock market anomalies. If high short-selling costs are the main driver of anomaly performance, returns should be concentrated in the short legs of high-cost stocks. Since SSP captures short sellers' information advantage, we expect anomaly returns to be stronger among high-SSP stocks.

Stock anomalies also provide a useful setting to investigate how stock lenders' market power influences asset prices, thereby linking the lending market to the equity market ([Blocher, Reed, and Van Wesep, 2013](#)). When lenders have large market power, they can extract most of the profits generated by short sellers, making anomaly returns insignificant after accounting for short-selling fees. In contrast, if anomalies remain profitable after adjusting for short-selling fees, short sellers retain a portion of the arbitrage profits.

We test this hypothesis following the methodology of [Muravyev, Pearson, and Pollet \(2025\)](#). We obtain anomaly data from the Open Source Asset Pricing database of [Chen and Zimmermann \(2022\)](#). We exclude anomalies with insufficient monthly observations after sorting stocks into decile portfolios, leaving 151 anomalies for analysis. We adjust stock returns by adding FIS short-selling fees, sort stocks into decile portfolios based on lagged anomaly variables, and calculate equal-weighted portfolio returns for each decile. Following [Muravyev, Pearson, and Pollet \(2025\)](#), we classify stocks in the first two deciles (approximately 20% of the sample) as the short leg, as anomaly traders usually short these stocks, while the remaining deciles form the long leg. We apply a 100% markup of the FIS short-selling fee to short-leg stocks to capture commission paid to intermediaries, and a 70% markup to long-leg stocks to reflect the fees earned by lenders. This adjustment ensures that long-short anomaly profits are measured net of short-selling fees. Since anomaly traders

pay borrowing fees on short-leg stocks and earn lending fees on long-leg stocks, the after-fee long-short return spreads approximate the realized profitability of trading on these anomalies. The results are reported in Table 6.

Panel A of Table 6 reports the portfolio analysis results for the full sample and the subsample with available short-selling fee data. For each anomaly, we sort all stocks into decile portfolios each month based on the anomaly variable and compute the average equal-weighted returns from 2007 to 2021. This procedure is repeated for all 151 anomalies. Columns (1) to (10) report the average returns of deciles across these anomalies. We follow [Muravyev, Pearson, and Pollet \(2025\)](#) to focus on equal-weighted portfolio returns. In the full sample, before adjusting for short-selling fees, monthly portfolio returns increase monotonically from 1.2833% for the short-leg stocks to 1.4352% for the long-leg stocks. The aggregate return spread between short- and long-leg portfolios is 0.1519% per month, which is statistically significant at the 1% level ($t - stat=4.07$). This finding suggests that, before accounting for fees, the 151 anomalies generate economically and statistically significant returns, allowing arbitrageurs to exploit these stock market anomalies without accounting for borrowing costs.

Panel A of Table 6 also reports the average short-selling fees across portfolios. Using the same methodology as in portfolio returns, we calculate the average short-selling fees for all decile portfolios across anomalies. Short-leg stocks have an average monthly short-selling fee of 0.2212%, slightly higher than the 0.2013% for long-leg stocks. After adjusting portfolio returns for these costs, monthly returns increase from 1.5045% for short-leg stocks to 1.5761% for long-leg stocks. However, the aggregate return spread declines to 0.0716%, which is statistically insignificant ($t - stat=1.58$). This result aligns with Table 3 of [Muravyev, Pearson, and Pollet \(2025\)](#), which shows that stock market anomalies become nearly unprofitable to trade after accounting for short-selling costs. Consistent with their findings, our results also suggest that lenders extract a substantial portion of short sellers' profits. The insignificant after-fee profitability supports the view that lenders have market power ([Chen, Kaniel, and Opp, 2025](#)). In particular, the after-fee return retained by short sellers is 0.0716%, compared to the

pre-fee return of 0.1519%, implying that lenders extract approximately 52.86% of arbitrage profits by leveraging their market power.¹⁹ This finding is expected, as stock lenders and short sellers share the profits generated from trading anomalies.

Section 2 documents that SSP at the individual stock level serves as a proxy for short sellers' information advantage, leading to stronger anomalies in high-SSP stocks relative to low-SSP stocks, as stated in Hypothesis 3.1. To test this hypothesis, we replicate the portfolio analysis from Panel A of Table 6 separately for high-SSP and low-SSP stocks at the cross-section using the monthly average SSP. Panels B and C of Table 6 report the equal-weighted portfolio returns before and after adjusting for short-selling fees in the respective subsamples. Panel B shows that for high-SSP stocks, both the pre-fee and the after-fee return spreads of anomalies are statistically significant. The before-fee portfolio returns increase from 1.3313% per month in the lowest decile to 1.5404% in the highest decile, generating a return spread of 0.2092%, which is significant at the 1% level ($t - stat=4.71$). After adjusting for short-selling fees, portfolio returns increase from 1.5902% to 1.7016%, with a return spread of 0.1114% that remains significant at the 5% level ($t - stat=2.11$). However, Panel C shows that for low-SSP stocks, while the before-fee spread of portfolio returns is 0.1283% per month and statistically significant ($t - stat=3.12$), the after-fee return spread declines to 0.0570% and becomes statistically insignificant ($t - stat=1.21$). Comparing the results in Panels B and C, our findings support Hypothesis 3.1, indicating that, after accounting for short-selling fees, stock market anomalies remain statistically significant only for high-SSP stocks.

Furthermore, we find that the split ratio of pre-fee anomaly profits between stock lenders and short sellers is different between high- and low-SSP stocks. Our analyses in Table 6 enable us to estimate split ratios by comparing pre-fee and after-fee anomaly returns. For high-SSP stocks, stock lenders extract 46.76% of arbitrage profits from anomalies since the after-fee return declines from 0.2092% to 0.1114%. In contrast, for low-SSP stocks, stock

¹⁹This number is consistent with [Chen, Kaniel, and Opp \(2025\)](#), which estimate that short-selling costs reduce about 60% of short sellers' profits.

lenders extract a larger share of 55.57% of arbitrage profits as the after-fee return decreases from 0.1283% to 0.0570%, indicating the role of short sellers' information advantage.

[Insert Table 6 here]

We also examine a setting in which short sellers circumvent short-sale constraints by constructing a synthetic short position consisting of a long put, a short call, and a long risk-free bond. This strategy allows arbitrageurs to use options to replicate short selling, analogous to stock lending mechanisms. When option-market liquidity costs are incorporated, the option-implied fee is close to the realized cost of short-selling in the equity market. We therefore adjust anomaly returns using this option-implied short-selling fee, calculated as the percentage difference between the cost of establishing a synthetic short position and the spot stock price. Due to the limited availability of option price data, this analysis includes 132 anomalies. The results, presented in Table 7, are consistent with those in Table 6. In particular, the after-fee anomaly return spread remains statistically significant only for high-SSP stocks. After accounting for the option-implied short-selling fee, the high-SSP portfolio continues to provide a significant return spread of 0.1031% per month (t -stat = 1.98), whereas the spread for the low-SSP portfolio is smaller and statistically insignificant at 0.0446% per month (t -stat = 1.22).

[Insert Table 7 here]

In summary, the results in Tables 6 and 7 provide compelling evidence that stock lenders share a portion of profits with short sellers in high-SSP stocks when exploiting anomalies, supporting the interpretation that SSP captures short sellers' information advantage. The split ratio of arbitrage profits between stock lenders and short sellers varies across high- and low-SSP stocks due to differences in short sellers' information advantage. These findings confirm Hypothesis 3.1 and suggest that short-selling costs alone cannot fully explain stock market anomalies. The residual profitability left to short sellers highlights their information advantage, enabling them to sustain profits even in the presence of high short-selling fees.

4.4.2. *The Joint Effect of SSP and Lender Market Power on Anomaly Performance*

We next examine the joint effect of short sellers' information advantage and stock lenders' market power on anomaly performance. As proposed in Hypothesis 3.2, stock lenders' market power significantly affects the split of short-selling profit between stock lenders and short sellers. Consistent with the analyses in Table 4, we use stock-level lender concentration data, obtained from Markit, as the primary measure of lenders' market power. We sort stocks by SSP into high- and low-SSP groups and, independently, by market power into high- and low-market power groups. Both SSP and market power are observed from the previous month when forming the portfolios. After obtaining these four groups, we perform portfolio analysis for the 151 stock market anomalies using the same methodology as in Table 6.

The results are reported in Table 8. Panel A shows portfolio analysis in the subsample of high-SSP and low-market power stocks. According to Hypothesis 3.2, when short sellers have a strong information advantage (i.e., high SSP) and stock lenders do not have market power, the split of profit from trading anomalies should favor short sellers. Before accounting for short-selling fees, the long-short return of trading 151 anomalies is 0.2868% per month ($t\text{-stat}=3.71$). After adjusting short-selling fees, the profitability shrinks to 0.2110% per month ($t\text{-stat}=2.59$), representing a 26.41% decrease relative to pre-fee profit.

Panel B of Table 8 reports the portfolio analysis for the subsample of high-SSP and high-market power stocks. The long-short return spread remains both economically and statistically meaningful before fees (0.3066% per month; $t\text{-stat}=3.99$) but is roughly halved after adjusting for short-selling fees (0.1550%; $t\text{-stat}=2.31$). In other words, stock lenders appropriate about 49% of pre-fee anomaly profits—nearly double the share inferred in Panel A of Table 8 (26.41%). This steeper pass-through from SSP into fees under high market power is exactly consistent with the prediction of Hypothesis 3.2, suggesting that lenders capture a larger portion of arbitrage profits when they can exert market power.

Panel C of Table 8 analyzes the stocks with low SSP and low market power. The return spread is modest before fees (0.1751%; $t\text{-stat}=2.45$) and becomes statistically insignificant

after fees (0.1155%; $t\text{-stat}=1.55$). Although the inferred share captured by fees is only about 34.05%, the limited pre-fee opportunity for low-SSP stocks leaves little remaining profit once fees are deducted. This aligns with Hypothesis 3.1 and Hypothesis 3.2 together, suggesting that when SSP is low, anomalies offer less pre-fee alpha, and even in the absence of concentrated lending power, the after-fee spread fails to reach statistical significance.

Finally, when SSP is low and market power is high, Panel D of Table 8 shows that lenders appropriate roughly half of the pre-fee profits, as the long-short return decreases from 0.2346% ($t\text{-stat}=3.83$) to 0.1196% ($t\text{-stat}=1.77$) after fees. The remaining after-fee spread is only marginally significant, yielding weak post-fee performance. This is consistent with Hypothesis 3.2, showing that when SSP is low, limited pre-fee alpha together with high lender market power further reduces the pass-through from SSP into after-fee returns.

[Insert Table 8 here]

As a robustness check, Table 9 replicates the four-way split by SSP (high vs. low) and lender market power (high vs. low), using stock returns adjusted for option-implied short-selling fees. Portfolio formation is identical to that in Table 8. However, the analysis includes a smaller set of anomalies due to the limited availability of option data. Panel A (high SSP and low market power) shows that both pre-fee and after-fee long-short profits remain economically and statistically significant. Lenders capture only about 20.02% of pre-fee profits: the return spread declines from 0.1617% to 0.1293% after fees. This low split ratio indicates that when short sellers are highly informed and lenders have limited market power, most anomaly profits still accrue to short sellers after fees. Comparing Panels A and B (both high SSP), higher lender market power raises the share of profits extracted through fees. The split ratio increases from 20.02% to 26.52%. At the same time, Panel B shows higher fee extraction by stock lenders, resulting in lower after-fee profits than in Panel A. This pattern is consistent with Hypothesis 3.2, indicating that stronger lender market power enables lenders to appropriate a larger fraction of SSP-implied profits. When we move to

low-SSP anomalies, both Panel C (low market power) and Panel D (high market power) show that after-fee long-short profits are statistically insignificant. This finding is consistent with the observation in Table 8, where anomalies are not profitably exploitable among low-SSP stocks because short-sellers lack an information advantage. In general, these results support the idea that lender market power plays an important role in determining how short-selling profits are divided between lenders and short sellers.

[Insert Table 9 here]

5. Conclusion

This paper examines a stock lending market where stock lenders have market power. In this market, lenders supply stock loans to short sellers and leverage their market power to extract a fraction of the profits generated from short-selling activities. The profitability of short-selling depends on the extent to which abnormal increases in short interest are followed by subsequent price declines, with the profit shared between short sellers and lenders. Lenders exploit their market power to extract a portion of these profits. In particular, they impose higher lending fees on stocks that are more sensitive to short-selling activity, while requiring lower fees from stocks with lower sensitivity.

We empirically estimate stock-level short-selling profitability (SSP) and examine its asset pricing implications. SSP is positively related to short-selling fees, consistent with lenders appropriating part of short sellers' expected profits. SSP is also persistent out of sample: short interest predicts future returns more strongly among high-SSP stocks. Consistent with [Muravyev, Pearson, and Pollet \(2025\)](#), a comprehensive set of market anomalies is unprofitably after accounting for short-selling fees. However, anomalies remain statistically significant for high-SSP stocks, especially when lenders lack market power. These results suggest that short-selling costs do not fully explain stock market anomalies, highlighting the role of lending market structure and lender behavior in shaping short-selling dynamics.

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Figure 1. Monthly Average Short-selling Profitability (SSP) of Stocks

This figure plots the time-series of the average SSP for all months from 2005 to 2021. The shaded areas denote the NBER recession periods.

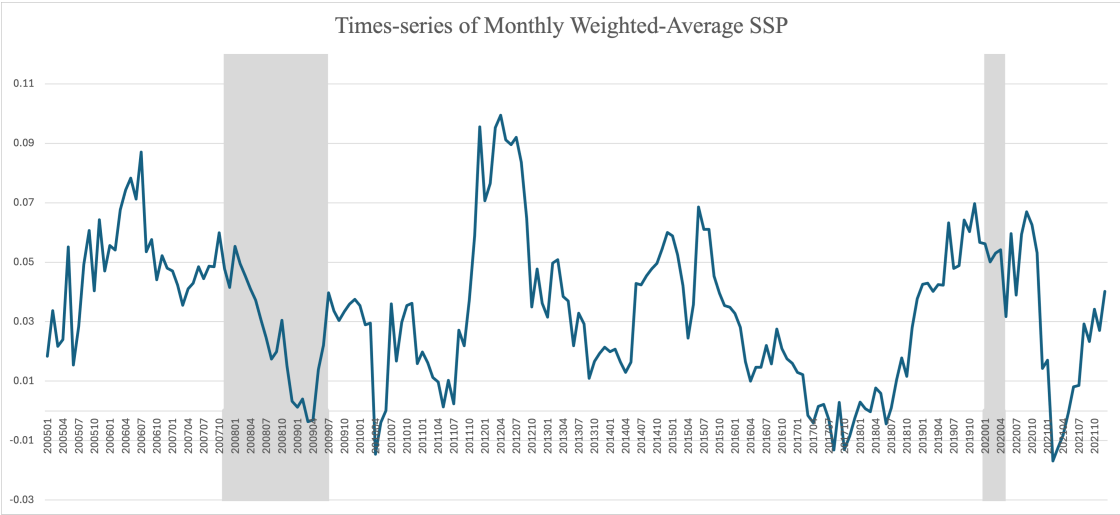


Table 1. Summary Statistics

This table reports annualized summary statistics (in percentage) for the main variables, including short-selling profitability (SSP), and other stock-level characteristics. Detailed definitions of these variables are provided in Appendix Table A1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Min.	1%	5%	Median	95%	99%	Max.	Mean	Std. Dev.	Skewness	Kurtosis	Obs.
SSP	-5.96	-1.90	-0.42	0.00	0.53	2.28	7.98	0.03	0.63	3.05	48.16	400,571
SIR	0.00	0.00	0.00	0.03	0.19	0.35	4.25	0.06	0.10	14.00	385.76	400,571
FIS fee	-4.86	-0.50	0.13	0.57	8.87	47.15	971.75	2.96	16.36	13.86	265.07	400,571
DCBS	1.00	1.00	1.00	1.00	4.00	9.00	10.00	1.46	1.48	3.95	19.24	345,458
Option-Implied fee	-0.82	-0.02	-0.01	0.04	0.09	0.99	58.87	0.09	0.48	56.45	4,959.44	74,531
MktPower	0.00	0.11	0.15	0.29	0.83	1.00	1.00	0.35	0.20	1.65	5.53	346,584
Utilization	0.00	0.03	0.25	7.95	62.25	85.58	100.00	16.07	19.86	1.81	5.92	346,584
Beta	-7.88	-0.07	0.25	1.08	2.51	3.53	52.24	1.19	0.79	7.23	346.13	400,571
ME	0.14	9.14	27.73	754	24,637	124,549	2,902,368	6,936	38,748	26.71	1,182	400,571
B/M	-9.60	-4.71	-3.31	-1.21	0.27	1.01	3.18	-1.31	1.14	-0.84	5.33	317,129
Mom	-1.00	-0.80	-0.57	0.07	1.13	2.70	105.71	0.17	0.91	28.31	2,142.65	399,719
Illiq	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	109.07	24,287	399,739
Disp	0.00	0.00	0.00	0.04	0.63	2.82	205.00	0.20	1.44	63.57	6,877.86	310,697
IO	0.00	0.02	0.10	0.77	1.05	1.18	78.57	0.69	0.38	67.97	13,785	394,557

Table 2. Regressions of SSP on Firm Characteristics and Securities Lending Market Variables

This table reports panel regression results of short-selling profitability (SSP) on firm characteristics and lending market conditions. The explanatory variables include beta, firm size, the book-to-market ratio, momentum, illiquidity, return volatility, lottery demand, firm age, analysts' forecast dispersion, the utilization ratio of stock loan inventory, market power, the average tenure of stock loans, and the short interest ratio. Detailed definitions of these variables are provided Appendix Table A1. Standard errors are adjusted for autocorrelation following [Newey and West \(1987\)](#). Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Beta	-0.0041 (-1.36)				-0.0050 (-1.45)	-0.0044*** (-2.88)		-0.0046*** (-2.90)
ME		-0.0121*** (-5.13)			-0.0142*** (-5.02)	0.0001 (0.07)		0.0006 (0.39)
B/M			-0.0033* (-1.96)		-0.0063*** (-3.86)	-0.0010 (-1.24)		0.0004 (0.44)
Mom				-0.0112*** (-6.42)	-0.0096*** (-4.53)	-0.0008 (-0.80)		-0.0010 (-0.95)
Illiq						0.0020* (1.83)		0.0022*** (1.99)
Vol						0.3052*** (2.84)		0.2535*** (2.24)
Maxret						0.0970*** (3.08)		0.0850*** (2.60)
FirmAge						-0.0069 (-1.49)		-0.0072 (-1.41)
Disp						-0.0005 (-1.10)		-0.0004 (-0.99)
Utilization							-0.0004*** (-2.97)	-0.0001** (-1.97)
MktPower							0.0240*** (2.38)	-0.0048 (-0.60)
AvgTenure							0.0001*** (4.22)	0.0000 (-1.00)
SIR							-0.0017 (-0.18)	-0.0130*** (-2.84)
Obs.	369,001	369,001	295,762	368,996	295,762	225,462	339,564	207,126
Adj. R ²	28.48%	28.49%	26.75%	28.51%	26.79%	34.41%	30.06%	24.75%

Table 3. The Role of SSP in the Stock Return Predictability of Short Interest

This table examines the time-series persistence of short-selling profitability (SSP) using out-of-sample portfolio analysis. Panel A reports equal-weighted portfolio returns based on rankings of abnormal short interest, without accounting for short-selling fees. At the beginning of each month, stocks are classified into high-SSP and low-SSP groups based on their stock-level SSP estimated in the previous month. The row labeled Low-High reports the return spread between the two extreme portfolios sorted by abnormal short interest. The subsequent rows report risk-adjusted returns (alphas) from asset pricing models, including the CAPM, the Fama–French three-factor (FF3), five-factor (FF5), and six-factor (FF6) models. Panel B follows the same methodology as Panel A but reports characteristic-adjusted portfolio returns following Daniel, Grinblatt, Titman, and Wermers (1997). t-statistics are adjusted for autocorrelation using the method of Newey and West (1987). Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Bivariate Portfolio Analysis - Short Interest and Expected Stock Returns

Deciles	Full Sample		High SSP		Low SSP	
	(1) abnSI	(2) Ret	(3) abnSI	(4) Ret	(5) abnSI	(6) Ret
1 (Low)	-0.0370	1.6024	-0.0381	1.7744	-0.0360	1.4024
2	-0.0076	1.1272	-0.0077	1.2696	-0.0077	1.0890
3	-0.0011	0.9323	-0.0012	1.0345	-0.0012	0.9098
4	0.0053	0.9874	0.0051	0.8850	0.0051	0.9742
5 (High)	0.0360	1.0089	0.0370	0.9538	0.0339	1.0479
Low-High		0.5935** (2.54)		0.8206*** (3.40)		0.3545 (1.14)
CAPM Alpha		0.6125*** (3.39)		0.9042*** (5.37)		0.3365 (1.26)
FF3 Alpha		0.5876*** (3.10)		0.8884*** (4.59)		0.3054 (1.07)
FF4 Alpha		0.5865*** (2.90)		0.8641*** (3.69)		0.3231 (1.17)
FF5 Alpha		0.6594*** (3.64)		1.0026*** (4.33)		0.4338 (1.58)

Panel B: DGTW Characteristics-adjusted Returns

Deciles	Full Sample	High SSP	Low SSP
	(1) Ret	(2) Ret	(3) Ret
1 (Low)	0.2000	0.3370	-0.0169
2	-0.2118	-0.0432	-0.2470
3	-0.3045	-0.1416	-0.4035
4	-0.3052	-0.4195	-0.3222
5 (High)	-0.3019	-0.2459	-0.3430
Low-High	0.5020** (2.13)	0.5829** (2.27)	0.3261 (1.23)

Table 4. SSP and Stock Lending Costs: The Role of Stock Lenders' Market Power

This table reports panel regression results examining the cross-sectional relationship between stock-level short-selling profitability (SSP) and short-selling fees, controlling for firm-, time-, and industry-fixed effects. t-stats are calculated using standard errors clustered at the firm level. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: SSP and FIS Short-selling Fees

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: FIS Short-selling Fees at the Individual Stock Level					
	Full Sample			Low Market Power Stocks		
SSP	0.1213** (2.26)	0.1143** (2.05)	0.1510*** (3.07)	0.2144*** (3.09)	0.0031 (0.10)	0.0092 (0.16)
Utilization	0.0000 (-0.18)	0.0001 (1.48)	-0.0002** (-2.23)	-0.0001 (-0.76)	0.0003*** (2.95)	0.0006*** (5.65)
AvgTenure	-1.8460** (-2.25)	-0.5485 (-0.65)	-3.2894*** (-3.48)	-3.2834** (-2.39)	-0.3373 (-0.89)	1.4793*** (3.68)
SIR	0.0480*** (17.23)	0.0471*** (17.23)	0.0597*** (15.25)	0.0533*** (11.73)	0.0556*** (22.51)	0.0510*** (20.42)
Beta	-0.0720** (-2.20)	-0.0997*** (-2.67)	-0.1236*** (-3.54)	-0.1180** (-2.56)	0.0091 (0.24)	-0.0225 (-0.52)
ME	-0.5752*** (-14.08)	-0.4120*** (-7.60)	-0.6939*** (-12.77)	-0.4590*** (-4.73)	-0.6091*** (-13.31)	-0.3007*** (-6.44)
B/M	0.0113 (0.64)	0.0072 (0.42)	-0.0099 (-0.34)	-0.0141 (-0.50)	0.0066 (0.36)	0.0201 (1.15)
Mom	0.0583 (0.90)	0.0293 (0.46)	0.1200*** (3.24)	0.0521 (1.24)	0.0317 (0.53)	0.0139 (0.22)
Disp	0.002 (0.27)	0.0024 (0.32)	0.0096 (0.81)	0.009 (0.63)	-0.0014 (-0.36)	0.0015 (0.32)
FirmAge		-0.2376*** (-3.10)		-0.4036*** (-3.09)		0.0752 (0.86)
Illiq		0.0127 (0.57)		0.0071 (0.29)		-0.0269 (-0.72)
Vol		6.4897** (2.43)		7.7062* (1.91)		5.1646*** (3.08)
IO		-1.7452*** (-4.81)		-1.3065 (-1.65)		-2.7831*** (-7.35)
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Obs.	118,796	118,264	43,410	43,101	75,063	74,850
Adj. R ²	0.6343	0.6372	0.6628	0.6842	0.6021	0.6054

Panel B: SSP and DCBS

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Monthly DCBS Scores at the Individual Stock Level					
	Full Sample			High Market Power Stocks	Low Market Power Stocks	
SSP	0.0260** (2.47)	0.0262** (2.46)	0.0295** (3.00)	0.0280** (2.57)	0.0197* (2.28)	0.0232* (2.01)
Utilization	0.0000 (0.75)	0.0000 (1.62)	0.0000 (0.74)	0.0000 (1.09)	0.0000 (1.06)	0.0000** (2.47)
AvgTenure	-0.1928 (-1.34)	-0.0012 (-0.01)	-0.3780** (-2.88)	-0.1471 (-1.35)	-0.1496 (-1.36)	0.0072 (0.07)
SIR	0.0061*** (12.88)	0.0060*** (13.49)	0.0056*** (11.61)	0.0054*** (9.25)	0.0064*** (7.81)	0.0064*** (7.92)
Beta	-0.0023 (-0.39)	-0.0042 (-0.70)	-0.0034 (-0.31)	-0.0050 (-0.45)	0.0009 (0.20)	-0.0012 (-0.27)
ME	-0.0716*** (-10.93)	-0.0503*** (-7.70)	-0.0942*** (-7.99)	-0.0730*** (-7.19)	-0.0572*** (-5.55)	-0.0393*** (-4.79)
B/M	0.0034 (1.17)	0.0025 (0.89)	-0.0028 (-1.65)	-0.0034** (-2.59)	0.0050** (2.47)	0.0043* (2.19)
Mom	-0.0022 (-0.60)	-0.0057* (-1.94)	0.0119** (2.46)	0.0064 (1.51)	-0.0045 (-1.03)	-0.0070* (-2.06)
Disp	-0.0010 (-1.62)	-0.0009 (-1.60)	-0.0004 (-0.43)	-0.0004 (-0.46)	-0.0013* (-1.95)	-0.0012 (-1.77)
FirmAge		-0.0203 (-1.21)		-0.0230 (-0.67)		-0.0233 (-1.54)
Illiq		0.0000 (0.00)		-0.0004 (-0.50)		0.0034* (2.02)
Vol		0.3282*** (4.65)		0.3546*** (3.74)		0.3598*** (3.57)
IO		-0.2606*** (-5.86)		-0.2386*** (-5.53)		-0.2454*** (-6.07)
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Obs.	118,763	118,236	43,522	43,215	75,101	74,886
Adj. R ²	0.7282	0.7340	0.7507	0.7559	0.7399	0.7452

Panel C: SSP and Option-Implied Short-selling Fees

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Option-Implied Short-selling Fee at the Individual Stock Level					
	Full Sample			Low Market Power Stocks		
	High Market Power Stocks			Low Market Power Stocks		
SSP	0.0007** (2.05)	0.0008** (2.18)	0.0014** (2.46)	0.0013** (2.24)	-0.0003 (-0.49)	-0.0002 (-0.41)
Utilization	0.0000*** (3.65)	0.0000*** (3.71)	0.0000 (1.04)	0.0000 (1.09)	0.0000 (1.63)	0.0000* (1.83)
AvgTenure	-0.0079*** (-3.69)	-0.0079*** (-2.96)	-0.0093*** (-3.17)	-0.0074** (-2.26)	-0.0019 (-0.76)	-0.0014 (-0.59)
SIR	0.0000* (1.70)	0.0000 (1.65)	0.0000 (1.59)	0.0000 (1.48)	0.0000** (2.22)	0.0000** (2.51)
Beta	-0.0006 (-1.42)	-0.0006 (-1.49)	-0.0008 (-1.20)	-0.0008 (-1.32)	-0.0004 (-0.95)	-0.0004 (-0.87)
ME	-0.0041*** (-13.17)	-0.0041*** (-11.90)	-0.0044*** (-9.27)	-0.0043*** (-8.86)	-0.0034*** (-9.76)	-0.0034*** (-9.59)
B/M	0.0003* (1.83)	0.0003* (1.78)	0.0003 (1.24)	0.0003 (1.10)	0.0001 (0.39)	0.0001 (0.52)
Mom	-0.0001 (-0.28)	0.0000 (0.73)	-0.0002 (-0.41)	-0.0002 (-0.47)	0.0002 (1.00)	0.0003 (1.49)
Disp	0.0000 (0.81)	0.0000 (0.73)	0.0000 (-0.67)	0.0000 (-0.40)	0.0001 (1.59)	0.0001 (1.46)
FirmAge		0.0017** (2.00)		0.0001 (0.08)		0.0015 (1.55)
Illiq		-0.0067 (-0.62)		0.0149 (1.26)		-0.0425 (-1.43)
Vol		0.0165 (1.39)		0.0057 (0.28)		0.0150 (0.90)
IO		0.0000 (-0.01)		-0.0012 (-0.53)		-0.0025 (-1.47)
Firm FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Obs.	18,303	18,213	8,603	8,582	9,320	9,285
Adj. R ²	0.5319	0.5322	0.5833	0.584	0.5619	0.5633

Table 5. SSP and Stock Lending Costs: Alternative Measures of Stock Lenders' Market Power

This table examines the relationship between short-selling profitability (SSP) and short-selling fees using alternative measures of stock lenders' market power, controlling for firm-, time-, and industry-fixed effects. Stock lenders have strong market power when the combined market share of the two largest stock lenders is high or when the utilization ratio of stock loan inventory is high. t-stats are calculated using standard errors clustered at the firm level. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Top 2 Stock Lenders' Shares			Utilization Ratio of Stock Loans				
	High Market Power	Low Market Power	Low Market Power	High Market Power	High Market Power	Low Market Power	Low Market Power	Low Market Power
SSP	0.1789** (2.27)	0.1626** (2.00)	0.0425 (1.21)	0.0712 (1.52)	0.2006*** (2.66)	0.1669** (2.05)	0.0323 (0.78)	0.0254 (0.59)
Utilization	-0.0002 (-1.46)	-0.0001 (-0.53)	0.0002** (2.16)	0.0004*** (3.32)	0.0002 (1.46)	0.0004** (2.34)	0.0001 (1.65)	0.0002** (2.53)
AvgTenure	-4.2630*** (-4.17)	-3.3817** (-2.21)	-0.9568 (-1.07)	0.2262 (0.27)	-1.4484*** (-3.28)	-0.5914 (-1.03)	0.3478 (0.29)	1.0387 (0.90)
SIR	0.0542*** (12.17)	0.0539*** (11.02)	0.0466*** (14.77)	0.0455*** (15.24)	0.0308*** (15.01)	0.0304*** (14.59)	0.0324*** (8.24)	0.0322*** (8.42)
Beta	-0.0469 (-0.96)	-0.0824 (-1.47)	-0.0482 (-1.30)	-0.0660* (-1.77)	0.0392 (1.45)	0.0155 (0.54)	-0.0659*** (-2.64)	-0.0756*** (-3.01)
ME	-0.6632*** (-10.97)	-0.5336*** (-4.64)	-0.4630*** (-8.21)	-0.3336*** (-5.57)	-0.5472*** (-15.79)	-0.4337*** (-9.51)	-0.2897*** (-10.23)	-0.2085*** (-7.10)
B/M	-0.0029 (-0.09)	-0.0019 (-0.06)	0.0197 (0.90)	0.0165 (0.76)	0.0067 (0.41)	-0.0038 (-0.24)	0.0077 (0.66)	0.0038 (0.33)
Mom	0.1088** (2.56)	0.0785 (1.62)	0.0776 (0.76)	0.0551 (0.54)	-0.0069 (-0.47)	-0.0243* (-1.86)	-0.0160 (-0.71)	-0.0323 (-1.52)
Disp	0.0151 (0.91)	0.0150 (0.89)	-0.0048 (-1.44)	-0.0039 (-1.18)	-0.0138* (-1.85)	-0.0122 (-1.63)	0.0024 (0.79)	0.0023 (0.77)
FirmAge		-0.4221*** (-2.90)		-0.0665 (-0.82)		-0.2017** (-2.24)		-0.1519** (-2.27)
Illiq		0.0116 (0.46)		-0.0055 (-0.64)		0.0562*** (2.99)		-0.0096** (-2.55)
Vol		8.4250* (1.88)		3.6604*** (2.60)		5.1038*** (3.17)		1.5475** (2.32)
IO		-1.1146 (-1.24)		-1.8001*** (-5.84)		-0.8863*** (-2.79)		-1.0821*** (-4.78)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	47,365	47,043	70,957	70,758	39,139	38,922	57,156	56,930
Adj.R ²	0.6855	0.6878	0.6125	0.6172	0.7438	0.7464	0.6247	0.6287

Table 6. SSP and Anomaly Performance: FIS Lending Fees

This table examines the impact of short-selling profitability (SSP) on anomaly performance. Following Muravyev, Pearson, and Pollet (2025), stocks are sorted into decile portfolios based on 151 anomalies. For each anomaly, we first calculate full-sample decile portfolio returns based on the anomaly variable. We then aggregate returns across all 151 anomalies, both before and after accounting for short-selling fee. Panel A reports aggregate equal-weight returns for decile portfolios before accounting for short-selling fees. The row labeled *Average Fee* reports the average short-selling fees of the aggregate decile portfolios, and the column labeled *High-Low* reports the return and fee spreads between the two extreme portfolios. The row labeled *Average Num. of Stocks* reports the average number of stocks in each decile portfolio across all anomalies. The row labeled *t - stat* reports the naive t-statistic of average returns for each decile portfolio, following Muravyev, Pearson, and Pollet (2025). The row labeled *Return after Fee* shows the after-fee returns estimated as described in Section 4.4. Panel B reports the aggregate return spreads for portfolios consisting of only high-SSP stocks, while Panel C presents the results for portfolios containing only low-SSP stocks. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	1 (Low)	2	3	4	5	6	7	8	9	10 (High)	High-Low
Panel A: Full Sample											
Return before Fee	1.2833	1.2369	1.2149	1.1935	1.2135	1.2198	1.2400	1.2672	1.3062	1.4352	0.1519***
Naive t	(60.71)	(91.49)	(138.29)	(136.91)	(139.99)	(130.56)	(139.76)	(111.16)	(99.32)	(57.48)	(4.07)
Average Fee	0.2212	0.1243	0.1079	0.1003	0.0991	0.0983	0.0994	0.1064	0.1208	0.2013	-0.0199
Naive t	(22.46)	(39.23)	(39.35)	(41.54)	(39.79)	(38.85)	(40.10)	(37.98)	(35.02)	(27.36)	(-1.47)
Return after Fee	1.5045	1.3611	1.2904	1.2638	1.2829	1.2887	1.3095	1.3417	1.3907	1.5761	0.0716
Naive t	(53.23)	(91.86)	(134.02)	(132.34)	(136.58)	(123.85)	(130.72)	(106.61)	(94.58)	(57.31)	(1.58)
Average Num of Stocks	193.02	147.68	135.49	132.04	128.92	129.10	128.83	134.32	143.93	192.92	
Panel B: High-SSP Stocks											
Return before Fee	1.3313	1.2531	1.2211	1.1958	1.2413	1.2417	1.2785	1.2823	1.3378	1.5404	0.2092***
Naive t	(49.32)	(72.42)	(90.93)	(87.39)	(93.88)	(81.26)	(90.20)	(81.20)	(74.12)	(53.53)	(4.71)
Average Fee	0.2589	0.1460	0.1266	0.1171	0.1171	0.1151	0.1161	0.1240	0.1407	0.2302	-0.0288*
Naive t	(23.03)	(36.41)	(36.36)	(36.98)	(34.81)	(35.01)	(36.26)	(34.36)	(32.36)	(26.82)	(-1.90)
Return after Fee	1.5902	1.3990	1.3097	1.2777	1.3233	1.3222	1.3598	1.3691	1.4364	1.7016	0.1114**
Naive t	(45.75)	(73.55)	(93.52)	(90.15)	(93.27)	(81.97)	(88.80)	(79.91)	(72.20)	(53.23)	(2.11)
Average Num of Stocks	80.60	62.73	58.67	56.94	56.64	55.82	56.22	58.37	62.07	80.61	
Panel C: Low-SSP Stocks											
Return before Fee	1.2498	1.2439	1.2325	1.2082	1.2128	1.2240	1.2365	1.2703	1.3120	1.3781	0.1283***
Naive t	(58.64)	(87.98)	(97.54)	(99.35)	(109.74)	(97.22)	(112.51)	(95.46)	(92.45)	(45.37)	(3.12)
Average Fee	0.2043	0.1161	0.1013	0.0938	0.0924	0.0929	0.0935	0.1006	0.1145	0.1899	-0.0143
Naive t	(22.03)	(39.26)	(39.11)	(42.99)	(41.27)	(38.94)	(39.69)	(38.51)	(35.93)	(26.99)	(-1.12)
Return after Fee	1.4540	1.3599	1.3034	1.2738	1.2775	1.2890	1.3019	1.3407	1.3922	1.5110	0.0570
Naive t	(53.51)	(90.63)	(97.17)	(98.84)	(110.57)	(96.31)	(110.46)	(95.03)	(91.26)	(48.00)	(1.21)
Average Num of Stocks	112.42	84.95	76.82	75.10	72.28	73.27	72.63	75.94	81.85	112.31	

Table 7. SSP and Anomaly Performance: Option-Implied Short-selling Fees

This table examines the effect of short-selling profitability (SSP) on anomaly performance using the same methodology as Table 6, but with stock returns adjusted for option-implied short-selling costs. Panel A reports results for the full sample. Panel B reports aggregate return spread for portfolios that include only high-SSP stocks, while Panel C presents the results for portfolios consisting only of low-SSP stocks. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	1 (Low)	2	3	4	5	6	7	8	9	10 (High)	High-Low
Panel A: Full Sample											
Return before Fee	0.7383 (37.28)	0.7888 (49.88)	0.7745 (63.21)	0.7510 (69.32)	0.7476 (69.79)	0.7563 (63.06)	0.7822 (62.51)	0.7561 (59.30)	0.7801 (47.40)	0.8328 (35.23)	0.0945*** (2.90)
Average Fee	0.5086 (32.13)	0.3771 (57.08)	0.3347 (76.46)	0.3149 (87.00)	0.3112 (80.12)	0.3092 (81.07)	0.3126 (76.28)	0.3279 (65.40)	0.3607 (51.18)	0.4751 (37.44)	-0.0335 (-1.38)
Return after Fee	1.2025 (49.61)	1.1473 (65.37)	1.0959 (82.41)	1.0551 (93.76)	1.0478 (94.24)	1.0551 (82.11)	1.0844 (80.48)	1.0719 (75.39)	1.1245 (60.18)	1.2704 (44.36)	0.0679 (1.60)
Average Num of Stocks	81.15	79.86	80.80	80.75	80.73	80.37	79.99	79.80	80.29	79.00	
Panel B: High-SSP Stocks											
Return before Fee	0.7880 (31.70)	0.8319 (36.26)	0.7731 (46.59)	0.7521 (49.98)	0.7410 (49.79)	0.7733 (50.85)	0.7820 (49.41)	0.7782 (48.61)	0.8021 (40.55)	0.9210 (32.07)	0.1330*** (3.24)
Average Fee	0.5400 (31.56)	0.4009 (56.40)	0.3543 (75.23)	0.3338 (85.16)	0.3297 (77.64)	0.3267 (78.78)	0.3302 (73.94)	0.3473 (63.28)	0.3831 (49.67)	0.5014 (37.03)	-0.0386 (-1.48)
Return after Fee	1.2838 (41.81)	1.2139 (48.62)	1.1142 (62.94)	1.0746 (68.72)	1.0598 (69.37)	1.0896 (66.83)	1.1019 (64.68)	1.1133 (62.14)	1.1692 (51.50)	1.3869 (39.29)	0.1031** (1.98)
Average Num of Stocks	42.14	41.26	41.84	41.75	41.66	41.61	41.37	41.21	41.51	40.63	
Panel C: Low-SSP Stocks											
Return before Fee	0.6666 (35.25)	0.7556 (44.70)	0.7574 (60.12)	0.7497 (56.79)	0.7442 (61.34)	0.7463 (60.29)	0.7561 (57.88)	0.7235 (50.76)	0.7597 (41.90)	0.7334 (31.46)	0.0669** (2.09)
Average Fee	0.4685 (33.24)	0.3506 (58.23)	0.3131 (78.20)	0.2961 (88.94)	0.2921 (85.70)	0.2920 (83.78)	0.2955 (80.17)	0.3076 (67.64)	0.3379 (52.50)	0.4432 (38.19)	-0.0253 (-1.15)
Return after Fee	1.0969 (51.71)	1.0905 (62.48)	1.0595 (81.63)	1.0366 (77.40)	1.0267 (84.58)	1.0293 (81.23)	1.0421 (76.84)	1.0203 (68.96)	1.0827 (56.49)	1.1415 (44.34)	0.0446 (1.22)
Average Num of Stocks	39.44	38.59	39.07	39.00	38.84	38.93	38.68	38.54	38.84	37.93	

Table 8. The Joint Effect of SSP and Stock Lenders' Market Power on Anomaly Performance: FIS Lending Fees

This table examines the joint effect of short sellers' information advantage and stock lenders' market power on anomaly performance. Stocks are sorted into four subgroups based on short-selling profitability (SSP) and lenders' market power. The analysis follows the same methodology used in Tables 6, consistent with [Muravyev, Pearson, and Pollet \(2025\)](#). Panel A reports aggregate equal-weight returns for decile portfolios comprising high-SSP and low-market power stocks. Panel B reports aggregate return spread for portfolios that include high-SSP and high-market power stocks. Panel C presents the results for portfolios consisting solely of low-SSP and low-market power stocks, while Panel D reports results for low-SSP and high-market power stocks. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Panel A: High-SSP and Low Market Power Stocks											
Return before Fee	1.3698	1.2103	1.2142	1.1720	1.1555	1.1711	1.1875	1.2199	1.3377	1.6565	0.2868***
t-stat	(35.79)	(47.22)	(54.95)	(54.12)	(62.49)	(55.80)	(56.34)	(55.20)	(48.86)	(25.50)	(3.71)
Average Fee	0.2349	0.1349	0.1136	0.1048	0.1045	0.1087	0.1114	0.1205	0.1405	0.2267	-0.0081
t-stat											(-0.67)
Return after Fee	1.6045	1.3458	1.2942	1.2460	1.2294	1.2479	1.2662	1.3048	1.4369	1.8156	0.2110**
t-stat	(36.09)	(49.65)	(57.26)	(56.14)	(63.85)	(56.75)	(58.31)	(56.69)	(50.05)	(27.18)	(2.59)
Average Num of Stocks	43.68	34.75	32.38	31.62	30.91	31.05	31.24	31.80	34.03	44.96	
Panel B: High-SSP and High Market Power Stocks											
Return before Fee	1.0057	1.0380	1.0469	1.0684	1.0683	1.0661	1.1194	1.1145	1.1844	1.3122	0.3066***
t-stat	(26.20)	(34.55)	(37.81)	(43.27)	(30.27)	(41.71)	(37.23)	(34.26)	(33.46)	(29.21)	(3.99)
Average Fee	0.4619	0.2999	0.2693	0.2557	0.2609	0.2671	0.2792	0.2990	0.3296	0.4439	-0.018
t-stat											(-0.89)
Return after Fee	1.4704	1.3398	1.2367	1.2489	1.2524	1.2546	1.3162	1.3253	1.4167	1.6254	0.1550**
t-stat	(32.29)	(41.39)	(42.52)	(49.46)	(34.34)	(46.19)	(43.90)	(40.25)	(39.93)	(34.11)	(2.31)
Average Num of Stocks	44.25	35.26	32.87	32.10	31.43	31.55	31.74	32.30	34.57	45.61	

Panel C: Low-SSP and Low Market Power Stocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Return before Fee	1.2691 (43.81)	1.1873 (57.69)	1.1563 (60.49)	1.1500 (76.68)	1.1248 (75.84)	1.1572 (64.89)	1.1822 (68.20)	1.1932 (71.03)	1.2850 (60.87)	1.4442 (24.93)	0.1751** (2.45)
t-stat											
Average Fee	0.1909	0.1055	0.0893	0.0844	0.0854	0.086	0.0905	0.0965	0.1145	0.1875	-0.0034 (-0.29)
t-stat											
Return after Fee	1.4608 (42.58)	1.2939 (61.41)	1.2199 (62.69)	1.2101 (78.63)	1.1856 (78.14)	1.2183 (66.55)	1.2465 (69.14)	1.2617 (73.28)	1.3659 (63.98)	1.5763 (26.61)	0.1155 (1.55)
t-stat											
Average Num of Stocks	43.45	34.50	32.15	31.37	30.65	30.80	30.98	31.55	33.79	44.76	

Panel D: Low-SSP and High Market Power Stocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Return before Fee	1.1080 (29.47)	1.0525 (39.06)	0.9912 (40.32)	0.9692 (37.61)	1.0027 (43.17)	0.9879 (39.52)	1.0137 (41.20)	1.0767 (40.78)	1.1749 (38.09)	1.3426 (31.58)	0.2346*** (3.83)
t-stat											
Average Fee	0.3701	0.2385	0.2136	0.2015	0.2076	0.2174	0.2290	0.2425	0.2693	0.3643	-0.0059 (-0.37)
t-stat											
Return after Fee	1.4798 (32.66)	1.2929 (44.40)	1.1418 (44.62)	1.1115 (41.51)	1.1492 (47.27)	1.1415 (42.83)	1.1758 (46.22)	1.2482 (48.22)	1.3652 (45.48)	1.5995 (35.67)	0.1196* (1.77)
t-stat											
Average Num of Stocks	43.98	35.01	32.62	31.87	31.17	31.30	31.49	32.05	34.30	45.31	

Table 9. The Joint Effect of SSP and Market Power on Anomaly Performance: Option-Implied Short-selling Fees

This table examines the joint effect of short sellers' information advantage and stock lenders' market power on anomaly performance, using stock returns adjusted for option-implied short-selling fees. This analysis follows the same methodology as in Table 8 following Muravyev, Pearson, and Pollet (2025). Panel A reports aggregate equal-weight returns for decile portfolios of high-SSP and low-market power stocks. Panel B reports aggregate return spreads for portfolios that include high-SSP and high-market power stocks. Panel C presents the results for portfolios consisting solely of low-SSP and low-market power stocks, while Panel D reports results for low-SSP and high-market power stocks. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: High-SSP and Low Market Power Stocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Return before Fee	0.9650	0.9401	0.8837	0.8747	0.8733	0.8952	0.9222	0.8879	0.9070	1.1267	0.1617***
t-stat	(28.66)	(37.83)	(39.84)	(38.85)	(51.32)	(43.32)	(41.31)	(40.99)	(32.62)	(31.82)	(3.06)
Average Fee	0.4484	0.3434	0.3080	0.2921	0.2884	0.2862	0.2900	0.3035	0.3306	0.4160	-0.0324*
t-stat	(35.80)	(62.16)	(84.13)	(96.72)	(93.98)	(92.24)	(83.55)	(69.98)	(53.02)	(40.70)	(-1.69)
Return after Fee	1.4134	1.2834	1.1918	1.1668	1.1617	1.1814	1.2122	1.1913	1.2376	1.5428	0.1293**
t-stat	(34.98)	(48.73)	(52.20)	(51.69)	(66.90)	(55.30)	(52.11)	(51.55)	(41.42)	(37.36)	(2.02)

Panel B: High-SSP and High Market Power Stocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Return before Fee	0.7095	0.7766	0.6731	0.6969	0.6508	0.6822	0.6440	0.6921	0.7165	0.8568	0.1473***
t-stat	(19.23)	(23.36)	(23.83)	(26.99)	(26.41)	(28.42)	(25.29)	(28.34)	(24.66)	(22.35)	(2.84)
Average Fee	0.5019	0.3914	0.3518	0.3331	0.3289	0.3282	0.3311	0.3428	0.3724	0.4629	-0.0390*
t-stat	(36.83)	(60.40)	(75.51)	(82.92)	(79.96)	(75.40)	(78.10)	(70.59)	(56.96)	(44.56)	(-1.94)
Return after Fee	1.2114	1.1680	1.0249	1.0300	0.9796	1.0104	0.9751	1.0349	1.0889	1.3197	0.1083*
t-stat	(30.46)	(32.57)	(33.92)	(38.48)	(39.08)	(39.72)	(37.23)	(40.58)	(34.60)	(31.88)	(1.90)

Panel C: Low-SSP and Low Market Power Stocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Return before Fee	0.9287	0.9638	0.9600	0.9270	0.9199	0.9538	0.9384	0.9133	0.9605	0.9628	0.0342
t-stat	(35.25)	(43.99)	(54.36)	(61.87)	(54.28)	(52.89)	(49.97)	(46.45)	(38.86)	(25.81)	(0.69)
Average Fee	0.4045	0.3115	0.2799	0.2663	0.2619	0.2612	0.2647	0.2753	0.3003	0.3819	-0.0226
t-stat	(34.11)	(57.41)	(76.20)	(96.09)	(93.96)	(93.09)	(82.17)	(65.73)	(50.42)	(38.48)	(-1.23)
Return after Fee	1.3332	1.2752	1.2398	1.1933	1.1818	1.2151	1.2030	1.1886	1.2608	1.3447	0.0115
t-stat	(43.83)	(55.40)	(68.71)	(79.40)	(69.00)	(65.07)	(62.41)	(58.00)	(46.77)	(33.36)	(0.21)

Panel D: Low-SSP and High Market Power Stocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	High-Low
Return before Fee	0.6837	0.6264	0.6808	0.5950	0.6271	0.5839	0.5970	0.5984	0.6087	0.7516	0.0679
t-stat	(20.05)	(24.41)	(25.54)	(25.29)	(29.65)	(27.27)	(25.62)	(24.84)	(20.48)	(17.63)	(1.20)
Average Fee	0.4385	0.3437	0.3118	0.2957	0.2918	0.2935	0.2904	0.3038	0.3284	0.4118	-0.0267
t-stat	(36.97)	(58.93)	(74.83)	(84.69)	(83.85)	(76.94)	(81.65)	(71.09)	(58.88)	(43.57)	(-1.49)
Return after Fee	1.1222	0.9702	0.9925	0.8907	0.9189	0.8774	0.8874	0.9022	0.9370	1.1634	0.0412
t-stat	(27.75)	(35.42)	(35.91)	(36.60)	(43.18)	(40.12)	(37.50)	(35.59)	(29.98)	(25.25)	(0.63)

Table A1. Definitions of Variables

Variable	Definition	Source
SIR	The short interest ratio, defined as the number of shares held short divided by total shares outstanding.	Compustat
SSP	Short-selling profitability, defined as the negative coefficient on lagged abnormal short interest ratio in Equation (1).	Estimated from SIR
FIS fee	The security-level short-selling fee, calculated as the difference between the federal funds rate and the rebate rate paid on collateralized stock loans.	FIS Securities Finance Market
DCBS	The Daily Cost of Borrowing Score (DCBS), ranging from 1 to 10, with higher values indicating higher borrowing costs.	IHS Markit
Option-implied fee	The option-implied short-selling fee, calculated as the difference between the synthetic stock price implied by options and the spot stock price. The synthetic stock price is computed as the call price minus the put price, adjusted for the discounted strike price.	OptionMetrics
MktPower	Stock lender market power, proxied by lender concentration as defined in the Markit database. The measure ranges from 0 to 1, where higher values indicate greater concentration of stock-lending inventory among fewer lenders.	IHS Markit
Utilization	The stock loan utilization rate, defined by the IHS Markit database as the portion of shares on loan to short sellers relative to the total available stock loan.	IHS Markit
AvgTenure	The average tenure of stock loans.	IHS Markit
Beta	The market beta of an individual stock.	Chen and Zimmermann (2022)
ME	Firm size, measured as market capitalization, calculated as the stock price multiplied by shares outstanding at the end of each month.	CRSP
B/M	The book-to-market ratio, defined as the book value of shareholders' equity at the end of the most recent June divided by current market capitalization. We use the natural logarithm of B/M in our empirical analyses.	Chen and Zimmermann (2022)

Variable	Definition	Source
Mom	Momentum, measured as the cumulative return from month t-12 to t-2.	Chen and Zimmermann (2022)
Illiq	Stock illiquidity, measured using the Amihud liquidity metric (Amihud, 2002).	Chen and Zimmermann (2022)
IO	Institutional ownership, defined as the fraction of shares held by institutional investors.	Thompson Reuters
Vol	Realized stock return volatility, calculated following Ang, Hodrick, Xing, and Zhang (2006).	Chen and Zimmermann (2022)
MaxRet	Lottery demand, measured following Bali, Brown, Murray, and Tang (2017).	Chen and Zimmermann (2022)
FirmAge	Firm age, measured following Barry and Brown (1984).	Chen and Zimmermann (2022)
Disp	Analyst forecast dispersion, measured as the standard deviation of analysts' forecasts of one-year-ahead earnings per share (EPS) divided by the absolute value of mean EPS.	I/B/E/S