Anomalies and Their Short Sale Costs☆

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Abstract

We find that short sale costs eliminate the abnormal profits generated by asset pricing anomalies. While many anomalies persist out-of-sample, they cannot be profitably exploited due to stock borrow fees. Using a comprehensive sample of 162 anomalies, we show that the average of these long-short anomalies earns a significant 0.15% per month before costs. However, this average is –0.02% once portfolio returns are adjusted for stock borrow fees. Moreover, the anomalies are not profitable before accounting for borrow fees if the stocks with high borrow fees, 12% of all stocks, are excluded from the analysis. Thus, short sale costs explain why these anomalies exist despite arbitrageurs' best efforts to eliminate them.

JEL Classification: G12, G13, G14

Keywords: anomalies, stock return predictability, stock borrow fee, stock lending fee, data mining

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Abstract

We find that short sale costs eliminate the abnormal profits generated by asset pricing anomalies. While many anomalies persist out-of-sample, they cannot be profitably exploited due to stock borrow fees. Using a comprehensive sample of 162 anomalies, we show that the average of these long-short anomalies earns a significant 0.15% per month before costs. However, this average is –0.02% once portfolio returns are adjusted for stock borrow fees. Moreover, the anomalies are not profitable before accounting for borrow fees if the stocks with high borrow fees, 12% of all stocks, are excluded from the analysis. Thus, short sale costs explain why these anomalies exist despite arbitrageurs' best efforts to eliminate them.

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1. Introduction

The interpretation of apparent asset pricing anomalies has long been controversial. Fama (1991) suggested that much of the apparent return predictability documented in the asset pricing literature is due to data mining.[1] Recently, Harvey, Liu, and Zhu (2016), Linnainmaa and Roberts (2018), Green, Hand, and Zhang (2017), and Hou, Xue, and Zhang (2020) also question whether anomalies are "real." In contrast, McLean and Pontiff (2016), Jacobs and Müller (2020), and Jensen, Kelly, and Pedersen (2021) conclude that anomalies generate abnormal returns even post-publication. The later findings are puzzling because many arbitrageurs have the knowledge, capital, and incentives to exploit anomalies.

If the anomalies are real, that is if they generate apparent alpha both in-sample and out-of-sample, then there should be an important limit to arbitrage that prevents investors from exploiting them. We hypothesize that the stock borrow fees that short sellers must pay on the short side to execute the relevant strategy may be a common limit to arbitrage for many seemingly unrelated anomalies. This trading cost provides a barrier to arbitrage that prevents sophisticated investors from exploiting the apparent mispricing.[2]

We begin our analysis by confirming that the average return on a large set of anomaly portfolios is both economically and statistically significant in our sample. We start with the 202 "clear anomalies" identified by Chen and Zimmerman (2021) in their study reproducing many of the in-sample results in the anomalies literature, and then restrict our sample to the 162 anomalies out of the 202 for which we can form well-populated decile portfolios. Our analysis is largely out-of-sample due to the constraints imposed by borrow fee availability. The borrow fee is not available until July 2006, and 82.7% of anomalies our sample are based on sample periods ending before 2006.[3] Thus our results are not affected by potential data snooping that is likely to inflate the average in-sample anomaly return.

We use anomaly signals to sort stocks into decile portfolios, where the signals are signed so that the average abnormal returns of portfolio one (ten) stocks should be negative (positive)

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[1] Fama (1991, p. 1585) writes "With many clever researchers on both sides of the efficiency fence, rummaging for forecasting variables, we are sure to find instances of 'reliable' return predictability that are in fact spurious."
[2] This does not explain why the mispricing occurs in the first place or why investors do not simply liquidate positions in assets with high borrowing costs.
[3] Even for anomalies identified more recently than the beginning of 2006, the borrow fee data is only available near the end of the sample period used in the original paper. For this subset of the anomalies, the median percentage of the sample period before 2006 is 88.0%.

based on the original paper that first described the anomaly. For each stock and month, we compute the abnormal return using a characteristics-matched benchmark as in Daniels et al. (1997; DGTW), and then compute the equal-weighted average abnormal return of each of the ten portfolios.[4] Across the 162 anomalies, the average abnormal return of portfolio one is −0.24% per month and statistically significant, while the average abnormal returns on the other nine portfolios are much smaller. The average abnormal return of the decile ten minus decile one long-short returns is positive and highly significant, driven by the negative return on portfolio one.[5]

We analyze the impact of short sale costs on anomaly profitability in two ways. First, we exclude the relatively small number of stocks with high borrow fees from the analysis. The stocks with a borrow fee greater than 1% per year represent only about 12% of the stock-months. We find that, after excluding the high-fee stocks, the means of the abnormal returns on the anomaly portfolios are essentially zero. The performance of the anomaly strategies after excluding these stocks indicates that most anomalies fail in the sample of stocks without high borrow fees. Second, we also adjust stock returns to directly account for the borrow fee that a short seller must pay, while including all stocks in the analysis. The results show that the average net-of-fee return on the combined anomaly portfolio is almost exactly zero.

Specifically, portfolio one, which drives the results, tends to include stocks with high borrow fees. We drop the high-fee stocks from the sorted portfolios (without resorting), and then recalculate portfolio returns. This approach removes 21.9% of stocks from portfolio one on average. Omitting the high-fee stocks, the average abnormal return on portfolio one is almost exactly zero (0.2 bps per month). The average returns of portfolios two through ten are also small, between zero and four bps per month. The average abnormal return for the ten-minus-one decile portfolio is also close to zero (3.6 bps per month), and not statistically significant. Since the estimates are so close to zero for the sample that excludes high borrow fee stocks, the average anomaly abnormal returns must be entirely due to the high-fee stocks.

[4] We differ slightly from DGTW in that we compute the characteristics-matched benchmark returns excluding stocks with high borrow fees. This approach addresses the concern that the stocks with high borrow fees distort the performance of the benchmark portfolios.
[5] The average out-of-sample returns we compute are smaller than the average in-sample returns in Chen and Zimmerman (2021). This is expected, because the out-of-sample returns are not impacted by data-snooping biases, and also because the markets have likely become more efficient over time.

We also retain the high-fee stocks in the sample but adjust the returns for the borrow fees. Borrow fees are akin to shadow dividends and in general increase returns. For portfolio one (which would be short sold), a short seller would pay the entire borrow fee. For portfolio ten (which would be held long), an institutional investor would receive part of the borrow fee but only if his shares are lent out. The fee adjustment changes the average portfolio one abnormal return from a significant −24 bps/month to an insignificant −1 bps/month. It also makes the average decile ten minus decile one long-short abnormal return switch from a significantly positive estimate to a slightly negative estimate. Thus, the average anomaly cannot profitably be exploited by a hedge fund or other investor who must pay the borrow fees to short sell stocks.

These related patterns are also observable for most individual anomalies. Consistent with the proposed mechanism, the impact of this adjustment is quite striking on the short side of these strategies and feeds through the performance of the short side to eliminate the long-short abnormal performance of many anomalies. Thus, most anomalies cannot profitably be exploited by investors who must pay the borrow fees to short sell stocks. This finding is consistent with many anomalies being "real," that is, not simply a consequence of data snooping, and it also explains why the performance persists in the presence of sophisticated investors.

Our results are robust to plausible variations in the analysis. We find similar results when we use raw returns instead of DGTW-adjusted returns. We split the anomalies into three groups according to whether the anomaly signal is computed from accounting data, stock returns/price data, or other data, and obtain similar results in all three subsets. The results also hold in the subsample of anomalies for which the *t*-statistic in the original paper documenting the anomaly exceeded five, and in the subsample of anomalies for which the original paper was published in one of the top three finance journals.

We examine five well-known and highly cited anomalies in detail. These are the post-issuance IPO return anomaly documented by Ritter (1991), the share issuance anomaly described by Fama and French (2008), the idiosyncratic volatility anomaly first studied by Ang et al. (2006), the maximum return anomaly described by Bali, Cakici, and Whitelaw (2010), and the share turnover volatility anomaly described by Chordia, Subrahmanyam, and Anshuman (2001). For all five, the average abnormal return for the portfolio to be shorted, before adjusting for borrow fees, is negative and economically significant. Despite the relatively short sample period, three of the five estimates are statistically significant at the 1% level, and the other two are significant at the 10% level. The long-short portfolio returns are also economically substantial for all five anomalies. Once stocks with high borrow fees are excluded from the short portfolios the estimates of the average abnormal returns are all near zero, and several flip sign to become positive. Similarly, the net-of-fee long-short portfolio return also is negative for three of the five anomalies, and near zero for the other two. For example, the long-short performance of the idiosyncratic risk strategy is 0.49% per month before adjusting for fees and −0.03% per month net of fees. Our results change the interpretation of these anomalies because a common limit to arbitrage, namely the stock borrow fee, precludes investors from profiting from this apparent mispricing.[6]

Of course, the idea that short-sale costs are a limit to arbitrage that can potentially explain the persistence of mispricing is not novel (see, for example, Lee, Shleifer, and Thaler (1991)). More recently, Stambaugh, Yu, and Yuan (2012) provide evidence that most of the return on 11 long-short anomaly portfolios comes from the short leg and suggest that short-sale costs allow this profitability to persist. Drechsler and Drechsler (2016) find that loan fees are related to the returns of anomaly portfolios. However, ours is the first study that shows that the net-of-fee returns on anomaly portfolios are near zero and that excluding stocks with high borrow fees leads to similar performance. That is, we find that the vast majority of anomalies with substantial out-of-sample performance cannot profitably be exploited by an investor who pays the borrow fees to short sell stocks.

The remainder of the paper is as follows. Section 2 briefly surveys the literature. Section 3 describes the data and the anomaly sample selection. Section 4 presents the abnormal return results for the 162 anomalies. These include the net-of-fee abnormal returns for the full sample and the results for the low-fee sample. Section 5 examines several specific well-known anomalies, some of which are closely related to popular asset pricing factors. Section 6 presents the result for several subsets of the anomalies. Section 7 briefly concludes.

[6] Interestingly, we obtain this result for the idiosyncratic risk anomaly even though several contributions to the literature state that idiosyncratic risk is a separate, important limit to arbitrage that interacts with shorting costs (e.g., Mitchell, Pulvino, and Stafford (2002), Pontiff (2006), and Stambaugh, Yu, Yuan (2015)). If idiosyncratic risk were a separate limit to arbitrage, then one would expect that the net-of-fee return and the return excluding high-fee stocks on the long-short would be positive. But they are not.

2. Literature Review

There is an active debate on whether stock return anomalies are real. Recently, Harvey, Liu, and Zhu (2016; abstract) assert that "most claimed research findings in financial economics are likely false," while Linnainmaa and Roberts (2018; abstract) "show the majority of accounting-based return anomalies, including investment, are most likely an artifact of data snooping." Green, Hand, and Zhang (2017; abstract) find that, "Outside of microcaps, the hedge returns to exploiting characteristics-based predictability also have been insignificantly different from zero since 2003." Hou, Xue, and Zhang (2020) claim that more than 60% of the results in the anomalies literature cannot even be reproduced in the original samples using conventional critical values once the contribution of microcap stocks is limited (Figure 2 Panel B, p. 2034).[7]

Other researchers reach different conclusions. McLean and Pontiff (2016) examine both out-of-sample and post-publication returns on long-short anomaly portfolios. While they find that the portfolios' out-of-sample and post-publication returns decrease to some extent compared to the corresponding in-sample counterparts, they reject the hypothesis that return predictability disappears out-of-sample. Jacobs and Müller (2020) find that anomalies remain strong post-publication in international equity markets and attribute it to mispricing rather than data mining. More recently, Jensen, Kelly, and Pedersen (2021) use a Bayesian statistical model and conclude that the literature's predictability results can be replicated in-sample and out-of-sample for most of the 153 characteristics they study.[8]

While limits of arbitrage are known to reduce anomaly profitability, the literature primarily focuses on trade execution costs related to the bid-ask spread and price impact. Shorting costs are quite distinct from execution costs. A short seller must pay the borrow fee every day he or she holds a short position. In contrast, execution costs are incurred only at the time of a trade, are non-linear in trade size, and depend on the quality of the execution algorithm used. These factors make it difficult to evaluate the effect of execution costs on anomalies, and lead to an active debate regarding their importance. For example, using TAQ data, Novy-Marx and Velikov (2015) show that the average trading costs of strategies to exploit anomaly returns range from 20 to 57 basis points for the mid-turnover anomalies. By contrast, Frazzini, Israel,

[7] However, Chen and Zimmerman (2021) find that "nearly 100% of the literature's predictability results can be reproduced, including the predictability results for 100% of the characteristics studied in Hou, Xue, and Zhang (2020)."

[8] Chen (2020) adjusts for the selective reporting of anomalies and concludes that "at least 80% of published cross-sectional predictors are real."

and Moskowitz (2018) argue that institutional trading costs are much smaller than is implied by the effective bid-ask spreads estimated using TAQ data.

Only few other studies focus on the effect of short sale costs on the returns to asset pricing anomalies. These studies have reported seemingly contrary results for a few specific anomalies, i.e., they find that the net-of-fee returns to anomaly portfolios are not close to zero. These seemingly contrary results should be discounted for at least two reasons. First, most other studies that consider stock borrow fees examine the in-sample net-of-fee returns. The in-sample anomaly return reflects both the expected return and data-snooping biases. While borrow fees can explain the expected abnormal return on an anomaly portfolio, they cannot explain the data-snooping biases. Thus, even if borrow fees drive the apparent expected abnormal return on a long-short anomaly portfolio, they are unlikely to explain in-sample average return.

Second, the fees paid by ultimate borrowers such as hedge funds are typically lower from the fees received by ultimate lenders due to prime broker markups, which D'Avolio (2002) estimates to be about 30% of the fee. To the extent that academic research uses the fees received by the ultimate lender rather than the fees that would be paid by the ultimate borrower the true cost to borrow stock is not fully reflected in abnormal return estimates.[9]

Drechsler and Drechsler (2016), Geczy, Musto, and Reed (2002), and Engelberg et al. (2020) are closely related papers that conclude that the net-of-fee returns on sets of long-short anomaly portfolios are positive, which differs from our conclusion. Drechsler and Drechsler (2016) examine only eight anomalies and use the lender-side fees, which are considerably smaller than the fees a typical hedge fund or other investor would pay. Geczy, Musto, and Reed (2002) use lender-side fee data from a one-year period and find that the net-of-fee returns to shorting certain categories of stocks, including IPO stocks, are positive.

Engelberg et al. (2020) reach their conclusion despite not having borrow fee data. Instead, they have Markit's Daily Cost of Borrow Score (DCBS), which is an ordinal measure ranging from one (low cost) to ten (high cost) computed by Markit. They convert each DCBS category to an estimate of the borrow fee using the mapping from DCBS to mean fee provided in Table III of Blocher and Whaley (2015) rather than using the stock-specific measure of the

[9] For example, the stock borrow fee data used in D'Avolio (2002), Geczy, Musto, and Reed (2002), Jones and Lamont (2002), Mitchell, Pulvino, and Stafford (2002), Ofek, Richardson, and Whitelaw (2004), and Cohen, Dieter, and Malloy (2007), and Drechsler and Drechsler (2016) are or appear to be measures of the fees received by stock lenders.

borrow fee from Markit. By excluding stocks with high borrow fees from the analysis in several of our specifications, we show that it is these stocks that are likely responsible for any apparent abnormal performance in these other papers. In addition, for some of the anomalies the sample period originally used to identify the anomaly overlaps with the sample period used by Engelberg et al. (2020). In such cases, the anomaly return is likely to include some data-snooping bias.

3. Anomalies and Data

This section describes how we identify and select the 162 anomalies, the stock borrow fee and other data we use, and the filters we apply in constructing the sample. We also present some summary statistics that describe the sample.

3.1 Anomalies

We rely on a comprehensive set of asset pricing anomalies that Chen and Zimmermann (2021) studied in their replication of the anomalies' in-sample performance. Chen and Zimmermann (2021) closely replicate the predictors used in the original papers that first described the anomalies, and confirm that almost all replicated signals remain significant predictors of returns in the samples used in the original papers. Conveniently, Chen and Zimmermann provide data at the stock-month level for the signed signals of the 202 anomalies that remain significant. These monthly anomaly signal data, which we downloaded from the authors' website, span the period from January 2000 to December 2020 and contain 1,960,237 stock-month observations.[10]

We restrict our sample to the 162 anomalies out of the 202 for which we can form well-populated decile portfolios. Specifically, each decile portfolio must contain at least 20 stocks on average. This filter drops primarily "discrete" anomalies (33 out of the 40 dropped), for which forming portfolios is problematic. Whether a stock paid a dividend is an example of a discrete anomaly, as defined by Chen and Zimmermann (2021). For the 162 anomalies that pass this screen, the bottom decile portfolio, portfolio one, contains 243 stocks on average, with the number of stocks varying from 24.3 to 404.2. As expected, some signals, such as return skewness, are almost always available, while other signals, such as R&D ability, are only

[10] The Chen and Zimmerman (2021) anomalies data are available at https://www.openassetpricing.com/. We downloaded the file signed_predictors_dl_wide.zip, which contained "202 predictive firm-level characteristics in wide format, signed so future mean returns increase in characteristics," and was last modified on 12/12/2021.

available for about 10% of the stock-months. Appendix A provides a complete list of the anomalies in the sample.

3.2 Stock borrow fees

Short sellers must pay a borrow fee, also called a loan fee, for every day they borrow shares. The return earned by a short seller is equal to his or her before-fee stock return less the borrow fee she pays. We use borrow fees and other data about stock borrowing and lending from the Markit Securities Finance Buy Side Analytics Data Feed available from Markit, Ltd. This database includes daily data on securities borrowing and lending activity, including rebates and borrow (loan) fees, the quantity on loan, the number of loans, the numbers of active brokers and lending agents, and other data. Markit obtains the information from more than 100 equity loan market participants, including beneficial owners, hedge funds, investment banks, lending agents, and prime brokers, who together account for approximately 85% of US securities loans (Markit, 2012). Following the literature, our sample begins in July 2006 because the data coverage expanded significantly around that time and the data are available at daily frequency beginning June 28, 2006. The end of the sample is December 2020.

The market for borrowing stock is described by D'Avolio (2002) and Kolasinski, Reed, and Ringgenberg (2013). It includes three groups of participants: (i) lenders such as mutual funds, pension funds, and insurance companies, some of which lend through agent lenders (custodians), (ii) ultimate borrowers, for example hedge funds, proprietary trading desks, and option market makers, and (iii) prime brokers. Typically hedge funds and option market makers borrow the securities from their prime brokers, who in turn borrow from the mutual funds, pension funds, and other ultimate lenders (Kolasinski, Reed, and Ringgenberg 2013, especially Figure 1). In this process the prime brokers "mark up" the fee, i.e. they borrow from the original lender and then relend to the option market maker or other short seller at a higher fee.

The borrow fee is not usually quoted directly but is derived from the quoted rebate rate. The security borrower usually provides cash collateral to the security lender, and the security lender pays interest, the rebate rate, on the cash collateral it holds. The borrow fee is the difference between the market short-term interest rate and the rebate rate paid on the cash collateral.[11] The rebate rate can be negative when securities are hard to borrow and the borrow fee is high. In rare cases, the borrow fee can also be negative, which occurs when the rebate rate that the security lender pays on cash collateral exceeds the short-term interest rate.

The market structure in which prime brokers are typically the financial intermediaries implies that there are two fees, a buy-side fee paid by the ultimate borrower (for example, a hedge fund or option market maker) and a lender-side fee received by the ultimate lender (for example, a mutual fund), which is lower than the buy-side fee. The main borrow fee variable we use is "IndicativeFee," which is a buy-side fee. Specifically, it is Markit's estimate of the "The expected borrow cost, in fee terms, for a hedge fund on a given day," based on "both borrow costs between Agent Lenders and Prime Brokers as well as rates from hedge funds to produce an indication of the current market rate" (Markit 2012).[12] To evaluate the performance of trading strategies, it is important to use the borrow fee paid by a typical institutional investor reflecting the cost of financial intermediation rather than the fee received by institutions for lending shares to prime brokers. The borrow fee is typically small, most commonly 0.375% per year, but can occasionally exceed 100% per year.

Stock borrow fees are essentially shadow dividends for investors holding short positions, but this dividend is not observed in CRSP and increases stock returns to some extent. However, the net return differs for the long side compared to the short side because intermediaries keep a part of the borrow fee paid by the short side and because not all shares are lent. Thus, the long side only receives a portion of this shadow dividend in expectation. Specifically, we first compute an average borrow fee over the next month (same period as return). We then convert this annualized fee to the monthly fee while recognizing that the fee is paid every calendar day. When we evaluate the performance of the anomalies, stocks in the lowest decile portfolios are sold short, and thus, short sellers must pay the entire fee. While stocks in the top decile (and other deciles) are purchased, but the long side receives only part of the fee – which is equal to the product of the proportion of all shared lent (utilization rate) and the proportion of the fee passed

[11] When the security borrower provides Treasury securities as collateral the borrow fee is quoted and the rebate rate is derived as the difference between the short-term interest rate and the borrow fee. During our data period Markit used the Federal Funds Open rate as the short-term interest rate in these calculations.

[12] The full description of the data item is "The expected borrow cost, in fee terms, for a hedge fund on a given day. This is a derived rate using Data Explorers proprietary analytics and data set. The calculation uses both borrow costs between Agent Lenders and Prime Brokers as well as rates from hedge funds to produce an indication of the current market rate. It should not be assumed that the indicative rate is the actual rate a Prime Broker will quote or charge but rather an indication of the standard market cost" (Markit, 2012).

along through intermediation, typically 0.7 of the fee. The other portion, 0.3 of the fee, is kept by intermediaries (D'Avolio, 2002).

3.3 Filters and Sample

Stock prices, returns, and dividend information (amounts and ex-dividend dates) are from the Center for Research in Securities Prices (CRSP) files, and we address NASDAQ delisting returns as in Shumway and Warther (1999). We limit the sample to common stocks (share codes 10 or 11 in CRSP), which is standard in the anomaly literature.

Because the borrow fee data are well populated starting from June 28, 2006, the performance evaluation period begins with July 2006, and the first anomaly signals we use are from the end of June 2006. December 2020, the last month for which we have the stock borrow fees, is the last month in the performance evaluation period. The latest anomaly signals we use are from the end of November 2020. Thus, the performance evaluation period covers 14 1/2 years running from July 2006 through December 2020.

To compute monthly returns, we compound daily returns over the next 21 trading days, which typically corresponds to one calendar month. Daily returns are adjusted for delisting before compounding. Computing monthly returns from daily returns offers several advantages over standard monthly returns from CRSP. Most importantly, many studies show the importance of skipping a day between signals and portfolio formation to avoid spurious predictability. Anomaly signals can potentially use information up to the last day of the month; thus, we skip a day between signals and returns and take monthly returns starting from the second trading day of a month (21 days starting with the 2^{nd} day).

We use the stock borrow fee data to identify stocks with high fees and to compute stock returns adjusted for the borrow fees. Thus, we need to aggregate the Markit data borrow fee data, which are at the stock-day level, to the stock-month level. We require the minimum number of fee observations during to interpolate the monthly fee that we use below to compute fee-adjusted returns. Specifically, for each stock and 21-day performance evaluation period, we require that borrow fee is observed on at least four days during the period. This requirement results in dropping only 1.6% of the combinations of stock and months that appear in the Markit data, and, on average, the fee is observed on 19.8 days per month. Thus, this, this filter will not have an important impact on our results.

We merge the anomaly signals, borrow fee data, and CRSP stock return data. Once the common stock and sample period filters are applied, the anomaly signal dataset contains 692,466 stock-months. The borrow fee dataset contains 655,728 stock-months, which indicates that Markit provides comprehensive coverage of the stocks used in the anomaly universe. Only 9 observations are dropped once the two datasets are merged (from 655,728 to 655,719 stock-months), which confirms that we handle the data sensibly.

Anomalies are often concentrated in penny stocks, which are not readily tradable (Hou, Xue, and Zhang, 2020). Therefore, to distinguish the impact of borrow fees from the role of penny stocks, we drop stocks with the lagged stock price below one dollar or lagged market capitalization below 50 million dollars. These two filters drop 25,706 and 67,381 stock-months, respectively. Microcap stocks typically have high borrow fees, and thus if anything this filter makes it harder to achieve our main result. Indeed, our results become stronger without the penny stock filters. The final sample contains 562,632 stock-months for 162 anomaly signals.

3.4 Summary statistics

Table 1 presents selected percentiles of the distributions and some other statistics for the stock-month observations in the dataset described in subsection 3.1. The unit of observation is a combination of a stock return from day t+1 to t+22 (a typical month) with valid data from Markit and CRSP at t.

The first row of Table 1 reveals that the mean borrow fee is 1.67% per year, and that this variable is positively skewed. The borrow fee is 0.25% at the first percentile, 0.38% at the 50th percentile, and then reaches 3% at the 90th percentile and 30% at the 99th percentile. Thus, any substantial impact of the borrow fee on the performance of a trading strategy can only be due to the extent to which the strategy is short selling stocks with fees above the 85th percentile. We classify a stock as high-fee on date t if the borrow fee at t is greater than 1%. Approximately 12% of the observations in our sample are designated as high-fee.

We also report information about utilization. The mean of utilization is 21.50% compared to a median of 9.32%, and the 90th and 99th percentiles are 50.71% and 90.09%, respectively. Note that the distribution of stock borrow fees and utilization have similarly right-skewed patterns.

4. Results for the 162 Anomalies

We begin by examining the 162 anomalies collectively. For each anomaly and month, we first sort stocks into decile portfolios based on the characteristic that defines the anomaly. We sign the anomaly characteristics so that, based on the original paper describing the anomaly, we expect to find negative abnormal returns on the decile one portfolio and positive abnormal returns on the decile ten portfolio. Jensen, Kelly, and Pedersen (2021) emphasize the importance of studying risk-adjusted performance of stock anomalies (e.g., high beta stocks earn higher returns, but their alphas are negative). Consequently, for each stock and month, we compute abnormal returns using a variant of the characteristics-matching approach of Daniel, et al. (DGTW; 1997) in which we exclude high-fee stocks in computing the benchmark portfolio returns. We compound daily DGTW returns to the monthly level in the manner that matches the horizon of each stock's return.

We then compute the equal-weighted average abnormal returns of the various sorted portfolios. It is well known that anomalies are not profitable in the recent sample if returns are value weighted (Hou, Xue, and Zhang, 2020). On the other hand, Jensen, Kelly, and Pedersen (2021) criticize value weighting as introducing unnecessary noise, and suggest that equal weighting while excluding low-cap stocks is a better procedure. Given the restrictions imposed by the need to merge the CRSP and with Markit data and out exclusion of stock-date observations with either a low price or a low market capitalization, our use of equal-weighted portfolio returns is consistent with the spirit of this approach.

The result is a set of ten decile portfolio average abnormal returns for each anomaly. Alternatively, for each decile we have 162 average abnormal portfolio returns. We exclude high-fee stocks in computing the benchmark portfolio returns because we are interested in identifying the impact of stock borrow fees on the portfolio returns. Since we will focus on the short side of these anomalies to examine the impact of the stock borrow fee in various contexts, risk-adjustment on this side is particularly important. We emphasize that it is possible to study the impact of the stock borrow fee on abnormal returns only if the benchmark portfolio returns do not themselves include the returns of the high-fee stocks.

Specifically, to compute the benchmark return for stock i in month t, we first exclude stocks with average month t borrow fees that exceed 1% per year. Using the remaining low-fee stocks, we follow DGTW and match each stock's return to the benchmark return for the same month on a portfolio of low-fee stocks with similar market capitalization, book-to-market value, and previous six-month return.[13] The abnormal return on stock *i* in month *t* is the difference between the return on stock *i* and the average value-weighted return on the matched benchmark portfolio during the same month. The abnormal return on a sorted decile portfolio in month *t* is then the cross-sectional average of the abnormal returns on the stocks held in the portfolio during the month. This modification of the DGTW characteristic-matching approach prevents the benchmark returns from being affected by the presence of high-fee stocks in the benchmark portfolios.

For each anomaly, the average abnormal return on each sorted decile portfolio is the time-series average of the monthly portfolio abnormal returns over the sample period running from July 2006 through December 2020.[14] We examine the distribution, across the 162 anomalies, of these time-series average portfolio abnormal returns.

4.1 Abnormal returns including all stocks and without adjusting for stock borrow fees

Figure 1 Panel A is a histogram that shows the cross-sectional distribution of the time-series average abnormal returns on the 162 decile one portfolios. Based on the original papers, we expect to find that the average abnormal returns on the decile one portfolios are generally negative, and they are. The average abnormal return is negative for 149 of the 162 decile one portfolios. Averaging across the 162 portfolios, the cross-sectional mean of the average decile one portfolio returns is −0.24%, or 24 basis points per month. Below we discuss tabulated results and hypothesis tests that show that this cross-sectional mean return is significantly different from zero at conventional levels of statistical significance.

We next shift our focus away from decile one and consider, for the 162 anomalies, the distributions of the average abnormal returns on all ten decile portfolios. In particular, the ten bars shown in Figure 2 Panel A display the interquartile ranges of the distributions of the average abnormal returns on the ten sets of sorted portfolios. For example, the leftmost (and darkest) of the ten bars shows the interquartile range of the distribution of the average abnormal returns on the 162 decile one portfolios, while the rightmost (and lightest) of the ten bars displays the

[13] We thank WRDS, and especially Rabih Moussawi and Gjergji Cici, for sharing the code that constructs the DGTW benchmarks. We modified the code to limit the benchmarks to low-fee stocks. This crucial step is much easier to implement for the DGTW benchmarks than for alternative approaches.
[14] The last anomaly signal is from the end of November 2020, and the last returns included in the analysis are from December 2020.

interquartile range of the distribution of the average returns on the 162 decile ten portfolios. For each bar, the horizontal black line at the approximate middle of the bar indicates the median of the average abnormal returns on the corresponding 162 portfolios, while the black "×" indicates the cross-sectional mean of the time-series average portfolio abnormal returns.

One immediately apparent feature of Panel A is that the cross-sectional mean and median abnormal returns are negative for all ten sets of average portfolio abnormal returns. This occurs because high-fee stocks, which tend to have negative abnormal returns, appear in all of the decile portfolios but are not included in the benchmark returns. As a result, the cross-sectional means and medians of the average abnormal returns are negative. This result highlights the importance of excluding the high-fee stocks from the benchmarks. If we include high-fee stocks in the benchmarks, then the distributions of the abnormal returns of the ten sets of portfolios would also be determined by the average fees of the stocks included in the benchmarks.

More importantly, Figure 2 Panel A also shows that the distribution of the average abnormal returns on the 162 decile one portfolios is quite different from the distributions of the average abnormal returns on the other nine sets of portfolios. In particular, the 25th percentile, median, 75th percentile, and mean of the average abnormal returns on the 162 decile one portfolios is each less than the corresponding statistic for all of the other nine sets of portfolios. As we show below, this occurs because the decile one portfolios tend to have more high-fee stocks, which tend to have negative abnormal returns. The distribution of the average abnormal returns on the 162 decile two portfolios also appears to be shifted down relative to the distributions for deciles two through ten. This occurs because the decile two portfolios tend to have more high fee stocks than the decile three through ten portfolios.[15]

In Table 2 we report the detailed abnormal return results that are summarized in Figure 1 Panel A and Figure 2 Panel A. The first row of Panel A displays the cross-sectional means, across the 162 anomalies, of the time-series average abnormal portfolio returns on the ten decile portfolios. The table also includes the cross-sectional mean of the 162 decile ten minus decile one long-short portfolio average abnormal returns. The second row displays *t*-statistic for tests of the hypotheses that the mean returns differ from zero. These *t*-statistics are computed using a panel regression in which the monthly portfolio return for each anomaly (net of the benchmark

[15] The average abnormal returns at the other extreme, decile ten, also tend to be lower than the average abnormal returns of the decile three through nine portfolios. This occurs because the decile ten portfolios tend to contain more high-fee stocks than the decile three through nine portfolios.

return) is regressed onto anomaly-by-decile fixed effects and the standard errors are double clustered by stock and month. Clustering by month is particularly important because the returns are strongly correlated across anomalies through the inclusion of a disproportionate number of stocks with high fees in portfolio one for many anomalies. This approach captures the contemporaneous cross-sectional correlation of the monthly portfolio abnormal returns. The third row shows naïve *t*-statistics computed from the cross-sectional standard deviations, across the 162 anomaly portfolios, of the average portfolio abnormal returns. These naïve *t*-statistics are based on the assumption that there is no cross-sectional correlation in the returns of the 162 decile portfolios. Because this assumption is almost certainly not exactly satisfied, these *t*-statistics provide upper bounds on the range of *t*-statistics that might plausibly be computed based on different assumptions about the cross-sectional correlations.

The fourth and fifth rows of Panel A display the average percentages of high-fee stocks and the average annual stock borrow fee of the stocks in each of the decile portfolios, computed in the same way we compute the cross-sectional means of the average abnormal returns reported in the first row of Panel A.[16] The last row shows the means of the numbers of stocks in the decile portfolios.

The results show that the decile one portfolios tend to underperform the other portfolios. The cross-sectional mean of the average abnormal portfolio returns across the 162 decile one portfolios is −0.24% per month, with a panel-adjusted *t*-statistic of −2.94 and a naïve *t*-statistic of −13.90. The means of the average abnormal returns of the other portfolios are much smaller. For example, the mean average abnormal return of the 162 decile five portfolios is only −0.05% per month. The mean of the 162 decile ten minus decile one long-short portfolio average abnormal returns is 0.15% per month, and is statistically significant at conventional levels (panel-adjusted *t*-statistic = 2.93). As pointed out in the discussion of Figure 2 Panel A, one can also see that the means are negative for all ten decile portfolios. This occurs high-fee stocks appear in the portfolios for all deciles, and high-fee stocks tend to have lower abnormal returns than the low-fee stocks used to construct the benchmarks. In fact, all portfolios contain economically

[16] Specifically, for each anomaly, decile portfolio, and month, we compute the average percentage of high-fee stocks and average borrow fee of the stocks in the decile portfolio that month. Then, for each anomaly and portfolio, we compute the time-series averages of the percentages of high-fee stock and the average borrow fees. Finally, for each decile, we compute the cross-sectional means, across the 162 anomalies, of the time-series averages.

significant percentages of high-fee stocks. Across the ten deciles, the smallest mean percentage of high-fee stocks is 9.25%, and the smallest mean average borrow fee is 1.08% per year.

Foreshadowing results we discuss below, the mean percentage of high-fee stocks in the decile one portfolios is 21.32%, greater than the mean percentages of high-fee stocks in the other deciles. The mean decile one borrow fee is 2.70% per year, also greater than the mean borrow fee for any of the other deciles. The decile two and decile ten portfolios also have relatively large mean percentages of high-fee stocks, 13.56% and 17.64%, respectively. The relatively high average percentage of high-fee stocks in the decile two portfolios should be unsurprising, given the high mean percentage of high-fee stocks in the decile one portfolios. The high mean percentage of high-fee stocks in the decile ten portfolios is explained by the fact that the decile ten portfolios tend to include smaller stocks, which also tend to have higher borrow fees.

Panel B displays percentiles that provide summary information about the distributions of the 162 average abnormal portfolio returns for each of the ten deciles. For portfolio one, the 75th percentile of the distribution of the 162 average abnormal returns is −0.11%, indicating that more than 75% of the decile one portfolios have negative average returns. The 95th percentile of the distribution is only 0.05%. The results also indicate that for portfolio one the distribution of the 162 anomaly returns is left-skewed. The median of −0.20% is larger than the mean of −0.24% reported in Panel A, and the minimum and 5th percentiles are further from the median than are the maximum and the 95th percentile. For the other nine decile portfolios, the distributions are generally slightly right-skewed. For decile ten, the distribution of the 162 returns is more disperse than for any of the other portfolios, consistent with the previous observation that this portfolio tends to include small stocks, which tend to have more volatile returns than larger stocks.

4.2 Abnormal returns after excluding high-fee stocks

We explore whether the abnormal returns are due to stocks with high borrow fees. We do this by repeating the analyses of the abnormal returns on the sorted decile portfolios, after excluding the high-fee stocks from the decile portfolios (without resorting). Figure 1 Panel B shows the distribution of the average abnormal returns on the 162 decile one portfolios, after excluding the high-fee stocks. The histogram displayed in Figure 1 Panel B is strikingly different from that shown in Figure 1 Panel A. In Panel B only 75 of the 162 decile one portfolios have negative average abnormal returns, while in Panel A 149 of the 162 decile one portfolios average returns are negative. Averaging across the 162 portfolios, the mean of the decile one portfolio average abnormal returns is 0.00% per month, and the median is 0.01% per month. These results excluding the high-fee stocks show that the poor performance of the decile one portfolios apparent in Figure 1 Panel A is due entirely to the high-fee stocks.

We next examine the distributions of the average abnormal returns on all ten sets of decile portfolios, excluding the high-fee stocks. For each of the ten sets of 162 decile portfolios, Figure 2 Panel B shows the interquartile ranges of the average abnormal returns on the 162 portfolios, after excluding the high-fee stocks. It shows that, for all ten deciles, the means and medians of the average abnormal returns on the 162 decile portfolios are all close to zero after excluding the high-fee stocks. The largest mean, which is for the decile 10 portfolios, is only 0.04% per month, and for this decile the median of the 162 average abnormal returns is 0.00% per month. The largest median, which is for the both the decile four and five portfolios, is only –0.02% per month, and for these two deciles the means of the 162 average abnormal returns are 0.00% and 0.02% per month, respectively. Comparing Figure 2 Panel B to Figure 2 Panel A, the results show that the pattern of average abnormal returns evident in pattern in Figure 2 Panel A is due to the high-fee stocks.

In Table 3 we report the detailed abnormal return results, excluding the high-fee stocks, that are summarized in Figure 1 Panel B and Figure 2 Panel B. The format of Table 3 Panel A follows that of Table 2 Panel A. The first row of Panel A displays the cross-sectional means, across the 162 anomalies, of the time-series average abnormal portfolio returns on the ten decile portfolios, excluding the high-fee stocks. It also includes the cross-sectional mean of the 162 decile ten minus decile one long-short portfolio average abnormal returns. The second and third rows show the panel-adjusted and naïve *t*-statistics, respectively. The fourth row reports the average numbers of stocks in the various decile portfolios, across the 162 anomalies.

Table 3 Panel B displays percentiles that provide summary information about the distributions of the 162 average abnormal portfolio returns for each of the ten deciles. All of the results in Table 3 are computed using the same approach used for the Table 2 results, except that after sorting we exclude the high-fee stocks before we compute the abnormal return for each anomaly, month, and decile portfolio.

The first row of Table 3 Panel A shows that, after excluding the high-fee stocks, the cross-sectional mean of the average abnormal returns of the 162 anomaly portfolios is close to zero for every decile. In particular, the mean of the average abnormal returns of the 162 decile one portfolios is 0.00%. The largest of the cross-sectional means, that for the decile ten portfolios, is only 0.04%. The panel-adjusted *t*-statistic that takes account of the contemporaneous correlations among the returns of the 162 decile ten portfolios is only 0.97, indicating that the 0.04% mean of the average abnormal returns is not significantly different from zero at any conventional level of significance. The mean of the decile ten minus decile one long-short portfolio average abnormal returns is also only 0.04%, and thus also not significantly different from zero at conventional levels.

The earlier results including all stocks (in Figure 1 Panel A, Figure 2 Panel A, and Table 2) provide evidence of negative abnormal returns on the decile one portfolios and positive abnormal returns on the decile ten minus decile one long-short portfolios. The results in Table 3 show that this evidence of abnormal returns is due entirely to the high-fee stocks. Once we exclude the high-fee stocks, the means of the 162 anomaly portfolio returns are close to zero for all ten deciles, and also for the decile ten minus decile one long-short portfolio. Thus, the results displayed in Table 3 confirm that the visual impression left by comparing Figure 1 Panel B to Panel A, and Figure 2 Panel B to Panel A, is not misleading.

Similar to Table 2 Panel B, Table 3 Panel B displays percentiles that provide summary information about the distributions of the 162 average portfolio abnormal returns for each of the ten deciles. The results displayed there are consistent with the results for the means of the average abnormal returns shown in the first row of Table 3, Panel A. The median of the distribution of the 162 decile one portfolio average abnormal returns is 0.01%. The medians are between –0.02% and 0.01% for the other nine decile portfolios, and the median of the distribution of decile ten minus decile one long-short portfolio returns is only 0.01%.

4.3 Abnormal returns net of stock borrow fees

We next consider whether an investor who pays the stock borrow fees to borrow and short sell stocks would be able profitably to exploit the anomalies. In this analysis we retain the high-fee stocks in the sorted portfolios, but adjust the stock returns to reflect the stock borrow fees that would be paid by an investor who borrowed the decile one stocks and sold them short. An investor who wants to short sell the decile one portfolio portfolios to exploit the negative average abnormal returns would need to borrow the stocks and pay the stock borrow fees. His or her return would be the negative of the stock return, minus the borrow fee paid during the month.

The adjusted return to the corresponding long position is the stock returns, *plus* the borrow fee paid during the month. Thus, because we report the returns to long positions, when a stock is held in a decile one portfolio we adjust the returns of stock *i* during month *t* for the stock borrow fees by adding the borrow fee on stock *i* in month *t* to stock *i*'s month *t* return. Because the stocks in the decile two portfolios might also be sold short, we compute the fee-adjusted returns of stocks held in the decile two portfolios in the same way.

Figure 1 Panel C displays a histogram that displays the distribution of the average fee-adjusted abnormal returns on the 162 decile one portfolios. The histogram in Panel C is strikingly different from that in Figure 1 Panel A—in Panel C only 79 of the 162 decile one portfolios have negative average abnormal returns. Taking the mean across the 162 portfolios, the mean decile one portfolio return is –0.01% per month, and the median return is 0.01% per month. These net-of-fee results show that the typical anomaly cannot profitably be exploited by short selling the decile one stocks. Once on takes account of the stock borrow fees that must be paid, the mean of the average fee-adjusted abnormal returns on the 162 decile one portfolios is close to zero, –0.01%.

Figure 2 Panel C presents the interquartile ranges of the distributions of average abnormal returns after adjusting for the stock borrow fees. The adjustment of the returns on the stocks in the decile three through ten portfolios differs from the adjustment of the returns of the stocks in the decile one and two portfolios. Based on the results in the original papers, and also those presented Figure 1 Panel A, Figure 2 Panel A, and Table 2, an investor who wanted to exploit the anomalies would short sell the decile one stocks. If an investor also wanted to trade the decile two stocks, he or she would also short sell those stocks. We adjust the returns of the decile one and two stocks by adding the stock borrow fee to the returns, as we described above.

On the other hand, an investor who wanted to trade to exploit the anomalies would hold long positions in the decile ten stocks, and perhaps also in the decile nine stocks. An investor who held the decile ten and/or nine stocks could make his or her shares available for lending, possibly receiving the borrow fee. But the fee the investor receives is not equal to the fee the borrower pays, due to prime broker intermediation spreads. To reflect this, we reduce the borrow fee received by the lender by 30% of its value to reflect D'Avolio's (2002) estimate that the borrow fee received by an ultimate stock lender (e.g., a pension or mutual fund) is 30% less than the borrow fee paid by the ultimate borrower (e.g., a hedge fund) due to intermediation spreads charged by prime brokers. In addition, the investor would receive the borrow fee only if the shares he or she made available were borrowed by a short seller, which is not guaranteed. To reflect this consideration, we assume that the probability an investor's shares held long are actually borrowed is equal to the utilization rate. Essentially, an investor lending shares in portfolio ten receives in expectation a proportion of the reduced (by 30%) borrow fee scaled by the utilization rate. For consistency, we also adjust the abnormal returns of the stocks in portfolios three through nine using the same approach.

For each decile, Figure 2 Panel C shows the interquartile range of these average fee-adjusted abnormal returns on the 162 portfolios. The results displayed there indicate that the average anomaly cannot profitably be exploited. After the fee adjustment, the interquartile range of the returns on the 162 decile one portfolios is approximately centered on zero, extending from −0.08% per month to 0.09% per month, with a mean of −0.01% per month and a median of 0.01% per month. Turning to the decile nine portfolios, which might also be sold short, one can see that the majority of the average fee-adjusted abnormal returns are actually positive. The interquartile range extends from −0.04% to 0.09% per month, and the mean and median of the returns on the 162 portfolios are both equal to 0.03% per month. Thus, the average anomaly cannot profitably be exploited by short selling the decile nine and ten portfolios.

The fee adjustment has relatively little impact on the returns on the decile three through ten portfolios, for three reasons. First, an investor who holds these stocks and makes them available for lending does not benefit from the full stock borrow fee, due to the intermediation spreads in the stock borrowing/lending market mentioned previously. Second, the probability that the stock is borrowed is equal to the utilization rate, which is less than 100%. Third, as we discuss below there are relatively few high-fee stocks in most of these portfolios.

In Table 4 we report the detailed results for the average net-of-fee abnormal returns on the ten sorted decile portfolios for the 162 anomalies, including all stocks. The computation of the net-of-fee abnormal returns is described above. The first row of Panel A reports the cross-sectional means of the average net-of-fee abnormal returns, across the 162 anomalies. The second and third rows report the panel-adjusted and naïve *t*-statistics, respectively. The fourth row reports the cross-sectional means, across the 162 anomalies, of the time-series average numbers of stocks in the decile portfolios. Panel B of Table 2 displays some percentiles that provide summary information about the distributions of the 162 average abnormal portfolio returns for each of the ten deciles.

The first row of Panel A shows that, for every decile, the cross-sectional mean of the average net-of-fee abnormal returns of the 162 anomaly portfolios is close to zero. The mean of the average net-of-fee abnormal returns of the 162 decile one portfolios is –0.01%. The other means range from –0.04% to 0.03%. None of the panel-adjusted *t*-statistics that takes account of the contemporaneous correlations among the returns of the decile portfolios indicate statistical significance at conventional levels, with the exception that the panel-adjusted *t*-statistic indicates that the mean of the decile four average fee-adjusted abnormal portfolio returns is significant at the 10% level (panel-adjusted *t*-statistic = –1.66). The mean of the decile ten minus decile one long-short portfolio average net-of-fee abnormal portfolio returns is only –0.02%, with a panel-adjusted *t*-statistic of –0.49 and a naïve *t*-statistic of –1.09.

Table 4 Panel B displays percentiles that provide summary information about the distributions of the 162 portfolio returns for each of the ten deciles. The results displayed there are consistent with the results for the mean abnormal returns in the first row of Table 4, Panel A. The median of the distribution of the decile one average fee-adjusted portfolio abnormal returns is 0.01%. The medians are between –0.05% and 0.03% for the other nine decile portfolios, and the median of the distribution of decile ten minus decile one long-short portfolio returns is only –0.03%.

These results show that a hedge fund or other sophisticated investor that has to pay the stock borrow fee cannot profitably exploit the anomalies. After the fee adjustment, the interquartile range of the returns on the 162 decile one average fee-adjusted portfolio abnormal returns is approximately centered on zero, extending from –0.08% per month to 0.09% per month, with a median of 0.01% per month. The mean of the 162 decile one average fee-adjusted portfolio abnormal returns is close to zero, only –0.01% per month. Turning to the decile nine portfolios, which might also be sold short, one can see that the majority of the fee-adjusted returns are actually positive. The interquartile range extends from –0.04% to 0.09% per month, and the mean and median of the returns on the 162 portfolios are both equal to 0.03% per month. Thus, the average anomaly cannot profitably be exploited by short selling the decile nine and ten portfolios.

4.4 Results for raw returns

We also analyze the raw returns of the sorted portfolios and present the results in Table 5. Panel A displays the means of the time-series average (raw) returns on the decile one portfolio and the decile ten minus one long-short portfolio, including all stocks and without any adjustment for stock borrow fees. Panel B displays the means of the average returns after excluding the high-fee stocks, and Panel C presents the results for the means of the net-of-fee average returns on the sorted portfolios.

The results in Panel A show that the means of the average raw return are positive for all ten sets of decile portfolios, as expected. The mean of the average decile ten minus decile one long-short portfolio returns is 0.16% per month, almost identical to the corresponding mean of the abnormal returns of 0.15% per month in Table 2 Panel A. The panel-adjusted *t*-statistic for the mean of the average returns on the decile ten minus decile one long-short portfolio returns is 2.91, indicating that the mean is significantly different from zero at any conventional level of statistical significance.

The results in Panel B show that the means of the average returns are higher after excluding the high-fee stocks. This has a greater impact on the means of the decile one portfolio returns than on the means of the decile ten portfolio returns. As a result, the mean of the average long-short portfolio returns displayed in Panel B is only 0.05% per month and is not statistically significant. This mean of 0.05% is only one basis point greater than the corresponding mean of 0.04% in Table 3 Panel A. It is consistent with the hypothesis that the statistically significant performance of the decile ten minus decile one long-short portfolio shown in Table 5 Panel A is driven by the high-fee stocks.

The results in Panel C show that the means of the average fee-adjusted returns on the ten sets of portfolios also exceed the corresponding means. This should be expected because the fee adjustment involves adding the fees to portfolios held long. The fee adjustment has a much greater impact on the means of the decile one portfolio returns than on the means of the decile ten portfolio returns. The mean of the decile one average returns increasing by 0.23% per year, while the mean of the decile ten average returns increases by only 0.06% per year. As a result, after fee adjustment the mean of the long-short portfolio returns in Panel B is essentially zero, −0.01% per month. This mean is very close to the corresponding mean of −0.02% per month in Table 4 Panel A.

These results for the means of the average long-short portfolio (raw) returns are very similar to the corresponding results for the means of the average long-short portfolio abnormal returns. They show that the statistically significant mean long-short portfolio return in Table 5 Panel A is due to the high-fee stocks and provide additional evidence consistent with the hypothesis that a hedge fund or other sophisticated investor that has to pay the stock borrow fee cannot profitably exploit the anomalies. In addition, the close similarity between the results for raw and abnormal returns show that the results and conclusions are not driven by the choice to of benchmark to use to compute the abnormal returns.

5. Returns on several specific anomaly portfolios

We next examine in detail (a) the abnormal returns on five well-known anomalies, and (b) the returns on four long-short portfolios that are related to several of the apparently priced "factors" that appear in some linear factor models of asset returns. Of the four long-short portfolios related to apparently priced factors, the returns of two are completely or almost completely explained by stock borrow fees, one does not garner a risk premium in our sample period, and a significant fraction of the returns of the fourth is explained by stock borrow fees. As a placebo test, we also consider two long-short portfolios related to theoretically well-grounded asset pricing factors. The returns of these two long-short portfolios are not explained by stock borrow fees.

5.1 Abnormal returns of five well-known anomalies

The five well-known anomalies we consider are the post-issuance IPO return anomaly documented by Ritter (1991), the share issuance anomaly described by Fama and French (2008), the idiosyncratic volatility (IVOL) anomaly first studied by Ang et al. (2006), the maximum return anomaly described by Bali, Cakici, and Whitelaw (2010), and the share turnover volatility anomaly described by Chordia, Subrahmanyam, and Anshuman (2001).[17]

In Table 6 we report the results for the five specific anomalies. Panel A displays the average abnormal returns on the decile one portfolio and the decile ten minus one long-short

[17] The bid-ask spread anomaly described by Amihud and Mendelson (1986) is possibly better known than several of the five anomalies we consider. While it is included in our list of 162 anomalies, we do not examine it in detail because it does not replicate in our 2006–2020 sample. Based on the original Amihud and Mendelson (1986) paper, one would expect the average abnormal return on the decile ten minus decile one long-short portfolio to be positive. However, in our data the average abnormal return on the decile one portfolio is 0.01% per month (*t*-statistic 0.04), the average abnormal return on the decile ten portfolio is –0.68% per month (*t*-statistic –2.95), and the average abnormal return on the decile ten minus decile one long-short portfolio is –0.68% per month (*t*-statistic –2.09).

portfolio, including all stocks and without any adjustment for stock borrow fees. In contrast to Panels A of Tables 2–4 that provided the mean of the time-series abnormal returns across 162 anomalies, each of the average abnormal returns reported in Table 6 is for either a single decile one portfolio or a single long-short decile ten minus decile one portfolio.

For all five anomalies, the point estimates of the abnormal return on the decile one portfolio are negative and large in magnitude, ranging from −0.40% per month (12 × (−0.40%) = −4.80% per year) to −0.80% per month (12 × (−0.80%) = −9.60% per year). The point estimates of the abnormal returns on the decile ten minus decile one long-short portfolio range from 0.33% per month (12 × 0.33% = 3.96% per year) to 0.69% per month (12 × 0.69% = 11.52% per year). Some, but not all, of these average abnormal returns are significantly different from zero at conventional levels. Except for the post-issuance IPO return anomaly documented by Ritter (1991), our 2006–2020 sample period is shorter than the sample periods used in the original papers, which at least partly explains the lack of statistical significance. For the post-issuance IPO return anomaly, which is the anomaly for which the *t*-statistic for the long-short portfolio abnormal returns is smallest, the average number of stocks in portfolio one is only 35, which likely contributes to the lack of significance.

Panel A also shows that large percentages of the stocks in the decile one portfolios have high borrow fees. For example, for the IPO post-issuance and share turnover anomalies, on average 56.17% and 57.45% of the stocks in the decile one portfolio have high fees. Even for the share issuance anomaly, which has smallest percentage of high-fee stocks in the decile one portfolio, the average percentage of high-fee stocks in the decile one portfolio is 27.20%. The average stock borrow fee (including the low-fee stocks) for the stocks in the decile one portfolios are also high, ranging from 3.76% per year for the share issuance anomaly to 10.01% per year for the share turnover volatility anomaly. These results for the percentages of high-fee stocks in the decile one portfolios and the average stock borrow fees suggest that the abnormal returns are due to the high-fee stocks.[18]

[18] Stambaugh, Yu and Yuan (2015) conclude that the idiosyncratic volatility (IVOL) anomaly is at least partly due to short-sale costs because the IVOL-return relation is stronger among overpriced stocks than among underpriced stocks. This is especially true for small stocks, which are more frequently hard-to-borrow than large stocks. However, Stambaugh, Yu, and Yuan (2015) do not have stock borrow fee data and thus are unable to perform the analyses that we carry out.

This is confirmed by results in Panel B, which displays the abnormal returns after excluding the high-fee stocks. Excluding the high-fee stocks, the average abnormal returns on the decile one portfolios are all small, ranging from –0.08% (*t*-statistic –0.30) for the share turnover anomaly to 0.10% (*t*-statistic 0.57) for the maximum return anomaly. The decile ten minus decile one long-short portfolio abnormal returns are negative for three of the five anomalies, being –0.11% per month (*t*-statistic –0.23), –0.10% per month (*t*-statistic –0.34), and –0.14% per month (*t*-statistic –0.48) for the IPO post-issuance, idiosyncratic risk, and maximum return anomalies, respectively. For the two anomalies with positive long-short portfolio returns, share issuance and turnover volatility, the average abnormal long-short portfolio returns are only 0.04% per month. These results show that the anomaly portfolio returns displayed in Panel A are due to the high-fee stocks.

In Panel C we report the results for net-of-fee abnormal returns on anomaly portfolios. These results show that none of these five anomalies can reliably be exploited by an investor who pays the stock borrow fees to short sell the stocks in the decile one portfolios. The decile one abnormal return that is largest in magnitude, that for the IPO post-issuance anomaly, is only –0.21% and is not statistically significant (*t*-statistic –0.63). The other four decile one abnormal returns are all small, ranging from –0.08% per month (*t*-statistic –0.60) for the share issuance anomaly to 0.05% (*t*-statistic 0.17) for the share issuance anomaly. The average long-short portfolio average abnormal return that is largest in magnitude, that for the share turnover anomaly, is only –0.15% per month (*t*-statistic –0.36). The long-short portfolio returns for the other four anomalies are all small, ranging from –0.06% per month (*t*-statistic –0.20) for the skewness anomaly to 0.06% per month (*t*-statistic 0.37) for the share issuance anomaly. These results show that the five anomalies cannot profitably be exploited by an investor who has to pay the stock borrow fees to short sell stocks.

5.2 Returns on four long-short portfolios related to asset pricing factors

The returns on some long-short portfolios, such as those based on momentum or profitability, can be interpreted either as anomalies or as priced "factors" that appear in some linear factor models of returns. For example, Carhart (1997) introduces a momentum factor, while Novy-Marx (2013) proposes a profitability factor. Our finding that short-sale costs explain the returns of many anomaly portfolios then raises the question: Are the returns of some of the long-short factor portfolios explained by short-sale costs? We explore this question by examining the raw returns of several long-short portfolios that are related to widely used asset pricing factors. The asset pricing literature on linear factor models constructs the factor returns without first adjusting the returns of the stocks that comprise the factor portfolios, that is it uses raw stock returns. Thus, different from most of the other analyses, we use raw rather than abnormal returns in this exercise because we want to examine whether the factors, as typically constructed, are impacted by stock borrow fees.

We focus on the returns of four long-short portfolios that are related to widely used factors. These four factor-related portfolios are based on momentum (Carhart (1997)), profitability (Novy-Marx (2013)), book-to-market (Rosenberg, Reid, and Lanstein (1985), Fama and French (1993)), and investment (Lyandres, Sun and Zhang (2008)).[19] To be consistent with the remainder of this paper, we compute the average returns of decile ten minus decile one long-short portfolios, rather than use the specific portfolio construction approaches in the papers that originally proposed the factors.

We report the results of the analysis in Table 6. Panel A displays the average monthly returns on the decile ten minus decile one long-short portfolio for each of the four factors, including all stocks and not adjusting the returns for stock borrow fees. Panel A also includes the average returns on the decile one portfolio, which would be sold short based on the results in the original paper. In Panel B we report the estimates of average returns after excluding the high-fee stocks from the portfolios, while in Panel C we report the net-of-fee average returns on the portfolios. The results for momentum are in the left-hand part of the table, followed by the results for profitability, book-to-market, and finally net investment on the right-hand side. Taking account of stock borrow fees has a large impact on the decile one and decile ten minus one portfolio returns for all four factors.

5.2.1 Portfolios sorted by momentum and profitability

The results in Panel A show that the momentum and profitability decile ten minus decile one long-short portfolios provide positive returns in our sample, with average returns of 0.21% and 0.62% per month, respectively. While the *t*-statistics are only 0.46 and 1.79, respectively, this lack of significant is almost certainly at least partly due to the fact that our sample period is

[19] Rosenberg, Reid, and Lanstein (1985) interpret the superior performance of value stocks as compared to growth stocks as evidence of market inefficiency, that is, as an anomaly, while Fama and French (1993) interpret the same phenomenon as a priced market factor.

considerably shorter than the sample periods used in the original papers that proposed the momentum and profitability factors. Regardless, the lack of significance of some of the point estimates does not prevent us from exploring the extent to which the average returns are affected by short-sale costs.

Panel A also reports the average percentages of high-fee stocks in the decile one and decile ten portfolios, as well as the average fees of the stocks in the portfolios, averaged across both high and low-fee stocks. The results for the percentages of high-fee stock and the average fees suggest that the positive returns of the long-short portfolios might be due to the high-fee stocks. For example, when stocks are sorted by profitability 44.83% of the decile one stocks have high borrow fees, while only 10.83% of the decile ten stocks have high fees. The average borrow fee in decile one is 5.53% per year, or about 0.46% per month, while the average borrow fee in decile ten is only 1.38% per year, which is less than 0.12% per month.

Panel B displays the estimates of average returns after excluding the high-fee stocks from the portfolios. Excluding the high-fee stocks has a large impact on the returns on the long-short portfolios when stocks are sorted by momentum or profitability. The returns on the decile ten minus decile one long-short momentum and profitability portfolios fall from 0.21% to 0.02% per month and from 0.62% to 0.10% per month, respectively. Thus, the results show that the high-fee stocks account for the bulk of the returns on the momentum and profitability long-short portfolios.

In Panel C we report the net-of-fee average returns on the several portfolios. These results show that, when stocks are sorted by momentum or profitability, an investor who has to pay stock borrow fees to short-sell stocks cannot profitably exploit the positive long-short portfolio returns reported in Panel A. The net-of-fee returns on the decile ten minus decile one long-short momentum and profitability are –0.01% per month and 0.19% per month respectively, much smaller than the unadjusted long-short portfolio returns of 0.21% and 0.62% reported in Panel A. While the 0.19% per month fee-adjusted return on the long-short profitability portfolio is not close to zero—it annualizes to approximately 12 × 0.19% = 2.26% per year—it is only 0.19%/0.62% = 30.47% of the magnitude of the unadjusted return of 0.62% per month. Thus, these results show taking account of stock borrow fees eliminates most of the returns on the long-short momentum and profitability portfolios.

5.2.2 Portfolios sorted by book-to-market

The results when we use book-to-market to sort stocks into decile portfolios are quite different from those when we sort using momentum or profitability. In our sample period, book-to-market is not associated with a return premium. The results in Table 7 Panel A show that the return on the decile ten minus decile one long-short book-to-market portfolio is very slightly negative in our sample, being −0.02% per month. The results in Panels B and C show that excluding the high-fee stocks or adjusting the stock returns for stock borrow fees reduces the long-short portfolios returns further to −0.22% or −0.23% per month, respectively. Thus, while taking account of stock borrow fees has a significant impact on the returns, it does not eliminate the book-to-market premium because there was not a book-to-market premium to begin with.

5.2.3 Portfolios sorted by investment

The results for the decile portfolios sorted by investment also differ from those when we sort by the other characteristics. The results in Panel A show that the average return on the decile ten minus decile one long-short portfolio is large, 0.47% per month. This result is similar to the corresponding results for momentum and profitability-sorted portfolios, though when sorting by net investment the average return is significant at conventional levels, as the *t*-statistic is 2.21. But different from the results when stocks are sorted by momentum or profitability, less than half of the 0.47% per month return is due to the high-fee stocks. The results in Table 7 Panel B show that, when we exclude the high-fee stocks from the portfolio, the average long-short portfolio return is 0.27% per month; thus, 57% (= 0.27%/0.47%) of the return remains after high-fee stocks are excluded. Similarly, the results in Panel C show that the fee-adjusted return on the long-short portfolio is 0.30% per month, which is 64% (= 0.30%/0.47%) of the corresponding unadjusted return reported in Panel A. Thus, while either excluding high-fee stocks or adjusting returns for stock borrow fees reduces the long-short portfolio returns, they do not eliminate them.

5.3 Portfolios related to the CAPM

As a placebo test, we also consider the returns on two sets of portfolios related to asset pricing factors that are grounded in theory. The first set of portfolios involves sorting using the Capital Asset Pricing Model (CAPM) beta, where portfolios one and ten contain low and high-beta stocks, respectively. The long-short portfolio is long high-beta stocks and short low-beta stocks. This is the single most theoretically well-grounded asset pricing factor, and so, the stock borrow fee should be largely unrelated to any differential performance across portfolios. The second set of portfolios is constructed using the tail risk beta proposed by Kelly and Jiang (2014); the long-short portfolio is long stocks with high tail risk beta and short stocks with low tail risk beta. While not as well-grounded as the CAPM beta, the relevance of higher order moments from a utility perspective provides a plausible motivation for this signal to be a measure of risk rather than a potential anomaly.

We report the results for these three sets of portfolios in Table 8. Similar to the analysis of the four sets of portfolios for which we report returns in Table 7, we examine the raw returns rather than the abnormal returns on the portfolios. As in the previous tables, the three panels display the average returns based on the full sample without any fee adjustment, the average returns after excluding high-fee stocks, and the average net-of-fee returns.

The left-hand part of Table 8 displays the results for the decile one portfolio, the decile 10 portfolio, and the decile ten minus one long-short portfolio when we stock stocks by the CAPM beta. During our sample period, the average returns on the decile one (low beta) portfolio, decile ten (high beta), and decile ten minus one long-short portfolios are 0.55%, 1.04%, and 0.49% per month, respectively. Excluding high fee stocks, the average returns are 0.69%, 1.30%, and 0.60% per month, respectively. Thus, excluding high-fee stocks actually increases the average return on the long-short portfolio by 0.11% per month instead of decreasing the differential. The net-of-fee returns on the decile one portfolio and the decile ten minus one long-short portfolio are 0.71%, 1.16%, and 0.45% per month, respectively. Thus, adjusting the returns for the stock borrow fees increases the average return one decile one portfolio by only 0.06% per month, and reduces the average return on the long-short portfolio by only 0.04% per month. Thus, excluding high-fee stocks and taking account of stock borrow fees by computing net-of-fee returns has a modest impact without a consistent direction on the returns of portfolios sorted by the CAPM beta coefficient.

The right-hand side of Table 8 displays the average returns of the portfolios sorted by tail risk beta. The average returns on the decile one (low beta) portfolio, decile ten (high beta), and decile ten minus one long-short portfolios are 0.71%, 1.19%, and 0.48% per month, respectively. Excluding high fee stocks, the average return on the decile one portfolio increases slightly to 0.82% per month, the decile ten return increases to 1.29% per month, and the average return on the long-short portfolio is unaffected and remains 0.48% per month. The net-of-fee returns on the decile one portfolio and the decile ten minus one long-short portfolio are 0.85%, 1.27% and

0.42% per month, respectively. Thus, adjusting the returns for the stock borrow fees reduces the average return on the long-short portfolio by only 0.06% per month. Following the pattern of results for portfolios sorted by the CAPM beta, the exclusion of high-fee stocks and accounting for stock borrow fees by computing net-of-fee returns has little impact on the returns of the tail risk beta long-short portfolio.

These patterns for CAPM beta and tail risk beta indicate that stock borrow feesdo not provide an explanation for differences in average returns that are closely related to theoretically well-grounded measures of systematic risk.

6. Results for Groups of Anomalies

Next, we analyze whether the main findings hold in several additional subsets of the anomalies. The results show that an investor who pays the borrow fee when he or she short-sells stock cannot profitably exploit the anomalies in any of the subsets we consider.

6.1 Accounting, Price, and Other Anomalies

We partition the 162 anomalies into 82 accounting anomalies, 45 price anomalies, and 35 other anomalies. The accounting and price anomalies are those that Chen and Zimmerman (2021) identify as "Accounting" and "Price" in their spreadsheet that provides the results of the their analysis of the individual anomalies.[20] The Accounting anomalies consist of those for which the sorting variable is computed from financial statement data. The Price anomalies consist of those for which the sorting variable is constructed from returns, or, in a few cases, dividend yields, earnings-to-price ratios, or market leverage. Our "Other" category includes the anomalies that Chen and Zimmerman (2021) label as "13F," "Analyst," "Event," "Options," "Trading," and "Other." We group these Chen and Zimmerman (2021) categories together into our single category "Other" because the small numbers of anomalies in some of these categories would severely limit the power of our statistical tests if we examined the categories separately.

For each category, we sort the stocks into decile portfolios, as before, and examine the distributions of the average abnormal returns of the decile-sorted portfolios. Panels A to C of Table 9 report the results (a) including all stocks without adjusting the returns for the borrow fees, (b) after excluding the high-fee stocks, and (c) including all stocks and adjusting the returns

[20] The spreadsheet can be found at https://www.openassetpricing.com/data/ by Chen and Zimmerman (2021).

for the stock borrow fee. Each panel reports the results for the anomalies in the groups Accounting, Price, and Other.

For all three groups, the unadjusted abnormal return results displayed in Panel A are consistent with the corresponding results for the full sample shown in Table 2. The means of the average abnormal returns on the decile one portfolios in the Accounting, Price, and Other anomalies are –0.20%, –0.25%, and –0.29% per month, respectively, similar to the corresponding mean average abnormal return for the full sample of –0.24% per month shown in Table 2 Panel A. Both the unadjusted and panel-adjusted *t*-statistics we report in Panel A indicate that the three abnormal performance estimates are statistically significant at conventional levels. Following a similar pattern, the means of the average abnormal returns on the decile ten minus decile one long-short portfolios are 0.16%, 0.15%, and 0.12% per month, near the corresponding full-sample estimate of 0.15% displayed in Table 2. Both the panel-adjusted and naïve *t*-statistics indicate that these mean long-short average portfolio abnormal returns are also significantly different from zero at conventional levels.

Panel B reports the mean average abnormal returns after excluding the high-fee stocks from the sorted decile portfolios. The means of the average abnormal returns on the decile ten minus decile one long-short portfolio are small and insignificant for all three subsets of anomalies, ranging from 0.02% to 0.05% per month. The means of the average abnormal returns of the decile one portfolios are also small, ranging from –0.06 to 0.03% per month. None of these means significant based on the panel-adjusted *t*-statistics.

In Panel C we report the results for the cross-sectional means of the average net-of-fee abnormal returns. Similar to the Panel B results, the means of average abnormal returns on the decile ten minus decile one long-short portfolio are small and insignificant for all three groups, ranging from –0.07% to 0.00% per month. Turning to the means of the average decile one portfolio abnormal returns, the largest is only –0.07%, which is not significant based on the panel-adjusted *t*-statistic of –0.69. These results, together with the results excluding high-fee stocks reported in Panel B, are consistent with the hypothesis that the abnormal performance evident in the Panel A results for each subsample is due to the high-fee stocks and cannot be exploited by an investor who must pay the stock borrow fees to short-sell stocks.

6.2 Additional subsets of anomalies

In Table 10 we report the means of the average portfolio abnormal returns for several other subsets of the anomalies. The first subset consists of the anomalies for which the sample used in the paper that originally identified the anomaly ended before 2006. For this subset, our analysis is fully out-of-sample, as our sample begins with July 2006. The second subset consists of the anomalies for which the *t*-statistic for the average anomaly return in Chen and Zimmerman's (2021) in-sample replication of the anomalies exceeds 5.0. These are the anomalies for which the statistical evidence is strongest. Finally, the third subset consists of the anomalies for which the original papers identifying the anomalies were published in the *Journal of Finance* (*JF*), *Journal of Financial Economics* (*JFE*), or *Review of Financial Studies* (*RFS*). One might conjecture that such anomalies are more likely to be important and/or robust.

The format of Table 10 is identical to that of Table 9. Panel A displays the means of the average abnormal returns including all stocks with any adjustment for stock borrow fees, Panel B displays the results after excluding the high-fee stocks from the sorted portfolios, and Panel C displays the average net-of-fee returns.

The results presented in Panel A provide evidence of abnormal anomaly returns for all three subsets. The means of the average abnormal returns on the decile one portfolios range from −0.28% to −0.23% per month, with panel-adjusted *t*-statistics ranging from −2.71 to −3.33. The average abnormal returns on the long-short portfolios range from 0.12% to 0.19% per month, with panel-adjusted *t*-statistics between 2.15 to 2.99. For the pre-2006 subsample of anomalies, the average long-short portfolio abnormal return of 0.12% per month is only slightly smaller than the full-sample long-short portfolio abnormal return of 0.15% per month displayed in Table 2 Panel A, consistent with the full-sample results. For the other two subsamples, the average long-short portfolio abnormal returns of 0.18% and 0.19% per month are slightly larger than the full-sample long-short portfolio abnormal return of 0.15% per month, consistent with these subsamples containing the stronger anomalies.

After excluding the high-fee stocks from the sorted decile portfolios (Panel B), the means of the abnormal returns on the decile ten portfolios are essentially zero, ranging from −0.02% to 0.01% per month. The average abnormal returns of the decile ten minus decile one long-short portfolios are also small, ranging from 0.01% to 0.07% per month. All three of these mean average abnormal returns are insignificant based on the panel-adjusted *t*-statistics. The naïve *t*-

statistic for the abnormal long-short portfolio return in the *JF*, *JFE*, and *RFS* subsample, which overstates the statistical significance of the mean, is only 2.28.

The means of the average net-of-fee abnormal returns displayed in Panel C range from −0.06% to 0.00% per month. All are insignificant based on the panel-adjusted *t*-statistics, and the largest of the naïve *t*-statistics is −1.98. The means of the average abnormal returns on the decile ten minus decile one long-short portfolio are also small, ranging from −0.05% to 0.04% per month. While the average abnormal return of −0.05% per month is significant based on the naïve *t*-statistic of −2.07, this overstates the statistical significance of the result. Even setting this issue aside, this result does not provide any evidence that the mean of the average abnormal long-short portfolio returns is positive.

These results, together with the results excluding high-fee stocks reported in Panel B, are consistent with the hypothesis that the average returns on the long-short portfolios subsets evident in the Panel A results are due to the high-fee stocks and cannot be exploited by an investor who must pay the stock borrow fee to short-sell stocks. Publishing the findings regarding an anomaly in a leading finance journal seems no different in the context of short sale costs as a common limit to arbitrage.

7. Conclusion

Short-sale costs provide a common limit to arbitrage that appears to explain the continued presence of many cross-sectional asset pricing anomalies. Using a sample of 162 anomalies, we find that the average long-short abnormal performance of these anomalies is 0.15% per month before costs. After adjusting portfolio returns to reflect stock borrow fees, average performance is near zero and flips sign to −0.02% per month. In addition, if the stocks with high borrow fees are removed from the analysis, there is a similar absence of abnormal performance before adjusting for the stock borrow fee. Thus, high borrow fees explain why so many of these anomalies exist despite efforts by sophisticated investors to exploit them.

This paper is the first analysis that shows that the net-of-fee returns on so many anomaly portfolios are near zero after adjusting performance for the stock borrow fee and that excluding stocks with high borrow fees leads to a similar absence of substantial outperformance. Our findings indicate that the most anomalies with significant out-of-sample performance are not exploitable by investors paying the stock borrow fees to short sell stocks. The remaining puzzle is not about the behavior of sophisticated investors, because the stock borrow fee prevents these investors from correcting the residual mispricing. Instead, we must turn to the multitude of the uninformed that choose not to liquidate their long positions in assets with high borrowing costs to address the underlying market inefficiency.

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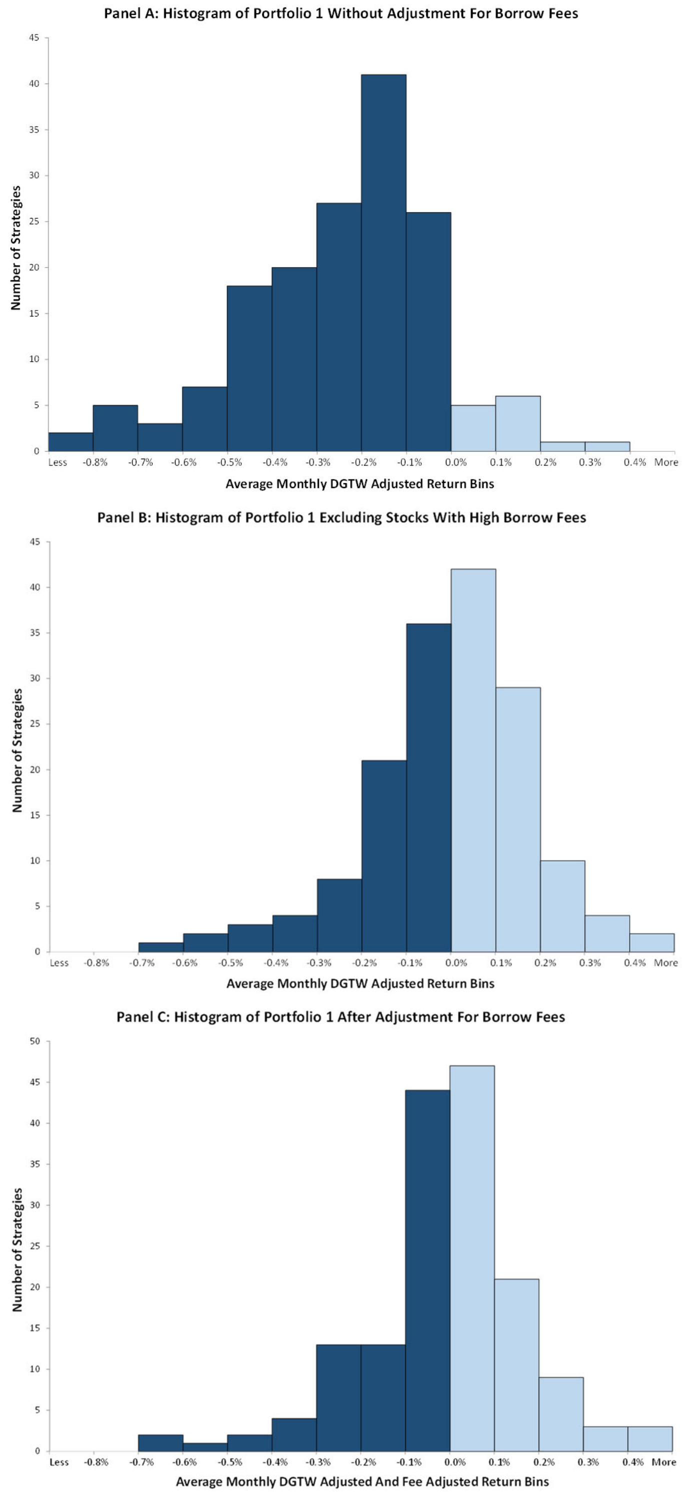

Figure 1. Histograms of Portfolio 1 average performance across anomalies
The histogram in Panel A is for the time-series average of monthly portfolio performance for each strategy before adjustment for the stock borrow fee. The histogram in Panel B is for the time-series average of monthly portfolio performance for each anomaly excluding stocks with high borrow fees. The histogram in Panel C is for the time-series average of monthly portfolio performance for each anomaly after adjusting returns for stock borrow fees. Returns that are below zero are in dark blue.

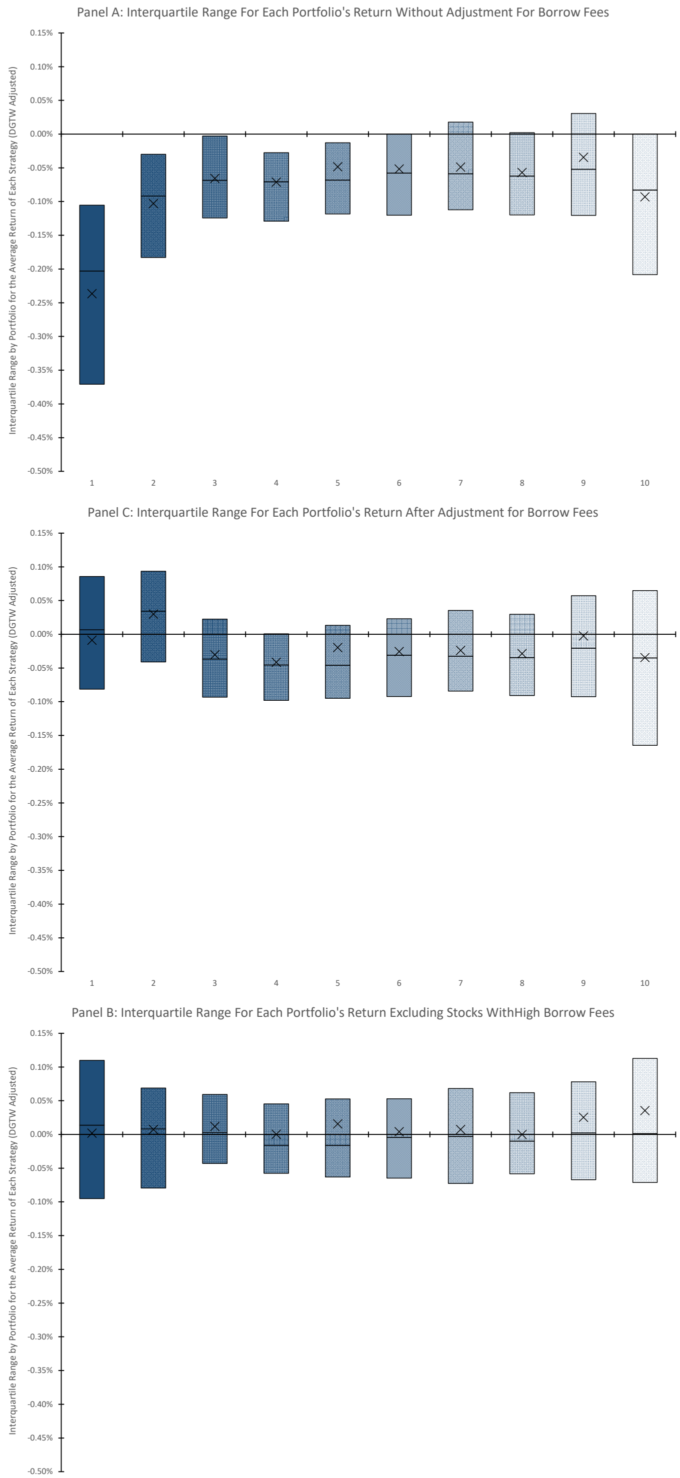

Figure 2. Interquartile ranges for each portfolio's performance across anomalies
The interquartile range in Panel A is for the time-series average of monthly portfolio performance for each strategy before adjustment for the stock borrow fee. The interquartile range in Panel B is for the monthly portfolio performance for each anomaly excluding stocks with high borrow fees. The interquartile range in Panel C is for the monthly portfolio performance for each anomaly after adjusting returns for stock borrow fees. The mean and median are marked × and −.

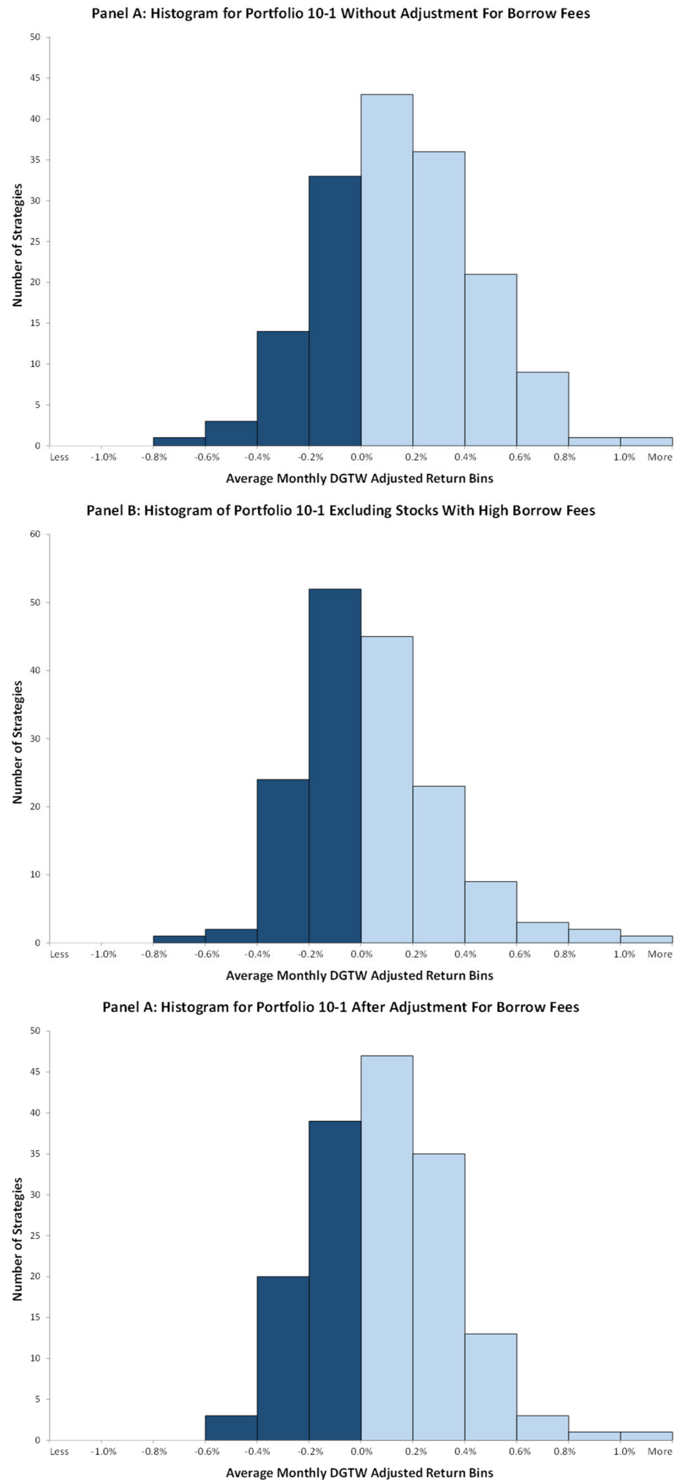

Figure 3. Histograms of Portfolio 10 minus Portfolio 1 average performance across anomalies
The histogram in Panel A is for the time-series average of monthly differential performance for each strategy before adjustment for the stock borrow fee. The histogram in Panel B is for the time-series average of monthly differential performance for each anomaly excluding stocks with high borrow fees. The histogram in Panel C is for the time-series average of monthly differential performance for each anomaly after adjusting returns for stock borrow fees.

Table 1
Summary statistics

This table presents selected statistics for the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters explained in Section 2. The unit of observation is a stock return from $t+1$ to $t+22$ with valid data in Markit and CRSP. Market capitalization is from CRSP and NYSE size decile is assigned accordingly. The sample period is July 2006 to December 2020.

Summary statistics for the CRSP stocks with an indicative borrowing fee in Markit									
	No. Obs.	Mean	Std. Dev.	Skewness	1%	10%	50%	90%	99%
DGTW ETB return	562,632	-0.0012	0.1327	3.4497	-0.3317	-0.1292	-0.0047	0.1230	0.3931
Regular return	562,632	0.0083	0.1500	2.7156	-0.3750	-0.1416	0.0055	0.1520	0.4544
Indicative borrowing fee	559,263	0.0166	0.0545	7.2294	0.0025	0.0028	0.0038	0.0300	0.3000
Fee, next month	562,392	0.0168	0.0548	7.2906	0.0026	0.0029	0.0038	0.0288	0.2854
Utilization	554,290	18.0742	21.50	1.67	0.07	0.74	9.32	50.71	90.09
Market cap, $mn	562,371	6104	28282	20	54	97	741	10517	107981
NYSE size decile	548,420	6	3	0	2	3	7	10	10

Table 2

Statistics for abnormal performance across portfolios formed for each strategy without adjustment for borrow fees

This table presents the average, across strategies, of the abnormal monthly performance for equal-weighted portfolios relative to the stocks without high borrowing fees in each associated DGTW benchmark portfolio. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters explained in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date $t+1$ until the close of trading date $t+22$. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1 Low	2	3	4	5	6	7	8	9	10 High	10-1
Panel A: Statistics for monthly abnormal performance across strategies for stocks sorted by signals into decile portfolios											
Average return	-0.24%	-0.10%	-0.07%	-0.07%	-0.05%	-0.05%	-0.05%	-0.06%	-0.03%	-0.09%	0.15%
t-statistic (panel adj.)	[-2.94]	[-2.44]	[-2.31]	[-2.82]	[-1.98]	[-1.94]	[-1.67]	[-1.95]	[-1.16]	[-1.81]	[2.93]
t-statistic (naive)	-13.90	-9.25	-7.12	-7.79	-4.06	-5.96	-5.25	-6.22	-2.83	-6.62	6.28
Percentage high fee	21.91%	13.73%	10.93%	10.04%	9.96%	9.39%	9.50%	10.20%	12.03%	18.33%	
Average fee (annual)	2.70%	1.58%	1.25%	1.16%	1.12%	1.08%	1.09%	1.14%	1.31%	2.03%	
Average # of stocks	243	239	244	247	250	240	237	238	239	236	
Panel B: Distribution of monthly abnormal performance across strategies for stocks sorted by signals into decile portfolios											
Min	-0.83%	-0.68%	-0.40%	-0.74%	-0.41%	-0.48%	-0.55%	-0.59%	-0.38%	-0.68%	-0.68%
P5	-0.66%	-0.30%	-0.23%	-0.19%	-0.21%	-0.21%	-0.21%	-0.22%	-0.23%	-0.35%	-0.27%
P25	-0.37%	-0.18%	-0.12%	-0.13%	-0.12%	-0.12%	-0.11%	-0.12%	-0.12%	-0.21%	-0.08%
Median	-0.20%	-0.09%	-0.07%	-0.07%	-0.07%	-0.06%	-0.06%	-0.06%	-0.05%	-0.08%	0.13%
P75	-0.11%	-0.03%	0.00%	-0.03%	-0.01%	0.00%	0.02%	0.00%	0.03%	0.00%	0.33%
P95	0.05%	0.08%	0.10%	0.07%	0.13%	0.13%	0.13%	0.13%	0.23%	0.18%	0.66%
Max	0.35%	0.56%	0.52%	0.76%	1.06%	0.31%	0.50%	0.34%	1.01%	0.62%	1.09%

Table 3

Statistics for abnormal performance across portfolios formed for each strategy excluding stocks with high borrow fees

This table presents the average, across strategies, of the abnormal monthly performance for equal-weighted portfolios relative to the stocks without high borrowing fees in each associated DGTW benchmark portfolio. Stocks with borrow fees of more than 1% are excluded from the performance of each strategy. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular anomaly signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The monthly performance for each portfolio is calculated only using the stocks with an indicative borrowing fee less than or equal to 1%, that is, stocks with borrow fees of more than 1% are excluded from the performance of each strategy. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1 Low	2	3	4	5	6	7	8	9	10 High	10-1
Panel A: Statistics for monthly abnormal performance across strategies for stocks sorted by signals into decile portfolios											
Average return	0.00%	0.01%	0.01%	0.00%	0.02%	0.00%	0.01%	0.00%	0.03%	0.04%	0.04%
t-statistic (panel adj.)	[0.04]	[0.22]	[0.46]	[0.01]	[0.36]	[0.02]	[0.26]	[0.04]	[0.85]	[0.97]	[0.81]
t-statistic (naive)	0.14	0.74	1.37	0.05	1.14	0.45	0.77	0.01	2.20	2.47	1.69
Average # of stocks	190	207	217	222	225	217	215	214	210	193	
Panel B: Distribution of monthly abnormal performance across strategies for stocks sorted by signals into decile portfolios											
Min	-0.63%	-0.56%	-0.27%	-0.19%	-0.27%	-0.34%	-0.35%	-0.52%	-0.27%	-0.28%	-0.61%
P5	-0.32%	-0.17%	-0.13%	-0.13%	-0.15%	-0.15%	-0.17%	-0.16%	-0.15%	-0.21%	-0.34%
P25	-0.10%	-0.08%	-0.04%	-0.06%	-0.06%	-0.06%	-0.07%	-0.06%	-0.07%	-0.07%	-0.14%
Median	0.01%	0.01%	0.00%	-0.02%	-0.02%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.01%
P75	0.11%	0.07%	0.06%	0.05%	0.05%	0.05%	0.07%	0.06%	0.08%	0.11%	0.18%
P95	0.27%	0.22%	0.18%	0.15%	0.19%	0.23%	0.22%	0.17%	0.27%	0.30%	0.50%
Max	0.46%	0.64%	0.75%	0.98%	1.42%	0.42%	0.59%	0.42%	1.00%	0.86%	1.01%

Table 4

Statistics for abnormal performance across portfolios formed for each strategy after adjustment for borrow fees

This table presents the average, across strategies, of the abnormal monthly performance for equal-weighted portfolios relative to the stocks without high borrowing fees in each associated DGTW benchmark portfolio. The cumulative indicative borrow fee during the evaluation period is added to each stock's return to adjust performance of each strategy for the potential cost of borrowing stock. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1 Low	2	3	4	5	6	7	8	9	10 High	10-1
Panel A: Statistics for monthly abnormal performance across strategies for stocks sorted by signals into decile portfolios											
Average return	-0.01%	0.03%	-0.03%	-0.04%	-0.02%	-0.03%	-0.02%	-0.03%	0.00%	-0.03%	-0.02%
t-statistic (panel adj.)	[-0.10]	[0.72]	[-1.09]	[-1.66]	[-0.94]	[-1.04]	[-0.78]	[-0.98]	[-0.12]	[-0.65]	[-0.49]
t-statistic (naive)	-0.60	2.93	-3.36	-4.64	-1.57	-2.90	-2.53	-3.15	-0.19	-2.47	-1.09
Percentage high fee	21.91%	13.73%	10.93%	10.04%	9.96%	9.39%	9.50%	10.20%	12.03%	18.33%	
Average fee (annual)	2.70%	1.58%	1.25%	1.16%	1.12%	1.08%	1.09%	1.14%	1.31%	2.03%	
Average # of stocks	243	239	244	247	250	240	237	238	239	236	
Panel B: Distribution of monthly abnormal performance across strategies for stocks sorted by signals into decile portfolios											
Min	-0.67%	-0.54%	-0.36%	-0.58%	-0.36%	-0.45%	-0.53%	-0.56%	-0.30%	-0.45%	-0.72%
P5	-0.31%	-0.14%	-0.19%	-0.15%	-0.18%	-0.17%	-0.19%	-0.20%	-0.17%	-0.31%	-0.43%
P25	-0.08%	-0.04%	-0.09%	-0.10%	-0.09%	-0.09%	-0.08%	-0.09%	-0.09%	-0.16%	-0.23%
Median	0.01%	0.03%	-0.04%	-0.05%	-0.05%	-0.03%	-0.03%	-0.03%	-0.02%	-0.03%	-0.03%
P75	0.09%	0.09%	0.02%	0.00%	0.01%	0.02%	0.04%	0.03%	0.06%	0.06%	0.16%
P95	0.29%	0.23%	0.12%	0.11%	0.16%	0.16%	0.15%	0.16%	0.26%	0.24%	0.43%
Max	0.46%	0.65%	0.60%	0.86%	1.15%	0.40%	0.57%	0.40%	1.04%	0.74%	0.90%

Table 5

Statistics for abnormal performance across portfolios formed for each strategy without adjustment for borrow fees

This table presents the average, across strategies, of the monthly raw return for equal-weighted portfolios. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	1 Low	2	3	4	5	6	7	8	9	10 High	10-1
Panel A: Average monthly raw returns across decile portfolios sorted for each anomaly											
Average return	0.80%	0.92%	0.97%	0.95%	0.99%	0.98%	0.98%	0.98%	1.00%	0.96%	0.16%
t-statistic (panel adj.)	[1.43]	[1.77]	[1.92]	[1.94]	[2.01]	[2.02]	[2.04]	[2.00]	[1.98]	[1.82]	[2.91]
t-statistic (naive)	44.87	70.08	74.74	85.82	45.16	75.46	92.42	100.82	72.62	59.65	6.67
Percentage high fee	21.91%	13.73%	10.93%	10.04%	9.96%	9.39%	9.50%	10.20%	12.03%	18.33%	
Average fee (annual)	2.70%	1.58%	1.25%	1.16%	1.12%	1.08%	1.09%	1.14%	1.31%	2.03%	
Average # of stocks	243	239	244	247	250	240	237	238	239	236	
Panel B: Average monthly raw returns across decile portfolios for each anomaly and excluding stocks with high borrow fees											
Average return	1.04%	1.03%	1.05%	1.03%	1.06%	1.04%	1.04%	1.04%	1.06%	1.09%	0.05%
t-statistic (panel adj.)	[1.90]	[2.02]	[2.11]	[2.11]	[2.16]	[2.15]	[2.17]	[2.13]	[2.13]	[2.10]	[0.98]
t-statistic (naive)	62.47	87.25	86.99	93.85	46.35	80.37	92.64	108.54	78.12	64.96	2.10
Average # of stocks	190	207	217	222	225	217	215	214	210	193	
Panel C: Average monthly returns across decile portfolios for each anomaly after adjustment for borrow fees											
Average return	1.03%	1.05%	1.01%	0.98%	1.02%	1.01%	1.01%	1.00%	1.03%	1.02%	-0.01%
t-statistic (panel adj.)	[1.81]	[2.02]	[1.98]	[2.00]	[2.06]	[2.06]	[2.08]	[2.04]	[2.03]	[1.91]	[-0.04]
t-statistic (naive)	62.23	85.01	77.09	89.78	45.45	76.53	95.04	103.24	76.72	62.35	-0.49

Table 6

Statistics for abnormal performance across portfolios formed for specific anomalies

This table presents the average abnormal monthly performance for equal-weighted portfolios relative to the stocks without high borrowing fees in each associated DGTW benchmark portfolio for each specific anomaly. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Specific Anomaly	IPO		Share Issuance		Idiosyncratic Risk		Skewness		Turnover Volatilty	
Portfolio	1 Low	10-1 Diff	1 Low	10-1 Diff	1 Low	10-1 Diff	1 Low	10-1 Diff	1 Low	10-1 Diff
Panel A: Statistics for monthly abnormal performance for each anomaly without adjustment for borrow fees										
Average return	-0.63%	0.40%	-0.40%	0.33%	-0.54%	0.49%	-0.42%	0.39%	-0.80%	0.69%
t-statistic	-1.84	1.07	-2.94	2.04	-2.21	1.46	-1.94	1.19	-2.70	1.60
Percentage high fee	56.17%		27.20%		42.99%		37.18%		57.45%	
Average fee (annual)	5.23%		3.76%		6.17%		5.31%		10.01%	
Average # of stocks	35		297		323		324		126	
Panel B: Statistics for monthly abnormal performance for each anomaly excluding stocks with high borrow fees										
Average return	0.01%	-0.11%	-0.02%	0.04%	0.05%	-0.10%	0.10%	-0.14%	-0.08%	0.04%
t-statistic	0.01	-0.23	-0.18	0.29	0.21	-0.34	0.57	-0.48	-0.30	0.11
Average # of stocks	15		216		184		203		53	
Panel C: Statistics for monthly abnormal performance for each anomaly after adjustment for borrow fees										
Average return	-0.21%	0.02%	-0.08%	0.06%	-0.02%	-0.03%	0.03%	-0.06%	0.05%	-0.15%
t-statistic	-0.63	0.05	-0.60	0.37	-0.06	-0.09	0.15	-0.20	0.17	-0.36

Table 7

Statistics for raw returns across portfolios formed for specific anomalies often used as factors

This table presents the average monthly returns for equal-weighted portfolios for each specific anomaly commonly used as a factor. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Strategy Category	Momentum			Profitability			Book-To-Market			Investment		
Portfolio	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff
Panel A: Statistics for monthly raw returns for each anomaly without adjustment for borrow fees												
Average return	0.78%	0.99%	0.21%	0.54%	1.16%	0.62%	0.99%	0.97%	-0.02%	0.51%	0.98%	0.47%
t-statistic	1.00	1.83	0.46	0.83	2.24	1.79	1.94	1.26	-0.04	0.79	1.70	2.21
Percentage high fee	30.83%	21.46%		44.83%	13.46%		21.81%	18.22%		19.10%	15.57%	
Average fee (annual)	3.92%	2.83%		5.53%	1.38%		3.12%	2.08%		2.63%	2.07%	
Average # of stocks	316	315		256	242		292	291		248	247	
Panel B: Statistics for monthly raw returns for each anomaly excluding stocks with high borrow fees												
Average return	1.15%	1.17%	0.02%	1.15%	1.25%	0.10%	1.38%	1.16%	-0.22%	0.78%	1.05%	0.27%
t-statistic	1.49	2.25	0.04	1.79	2.48	0.26	2.85	1.52	-0.47	1.25	1.87	1.29
Average # of stocks	218	247		141	209		228	238		201	209	
Panel C: Statistics for monthly returns for each anomaly after adjustment for borrow fees												
Average return	1.11%	1.10%	-0.01%	1.01%	1.20%	0.19%	1.25%	1.02%	-0.23%	0.73%	1.03%	0.30%
t-statistic	1.42	2.02	-0.02	1.55	2.32	0.54	2.45	1.32	-0.50	1.14	1.79	1.42

Table 8

Statistics for raw returns across portfolios formed using risk-based betas

This table presents the average monthly returns for equal-weighted portfolios sorted using CAPM Beta and Tail Risk Beta signals. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Strategy Category	CAPM Beta			Tail Risk Beta		
Portfolio	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff
Panel A: Statistics for monthly raw returns for each anomaly without adjustment for borrow fees						
Average return	0.55%	1.04%	0.49%	0.71%	1.19%	0.48%
t-statistic	1.77	1.29	0.87	2.29	1.74	1.09
Percentage high fee	19.41%	26.14%		14.56%	19.24%	
Average fee (annual)	1.95%	3.33%		1.68%	2.53%	
Average # of stocks	297	296		242	241	
Panel B: Statistics for monthly raw returns for each anomaly excluding stocks with high borrow fees						
Average return	0.69%	1.30%	0.60%	0.82%	1.29%	0.48%
t-statistic	2.31	1.61	1.04	2.71	1.90	1.05
Average # of stocks	239	219		207	195	
Panel C: Statistics for monthly returns for each anomaly after adjustment for borrow fees						
Average return	0.71%	1.16%	0.45%	0.85%	1.27%	0.42%
t-statistic	2.31	1.44	0.79	2.74	1.86	0.95

Table 9

Statistics for abnormal performance across portfolios formed for broad categories of strategies

This table presents the average, across strategies, of the abnormal monthly performance for equal-weighted portfolios relative to the stocks without high borrowing fees in each associated DGTW benchmark portfolio. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Strategy Category	Accounting (82 Anomalies)			Price (45 Anomalies)			Other (35 Anomalies)		
Portfolio	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff
Panel A: Statistics for monthly abnormal performance for subsets of strategies without adjustment for borrow fees									
Average return	-0.20%	-0.05%	0.16%	-0.25%	-0.12%	0.15%	-0.29%	-0.17%	0.12%
t-statistic (panel adj.)	[-2.63]	[-0.75]	[3.06]	[-2.76]	[-1.80]	[1.87]	[-3.00]	[-2.98]	[1.04]
t-statistic (naive)	-9.06	-2.51	5.27	-7.87	-4.07	3.00	-7.49	-7.18	2.31
Percentage high fee	21.82%	17.20%		24.11%	18.07%		18.77%	21.51%	
Average fee (annual)	2.59%	2.02%		2.94%	2.15%		2.64%	1.88%	
Average # of stocks	236	231		268	259		226	219	
Panel B: Statistics for monthly abnormal performance for subsets of strategies excluding stocks with high borrow fees									
Average return	0.03%	0.08%	0.05%	0.00%	0.01%	0.02%	-0.06%	-0.04%	0.02%
t-statistic (panel adj.)	[0.46]	[1.58]	[0.99]	[-0.01]	[0.35]	[0.32]	[-0.74]	[-0.79]	[0.15]
t-statistic (naive)	1.41	3.66	1.66	-0.02	0.49	0.54	-2.00	-2.39	0.44
Average # of stocks	185	191		203	212		184	172	
Panel C: Statistics for monthly abnormal performance for subsets of strategies after adjustment for borrow fees									
Average return	0.01%	0.01%	0.00%	-0.01%	-0.05%	-0.04%	-0.07%	-0.12%	-0.06%
t-statistic (panel adj.)	[0.19]	[0.22]	[-0.01]	[-0.07]	[-0.78]	[-0.48]	[-0.69]	[-2.36]	[-0.58]
t-statistic (naive)	0.73	0.69	-0.02	-0.24	-1.91	-0.85	-2.19	-6.25	-1.43

Table 10

Statistics for abnormal performance across portfolios formed for interesting subsets of strategies

This table presents the average, across strategies, of the abnormal monthly performance for equal-weighted portfolios relative to the stocks without high borrowing fees in each associated DGTW benchmark portfolio. The sample includes the common stocks in CRSP on a given date t that match to an indicative borrowing fee in Markit, subject to the stock filters in Section 2. Stocks are sorted into deciles for each strategy using a particular signal on trading date t and held in portfolios from the close of trading date t+1 until the close of trading date t+22. The sample period is July 2006 to December 2020. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Strategy Subset	Sample End < 2006			t-statistic > 5			JF, JFE, RFS		
Portfolio	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff	1 Low	10 High	10-1 Diff
Panel A: Statistics for monthly abnormal performance for subsets of strategies without adjustment for borrow fees									
Average return	-0.23%	-0.11%	0.12%	-0.28%	-0.10%	0.19%	-0.26%	-0.09%	0.18%
t-statistic (panel adj.)	[-2.71]	[-2.15]	[2.15]	[-3.33]	[-1.56]	[2.99]	[-3.01]	[-1.59]	[2.89]
t-statistic (naive)	-12.58	-7.06	4.91	-8.30	-4.39	3.92	-10.92	-4.36	5.41
Percentage high fee	21.99%	18.88%		20.14%	19.44%		22.56%	19.33%	
Average fee (annual)	2.74%	2.07%		2.60%	2.27%		2.81%	2.08%	
Average # of stocks	247	239		255	248		239	230	
Panel B: Statistics for monthly abnormal performance for subsets of strategies excluding stocks with high borrow fees									
Average return	0.01%	0.02%	0.01%	-0.02%	0.05%	0.07%	-0.01%	0.04%	0.06%
t-statistic (panel adj.)	[0.17]	[0.55]	[0.22]	[-0.22]	[1.00]	[1.18]	[-0.22]	[1.18]	[1.17]
t-statistic (naive)	0.74	1.22	0.49	-0.52	1.67	1.47	-0.80	2.19	2.16
Average # of stocks	192	194		204	200		185	185	
Panel C: Statistics for monthly abnormal performance for subsets of strategies after adjustment for borrow fees									
Average return	0.00%	-0.05%	-0.05%	-0.06%	-0.04%	0.04%	-0.02%	-0.03%	0.00%
t-statistic (panel adj.)	[0.00]	[-0.98]	[-0.85]	[-0.72]	[-0.48]	[0.57]	[-0.26]	[-0.43]	[0.05]
t-statistic (naive)	0.02	-3.28	-2.07	-1.98	-1.42	0.76	-1.07	-1.32	-0.02