Finbar O'Brien
May 25th, 2024

Cheap-Minus-Expensive-to-Short Factor Study

Broad Overview:

Short rebate fees have been extensively covered in financial literature, primarily investigating the value of utilizing these fees in a factor based asset pricing model, and the feasibility of executing a rebate fee Long-Short strategy. Conflicting results arise in these studies, and this report is a condensed summarization of several impactful papers on this topic, presenting a broad view of opinions. The primary paper reviewed is *The Shorting Premium and Asset Pricing Anomalies*, which starts off this discussion. We later review a more dynamic aspect of short selling by measuring shorting risk, and investigate this measure's relationship to the cross section of stock returns.

The Shorting Premium and Asset Pricing Anomalies

Overview:

Short rebate fees have the potential to be a strong predictor of stock returns, gross and net of fees. The cheap-minus-expensive-to-short(CME) portfolio has documented monthly returns of 1.43% gross, .91% net, and a 1.53% Fama-French 4 factor(FF4) alpha. Short rebate fees have significant interaction with several well documented asset pricing anomalies, including value-growth, momentum, idiosyncratic volatility, composite equity issuance, financial distress, max return, net stock issuance, and gross profitability. These anomalies are insignificant within the 80% of stocks with low short rebate fees, but are heavily amplified among stocks with high shorting fees.

Initial Results/Methodology:

Shorting fees predictability on the cross section of stock returns is evaluated by sorting stocks into deciles, evaluating the individual decile returns, and decomposing their corresponding Long-Short portfolios. The top 8 deciles have relatively small short fees(averaging less than 30 bps per annum), the 9th decile has moderate short fees(averaging 75 bps per annum), and the 10th decile is highly expensive to short, with an average fee of 568 per annum. The 10th decile is also split in halves 10a and 10b, with respective fees of 228 and 908 per annum.

Initial analysis of these groupings show the following:

1) Monthly return on the first 8 deciles is positive and flat, ranging from .74% to .86%.
2) Returns drop significantly among the remaining deciles, at .53 for the 9th decile, and -.68 for the 10th.

Following from this information, the CME portfolio, a portfolio long in the first decile(cheapest to short) and short in the 10th decile(most expensive to short), generates an impressive monthly return of 1.43%, while maintaining statistical significance(t-stat 4.99). Additionally, this return cannot be explained by exposure to the conventional Fama French Factors, as its FF4 alpha is 1.53%. This return is amplified when examining the highest short fee section of the 10th decile, with the cheap minus 10b portfolio generating average monthly returns of 2.14% per month, and a 2.28% alpha. Even after accounting for shorting fees the portfolio's return is significant, at .91% net return per month for the CME, and 1.28% net return per month for the Cheap Minus 10b portfolio.

Table 2: **Cross-section of Returns by Shorting Fee**

At the end of each month from January 2004 to December 2013 we sort stocks into deciles by their shorting fee. Only stocks above the tenth percentile of both market capitalization and share price are included. The table reports equal-weighted averages of the monthly decile portfolio returns and stock characteristics. Decile 1 contains the cheapest-to-short stocks, while decile 10 contains the most expensive-to-short stocks. Fee is the annualized short fee in basis points; *mktcap* is market capitalization; B/M is the book-to-market ratio; *mom* is the average return over the previous twelve months; *ivol* is the idiosyncratic volatility; *cei* is composite equity issuance; *distress* is financial distress. *Gross Ret* is the (usual) raw return without accounting for shorting fees; *Net Ret* is the return net of shorting fees. $FF4\,\alpha$ is the Fama-French 4-factor alpha. Returns are monthly and in percent. Panel B further splits the stocks in decile 10 by their shorting fee.

Fee Decile	No. Stocks	*Fee* (*bps*)	SIR_{IO} (%)	*mktcap* ($ *bil*)	B/M	*mom* (%)	*ivol* (%)	*cei*	*distress*	*maxret* (%)	*nsi*	*Gross Ret* (%)	*Net Ret* (%)	$FF4\,\alpha$ (%)
Panel A: Portfolio Characteristics and Returns by Decile														
1 (Cheap)	332	2	4.5	16.05	0.62	9.91	1.65	0.04	-8.35	4.63	0.02	0.98	0.99	0.11
2	332	8	5.9	6.50	0.64	10.18	1.82	0.06	-8.37	5.08	0.02	1.05	1.06	0.15
3	333	10	6.6	3.69	0.64	9.90	1.92	0.08	-8.33	5.30	0.03	1.10	1.11	0.16
4	332	12	6.5	2.34	0.66	9.91	2.01	0.09	-8.33	5.52	0.03	1.03	1.05	0.11
5	332	13	6.3	1.99	0.69	9.68	2.10	0.09	-8.25	5.71	0.03	1.13	1.14	0.17
6	333	15	6.2	1.81	0.72	9.12	2.21	0.09	-8.26	5.93	0.03	1.10	1.12	0.18
7	333	18	6.9	2.56	0.73	10.07	2.26	0.10	-8.22	6.11	0.04	1.20	1.22	0.25
8	332	29	8.9	2.92	0.72	10.47	2.41	0.14	-8.05	6.44	0.05	1.11	1.13	0.16
9	333	71	12.5	3.11	0.69	10.34	2.67	0.21	-7.78	6.98	0.07	0.83	0.89	-0.10
10 (Expensive)	332	696	26.5	1.22	0.66	12.63	3.41	0.44	-3.24	8.76	0.13	-0.34	0.21	-1.33
$1-10$ Return												1.31	0.78	1.44
(t-stat)												(5.00)	(3.01)	(6.90)
Panel B: Highest Fee Decile														
10*a* (Expensive)	166	223	18.5	1.56	0.68	10.46	3.11	0.33	-7.48	8.00	0.10	0.32	0.49	-0.63
10*b* (Expensive)	166	1172	34.5	0.88	0.64	14.75	3.72	0.57	1.16	9.52	0.15	-0.99	-0.08	-2.02
$1-10b$ Return												1.97	1.06	2.14
(t-stat)												(5.95)	(3.27)	(7.87)

Table 3: **Summary Statistics for the CME factor**

Summary statistics for the monthly return of the CME (cheap-minus-expensive) factor. Panel A reports moments of the CME return. Panel B gives the correlation matrix for the return of the CME portfolio and the four Fama-French factors, $MKTRF$, SMB, HML, and UMD. The sample is January 2004 to October 2012.

Panel A: Moments					
N	Mean(%)	Std. Dev.(%)	Skewness	Kurtosis	AC(1)
108	1.43	2.94	-0.49	1.89	0.27
Panel B: Correlations					
	CME	$MKTRF$	SMB	HML	UMD
CME	1.00	-0.38	-0.49	-0.31	0.50
$MKTRF$		1.00	0.48	0.33	-0.35
SMB			1.00	0.19	-0.10
HML				1.00	-0.32
UMD					1.00

Relationship with Asset pricing Anomalies:

This section analyzes the relationship between stock short fees and various cross section pricing anomalies. The goal is to evaluate the relevance of adding the CME factor to the existing FF4 model, determining if it provides a more accurate prediction of asset returns. The anomalies examined are value-growth, momentum, idiosyncratic volatility, composite equity issuance, financial distress, max return, net stock issuance, and gross profitability.

Method 1: Evaluating Unconditional Returns
In this section stocks are grouped into deciles based on the 8 pricing anomalies mentioned above, with the 1st decile being the long end, and the 10th decile being the short end. Short fees have no impact on decile grouping.

With the exception of momentum, each anomaly displays significant net and gross returns over the sample period. When incorporating for the 4 Fama French Factors, the alphas for each anomaly is high, with the majority remaining well over .70% per month. Therefore, the risk factors in the FF4 model are insufficient to explain the large returns these anomalies present. However, when incorporating the CME return as an additional factor, these alphas all experience large decreases. With the exception of value-growth, all FF4 + CME anomaly alphas become insignificant. This reinforces the potency of CME as a potential factor, as it provides great increases in model accuracy when supplementing the existing FF4 model. Further support for this is illustrated by the density of high short fees among the 10th decile for each anomaly. The stocks being shorted based upon each anomaly grouping(the 10th decile) have

short fees well above the average, giving greater conviction for the CME factor's ability to capture the alpha from those pricing anomalies.

Table 4: **Anomaly Returns and Shorting Fees**

The table reports the returns and shorting fees by decile for eight anomalies. For each anomaly, we sort stocks into deciles so that decile 1 is the long leg of the anomaly strategy and decile 10 is the short leg. The upper part of Panel A reports the average monthly returns for each anomaly decile. The lower part reports the average return on the long-short portfolio ("L-S"), which is long the stocks in decile 1 and short the stocks in decile 10, its FF4 alpha, and its FF4 + CME model alpha. Panel B reports the average annualized shorting fee in basis points for the stocks in each anomaly decile. The anomalies are: value-growth (B/M), momentum (mom), idiosyncratic volatility ($ivol$), composite equity issuance (cei), financial distress ($distress$), max return ($maxret$), net share issuance (nsi), and gross profitability ($gprof$). The sample is January 2004 to December 2013.

Anomaly	Anomalies							
Rank	B/M	mom	$ivol$	cei	$distress$	$maxret$	nsi	$gprof$
Panel A: Anomaly Strategy Returns (%)								
1 (Long)	1.15	1.15	0.92	0.99	1.09	0.93	0.95	1.24
2	1.03	0.94	1.06	0.93	1.08	1.01	0.94	1.09
3	0.96	0.94	1.03	1.08	1.08	1.09	0.91	1.13
4	1.05	1.05	0.95	1.09	1.07	1.06	0.92	1.11
5	0.87	0.97	1.06	1.09	1.13	1.08	1.13	1.18
6	1.03	1.01	1.10	1.24	1.11	0.97	1.12	1.03
7	0.91	1.07	1.00	1.07	1.14	0.96	1.11	0.97
8	0.85	1.01	1.05	1.08	1.16	0.89	1.05	0.82
9	0.75	0.92	0.81	0.86	1.00	0.81	0.75	0.41
10 (Short)	0.64	1.00	0.22	0.48	0.47	0.39	0.40	0.28
L-S Return	0.51	0.15	0.70	0.51	0.62	0.54	0.55	0.96
(t-stat)	(1.52)	(0.25)	(1.49)	(1.92)	(1.19)	(1.20)	(2.26)	(3.46)
L-S Net Fee Return	0.44	0.07	0.47	0.40	0.44	0.37	0.41	0.84
(t-stat)	(1.29)	(0.11)	(1.00)	(1.51)	(0.84)	(0.83)	(1.69)	(3.05)
L-S FF4 α	0.45	0.19	1.20	0.78	0.98	1.05	0.70	1.07
(t-stat)	(2.24)	(0.64)	(4.30)	(3.42)	(3.87)	(4.09)	(3.34)	(3.55)
L-S FF4+CME α	0.65	0.16	0.08	0.14	0.48	0.25	0.03	0.40
(t-stat)	(2.68)	(0.44)	(0.29)	(0.56)	(1.61)	(0.89)	(0.13)	(1.14)
Panel B: Average Annual Shorting Fee (bps)								
1 (Long)	92	127	26	50	51	38	48	93
2	60	63	27	51	35	39	46	60
3	58	54	32	41	37	44	68	54
4	57	52	40	43	41	52	84	58
5	57	49	50	40	46	60	65	65
6	63	54	61	44	51	67	62	57
7	67	61	80	44	68	86	55	77
8	78	75	108	60	85	108	70	79
9	97	105	160	94	131	147	139	92
10 (Short)	181	212	290	182	272	234	213	233

Method 2: Evaluating Returns Conditional on Shorting Fees

In this section, stocks are grouped into 4 buckets based on their shorting fees. The top 8 shorting fee deciles(same ranking as in the Initial Results Section) are grouped together in a Low Fee bucket F0, and the remaining deciles are sorted into 3 equal sized buckets F1, F2, and F3. These buckets are in ascending order based on fee, with F1 and F2 having intermediate fees, and F3 having high average shorting fees. Long-Short portfolios for each pricing anomaly are constructed for each bucket.

In the F0 bucket, with the minor exception of Gross Profitability, all remaining anomaly returns are small(below .25% per month). This is an important contrast to the results in the Unconditional Return grouping, where all but 1 anomaly had significant returns. This shows us that in 80% of our stock data, which makes up an even greater representation of market cap, this subgroup demonstrates very weak anomaly returns.

Additionally, our anomaly returns have increasing values as we go through the higher short fee groupings. In the F3 group, almost all anomaly returns are large and statistically significant, having great spreads between the F3 and F0 returns for each anomaly.

A similar pattern emerges when evaluating the FF4 alphas for each anomaly and F group. Alphas in the F0 group are far lower than in the Unconditional Return grouping, and alphas increase for each anomaly as we move through the higher short fee groupings. In the F2 group, all alphas are significantly significant or close to it. In the F3 group alphas are the highest, and all but momentum are large and statistically significant.

A modification of the FF4 is made, using the CME portfolio return as a proxy for shorting risk. This new model has notable results. For the F0 bucket, there is little difference with the new model and the FF4 model, as the alpha values in the F0 bucket under the FF4 model were already insignificant. In the F1 and F2 buckets, all alpha values for the new model are also insignificant, which is a large improvement from the FF4 model in the previous results.

In the F3 bucket, the results are the most drastic. All alphas except value-growth are reduced to insignificance, demonstrating the far superior predicting power of the FF4 + CME model, compared to the FF4 model.

In summary of this entire section, the FF4 + CME factor provides a far more accurate prediction of anomaly returns compared to the FF4 model, showing a notable relationship between a stock's short fees

and anomaly return values.

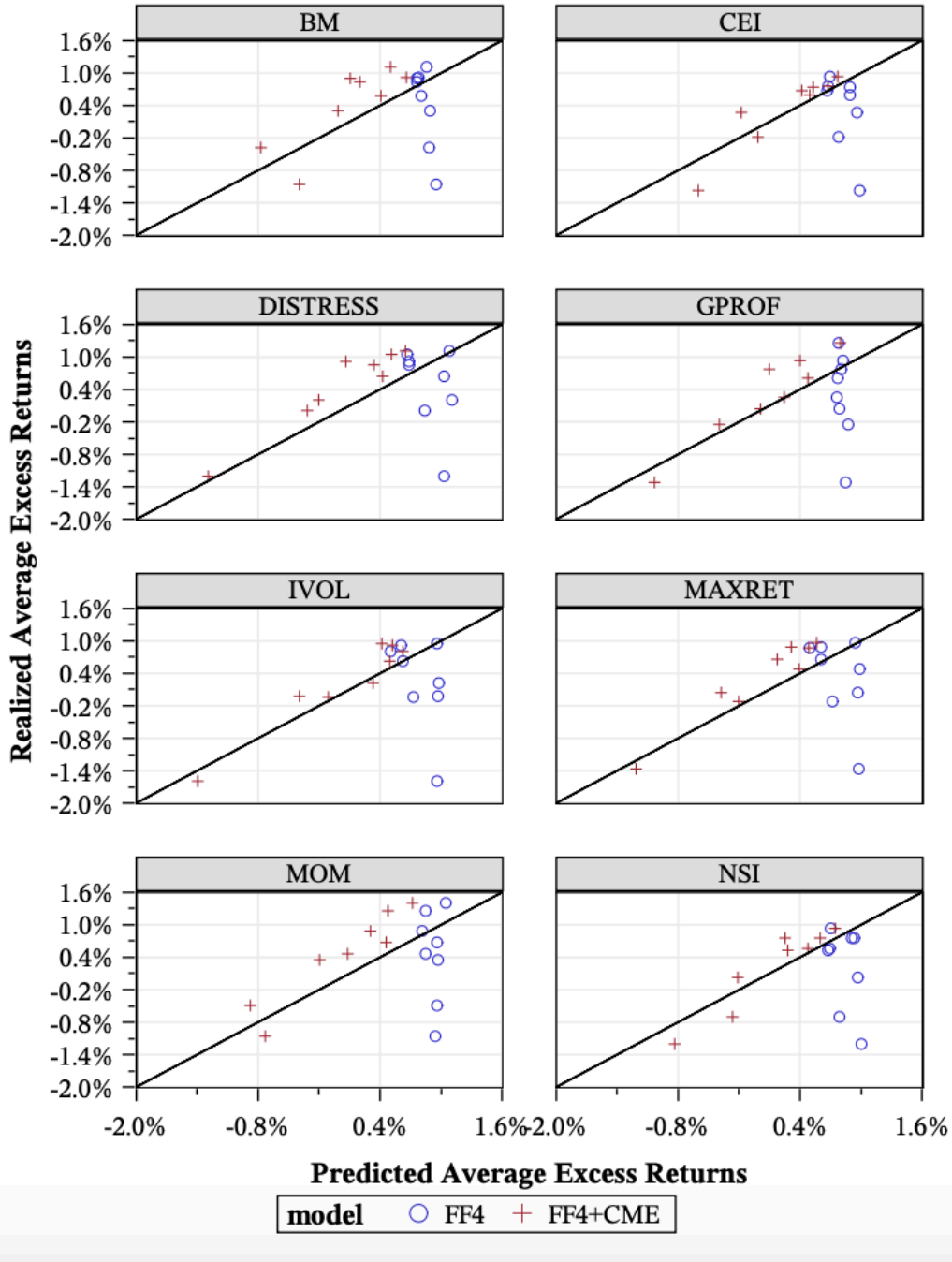
Table 5: **Anomaly Returns Conditional on Shorting Fees**

We divide the short-fee deciles from Table 2 into four buckets. Deciles 1-8, the low-fee stocks, are placed into the $F0$ bucket. Deciles 9 and 10, the intermediate- and high-fee stocks, are divided into three equal-sized buckets, $F1$ to $F3$, based on shorting fee, with $F3$ containing the highest fee stocks. We then sort the stocks within each bucket into portfolios based on the anomaly characteristic and let the bucket's long-short anomaly return be given by the difference between the returns of the extreme portfolios. Due to the larger number of stocks in the $F0$ bucket, we sort it into deciles based on the anomaly characteristic, while $F1$ to $F3$ are sorted into terciles. Panel A reports the monthly anomaly long-short returns for each anomaly and bucket. Panel B reports the corresponding FF4 alphas. Panel C reports the FF4 + CME alphas. The sample period is January 2004 to December 2013.

Fee	Anomalies							
Bucket	B/M	mom	$ivol$	cei	$distress$	$maxret$	nsi	$gprof$
Panel A: Monthly Returns (%)								
$F0$	0.19	-0.15	-0.14	0.19	-0.07	-0.10	0.17	0.65
(t-stat)	(0.60)	(0.25)	(0.32)	(0.87)	(0.13)	(0.23)	(0.82)	(2.51)
$F1$	0.26	0.22	0.69	0.17	0.22	0.41	-0.21	0.68
(t-stat)	(0.79)	(0.47)	(1.98)	(0.49)	(0.45)	(1.09)	(0.64)	(2.17)
$F2$	0.59	0.11	0.65	0.41	0.71	0.62	0.50	0.74
(t-stat)	(1.56)	(0.20)	(1.61)	(0.98)	(1.26)	(1.53)	(1.46)	(2.36)
$F3$	0.67	0.56	1.56	1.00	1.22	1.26	0.49	1.06
(t-stat)	(1.48)	(1.09)	(3.40)	(1.88)	(2.03)	(2.73)	(1.28)	(2.63)
$F3 - F0$	0.48	0.71	1.70	0.80	1.29	1.36	0.33	0.41
(t-stat)	(1.33)	(1.13)	(3.62)	(1.74)	(2.46)	(3.31)	(1.00)	(1.26)
Panel B: Fama-French 4-Factor Alphas (%)								
$F0$	0.11	0.05	0.32	0.40	0.34	0.35	0.38	0.64
(t-stat)	(0.73)	(0.18)	(1.42)	(2.38)	(1.50)	(1.69)	(2.32)	(2.63)
$F1$	0.30	0.37	1.06	0.38	0.56	0.79	0.03	0.62
(t-stat)	(1.09)	(1.14)	(4.06)	(1.24)	(1.96)	(2.81)	(0.11)	(2.04)
$F2$	0.72	0.22	1.00	0.71	1.13	0.98	0.79	0.72
(t-stat)	(2.32)	(0.58)	(3.23)	(2.01)	(3.07)	(3.35)	(2.90)	(2.26)
$F3$	0.74	0.54	1.79	1.21	1.41	1.51	0.70	1.03
(t-stat)	(2.12)	(1.12)	(4.10)	(2.42)	(2.62)	(3.54)	(2.12)	(2.56)
$F3 - F0$	0.63	0.49	1.48	0.81	1.07	1.17	0.32	0.40
(t-stat)	(1.80)	(0.90)	(3.60)	(1.74)	(2.13)	(3.06)	(1.07)	(1.19)
Panel C: Fama-French 4-Factor + CME Alphas (%)								
$F0$	0.30	0.18	-0.18	0.11	0.19	0.09	0.10	0.29
(t-stat)	(1.70)	(0.50)	(0.72)	(0.56)	(0.72)	(0.38)	(0.53)	(1.04)
$F1$	0.48	0.48	0.71	0.12	0.49	0.56	-0.32	0.42
(t-stat)	(1.48)	(1.26)	(2.31)	(0.34)	(1.45)	(1.68)	(0.99)	(1.16)
$F2$	0.48	-0.21	-0.07	-0.07	0.59	0.17	0.08	0.69
(t-stat)	(1.30)	(0.46)	(0.22)	(0.17)	(1.37)	(0.52)	(0.26)	(1.81)
$F3$	1.10	0.69	0.23	0.67	0.12	0.20	-0.01	0.37
(t-stat)	(2.66)	(1.19)	(0.52)	(1.14)	(0.20)	(0.44)	(0.01)	(0.79)
$F3 - F0$	0.80	0.52	0.42	0.57	-0.08	0.11	-0.11	0.08
(t-stat)	(1.90)	(0.80)	(0.92)	(1.02)	(0.14)	(0.26)	(0.30)	(0.19)

Figure 3: Realized versus Predicted Average Excess Returns

For each anomaly, the figure plots the realized average monthly excess return versus the predicted average monthly excess return for each of the extreme characteristic-sorted portfolios in each of the short-fee sorted buckets of Table 5. The blue circles correspond to the Fama-French four-factor (FF4) model, while the red pluses correspond to the FF4 + CME model. The sample period is January 2004 to December 2013.



Size and Liquidity:

A potential rebuttal to the validity of the CME factor can be derived from the average firm size in the high short fee groupings. In the 10th decile, the average short fee is around $1.3 billion, making them typically small mid-cap stocks. Similarly, the lower liquidity levels of such smaller stocks could also be important, showing that the CME factor is driven by firm size or liquidity, not exposure to short fees. This hypothesis is tested, and refuted.

Stocks with the same size and liquidity as those in the high fee buckets are selected from the low fee bucket, and portfolios for each anomaly are constructed.

The results of these portfolios are far different from those constructed in the high short fee buckets, where the new portfolios have far lower alphas than their counterparts, demonstrating that firm size and liquidity do not drive the CME factor.

Long Sample Analysis:

Due to sample size constraints, a proxy for short fees is constructed using short interest as a fraction of institutional owned shares. This proxy dates from 1980 to 2012, and its results largely mimic the results of the values with the exact short fee information.

Conclusion:

Shorting fees have strong prediction power on the cross section of stock returns. A portfolio long in the cheapest to short decile and short in the most expensive to short decile garners an 1.43% gross monthly return with a 1.53% FF4 alpha. Shorting fees incorporation into the FF4 model also provides significant increases in predicting the returns of several documented pricing anomalies, compared to a FF4 model.

The Information Value of Stock Lending Fees: Are Lenders Price Takers?

Overview:
We find that higher stock lending fees predict significantly lower future returns after controlling for shorting demand for U.S. stocks during the period 2007–2010. These results suggest that active institutional investors on the supply side play an important role in the return predictability of fees and they not only respond to demand but also price in additional information around earnings news announcements. Overall, we find evidence that stock lenders are informed and, together with short sellers, contribute to the price discovery process.

Hypothesis Examined:
Hypothesis 1 (H1): Lending fees predict future stock returns after controlling for the current shorting demand, reflecting new information from the supply side.

Hypothesis 1A (H1A): Lending fees do not predict future stock returns after controlling for the current shorting demand.

Hypothesis 2 (H2): Lending fees in the presence of active institutional investors capture new information such as future shorting demand and negative earnings surprise.

Hypothesis 2A (H2A): The presence of active institutional investors has no significant role in explaining the new information captured in lending fees

Results:
We find a statistically significant negative relation between lending fees and future returns. Stocks with 100% higher lending fees earn 17 bps lower future returns over the next 20 days, after accounting for other key stock characteristics. This finding provides evidence in support of Hypothesis 1. We also find that the negative relation between lending fees and future returns is robust after controlling for shorting demand, providing support for the idea that lending fees have information value beyond shorting demand and rejecting Hypothesis 1A.

We find that lagged lending fee is positively related to future shorting demand, and lagged shorting demand is positively related to future lending fees. Once we control for institutional ownership, lagged shorting demand is significantly and negatively related to future lending fees, whereas institutional ownership is positively and significantly related to future lending fees. Essentially, institutional ownership in conjunction with demand plays a role in establishing fees. More importantly, the results provide support for our Hypothesis 2 that fees contain information in addition to short sellers' private information that is captured in demand. This result is robust even after taking into account the co-integration of lending fees and shorting demand.

Conclusion:
In examining the information content in U.S. stock lending fees from 2007 to 2010, we find that fees predict future stock returns even after controlling for past and current demand and supply. We link this return predictability to active institutional investor participation in the lending market and show that

active lenders price in new and expected shorting demand prior to negative news announcements. This suggests that active and informed institutional lenders strategically raise fees when they are unable to trade on their private information before public announcements. We conclude that lending fees are closely related to future anticipated shorting demand by informed lenders, especially around news events when active institutional lenders may have an information advantage. Overall, our findings suggest that in recent years in the modernized stock lending market, lenders pay significant attention to their lending desks and the management of lending fees in response to borrowing demand and their own private information. We show that understanding stock lenders' behavior is not only important for short-sale constraint implications but also for price discovery, especially around corporate news events.

Anomalies and their Short Sale Cost

Overview:

This paper focuses on the ability to capture price abnormalities based on stock short fees, and comes to the same initial conclusion as "The Shorting Premium and Asset Pricing Anomalies", in that stock short rebate fees do have a strong relationship with pricing anomalies. However, this paper concludes that while most portfolios constructed based upon pricing anomalies can generate significant gross returns, after considering short fees these returns are insignificant or even negative. It further concludes that most returns in these pricing anomaly portfolios are generated by high short fee stocks, and that removing these high fee stocks from those portfolios reduces their returns to insignificant amounts. Its data sample ranges from July 2006 to December 2020.

Results:

In this section, portfolios are constructed for the most common anomalies used in factor models. It finds that while the Momentum factor portfolio has strong gross returns of .21% per month, after accounting for borrowing fees this return drops to -.01% per month. Profitability has similar results, generating .62% gross monthly returns but only .19% net monthly returns. While the .19% net monthly returns of the Profitability factor are significant, they are only ~30% of the magnitude of the gross returns, as the short fees remove most return potential. Generally, 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.

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

In the same data sample, Book-to-Market portfolios are not associated with any risk premium, generating -.02% gross monthly returns and -.23% net of fee returns.

Portfolios based on the Investment factor have different results, with gross monthly returns of .47% per month, while maintaining .30% net of fee returns. Also, when eliminating high fee stocks from this portfolio, monthly returns remain at .27%, signifying that high fee stocks are not the only drivers of the Investment Factor return.

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

Conclusion:

Cross sectional asset pricing anomalies exist, and they have a strong relationship with short rebate fees. However, these shorting costs limit such arbitrage opportunities, making exploiting these pricing anomalies unfeasible. We note that these conclusions do not address the market inefficiency of individuals who do not liquidate their positions in the high fee stocks, given their track record of abnormally low returns.

Short-Selling Risk

Overview:
Short sellers face unique risks, such as the risk that stock loans become expensive and the risk that stock loans are recalled. We show that short-selling risk affects prices among the cross-section of stocks. Stocks with more short-selling risk have lower returns, less price efficiency, and less short selling.

Short Selling Risk Explained:
We show that the dynamic risks associated with short selling result in significant limits to arbitrage. In particular, stocks with more short-selling risk have lower future returns, less price efficiency, and less short selling. Consider two stocks – A and B – that are identical in every way except for their short selling risk. Specifically, stock A and stock B have identical fundamentals as well as identical loan fees and number of shares available today, but future loan fees and share availability are more uncertain for stock B than for stock A; that is, there is considerable risk that future loan fees for stock B will be higher and future shares of stock B will be unavailable for borrowing. Since higher loan fees reduce the profits from short selling and limited share availability can force short sellers to close their position before the arbitrage is complete, a short seller would prefer to short stock A because it has lower short-selling risk. In this paper, we present the first evidence that uncertainty regarding future short sale constraints is a significant risk, and we show that this risk affects trading and asset prices.

Short Risk Measure:
As noted by D'Avolio (2002a), "…a short seller is concerned not only with the level of fees, but also with fee variance." Accordingly, we focus on the variance of lending fees as our natural proxy for short selling risk. To get the best possible measure of this proxy, we project the variance of lending fees on several equity lending market characteristics and firm characteristics. We then use fitted values from this forecasting model (ShortRisk) as our measure of short-selling risk. Using this measure, we examine whether short-selling risk affects arbitrage activity. If short-selling risk limits the ability of arbitrageurs to trade and correct mispricing, then it should be related to returns, market efficiency, and short-selling activity.

Forecasting Model of Future Short-Selling Risk

This table presents estimates from an OLS panel regression predicting short-selling risk using the model

$$Var(LoanFees_{i,t+1}) = \alpha + \beta_1 VarNewFee_{i,t} + +\beta_2 VarUtilization_{i,t} + \beta_3 TailNewFee_{i,t} + \beta_4 TailUtilization_{i,t} + FE_i + FirmCharacteristics + \varepsilon_{i,t+1},$$

where *VarNewFee* is the variance of loan fees for new equity loans, *VarUtilization* is the natural log of the variance of the ratio of equity loan supply to loan demand (i.e., utilization), and *TailNewFee* and *TailUtilization* are the 99th percentile of a normal distribution using the trailing annual mean and variance of loan fee and utilization, respectively. FE_i indicates firm fixed effects and *FirmCharacteristics* is a vector of time-varying firm characteristics that include the lagged value of fee risk, the natural log of one plus the number of shares that failed to deliver (as a percentage of shares outstanding), the natural log of trading volume (as a percentage of shares outstanding), the natural log of the bid-ask spread (as a fraction of the closing mid-price), the natural log of market capitalization, the natural log of return volatility (calculated as the standard deviation of daily stock returns each month), an indicator variable for stocks paying a dividend this month, an indicator variable for stocks that had an IPO within the previous 90 days, and an indicator variable for stocks with listed options. *t*-statistics, calculated using standard errors clustered by firm and date, are shown below the estimates in italics. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Explanatory Variable	Dependent Variable: Var($LoanFee_{t+1}$)		
	(1)	(2)	(3)
VarNewFee	0.7680***	0.7316***	0.0611***
	(24.49)	*(27.27)*	*(5.42)*
VarUtilization	0.1348***	0.1242***	0.0151***
	(9.50)	*(9.88)*	*(3.39)*
TailNewFee	0.1266***	0.1244***	0.0050*
	(7.24)	*(7.49)*	*(1.69)*
TailUtilization	-0.0929	-0.0568	-0.0160
	(-1.60)	*(-1.06)*	*(-1.28)*
Qty. Failures		0.0061**	0.0094***
		(2.25)	*(4.70)*
Volume		0.2858***	0.0813***
		(7.12)	*(6.43)*
Bid-Ask		0.1408***	0.0330***
		(7.06)	*(2.89)*
Market Cap		-0.6539***	0.0330
		(-6.59)	*(1.22)*
Var($LoanFee_t$)			0.9100***
			(65.42)
Volatility			0.0830***
			(2.78)
Dividend Indicator			0.0139
			(1.10)
IPO Indicator			0.1533**
			(2.06)
Option Indicator			-0.0434**
			(-2.47)
N	164,811	162,663	162,657
R^2	0.82	0.83	0.97

Results:

We find a strong relation between short-selling risk and future returns. Stocks in the low short-selling risk grouping(Quintile) earn monthly returns of 0.58% per month while stocks in the high short-selling risk

grouping earn monthly returns of -0.49% per month. Thus, a long-short portfolio formed by buying stocks with low short risk and shorting stocks with high short risk earns 1.08% per month. This long-short portfolios consistently earn large returns, with a five-factor alpha of 0.80% per month. We also find that the returns to short selling are largest when arbitrage is riskiest.

Table III

Monthly Portfolio Returns from Conditioning on Short-Selling Risk

This table presents monthly returns (in percent) for portfolios calculated over the period July 2006 through December 2011. In Panel A we examine equal-weighted portfolios formed by first sorting into quintiles using the previous month's short interest and then sorting into quintiles using the previous month's short-selling risk. In Panel B we examine value-weighted portfolios formed by first sorting into quintiles using the previous month's market capitalization as in Fama and French (2008) and then sorting into quintiles using the previous month's short-selling risk. All portfolios are held for one month. The last column in each panel (Long-Short) shows returns to a long-short portfolio where firms with short-selling risk in the lowest (highest) quintile are assigned to the long (short) portfolio. *t*-statistics are below the estimates in italics. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: ShortRisk and Short Interest (EW Portfolios)

	Short Risk 1	Short Risk 2	Short Risk 3	Short Risk 4	Short Risk 5	Long-Short
All Firms	0.58***	0.50***	0.27***	0.26***	-0.49***	1.08***
	(8.23)	*(7.05)*	*(3.84)*	*(3.61)*	*(-5.61)*	*(9.55)*
Short Interest:						
1 (Low)	0.21	0.55***	0.46***	-0.16	-0.42**	0.63**
	(1.25)	*(3.38)*	*(2.90)*	*(-0.94)*	*(-2.23)*	*(2.49)*
2	0.75***	0.81***	0.35**	0.31**	-0.44**	1.19***
	(4.79)	*(5.25)*	*(2.40)*	*(2.11)*	*(-2.50)*	*(5.04)*
3	0.82***	0.74***	0.20	0.38**	-0.30	1.12***
	(5.39)	*(4.96)*	*(1.30)*	*(2.51)*	*(-1.64)*	*(4.72)*
4	0.55***	0.32**	0.29*	0.26	-0.32	0.87***
	(3.60)	*(2.16)*	*(1.89)*	*(1.52)*	*(-1.62)*	*(3.47)*
5 (High)	0.30*	0.52***	0.19	0.09	-0.85***	1.15***
	(1.88)	*(3.25)*	*(1.13)*	*(0.45)*	*(-3.96)*	*(4.30)*

Panel B: ShortRisk and Firm Size (VW Portfolios)

	Short Risk 1	Short Risk 2	Short Risk 3	Short Risk 4	Short Risk 5	Long-Short
Size:						
Micro	-0.03	0.05	0.03	-0.51***	-1.07***	1.04***
(44% of sample)	*(-0.24)*	*(0.41)*	*(0.25)*	*(-4.05)*	*(-7.38)*	*(5.66)*
Small	0.52***	0.40***	0.37**	0.28**	-0.13	0.65***
(31% of sample)	*(4.23)*	*(3.32)*	*(2.93)*	*(2.04)*	*(-0.79)*	*(3.19)*
Big	0.18*	0.21**	0.14	0.33***	-0.06	0.24
(25% of sample)	*(1.74)*	*(2.13)*	*(1.42)*	*(3.64)*	*(-0.71)*	*(1.42)*

Conclusion

Overall, we find that short-selling risk is associated with decreased price efficiency and less short selling, especially for trades with longer holding periods. This evidence sheds light on two puzzles in the short-selling literature. Specifically, several papers have shown that high short interest predicts low future returns, which begs the question of why publicly available short interest data continue to have return predictability. Our results show that this puzzle is particularly strong among stocks with high short-selling risk, which suggests that dynamic short sale constraints may explain some of the puzzle. Moreover, the literature finds it surprising that investors do not short sell stocks in larger amounts. We find that short sellers trade less when short-selling risk is high, which suggests that dynamic short sale constraints help explain the low level of short selling. Taking the two puzzles together, the overall idea emerges; when short selling is risky, short sellers are less likely to trade and prices are too high.

Is There a Risk Premium in the Stock Lending Market? Evidence from Equity Options

Overview:
Recent research argues that uncertainty about future stock borrowing fees is an impediment to short-selling and this risk explains the performance of short strategies. One possible mechanism is that borrowing fee risk carries a risk premium. Since the present value of the uncertain borrowing fee is reflected in options prices, the difference between option-implied and realized fees estimates this premium. We find that the risk premium is small. Moreover, if the risk premium is substantial, then it should be reflected in the returns to short selling stock after adjusting for the stock borrowing fee. However, borrowing fee risk does not predict the fee adjusted returns.

Key Information:
This paper investigates the idea that the returns to short selling net of borrow fees should reflect a risk premium. For example, the typical net of fee return on stock positions exposed to short fee risk should be significantly higher than the net of fee return on a similar position not exposed to such short fee risk. Therefore, short fee risk should be a predictor of net return in short positions, and stock returns before adjusting for short fees should be predictable using short fee risk.

Key Results:
As expected, there is a strong univariate relationship between short fee risk(as measured by the volatility of the indicative borrowing fee during the previous 12 months) and subsequent stock returns. The predictive relation between short fee risk and the subsequent return is negative and highly significant.

The results for the net-of-fee returns are strikingly different from those for the unadjusted returns, and the results provide no evidence of any relation between short fee risk and the net-of-fee return. That is, we find no evidence of compensation for holding short positions exposed to short fee risk after taking into account the borrowing fees paid by short sellers to maintain the short positions.

Table 7

Stock return predictability using short fee risk and other characteristics

This table presents regressions that use the option-implied borrowing fee to predict the stock return from the close of trading date t+1 to the close of trading date t+22. The unit of observation is the combination of a stock and trading date for the optionable subset of common stocks in CRSP with market capitalization > $10 million and stock price > $5 that match to a valid put-call pair in Optionmetrics and an indicative borrowing fee in Markit. The computation of the option-implied borrowing fee is described in Section 2. For each option in a valid put-call pair, open interest is positive, the absolute delta is between 0.01 and 0.99, implied volatility is between 0.03 and 2, the bid is greater than 0.1, and the bid is less than the ask. In addition, the sum of the call and put bid-ask spreads divided by the stock price is ≤ 5%, the put moneyness, K/S, is ≤ 1.1, time to maturity is greater than 15 days and less than 90 days, and the sum of dividends paid during the remaining life of the option pair is less than 5% of the stock price. Short interest is the number of shares short from Markit divided by shares outstanding from CRSP. Short fee risk is the log of the variance of the daily indicative borrowing fee during the preceding 12 months. The log of market capitalization is from CRSP. Utilization is from Markit. In Column 2 and Column 6 the dependent variable is the stock return adjusted for the indicative borrowing fee. For these specifications, columns labeled with #, the cumulative indicative borrowing fee during the evaluation period for each stock is added to the return. The sample period is July 2006 to August 2015. The hard-to-borrow sample uses observations where the indicative fee is greater than 1%. The t-statistics are based on robust standard errors double clustered by stock and date. They are reported in brackets below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Stock returns for the next month (trading days t+2 through t+22)									
	All Observations					Hard-to-borrow (Indicative Fee > 1%)				
Model	1	2#	3	4	5#	6	7#	8	9	10#
Short fee risk	-0.0003***	0.0000	0.0000	0.0001	0.0001	-0.0027***	-0.0003	-0.0013	-0.0012	-0.0002
	[-4.3]	[-0.7]	[0.1]	[0.9]	[1.1]	[-3.8]	[-0.4]	[-1.6]	[-1.5]	[-1.2]
Implied borrowing fee			-0.0298***	-0.0290***	-0.0124**			-0.0405**	-0.0394**	0.0047
			[-4.1]	[-4.0]	[-2.2]			[-2.0]	[-2.0]	[1.0]
Indicative borrowing fee			-0.0604***	-0.0528***				-0.0157	-0.0130	
			[-3.9]	[-3.3]				[-0.7]	[-0.6]	
Short interest			-0.0331***	-0.0156	-0.0216*			-0.0072	-0.0015	-0.0033
			[-4.9]	[-1.4]	[-1.9]			[-0.4]	[-0.1]	[-0.7]
Market capitalization			-0.0009***	-0.0010***	-0.0011***			0.0008	0.0009	0.0002
			[-3.7]	[-4.2]	[-4.3]			[0.5]	[0.5]	[0.1]
Utilization				-0.0001**	0.0000				-0.0001	0.0000
				[-2.2]	[-1.2]				[-0.9]	[0.7]
Constant	0.0021***	0.0025***	0.0113***	0.0125***	0.0128***	0.0176**	0.0009	0.0084	0.0119	0.0020
	[4.9]	[6.0]	[4.9]	[5.4]	[5.5]	[2.3]	[0.1]	[0.9]	[1.2]	[0.8]
Number of Observations	3,094,181	2,895,169	3,094,160	3,094,138	2,895,157	209,585	188,522	209,582	209,567	188,519

Conclusion:

Conclusions from existing literature surmise that the returns to short selling net of the borrowing fees should reflect a premium to compensate short sellers for bearing short fee risk. This implies that the net-of-fee return to shorting should be predicted by short-fee risk. We find that it is not. In contrast, the option-implied borrowing fee predicts future stock returns even after controlling for other measures of short selling activity, consistent with its interpretation as a measure of the current and expected future costs of borrowing stock. However, there is a predictive relationship of short fees, and future stock returns.

Literature Conclusions

a) *The Shorting Premium and Asset Pricing Anomalies*
    i) Shorting fees have strong prediction power on the cross section of stock returns. A portfolio long in the cheapest to short decile and short in the most expensive to short decile garners an 1.43% gross monthly return with a 1.53% FF4 alpha. Shorting fees incorporation into the FF4 model also provides significant increases in predicting the returns of several documented pricing anomalies, compared to a FF4 model.
b) *Anomalies and their Short Sale Cost*
    i) Several cross sectional pricing anomalies exist, and they have a significant relationship with short fees. However, shorting costs tend to limit the feasibility of exploiting these anomalies, allowing short fee based portfolios to generate significant gross returns, but weak net of fee returns. With this in mind, this still does not explain the market inefficiency of individuals who continue to hold high short fee stocks, given their poor performance record.
c) *Is There a Risk Premium in the Stock Lending Market? Evidence from Equity Options.*
    i) Using both short fees and equity pricing options, a strong relationship between future stock returns and short fees/short fee risk is discovered. While gross fee return to shorting can be predicted by short fees and short fee risk, net of fee returns are not.
d) *Short Selling Risk*
    i) Overall, short-selling risk is associated with decreased price efficiency and less short selling, especially for trades with longer holding periods. Investigating the question of why publicly available short interest data continues to predict low future returns, this study suggests that dynamic short sale constraints may explain some of the puzzle, and the low level of short selling. Its general idea is: When short selling is risky, short sellers are less likely to trade and prices are too high.
e) *The Information Value of Stock Lending Fees: Are Lenders Price Takers?*
    i) In examining the information content in U.S. stock lending fees from 2007 to 2010, this study finds that fees predict future stock returns even after controlling for past and current demand and supply. It links this return predictability to active institutional investor participation in the lending market and shows that active lenders price in new and expected shorting demand prior to negative news announcements. This suggests that active and informed institutional lenders strategically raise fees when they are unable to trade on their private information before public announcements. It concludes that lending fees are closely related to future anticipated shorting demand by informed lenders, especially around news events when active institutional lenders may have an information advantage. Overall, it shows that understanding stock lenders' behavior is not only important for short-sale constraint implications but also for price discovery, especially around corporate news events.

Combined Conclusions:

The results from the literature come to a general consensus on one topic: Short Fees are a strong predictor of cross sectional pricing anomalies. This is robustly demonstrated in each paper, which supports a key idea in "*The Shorting Premium and Asset Pricing Anomalies"*, that the addition of the CME factor into the FF4 model has strong logical and statistical backing.

Although each study agrees on the relationship between short fees and pricing anomalies, they have unique theories on why this occurs. "*The Shorting Premium and Asset Pricing Anomalies"* ties this to the idea that shorting is concentrated in the portfolios of a narrow minority of market participants, and that this limited risk sharing brings a risk premium. "*Anomalies and their Short Sale Cost*" finds that high short fees prevent investors from exploiting price anomalies, allowing them to persist due to a lack of downward price pressure. "*Is There a Risk Premium in the Stock Lending Market? Evidence from Equity Options*" focuses on the risks associated with short selling, but it comes to essentially the same explanation as "*Anomalies and their Short Sale Cost*", in that investors are unlikely to short when such fees are high. "Short Selling Risk" also finds that when short selling risk is high(as is the case with high short fee stocks), investors are less likely to take short positions, allowing prices to remain inflated. "*The Information Value of Stock Lending Fees: Are Lenders Price Takers?*" takes a different perspective, linking short fees predictability on stock returns to active institutional participation in the lending market. It argues that active and informed lenders strategically raise fees when they cannot trade on private information prior to public news announcements, supported by their evidence that lending fees are closely related to future shorting demand, especially around news events when active institutional lenders may have an information advantage. Regardless of each studies' theories on why the relationship between short fees and pricing anomalies occurs, they all reach the same conclusion that short fees are a strong predictor of future returns.

However, there is an important difference of opinions on the feasibility of executing a Long Short strategy based upon short fees. "*The Shorting Premium and Asset Pricing Anomalies"* claims that such a portfolio has significant monthly gross(1.43%) and net(.91%) returns. "*Short Selling Risk*" may align with this conclusion, finding a 1.08% monthly return for a portfolio long on low short risk stocks and short on high risk stocks. However, it is not noted if this is gross or net of fees. Also, it invests based upon short risk, which is associated with short fee, but they are notably different. In contrast, "*Anomalies and their Short Sale Cost*", finds that while a long short CME portfolio does earn strong gross returns, its net of fee returns are insignificant. "*Is There a Risk Premium in the Stock Lending Market? Evidence from Equity Options*" aligns with this perspective as well. This strong difference in opinions makes it difficult to draw any certainty on whether a Long-Short rebate fee portfolio would generate excess returns. We will wait to see the results of our own backtest to determine any conclusion on this matter.

A key take away from these separate studies is that because short fees have such a strong predictive relationship with future returns, it has great potential for inclusion in an asset pricing model. The only paper listed that investigates the actual inclusion of the CME factor into a FF4 model is "*The Shorting Premium and Asset Pricing Anomalies",* which finds phenomenal results. While the other papers do not specifically investigate this in depth, their separate findings corroborate this claim.

Works Cited

Dmitriy Muravyev, et al. *Anomalies and Their Short Sale Costs*. 2022.

Drechsler, Itamar, and Freda) Song. "The Shorting Premium and Asset Pricing Anomalies." *Ssrn.com*, July 2014, deliverypdf.ssrn.com/delivery.php?ID=110099072074091027000079069093087070053078038028040067091040123059017006038081086010037009112126098030020031072046037123120094125106095072095116086098006084028085066000110073119011087064093116097&EXT=pdf&INDEX=TRUE. Accessed 25 May 2024.

Duong, et al. *The Information Value of Stock Lending Fees: Are Lenders Price Takers?*

Engelberg, Joseph, et al. "Short Selling Risk." *SSRN Electronic Journal*, 2013, https://doi.org/10.2139/ssrn.2312625. Accessed 17 June 2020.

Muravyev, Dmitriy, et al. "Is There a Risk Premium in the Stock Lending Market? Evidence from Equity Options." *SSRN Electronic Journal*, 2016, https://doi.org/10.2139/ssrn.2799315. Accessed 14 June 2020.