Quantitative Asset Management

Bernard Herskovic

UCLA Anderson
SCHOOL of MANAGEMENT

Spring 2019

Lecture 5: Commodity, Short-selling, and Comomentum

1. The shorting premium and asset pricing anomalies

   Itamar Drechsler and Qingyi Freda Song Drechsler (2016, working paper)

2. Comomentum: Inferring arbitrage activity from return correlations

   Dong Lou and Christopher Polk (2016, working paper)

3. Facts and fantasies about commodity futures

   Gary Gorton and K Geert Rouwenhorst (2006, Financial Analysts Journal)

4. An anatomy of commodity futures risk premia

   Marta Szymanowska, Frans Roon, Theo Nijman, and Rob Goorbergh (2014, JF)

The shorting premium and asset pricing anomalies

Itamar Drechsler and Qingyi Freda Song Drechsler (2016, working paper)

Shorting Premium

- Shorting premium: cheap-minus-expensive-to-short (CME)
- Significant and positive: avg. returns and four-factor alpha

- Thoughts?

Shorting Premium

- Short fee interact with other anomalies
  - Short fees are higher for stocks that anomalies target for shorting
  - Anomalies are nonexistent among low short fee stocks
- Anomalies considered:
  - value-growth (Fama and French, 1992)
  - momentum (Jegadeesh and Titman, 1993),
  - idiosyncratic volatility (Ang et al., 2006)
  - composite equity issuance (Daniel and Titman, 2006)
  - financial distress (Campbell et al., 2008)
  - max return (Bali et al., 2011)
  - net stock issuance (Loughran and Ritter, 1995)
  - gross profitability (Novy-Marx, 2013)
- Anomalies' alphas are small after controlling for CME

Shorting Premium

Data:

- Lending fees from Markit Securities Finance (MSF)
- These are actual (not quoted) rates on security loans
- Time period: January 2004 to December 2013
- Daily frequency

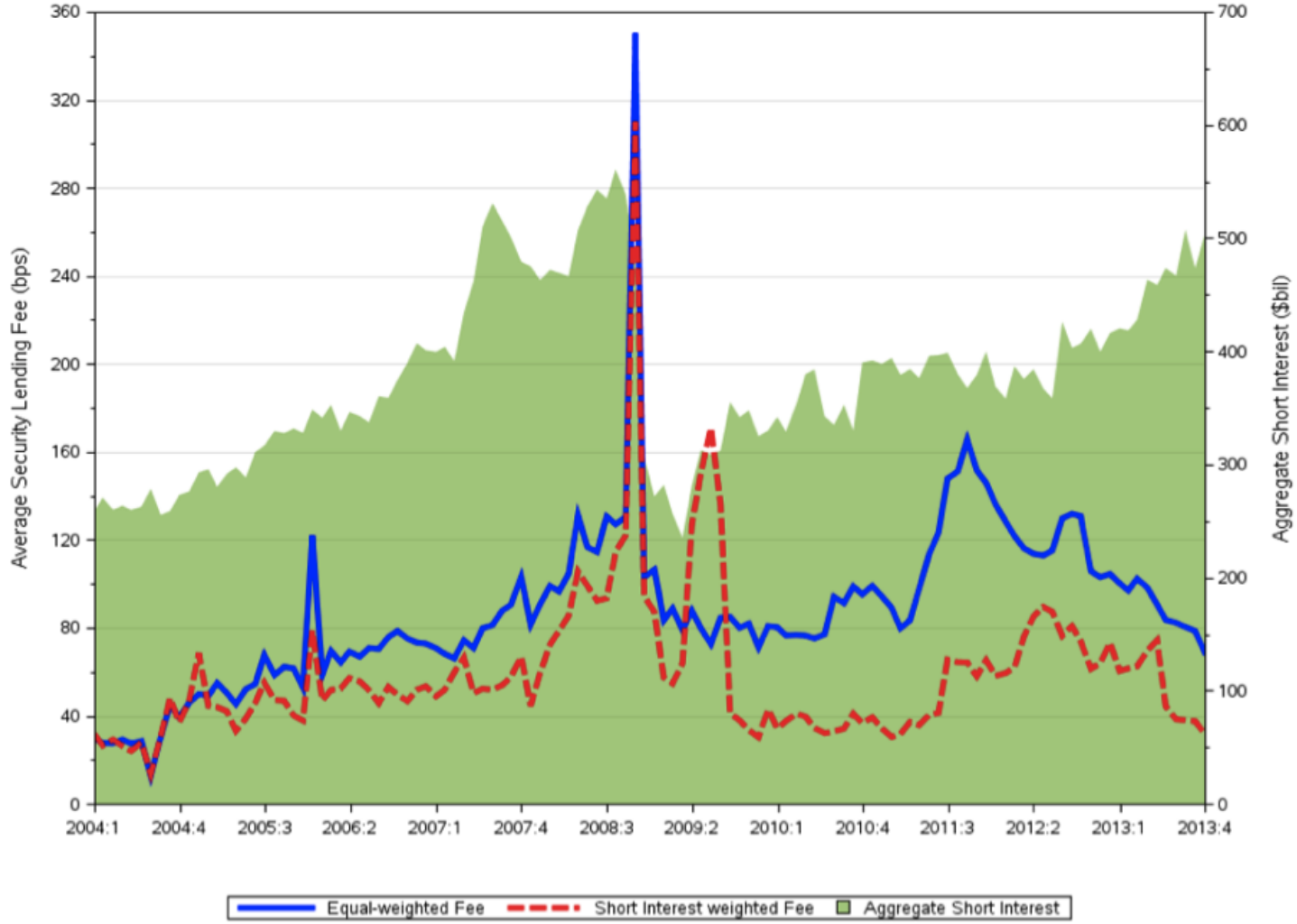
- Merge with CRSP/Compustat
- Drop small market cap stocks
- Drop stock with low share price (penny stocks)

- Lending fees: value-weighted fees
- Also use short fee proxy: Short Interest Ratio relative to Institutional Ownership (available post 1980)

Summary Stats

Year	No. Stocks	Market Cap. ($mil)	B/M	IOR (%)	SIR (%)	SIR_{IO} (%)	Aggregate Short Interest ($bil)	Short Fee (bps)
2004	3,072	3,988	0.58	59.2	4.4	8.0	267	33
2005	3,435	3,919	0.52	60.1	4.4	8.3	312	61
2006	3,529	4,100	0.52	62.2	5.2	9.0	362	70
2007	3,653	4,384	0.51	64.5	6.2	9.9	464	80
2008	3,568	3,803	0.60	64.9	7.3	11.3	473	134
2009	3,358	3,014	1.00	60.6	4.9	8.4	307	81
2010	3,283	3,792	0.85	60.1	5.0	9.4	360	86
2011	3,195	4,500	0.70	63.2	5.0	8.7	385	124
2012	3,113	4,811	0.77	63.0	5.0	9.0	392	118
2013	3,036	5,853	0.73	62.6	4.7	8.2	472	86

The table reports data summary statistics. The figures reported for a given year are averages for the months in that year. IOR is institutional ownership ratio, the ratio of shares held by institutions to total common shares outstanding; SIR is the short interest ratio, the ratio of short interest to total shares outstanding; SIR_{IO} is short interest divided by shares held by institutions; Aggregate Short Interest is the total value of shares shorted for all stocks in dollars; Short Fee is the annual borrowing fee in basis points. All quantities except Aggregate Short Interest are equal-weighted averages.



The figure plots the monthly time series of aggregate short interest and the average lending (i.e., shorting) fee across all stocks. The shaded area plots the aggregate dollar value of shares shorted across all stocks in billions of dollars, measured in the middle of the month. The solid blue line plots the equal weighted average annual shorting fee across all stocks in basis points. The dashed red line reports the short-interest weighted average annual shorting fee across all stocks in basis points.

Table 2: Short fee sorted portfolios

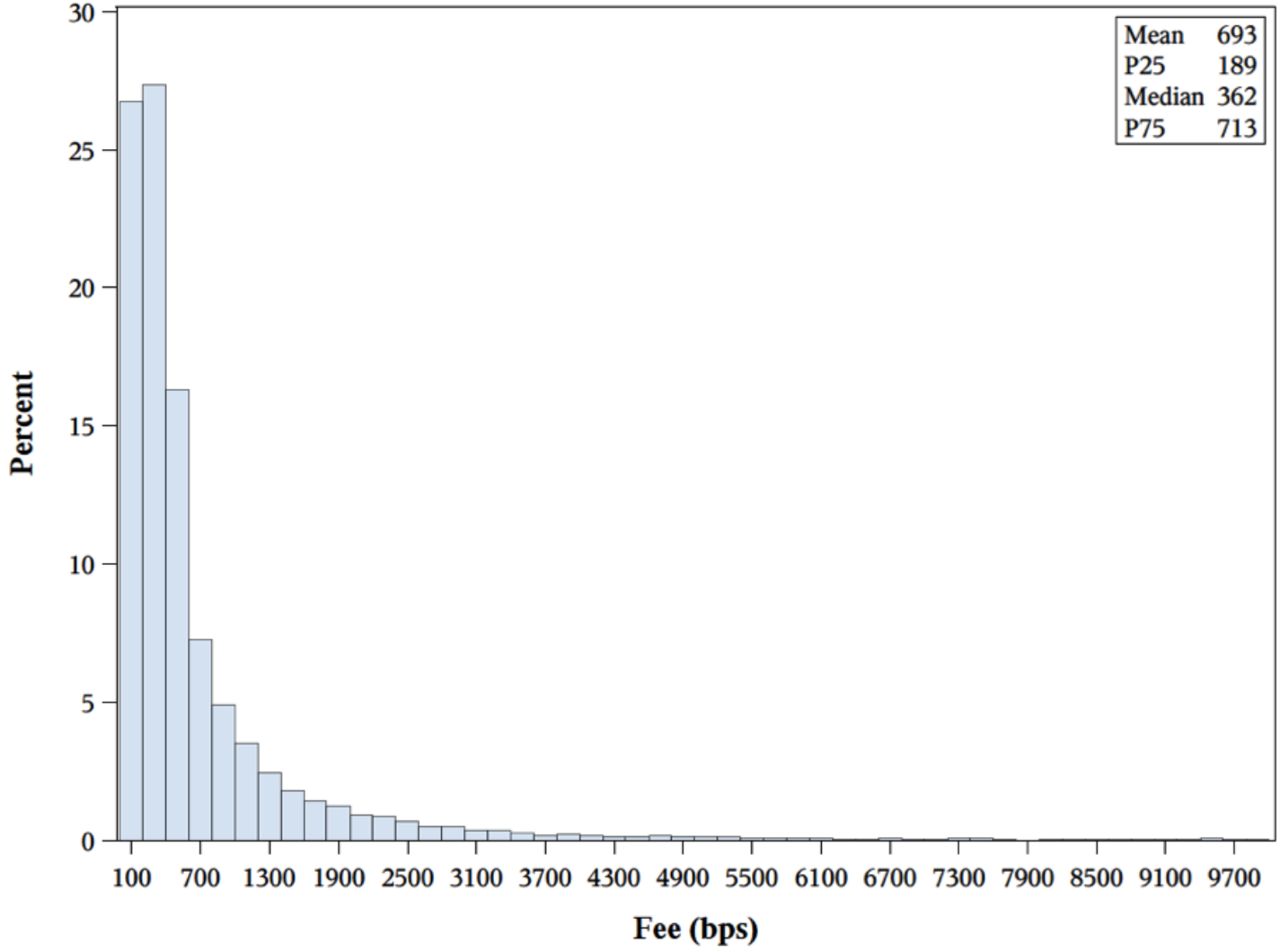
Fee Decile	No. Stocks	*Fee* (*bps*)	SIR_{IO} (%)	*mktcap* ($*bil*)	*B/M*	*mom* (%)	*ivol* (%)	*cei*	*distress*	*maxret* (%)	*nsi*	*Gross Ret* (%)	*Net Ret* (%)	$FF4\,\alpha$ (%)
Panel A: Portfolio Characteristics and Returns by Decile														
1 (Cheap)	332	2	4.5	16.05	0.62	9.91	1.65	0.04	-8.35	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)

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. GrossRet is the (usual) raw return without accounting for shorting fees; NetRet is the return net of shorting fees.

Shorting Premium

- The gross returns are similar among the top eight deciles, which are cheap-to-short stocks
- Highly significant FF4 alpha
- Shorting fee are related to characteristics from other anomalies (e.g. ivol, mom)
- Strong positive relationship between short fees and SIR_{IO} (short interest as a fraction of institutional ownership)
- Premium is large even after fees

- What can explain the shorting premium?



The figure plots a histogram of the annual short fees for the expensive-to-short stocks (decile 10 in Table 2). It is calculated for the sample of all short fees for decile-10 stocks from January 2004 to December 2013. The legend reports the distribution's mean, 25-percentile ("P25"), median, and 75th-percentile ("P75") values.

CME Portfolio: cheap-minus-expensive

What is the implied Sharpe Ratio?

Panel A: Moments

N	Mean(%)	Std. Dev.(%)	Skewness	Kurtosis	AC(1)
120	1.31	2.87	-0.38	1.51	0.26

Panel B: Correlations

	CME	*MKTRF*	*SMB*	*HML*	*UMD*
CME	1.00	-0.36	-0.47	-0.28	0.46
MKTRF		1.00	0.46	0.34	-0.33
SMB			1.00	0.18	-0.10
HML				1.00	-0.32
UMD					1.00

Summary statistics for the monthly return of the CME (cheap-minus-expensive) portfolio. Panel A reports moments of the CME return. Panel B gives the correlation matrix for the returns of the CME portfolio and the four Fama-French factors, MKTRF, SMB, HML, and UMD. The sample is January 2004 to December 2013.

CME Portfolio: cheap-minus-expensive

Which stocks are expensive to short?

Anomaly Rank	Anomalies *B/M*	*mom*	*ivol*	*cei*	*distress*	*maxret*	*nsi*	*gprof*
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

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. 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.

Shorting Fess and Anomalies

Can the CME portfolio explain these anomalies?

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)

Shorting Fees and Anomalies

Can the CME portfolio explain these anomalies?

- Little evidence of anomaly returns within the eighty percent of stocks that have low shorting fees.
- Anomalies are concentrated among stocks with significant fees, and are especially large for the highest short-fee stocks.
- Momentum, which exhibits a negligible return spread unconditionally, is sizable among the high-fee stocks.

- Similar patterns in alphas?

Anomalies conditional on shorting fees (double sort)

Where are the anomalies among cheap-to-short stocks?

Fee	Anomalies							
Bucket	*B/M*	*mom*	*ivol*	*cei*	*distress*	*maxret*	*nsi*	*gprof*
				Panel A: Monthly Returns (%)				
*F*0	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)
*F*1	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)
*F*2	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)
*F*3	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)
*F*3 − *F*0	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)

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.

Anomalies conditional on shorting fees (double sort)

Where are the anomalies among cheap-to-short stocks?

Fee	Anomalies							
Bucket	*B/M*	*mom*	*ivol*	*cei*	*distress*	*maxret*	*nsi*	*gprof*
Panel B: Fama-French 4-Factor Alphas (%)								
*F*0	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)
*F*1	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)
*F*2	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)
*F*3	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)

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 B reports the corresponding FF4 alphas.

Anomalies conditional on shorting fees (double sort)

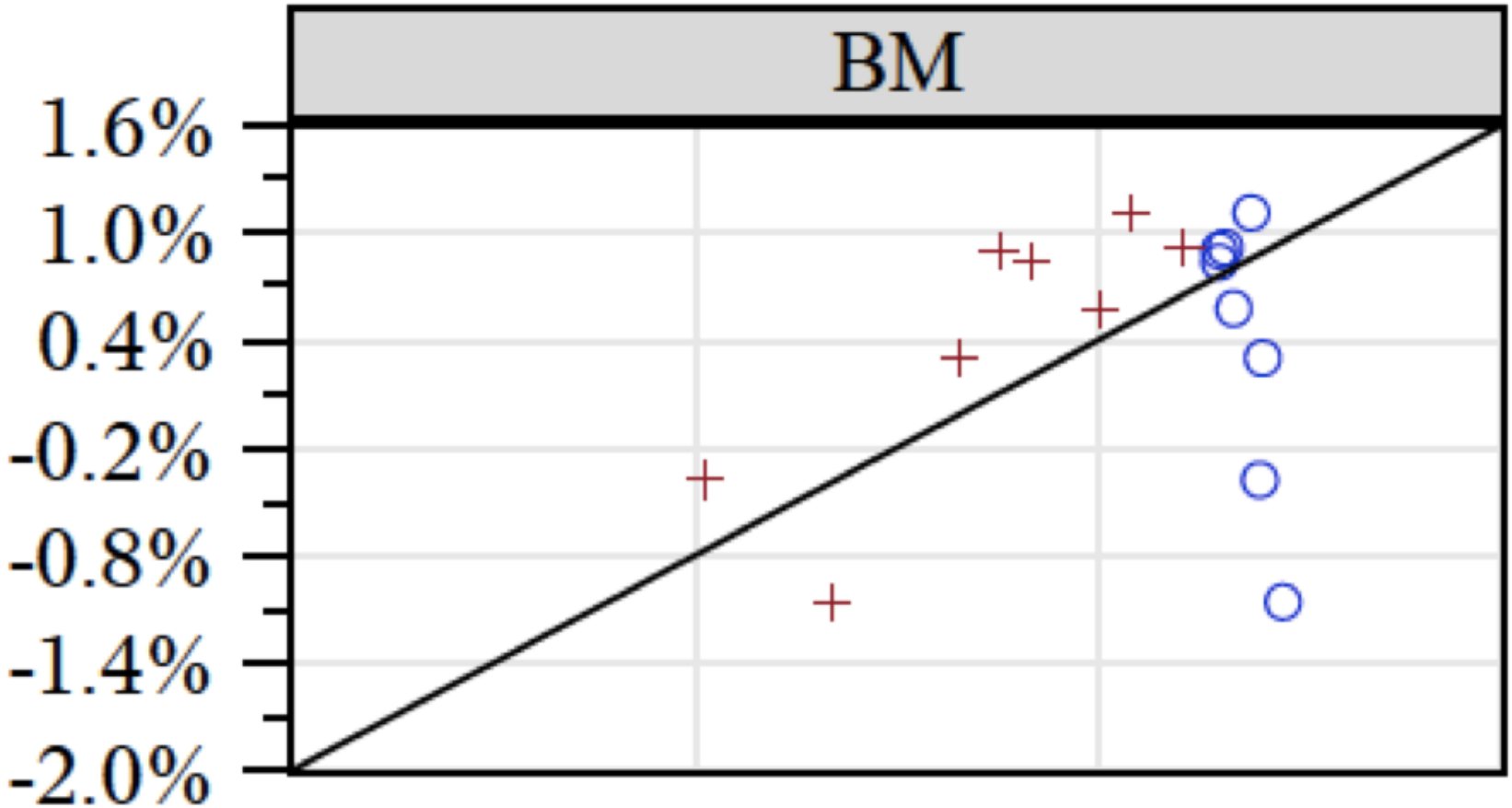
Where are the anomalies among cheap-to-short stocks?

Fee	Anomalies							
Bucket	*B/M*	*mom*	*ivol*	*cei*	*distress*	*maxret*	*nsi*	*gprof*
Panel C: Fama-French 4-Factor + *CME* Alphas (%)								
*F*0	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)
*F*1	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)
*F*2	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)
*F*3	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)
*F*3 − *F*0	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)

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 C reports the FF4 + CME alphas.

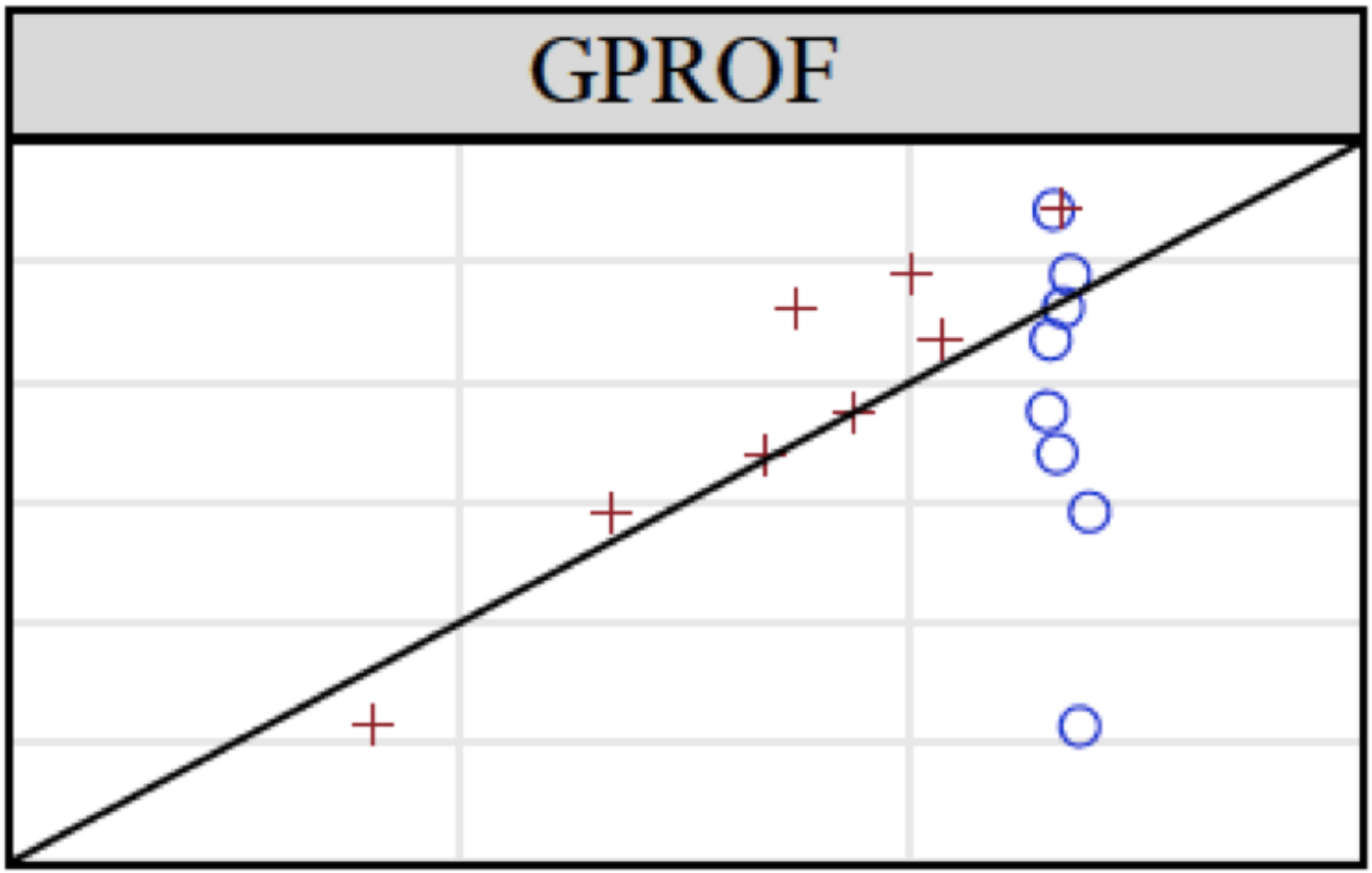
How to test whether CME can improve the FF4 model fit?

Predicted vs. Realized Average Returns



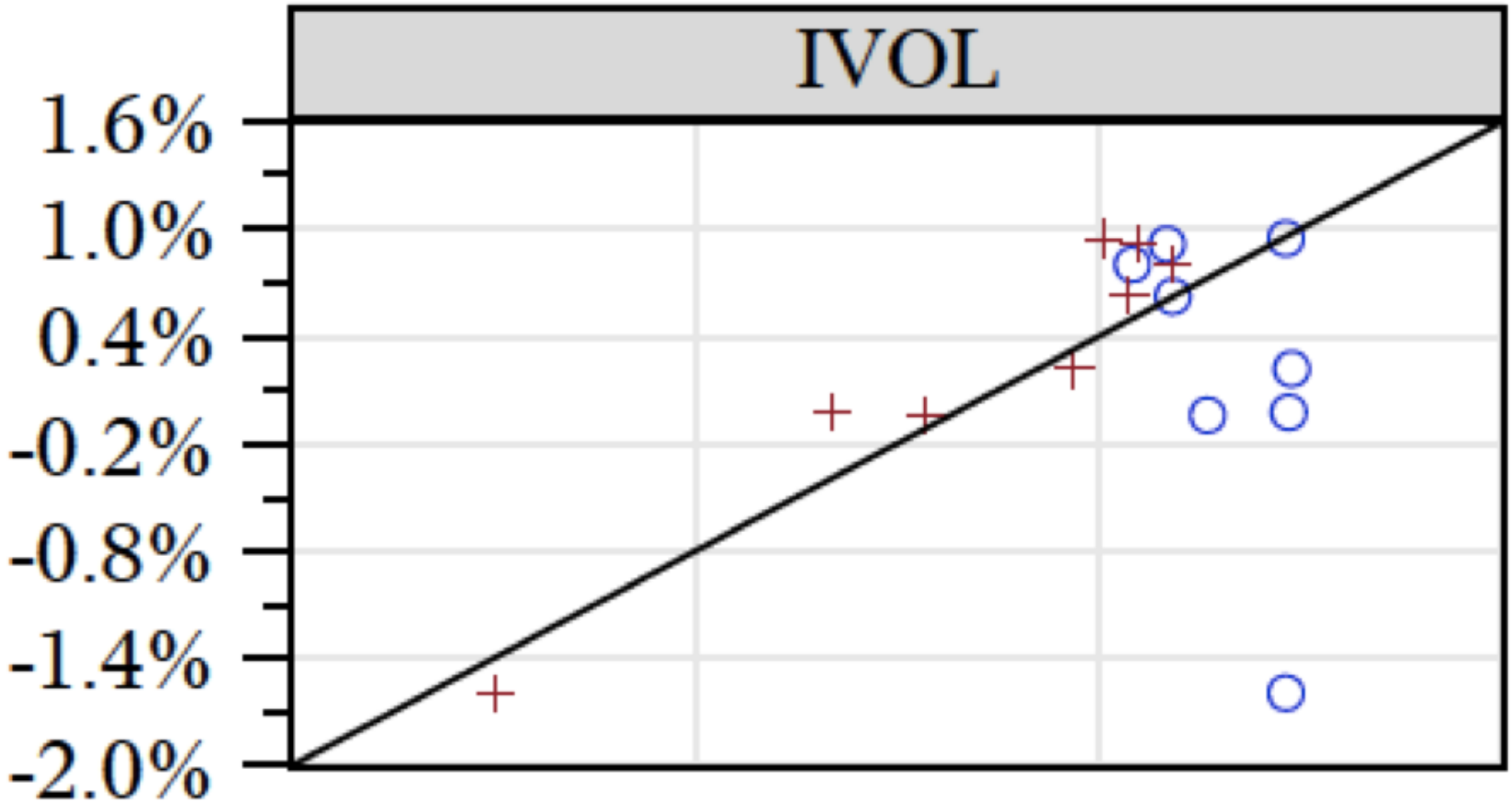
For each anomaly, the figure plots the realized average monthly excess return versus the predicted average monthly excess return for each of the extreme characteristic-sorted portfolios in each of the short-fee sorted buckets of Table 5. The blue circles correspond to the Fama-French four-factor (FF4)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

Predicted vs. Realized Average Returns



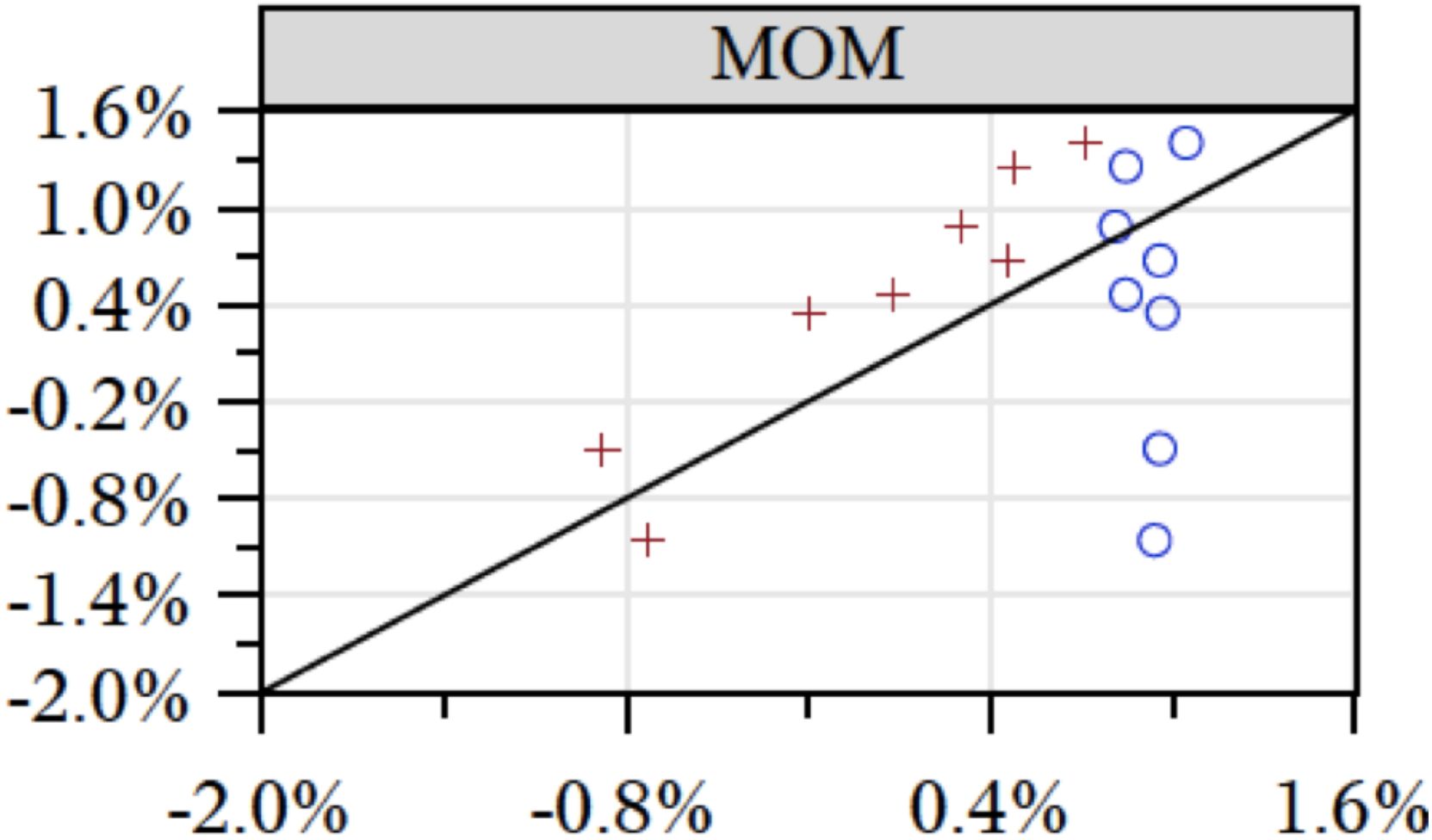
For each anomaly, the figure plots the realized average monthly excess return versus the predicted average monthly excess return for each of the extreme characteristic-sorted portfolios in each of the short-fee sorted buckets of Table 5. The blue circles correspond to the Fama-French four-factor (FF4)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

Predicted vs. Realized Average 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.

Predicted vs. Realized Average 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.

CME seems a huge improvement..

What is going on? Two competing views:

- Absence of significant anomaly returns and FF4 alphas in the low fee stocks supports the view that market frictions are responsible for large anomaly returns
  - Strong interaction between the level of short fees and average anomaly returns
- FF4+CME seems successful: compensation for exposure to shorting risk.

- More: characteristic matching (Tables 6 and 7), Fama and MacBeth Table 8), longer sample, ...

- What else would you do the further verify the Shorting Premium?

Shorting Premium: takeaway

- Short fees are a strong predictor of the cross-section of stock returns
  - Both gross and net of fees
  - FF4 alphas
- Short fees are substantially higher for the stocks targeted for selling by the anomalies.
- Strong interaction between the level of short fees and the magnitude of anomaly returns.
  - The anomalies largely disappear among the 80% of stocks that have low fees, but are highly amplified among those with high fees.
- FF4+CME explains most of the anomaly returns among both high- and low-fee stocks.

Comomentum: Inferring arbitrage activity from return correlations

Dong Lou and Christopher Polk (2016, working paper)

Arbitrage Activity

- How to measure arbitrage activity?
  - Extremely difficult to measure at any given point in time.
  - Huge measurement challenge
- Arbitrage activity $\implies$ stock return comovement
- Link time-series variation in our new measure to variation in existing variables previously tied to arbitrage activity
- Forecast time variation in whether prices slowly correct or instead overshoot as a function of our arbitrage activity proxy.
- This approach enables us to identify periods when there is too little or too much arbitrage trading, depending on the subsequent return pattern.

Comovement as a measure of arbitrage activity

Should comovement in stock returns forecast anomaly returns?

Anchoring hypothesis: Value vs. Momentum

Momentum

- Failure of rational models to explain these stylized facts
- No fundamental anchor
- Arbitrageurs do not base their demand on an independent estimate of fundamental value.
- Unanchored strategy with positive-feedback: momentum is thus the most likely place where arbitrage activity can be destabilizing when trading becomes too crowded

Comomentum

- Comomentum is significantly correlated with existing variables plausibly linked to the size of arbitrage activity in this market.
- When comomentum is relatively high, the long-run buy-and-hold returns to a momentum strategy are negative, consistent with relatively high amounts of arbitrage activity pushing prices further away from fundamentals.
- Comomentum forecasts relatively high holding-period return volatility and relatively more negative holding-period return skewness for the momentum strategy.

Comomentum

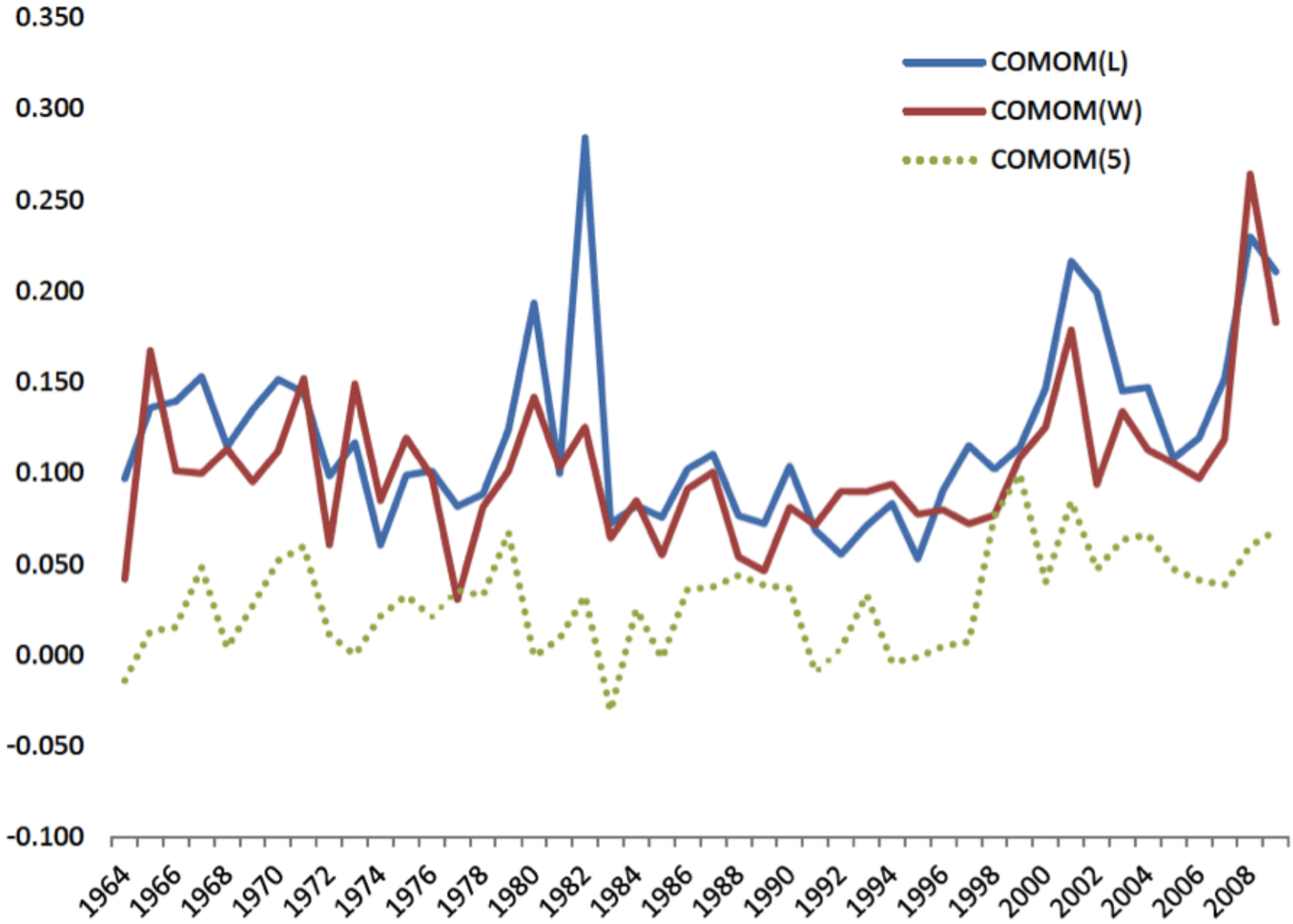
Data:

- CRSP stocks
- Drop stock with share price below \$5
- Drop stock in the bottom decile of NYSE market cap
- Institutional ownership data from Thompson Financial
- AUM from TASS
- Hedge fund returns from CRSP

Comomentum

- At the end of each month, sort all stocks into deciles based on their previous 12-month return (skipping the most recent month)
- For each stock compute the Fama and French three-factor model residuals
- Compute pairwise partial correlations using 52 weekly returns for all stocks in each decile in the portfolio ranking period
  - Use FF3 residuals: control for the Fama-French three factors when computing these partial correlations
- Loser comomentum (comomL): average pairwise partial correlation for the loser decile
- Winner comomentum (comomW): average pairwise partial correlation for the winner decile

Comomentum Time Series



Summary Stats

Panel A: Summary Statistics					
Variable	N	Mean	Std. Dev.	Min	Max
$comom^L$	559	0.118	0.046	0.028	0.287
$comom^W$	559	0.096	0.036	0.021	0.264
$mktret36$	559	0.360	0.331	-0.419	1.231
$mktvol36$	559	0.043	0.011	0.020	0.067

Correlations

Does comomentum capture time-varying expected returns?

Panel B: Correlation				
	$comom^L$	$comom^W$	$mktret36$	$mktvol36$
$comom^L$	1.000			
$comom^W$	0.524	1.000		
$mktret36$	-0.187	-0.350	1.000	
$mktvol36$	0.125	0.092	-0.393	1.000

Autocorrelations

Panel C: Autocorrelation				
	$comom_t^L$	$comom_t^W$	$comom_{t+1}^L$	$comom_{t+1}^W$
$comom_t^L$	1.000			
$comom_t^W$	0.524	1.000		
$comom_{t+1}^L$	0.351	0.273	1.000	
$comom_{t+1}^W$	0.300	0.217	0.527	1.000

Comomentum

Comomentum is associated to several variables that proxy for the size of arbitrage activity in the momentum strategy

Dependent Variable		$comom_t^W$			$comom_t^L$	
	[1]	[2]	[3]	[4]	[5]	[6]
pih_{t-1}^W	0.103***	0.117***	0.190***	0.112**	0.110**	0.095**
	[0.035]	[0.035]	[0.063]	[0.050]	[0.047]	[0.045]
$shadow_{t-1}$	0.151***	0.130***	0.093*	0.256***	0.285***	0.200**
	[0.044]	[0.044]	[0.055]	[0.083]	[0.082]	[0.094]
$mom12_{t-1}$	0.203**	0.228**	0.226**	0.438***	0.383***	0.409***
	[0.091]	[0.091]	[0.113]	[0.144]	[0.140]	[0.137]
AUM_{t-1}			0.058***			0.079***
			[0.018]			[0.017]
$mktret36_{t-1}$		-0.009*	-0.009		0.011	0.001
		[0.005]	[0.007]		[0.007]	[0.010]
$mktvol36_{t-1}$		0.120	0.215		0.218	-0.290
		[0.166]	[0.358]		[0.221]	[0.341]
TREND	YES	YES	YES	YES	YES	YES
Adj-R^2	0.34	0.34	0.38	0.18	0.19	0.47
No. Obs.	357	357	180	357	357	180

Does variation in arbitrage activity forecast variation in the long-run reversal of momentum returns?

Forecasting Momentum Returns with Comomentum

Comomentum and reversals?

- At the end of each month, all stocks are sorted into deciles based on their lagged 12-month cumulative returns (skipping the most recent month).
- All months are then classified into five groups based on $comom^L$

Panel A: Raw Momentum Returns

		Year 0		Year 1		Year 2		Year 3	
Rank	No Obs.	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
1	110	**8.84%**	(29.59)	**0.69%**	(4.56)	0.14%	(0.56)	-0.05%	(-0.21)
2	111	**8.94%**	(24.66)	**1.05%**	(6.67)	-0.27%	(-1.09)	**-0.54%**	(-2.64)
3	111	**9.19%**	(15.66)	**0.73%**	(3.15)	-0.51%	(-1.66)	**-0.52%**	(-2.89)
4	111	**9.51%**	(16.57)	0.44%	(1.54)	**-0.58%**	(-2.39)	-0.46%	(-1.81)
5	111	**11.24%**	(13.58)	-0.18%	(-0.35)	**-1.05%**	(-2.81)	0.16%	(0.45)
5-1		**2.40%**	(2.76)	**-0.87%**	(-2.11)	**-1.20%**	(-2.72)	0.21%	(0.61)
OLS		**0.006**	(2.83)	**-0.002**	(-2.02)	**-0.003**	(-2.81)	0.000	(0.45)

Forecasting Momentum Returns with Comomentum

Comomentum and reversals?

- At the end of each month, all stocks are sorted into deciles based on their lagged 12-month cumulative returns (skipping the most recent month).
- All months are then classified into five groups based on $comom^L$

Panel B: Three-Factor Adjusted Momentum Returns

		Year 0		Year 1		Year 2		Year 3	
Rank	No Obs.	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
1	110	**8.45%**	(24.33)	**0.70%**	(3.63)	-0.03%	(-0.10)	-0.15%	(-1.07)
2	111	**8.53%**	(19.67)	**1.06%**	(5.00)	**-0.44%**	(-2.33)	**-0.87%**	(-3.46)
3	111	**8.74%**	(13.91)	**0.61%**	(3.22)	**-0.67%**	(-3.17)	**-0.70%**	(-2.74)
4	111	**9.13%**	(14.31)	0.35%	(1.53)	**-0.61%**	(-2.35)	**-0.69%**	(-2.28)
5	111	**10.81%**	(13.14)	-0.08%	(-0.18)	**-0.80%**	(-2.31)	0.14%	(0.90)
5-1		**2.37%**	(2.64)	**-0.79%**	(-2.22)	**-0.78%**	(-2.33)	0.28%	(0.95)
OLS		**0.006**	(2.65)	**-0.002**	(-2.09)	**-0.002**	(-2.38)	0.000	(0.64)

- Robustness in Tables 4 and 5

Covalue?

Covalue vs. Comomentum

- Momentum trading is an unanchored strategy
- Momentum has positive feedback: hard to traders to know when to stop
- Different effect for anchored strategies: stabilizing rather than destabilizing arbitrage activity

Forecasting Value with Covalue

Covalue and reversals?

- At the end of each month, all stocks are sorted into deciles based on their book-to-market ratios
- All months are then classified into five groups based on *covalue*

Panel A: Raw Value Strategy Returns

		Year 0		Year 1		Year 2		Year 3	
Rank	No Obs.	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
1	110	**-3.52%**	(-8.13)	0.09%	(0.39)	0.05%	(0.23)	0.46%	(1.89)
2	111	**-4.33%**	(-14.60)	0.35%	(1.66)	0.30%	(1.03)	0.11%	(0.28)
3	111	**-4.00%**	(-9.96)	0.30%	(1.06)	**0.97%**	(5.40)	**0.83%**	(5.29)
4	111	**-4.41%**	(-7.98)	**0.84%**	(2.77)	**1.29%**	(5.29)	**0.79%**	(4.21)
5	111	**-5.67%**	(-5.56)	**1.61%**	(3.82)	**1.61%**	(5.36)	**0.69%**	(1.98)
5-1		-2.16%	(-1.94)	**1.52%**	(3.18)	**1.57%**	(4.22)	0.24%	(0.56)
OLS		-0.004	(-1.86)	**0.004**	(3.35)	**0.004**	(4.92)	0.001	(1.21)

Comomentum: takeaway

- Novel measure of arbitrage activity to study destabilizing effect in the stock market
- Comomentum: high-frequency abnormal return correlation among stocks on which a typical momentum strategy
- Low comomentum periods: momentum strategies are profitable and stabilizing
  - Underreaction that arbitrageurs correct
- High comomentum: momentum tends to crash and revert, reflecting prior overreaction resulting from crowded
  - Overreaction from crowded trading pushing prices away from fundamental
- Covalue positively forecasts future value strategy returns and is positively correlated with the value spread

Facts and fantasies about commodity futures

Gary Gorton and K Geert Rouwenhorst (2006, Financial Analysts Journal)

Facts and fantasies about commodity futures

- Commodity futures are derivative securities, not claims on long-lived corporations
- They are short-maturity claims on real assets
- Unlike financial assets, many commodities have pronounced seasonality in price levels and volatilities

- Commodity futures do not raise resources for companies to invest
- Commodity futures allow companies to obtain insurance for the future value of their outputs
- Commodity futures do not represent direct exposure to actual commodities
- Futures prices represent bets on the expected future spot price

Facts and fantasies about commodity futures

- Commodity futures contract: an agreement to buy (or sell) a specified quantity of a commodity at a future date at a price agreed upon when the parties entered into the contract—the futures prices
- Similar to buy/sell a foreign currency forward?

- Futures markets are forward looking and the futures price embeds expectations about the future spot price

Facts and fantasies about commodity futures

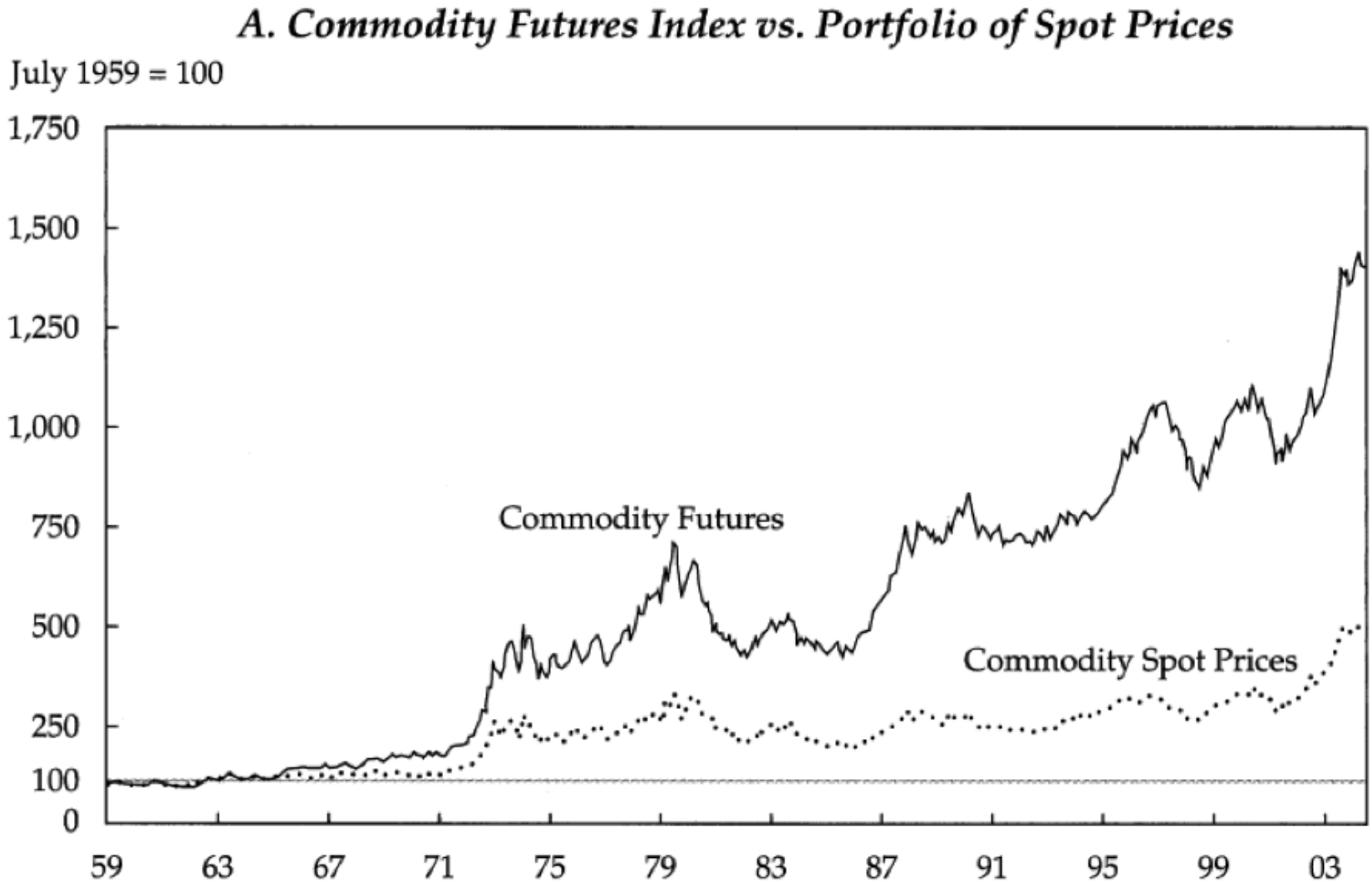
- A futures contract is a bet on the future spot price
- In a futures contract, an investor assumes the risk of unexpected movements in the future spot price

- What return can investors in futures expect to earn if they do not benefit from expected spot price movements and are unable to outsmart the market?

  Risk premium: the difference between the current futures price and the expected future spot price

- Let us focus on an equally-weighted commodity futures index:

Index


A. Commodity Futures Index vs. Portfolio of Spot Prices
July 1959 = 100
1,750
1,500
1,250
1,000
750
500
250
100
0
Commodity Futures
Commodity Spot Prices
59
63
67
71
75
79
83
87
91
95
99
03

An anatomy of commodity futures risk premia

Marta Szymanowska, Frans Roon, Theo Nijman, and Rob Goorbergh (2014, JF)

Commodity Futures

Commodity Futures: similar to bonds or equity?

- Each commodity has multiple futures contracts that differ in time-to-maturity.
  - There is a term structure both of futures prices and of futures expected returns or risk premia
- Commodity futures differ on characteristics such as the sector to which they belong (e.g., Energy vs. Metals), as well as on characteristics like momentum and valuation ratios

Commodity Futures

- Expected returns: spot and term premia
- Time-varying risk premium
- Cross-sectional of commodity futures: basis factor

Commodity Futures

Theory: cost-of-carry model

- Cost-of-carry model:

$$F_t^{(n)} = S_t \left(1 + RF_t^{(n)}\right)^n \left(1 + U_t^{(n)}\right)^n - C_{t+n}$$

  where S_t is the spot price, $F_t^{(n)}$ is the futures price, $U_t^{(n)}$ is the storage price, C_{t+n} is a cash payment, $RF_t^{(n)}$ is a risk-free rate

- Per-period basis, $y_t^{(n)}$, satisfies

$$F_t^{(n)} = S_t \exp\left\{y_t^{(n)} \times n\right\}$$

  in logs we have: $f_t^{(n)} = s_t + n y_t^{(n)}$

- Hence, the basis (or cost of carry) is

$$y_t^{(n)} = \frac{1}{n} \ln\left\{\left(1 + RF_t^{(n)}\right)^n \left(1 + U_t^{(n)}\right)^n - \frac{C_{t+n}}{S_t}\right\}$$

Commodity Futures

Theory: premia definition

- Per-period basis, $y_t^{(n)}$, satisfies

$$f_t^{(n)} = s_t + n y_t^{(n)}$$

- Spot risk premium ($\pi_{s,t}$) is the expected spot return in excess of the one-period basis:

$$E_t\left[r_{s,t+1}\right] = E_t\left[\ln(S_{t+1}) - \ln(S_t)\right] = E_t\left[s_{t+1} - s_t\right] = y_t^{(1)} + \pi_{s,t}$$

- Term premium ($\pi_{y,t}^{(n)}$) is the (expected) deviation from the expectations hypothesis of the term structure of the basis

$$n y_t^{(n)} = y_t^{(1)} + (n-1) E_t\left[y_{t+1}^{(n-1)}\right] - \pi_{y,t}^{(n)}$$

Commodity Futures

Theory: premia definition

- Spot premium can be earned with long position in short-term futures contract

$$E_t\left[r^{(1)}_{fut,t+1}\right] = E_t\left[s_{t+1} - f^{(1)}_t\right] = E_t\left[s_{t+1} - s_t - y^{(1)}_t\right] = \pi_{s,t}$$

- By definition: $\pi^{(1)}_{y,t} = 0$
- Holding-until-maturity return:

$$E_t\left[r^{(n)}_{fut,t\to t+n}\right] = E_t\left[s_{t+n} - f^{(n)}_t\right]$$

$$= E_t\left[\left(s_{t+n} - f^{(1)}_{t+n-1}\right) + \left(f^{(1)}_{t+n-1} - f^{(2)}_{t+n-2}\right) + \cdots + \left(f^{(n-1)}_{t+1} - f^{(n)}_t\right)\right]$$

$$= \sum_{j=0}^{n-1} E_t\left[\pi_{s,t+j}\right] + \sum_{j=0}^{n-1} E_t\left[\pi^{(n-j)}_{y,t+j}\right].$$

The expected return of the Holding strategy is the sum of expected spot premia and term premia for all maturities up to n

Commodity Futures

Theory: short roll vs. excess holding definition

- Short roll: invest in one-period futures contracts for n consecutive periods, rolling them over each period:

$$\text{Short Roll: } E_t\left[\sum_{j=1}^{n} r^{(1)}_{fut,t+j}\right] = \sum_{j=0}^{n-1} E_t\left[\pi_{s,t+j}\right]$$

- Excess Holding: long position in the Holding strategy and short position in the Short Roll strategy

$$\text{Excess Holding: } E_t\left[r^{(n)}_{fut,t\to t+n} - \sum_{j=1}^{n} r^{(1)}_{fut,t+j}\right] = \sum_{j=0}^{n-1} E_t\left[\pi^{(n-j)}_{y,t+j}\right]$$

Commodity Futures

Data: unconditional premia (Table 1)

The table contains summary statistics for the seven sector indices as well as for the EW (overall) commodity index. The table presents mean returns, standard deviations, and t-statistics for the various sector indices for the nearest-to-maturity contracts, second nearest-to-maturity contracts, and so on. The first panel shows summary statistics for the Short Roll returns, and the second one for the Excess Holding returns. t-statistics are based on Newey–West corrected standard errors. The returns are quoted bimonthly for a sample period between March 1986 and December 2010.

		Annualized Mean Returns				Annualized Standard Deviations				t-Statistics			
		n=1	n=2	n=3	n=4	n=1	n=2	n=3	n=4	n=1	n=2	n=3	n=4
Short Roll	Energy	10.83%	9.83%	8.96%	8.56%	32.88%	29.06%	28.80%	28.5%	(1.64)	(1.68)	(1.55)	(1.49)
	Meats	4.20%	4.03%	3.93%	3.89%	13.03%	11.98%	12.08%	12.6%	(1.60)	(1.67)	(1.62)	(1.53)
	Metals	5.42%	5.02%	4.76%	4.63%	17.16%	15.42%	15.10%	15.0%	(1.57)	(1.62)	(1.57)	(1.54)
	Grains	−6.10%	−6.24%	−6.50%	−6.74%	18.96%	18.56%	18.11%	17.8%	(−1.60)	(−1.67)	(−1.78)	(−1.88)
	Oilseeds	1.86%	1.61%	1.46%	1.26%	20.96%	18.44%	17.65%	16.8%	(0.44)	(0.43)	(0.41)	(0.37)
	Softs	−6.58%	−6.57%	−6.58%	−6.70%	18.48%	16.72%	15.52%	14.7%	(−1.77)	(−1.95)	(−2.11)	(−2.27)
	Ind materials	−4.82%	−4.62%	−4.83%	−4.87%	19.56%	18.21%	17.94%	18.6%	(−1.22)	(−1.26)	(−1.34)	(−1.30)
	EW	0.65%	0.38%	0.11%	−0.07%	11.70%	11.32%	11.42%	11.3%	(0.27)	(0.16)	(0.05)	(-0.03)
Excess Holding	Energy		0.19%	0.43%	0.56%		1.45%	2.32%	3.2%		(0.65)	(0.92)	(0.86)
	Meats		0.10%	−0.06%	−0.16%		2.08%	3.52%	4.7%		(0.24)	(−0.08)	(−0.16)
	Metals		0.03%	0.00%	−0.06%		0.49%	0.87%	1.3%		(0.29)	(0.02)	(−0.24)
	Grains		0.82%	1.68%	1.49%		4.90%	7.64%	10.0%		(0.83)	(1.09)	(0.74)
	Oilseeds		0.22%	0.40%	−0.82%		1.10%	1.91%	4.9%		(0.97)	(1.03)	(−0.83)
	Softs		0.32%	0.52%	−1.11%		1.20%	1.80%	21.1%		(1.32)	(1.43)	(−0.26)
	Ind materials		1.41%	2.88%	3.52%		2.91%	6.91%	16.4%		(2.40)	(2.07)	(1.07)
	EW		0.73%	1.08%	2.77%		1.20%	2.07%	4.3%		(3.01)	(2.58)	(3.21)

- Large cross-sectional variation
- Negligible short roll premium on average

Sorts based on basis

Data: conditional premia (Table 2) mean basis-sorted portfolios

Panel A. Basis

		Annualized Mean Returns				Annualized Standard Deviations			
		n=1	n=2	n=3	n=4	n=1	n=2	n=3	n=4
Short Roll	Low	4.82%	7.00%	7.89%	9.92%	16.97%	15.39%	16.83%	18.3%
	P2	4.68%	4.68%	3.46%	5.46%	14.25%	12.83%	11.18%	13.1%
	P3	−2.93%	−3.71%	−2.01%	−0.89%	13.46%	12.93%	12.78%	13.9%
	High	−3.47%	−4.35%	−5.61%	−4.62%	15.98%	13.16%	11.95%	15.0%
	P4–P1	−8.29%	−11.35%	−13.51%	−14.53%	17.15%	12.96%	12.76%	16.1%
	t(P4–P1)	(−2.40)	(−4.33)	(−5.22)	(−4.45)				
Excess Holding	Low		0.32%	0.07%	−0.30%		1.61%	2.33%	3.2%
	P2		0.20%	0.35%	0.59%		0.98%	1.57%	2.0%
	P3		0.47%	0.84%	0.88%		0.95%	1.41%	1.9%
	High		0.93%	1.51%	1.53%		1.37%	2.20%	2.2%
	P4–P1		0.61%	1.44%	1.84%		1.75%	2.43%	3.0%
	t(P4–P1)		(1.72)	(2.91)	(3.00)				

The table contains mean returns and standard deviations (for Short Roll and Excess Holding returns) when futures contracts are sorted on the basis in Panel A and mean and demeaned basis in Panel B. In Panel B for each of the returns, the first row, "mono," indicates whether the underlying mean returns on the four portfolios show a monotonic pattern across the sort. The next two rows show mean returns and t-statistics for the spread in mean return across the four portfolios. t-statistics are in parentheses and are based on NeweyWest corrected standard errors. The returns are quoted bimonthly for a sample period between March 1986 and December 2010

Sorts based on basis

Data: conditional premia (Table 2) basis-sorted portfolios

Panel B. Cross-Section of Basis

		B.1 Mean Basis				B.2 De-Meaned Basis			
Short Roll	Mono	*y*	*y*	*y*	*y*	*y*	*y*	*y*	y
	P4–P1	−15.42%	−15.36%	−14.86%	−18.02%	−3.82%	−5.27%	−6.66%	-10.22%
	t-Stat	(−4.37)	(−4.40)	(−4.17)	(−3.91)	(−1.12)	(−2.01)	(−2.74)	(−3.27)
Excess	Mono		*y*		*y*				
Holding	P4–P1		1.12%	1.59%	2.37%		0.23%	0.80%	1.15%
	t-Stat		(3.55)	(3.20)	(3.22)		(0.62)	(1.56)	(1.64)

The table contains mean returns and standard deviations (for Short Roll and Excess Holding returns) when futures contracts are sorted on the basis in Panel A and mean and demeaned basis in Panel B. In Panel B for each of the returns, the first row, "mono," indicates whether the underlying mean returns on the four portfolios show a monotonic pattern across the sort. The next two rows show mean returns and t-statistics for the spread in mean return across the four portfolios. t-statistics are in parentheses and are based on NeweyWest corrected standard errors. The returns are quoted bimonthly for a sample period between March 1986 and December 2010

Takeaway

- Risk premia in commodity futures markets
- Futures expected returns to consist of two risk premia: spot premia related to the risk in the underlying commodity, and term premia related to the changes in basis
- Premia can be isolated using simple trading strategies
- Spot and term premia: opposite signs and predictable
- Sorting on the futures basis results in sizable spot and term premia
- Cross-section: spot premia based on these characteristics can be captured by one basis factor (long-short basis portfolio), whereas two additional factors are needed to explain term premia (long and short portfolios separately).