Factor Chasing and the Cross Country Factor Momentum Anomaly

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Outlook

- We report a new stylized fact in international factor momentum
- Factor return continuation is not only evident within countries (see e.g. Ehsani and Linnainmaa, 2022, JF), but also *across* countries
- Cross-country factor momentum even works for individual factors
- A simple strategy that chases winning factors across countries yields abnormal returns, esp. controlling for stock momentum
- Factor chasing strategies are particularly lucrative in in times of high sentiment and pronounced in countries with high aggregate mispricing
- Our results are probably driven by international underreaction to fundamental information

Data

- International factor return data by Jensen, Kelly, and Pedersen (2021) (`https://jkpfactors.com/`)
- 153 Factors (from 13 themes) $\times$ 73 countries
- Sample: July 1998 - December 2021

Formal Definition of relative returns

- Main stylized fact: Winning countries (winning in factors) outperform losing countries
- To orthogonalize against factor momentum we compute relative returns
- We invest into country-factors that outperform other countries in the same factor

The sorting signal is calculated as:

$$r_{F,c,t}^{rel} = r_{F,c,t} - \underset{C \in \mathcal{C}}{\mathrm{median}}\left(r_{F,c,t}\right) \tag{1}$$

At time t we compute relative returns $r_{F,c,t}^{rel}$ for factor $F \in \mathcal{F}$ in country $c \in \mathcal{C}$ by subtracting the cross-country factor median from $r_{F,c,t}$

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Relative Returns
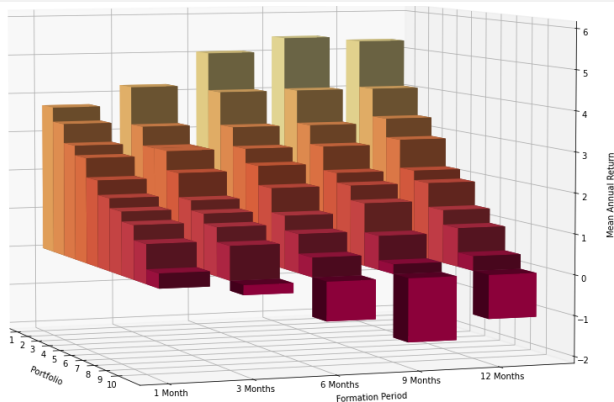## Returns to relative return sorted portfolios

Figure: Relative Return sorted Portfolios. At time t we compute relative returns $r_{F,c,t}^{rel}$ for factor $F \in \mathcal{F}$ in country $c \in \mathcal{C}$ by subtracting the cross-country factor median from $r_{F,c,t}$: $r_{F,c,t}^{rel} = r_{F,c,t} - \underset{c \in \mathcal{C}}{\text{median}}\left(r_{F,c,t}\right)$. We then sort all n factors by their average prior relative return $\sum_{s=t-FP}^{t-1} r_{F,c,s}^{rel}$.

Relative Returns

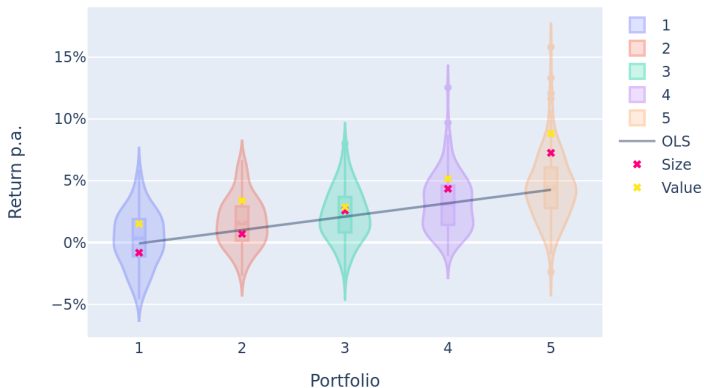Violin plots: Single factor level

Figure: Prior relative returns. This figure depicts average yearly returns of portfolios sorted on prior 9 months relative returns. At time t we compute relative returns $r^{rel}_{F,c,t}$ for factor $F \in \mathcal{F}$ in country $c \in \mathcal{C}$ by subtracting the cross-country factor median from $r_{F,c,t}$: $r^{rel}_{F,c,t} = r_{F,c,t} - \underset{c \in \mathcal{C}}{\text{median}}\left(r_{F,c,t}\right)$. We then sort all n factors by their average prior relative return $\sum_{s=t-FP}^{t-1} r^{rel}_{F,c,s}$.

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Formal Definition

Factor chasing for factor i:

$$r_{t+1}^{FC,i} = \left(\frac{1}{0.3 \cdot N} \sum_{\substack{n,i \in N,I \\ r_{t-h:t}^{n,i} > Q(0.7)}} r_{t+1}^{n,i} \right) - \left(\frac{1}{0.3 \cdot N} \sum_{\substack{n,i \in N,I \\ r_{t-h:t}^{n,i} < Q(0.3)}} r_{t+1}^{n,i} \right) \qquad (2)$$

$N \ldots$ countries, $I \ldots$ factors

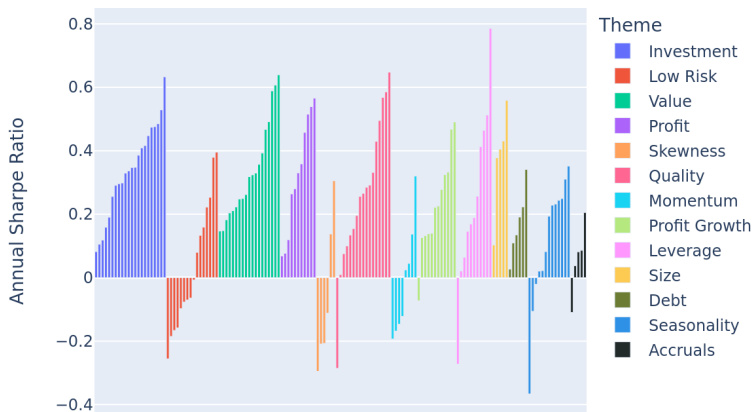# Factor Chasing

Annual theme-sorted performance

Figure: Factor chasing performance plots - 9 months formation period

Table: Portfolio exposures to factor models. This table reports average alphas of time-series regressions of the form: $r_{i,t} = \alpha + \beta F_{n,t} + \epsilon_{i,t}$ where $r_{i,t}$ is the return of the factor chasing strategy corresponding to factor i at time t. Panel A shows average alphas with p-values given at the usual levels of 90% (*), 95% (**) and 99% (***) and calculated using GRS tests. Systematic factor chasing strategies are a subset of the baseline strategies that only chase the FF6 factors. Demeaned factors correspond to baseline factor chasing strategies robust to unconditional risk premia differences between countries. Panel B shows the same spanning tests with augmented factor models. Augmented factor models add the chased factor F_i to the respective asset pricing model. Panel C depicts average correlations of factor chasing strategies.

| | Panel A: Common Factor Models | | | | | | | | |
| | Baseline | | | Systematic Factors | | | Demeaned Factors | | |
	FF6	FF5	C4	FF6	FF5	C4	FF6	FF5	C4
1 Month	2.01**	1.81*	2.41***	3.16***	2.93	4.63***	2.91***	2.69***	3.21***
3 Months	2.24*	2.67	2.52**	3.54***	4.04***	4.02***	3.15***	3.59***	3.39***
6 Months	1.51**	2.34**	1.97**	3.28***	4.20***	4.22***	2.92***	3.78***	3.32***
9 Months	1.14**	2.06***	1.62***	2.64***	3.55***	3.28***	2.49***	3.44***	2.87***
12 Months	1.19**	2.32 **	1.65**	3.03***	4.16***	3.28***	2.63***	3.78***	2.82***

| | Panel B: Augmented Factor Models | | | | | | | | |
| | Baseline | | | Systematic Factors | | | Demeaned Factors | | |
	FF6 + F_i	FF5 + F_i	C4 + F_i	FF6 + F_i	FF5 + F_i	C4 + F_i	FF6 + F_i	FF5 + F_i	C4 + F_i
1 Month	1.98 [0.00]	1.84 [0.00]	2.30 [0.00]	-	-	-	2.89 [0.00]	2.74 [0.00]	3.16 [0.00]
3 Months	2.16 [0.00]	2.67 [0.00]	2.38 [0.00]	-	-	-	3.14 [0.00]	3.69 [0.00]	3.32 [0.00]
6 Months	1.43 [0.00]	2.30 [0.00]	1.78 [0.00]	-	-	-	2.90 [0.00]	3.85 [0.00]	3.19 [0.00]
9 Months	1.06 [0.00]	2.01 [0.00]	1.41 [0.00]	-	-	-	2.45 [0.00]	3.49 [0.00]	2.72 [0.00]
12 Months	1.12 [0.00]	2.30 [0.00]	1.42 [0.00]	-	-	-	2.55 [0.00]	3.82 [0.00]	2.64 [0.00]

| | Panel C: Factor Correlations | | | | | | | | |
| | Baseline | | | Systematic Factors | | | Demeaned Factors | | |
	$\rho(F_i)$	$\rho(MKT_{exc})$	$\rho(MOM)$	$\rho(F_i)$	$\rho(MKT_{exc})$	$\rho(MOM)$	$\rho(F_i)$	$\rho(MKT_{exc})$	$\rho(MOM)$
1 Month	0.03	-0.15	0.16	-0.00	-0.17	0.18	0.04	-0.18	0.48
3 Month	0.05	-0.20	0.34	-0.01	-0.21	0.42	0.05	-0.22	0.46
6 Month	0.07	-0.20	0.41	-0.00	-0.18	0.44	0.07	-0.21	0.50
9 Month	0.07	-0.21	0.44	-0.02	-0.23	0.50	0.07	-0.22	0.49
12 Month	0.05	-0.19	0.46	-0.02	-0.23	0.54	0.05	-0.19	0.46

Explaining Factor Chasing

Panel Regressions
Country level regressions

Explanations for Factor Chasing

- Investor underreaction: Underreaction to news (see e.g Hong and Stein, 1999, JF)
- Investor overreaction: Positive feedback trading of foreign investors (Bohn and Tesar, 1996, AER; Brennan and Cao, 1997, JF)
- Risk: Market risk / Limits to arbitrage and arbitrage risk (Shleifer and Vishny, 1997, JF)

To explain country level factor returns we run predictive regressions in the form:

$$r_{i,t+1} = \alpha + \beta_P P_{i,t} + \epsilon_{i,t} \tag{3}$$

with returns of factor i that are regressed on rolling averages of predictive variables P.

Panel Regressions
Country level regressions

In the previously shown regression equation we test the predictive performance of eight variables:

- Return (control for factor momentum)
- Sentiment (country level consumer confidence index as in Antoniou, Doukas and Subrahmanyam, 2013, JFQA)
- Short selling practiced dummy (following Bris, Goetzmann, and Zhu, 2007, JF)
- Characteristic Spread
- Mispricing Spread (as similarly applied in Jacobs, 2016, JFE)
- BidAsk Spread (Average)
- Market Volatility
- Foreign Equity Inflows (taken from IMF BOP data)

All variables are rolling means of prior twelve-month measures.

Panel Regressions
Country level regressions

Characteristic spreads are the median difference in the sorting signal between the long-, and the short leg of a strategy. The idea to use characteristic spreads originally comes from Stambaugh, Yu, and Yuan (2015) and was applied in Jacobs (2016) to build mispricing scores. Jacobs (2016) shows that mispricing scores capture mispricing in international markets. Following Jacobs (2016) we built characteristic spreads as the average difference in the sorting signal between the long- and the short leg of a factor:

$$CharSpread = S_i^H - S_i^L \tag{4}$$

With S as the median sorting signal of H (the high signal portfolio) and S (the low signal portfolio).

To account for different scale of the signals, we apply z-scores to retrieve demeaned measures with a standard deviation of one.

Country Level Regressions

Table: Country level regression:
$ret_{i,c,t} = \alpha + \beta_1 Return + \beta_2 Sentiment + \beta_3 D^{ShortSellingPracticed} + \beta_4 Char.Spread + \beta_5 Misp.Spread + \epsilon_{i,t}$. All covariates are trailing 12 months aggregates and standardized to have a mean of zero and a variance of one. Standard errors are HAC (5 months), clustered on the country and factor level. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

| | Monthly factor returns | | | | |
	(1)	(2)	(3)	(4)	(5)
const	0.22***	-0.51***	0.18***	0.19	-0.46*
Return	0.11***	0.09***	0.10***	0.11***	0.09***
Sentiment	0.13***	0.13***	0.13***	0.04***	0.04***
Short Selling Practiced	-0.09***	-0.09***	-0.07***	-0.05***	-0.14***
Char. Spread	0.02***	0.03***	0.02***	0.02***	0.03***
Misp. Spread	0.08***	0.08***	0.09***	0.05***	0.05***
BidAsk Spread	0.08***	0.08***	0.12***	0.02*	0.05**
Market Volatility	-0.06***	-0.06***	-0.10***	0.02	0.00
Foreign Equity Inflows	-0.08***	-0.08***	-0.08***	-0.04***	-0.04***
Observations	801'206	801'206	801'206	801'206	801'206
R-squared	0.00	0.00	0.00	0.02	0.02
Factor FE	No	Yes	No	No	Yes
Country FE	No	No	Yes	No	Yes
Time FE	No	No	No	Yes	Yes

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Mispricing Dispersion

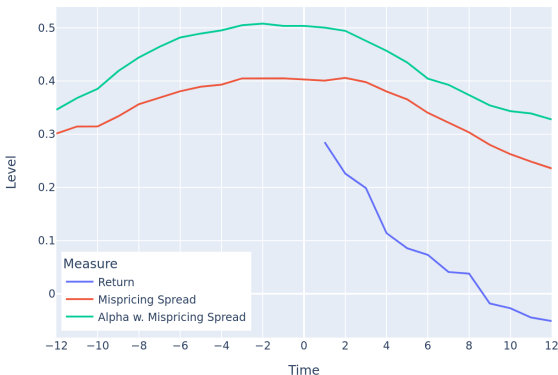## Accumulating mispricing dispersion in event time

Figure: Differences between winning- and losing countries in event time. This figure depicts the differences in average mispricing spreads and alpha weighted mispricing spreads between winning and losing countries. At $t = 0$ we sort all factors into winning- and losing country portfolios and observe aggregate mispricing in the time from $t - 12$ to $t + 12$.

Conclusion

- We report a new international factor momentum stylized fact
- Factor return continuation is not only evident within countries (see e.g. Ehsani and Linnainmaa, 2022, JF), but also *across* countries
- Cross-country factor momentum even works for individual factors
- A simple strategy that chases winning factors across countries yields abnormal returns, esp. controlling for stock momentum
- Factor chasing strategies are particularly lucrative in in times of high sentiment and pronounced in countries with high aggregate mispricing
- Our results are probably driven by international underreaction to fundamental information

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Thank you for your attention.

Comments are most welcome!

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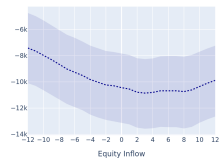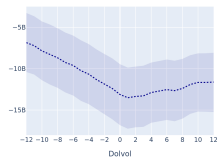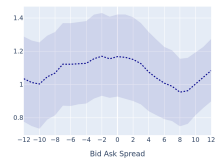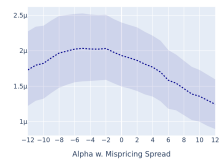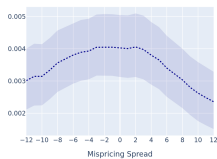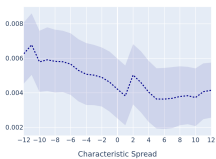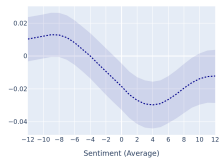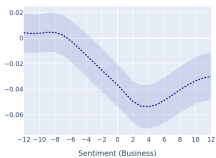
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References II

Ehsani, S. and Linnainmaa, J. T. (2022). Factor Momentum and the Momentum Factor. *The Journal of Finance* 77 (3), 1877–1919.

Winners and Losers

What distinguishes winning from losing countries?

Cross Sectional Dependence

Table: Cross Sectional Dependence of Factor Chasing Strategies: Region & Formation. This table examines average monthly factor chasing returns with the following cross-sectional regression: $\overline{ret}_i = \alpha_i + \beta_1 D_i^{FP1} + \beta_2 D_i^{FP3} + \beta_3 D_i^{FP6} + \beta_4 D_i^{FP9} + \beta_5 D_i^{EW} + \epsilon_i$, where $\overline{ret}_i$ is the average factor chasing strategy return for factor i. D_i^{FP1} to D_i^{FP9} are formation period dummies. When all four dummies equal zero, the average strategy return corresponds to a twelve-month formation period. D_i^{EW} is a portfolio weighting dummy that equals one, if all countries in the cross-section are weighted equally and zero, if the countries are weighted according to their GDP. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

	Average Monthly factor chasing returns		
	(1) World	(2) Developed Markets	(3) Non-Developed Markets
const	0.24***	0.13***	0.35***
1 Month FP	-0.13***	-0.06***	-0.21***
3 Months FP	-0.06***	0.02*	-0.14***
6 Months FP	-0.02	0.03**	-0.10***
9 Months FP	0.02	0.03**	0.00
Equal Weighting	0.05***	0.09***	-0.03**
Observations	1,510	1,510	1,510
R-squared	0.67	0.68	0.55
Factor FE	Yes	Yes	Yes

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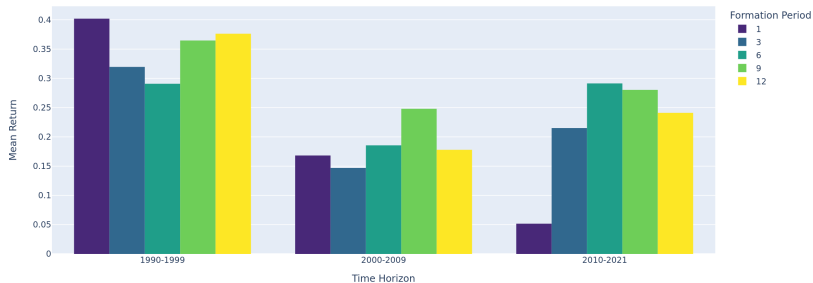# Further Properties
Time Robustness

Figure: Robustness to the sample period

Further Properties
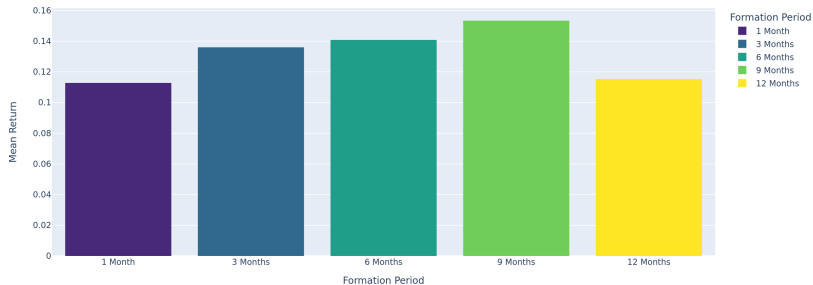## Demeaned Factor Chasing

Figure: Chasing demeaned factor returns | robustness against unconditional differences between factor returns

Further properties
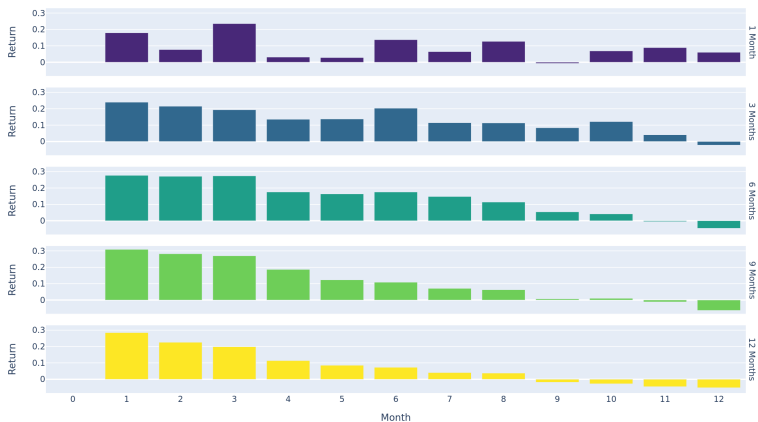## Holding Period Factor Chasing Returns

Figure: Holding period returns of factor chasing strategies

Portfolio Implications: Biannual Factor Chasing

Long only 6 month formation - 6 month holding portfolios
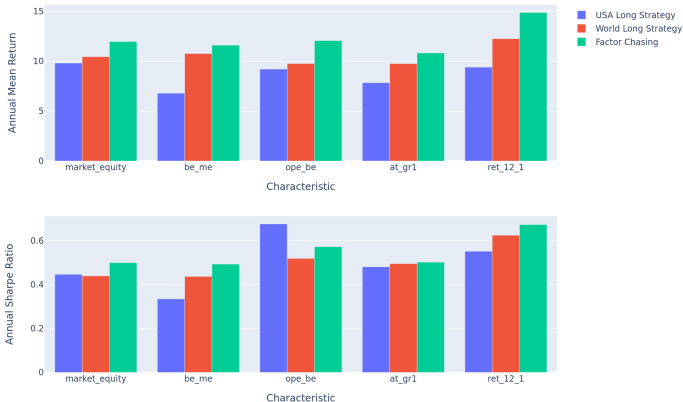

Figure: This plot depicts annual mean returns and annual Sharpe ratios of 5 distinct long-only factor chasing strategies. All strategies buy the 6 best performing country-factors (backward looking 6 month) and hold the portfolio without re-balancing for the next 6 months.

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Long-only Factor Chasing

Performance plots for individual countries
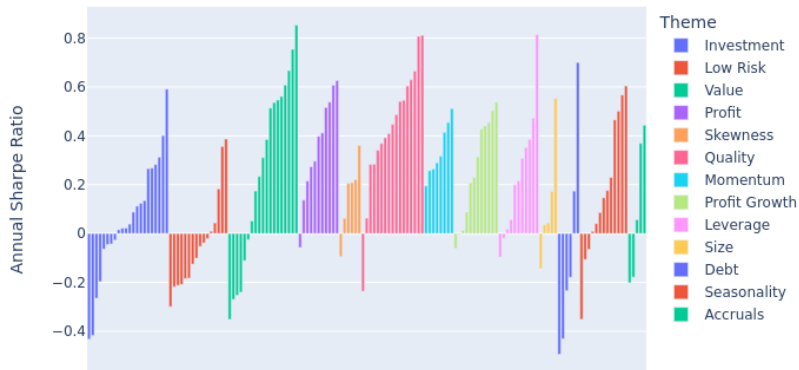
Factor Chasing and Factor Momentum

Table: Factor chasing and the cross-section of national factor momentum strategies. The sample consists of pairs of national time-series factor momentum strategies and a dummy indicating when a factor belongs to the lower 50% of its factor twins in other countries (winning/ losing countries in that factor). Panel A contains all observations, while Panel B contains high sentiment times (highest 50% of the sample), and Panel C contains low sentiment times (lowest 50% of the sample).

	Annualized time-series factor momentum returns				
	(1) 1 Month	(2) 3 Months	(3) 6 Months	(4) 9 Months	(5) 12 Months
Panel A: All Times					
Losing Countries	-1.8	-1.08	-1.44	-0.60	-1.80
Winning Countries	3.24	2.16	1.56	2.04	2.16
Panel B: High Sentiment					
Losing Countries	-1.44	-0.36	-0.72	0.48	0.12
Winning Countries	3.00	1.92	2.4	2.88	2.16
Panel C: Low Sentiment					
Losing Countries	-2.4	-2.64	-2.76	-1.56	-2.52
Winning Countries	2.16	2.04	1.32	1.56	1.80

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Global Factor-Chasing vs Global FF Factors

	SMB	HML	RMW	CMA	WML
alpha	0.48***	0.55***	0.31*	0.27	0.27**
	(0.11)	(0.14)	(0.17)	(0.17)	(0.13)
Market-WorldF	-0.04	-0.06	-0.07	-0.06	-0.08**
	(0.03)	(0.04)	(0.05)	(0.04)	(0.04)
SMB-WorldF	-0.07	-0.14*	-0.15*	-0.08	-0.13
	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)
HML-WorldF	-0.24***	-0.22**	-0.22*	-0.19	-0.26**
	(0.09)	(0.11)	(0.12)	(0.15)	(0.11)
RMW-WorldF	-0.14	-0.18	-0.15	-0.30**	-0.13
	(0.10)	(0.14)	(0.15)	(0.13)	(0.12)
CMA-WorldF	0.20*	0.29**	0.08	0.07	0.45***
	(0.10)	(0.13)	(0.16)	(0.14)	(0.14)
WML-WorldF	-0.09*	-0.05	-0.09	-0.03	-0.12*
	(0.05)	(0.06)	(0.08)	(0.09)	(0.07)
Observations	269	269	269	269	269
R^2	0.10	0.14	0.06	0.05	0.15
Adjusted R^2	0.08	0.12	0.04	0.03	0.13
Residual Std. Error	1.67(df = 262)	2.04(df = 262)	2.36(df = 262)	2.09(df = 262)	2.03(df = 262)
F Statistic	2.68** (df = 6.0; 262.0)	3.58*** (df = 6.0; 262.0)	2.47** (df = 6.0; 262.0)	1.79 (df = 6.0; 262.0)	4.15*** (df = 6.0; 262.0)

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table: This table shows results of regressing 5 factor chasing strategies (size, value, profitability, investment, momentum) on the five Fama-French 2015 developed market factors. In 4 of 5 cases, the factor chasing strategies correlate negatively with their corresponding global factor return.
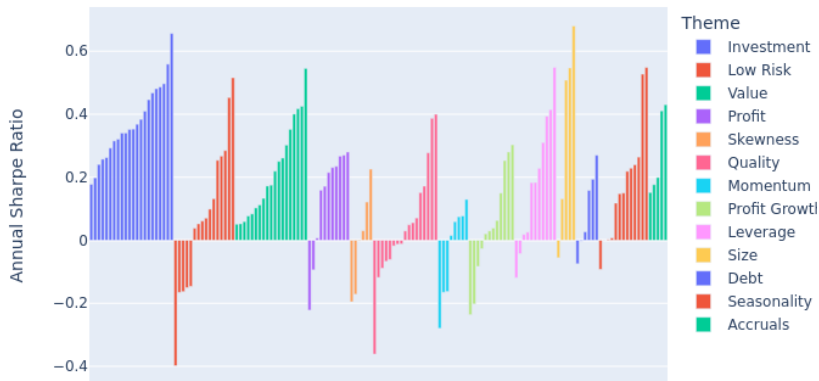
Residual Factor Chasing

Figure: Barplot of Annual Sharpe Ratios for Residual Factor Chasing Strategies. This plot shows the annualized Sharpe Ratio of individual cross-country residual factor chasing strategies. Bars are grouped and colored according to the 13 themes of Jensen, Kelly, and Pedersen (2021).