How Global is Factor Predictability? Evidence from Nested Factor Momentum

AWG 2024

Merlin Bartel
Sebastian Stöckl

Liechtenstein Business School
University of Liechtenstein

September 13th, 2024

Outlook

- Empirical project in international asset pricing

Outlook

- Empirical project in international asset pricing
- Key question: "Are assets priced locally or globally?"

Outlook

- Empirical project in international asset pricing
- Key question: "Are assets priced locally or globally?"
- Setting: Theoretical literature: Assets are priced **globally**

Outlook

- Empirical project in international asset pricing
- Key question: "Are assets priced locally or globally?"
- Setting: Theoretical literature: Assets are priced **globally**
- Fama and French (2012) and others (Griffin, 2002; Fama and French, 2017; Hollstein, 2022)) show that **local** asset pricing models outperform regional and global models in international markets

Outlook

- Empirical project in international asset pricing
- Key question: "Are assets priced locally or globally?"
- Setting: Theoretical literature: Assets are priced **globally**
- Fama and French (2012) and others (Griffin, 2002; Fama and French, 2017; Hollstein, 2022)) show that **local** asset pricing models outperform regional and global models in international markets
- -> Dominance of **local** models over global models

Rationale

- Recently **factor timing**: shown as a crucial component of empirical asset pricing models (Ehsani and Linnainmaa, 2022)

Rationale

- Recently **factor timing**: shown as a crucial component of empirical asset pricing models (Ehsani and Linnainmaa, 2022)
- Augmenting factor models with factor timing signals significantly improves pricing capabilities (i.e. integrating factor momentum)

Rationale

- Recently **factor timing**: shown as a crucial component of empirical asset pricing models (Ehsani and Linnainmaa, 2022)
- Augmenting factor models with factor timing signals significantly improves pricing capabilities (i.e. integrating factor momentum)
- Ehsani and Linnainmaa (2022) call for generally timing-augmented factor models (such as a Fama-French 6 factor model with factor momentum)

Rationale

- We **revisit** the established dominance of local factors in international asset pricing through the lens of factor timing

Rationale

- We **revisit** the established dominance of local factors in international asset pricing through the lens of factor timing
- Focus on the predictability of country-level risk factors with **local, regional, and global factor momentum signals**

Rationale

- We **revisit** the established dominance of local factors in international asset pricing through the lens of factor timing
- Focus on the predictability of country-level risk factors with **local, regional, and global factor momentum signals**
- If predictability reflects country-specific patterns as seen in current asset pricing, country-level factor momentum signals should exceed regional and global signals

Rationale

- We **revisit** the established dominance of local factors in international asset pricing through the lens of factor timing
- Focus on the predictability of country-level risk factors with **local, regional, and global factor momentum signals**
- If predictability reflects country-specific patterns as seen in current asset pricing, country-level factor momentum signals should exceed regional and global signals
- Intuition: If local factors solely drive factor momentum, then building strategies on global signals would result in insignificant abnormal returns

Rationale

- We **revisit** the established dominance of local factors in international asset pricing through the lens of factor timing
- Focus on the predictability of country-level risk factors with **local, regional, and global factor momentum signals**
- If predictability reflects country-specific patterns as seen in current asset pricing, country-level factor momentum signals should exceed regional and global signals
- Intuition: If local factors solely drive factor momentum, then building strategies on global signals would result in insignificant abnormal returns
- Predictors are compared on maximization of investor's utility/ Sharpe ratio levels. Comparing factor models according to their Sharpe ratio (Barillas et al., 2020)

Outlook

- Regional and global signals **surpass** local signals in forecasting factor risk premiums

Outlook

- Regional and global signals **surpass** local signals in forecasting factor risk premiums
- Resulting strategies show higher Sharpe ratios, lower dispersion, and lower maximum drawdowns.
- Non-local factor predictability potentially improves leading asset pricing models

Outlook

- Regional and global signals **surpass** local signals in forecasting factor risk premiums
- Resulting strategies show higher Sharpe ratios, lower dispersion, and lower maximum drawdowns.
- Non-local factor predictability potentially improves leading asset pricing models
- Moreover, non-local signals revive momentum investing in markets previously lacking momentum opportunities, such as Japan

Outlook

Global Factor Momentum

Formal Strategy Definitions

For each country $c \in C$ and signal formation area A, factors are sorted into winners $W_{c,t}$ and losers $L_{c,t}$, where:

$$W^A_{c,t} = \{i \in I | M^A_{i,t} > median(M^A_{.,t})\}$$

and

$$L^A_{c,t} = \{i \in I | M_{i,t} \leq median(M^A_{.,t})\}$$

The return of a momentum strategy portfolio in a country c, for formation region A at time $t+1$, denoted by $F^A_{c,t+1}$is calculated as the difference between the average return of the winners $W^A_{c,t}$ and the losers $L^A_{c,t}$:

$$P^A_{c,t+1} = \frac{1}{|W^A_{c,t}|} \sum_{i \in W^A_{c,t}} F_{i,t+1} - \frac{1}{|L^A_{c,t}|} \sum_{i \in L^A_{c,t}} F_{i,t+1}$$

Data

- International factor return data by Jensen, Kelly, and Pedersen (2023) (`https://jkpfactors.com/`)
- 153 Factors (from 13 themes) x 73 countries
- $h = 1$ following Gupta and Kelly (2019)
- Sample:
  - Time-frame: July 1998 - December 2022
  - Main Cross-section: 23 developed countries

    [AUS, AUT, BEL, CAN, CHE, DEU, DNK, ESP, FIN,FRA, GBR, HKG, ISR, ITA, JPN, KOR, NLD, NOR, NZL, POL, SGP, SWE, USA]

Number of Factors

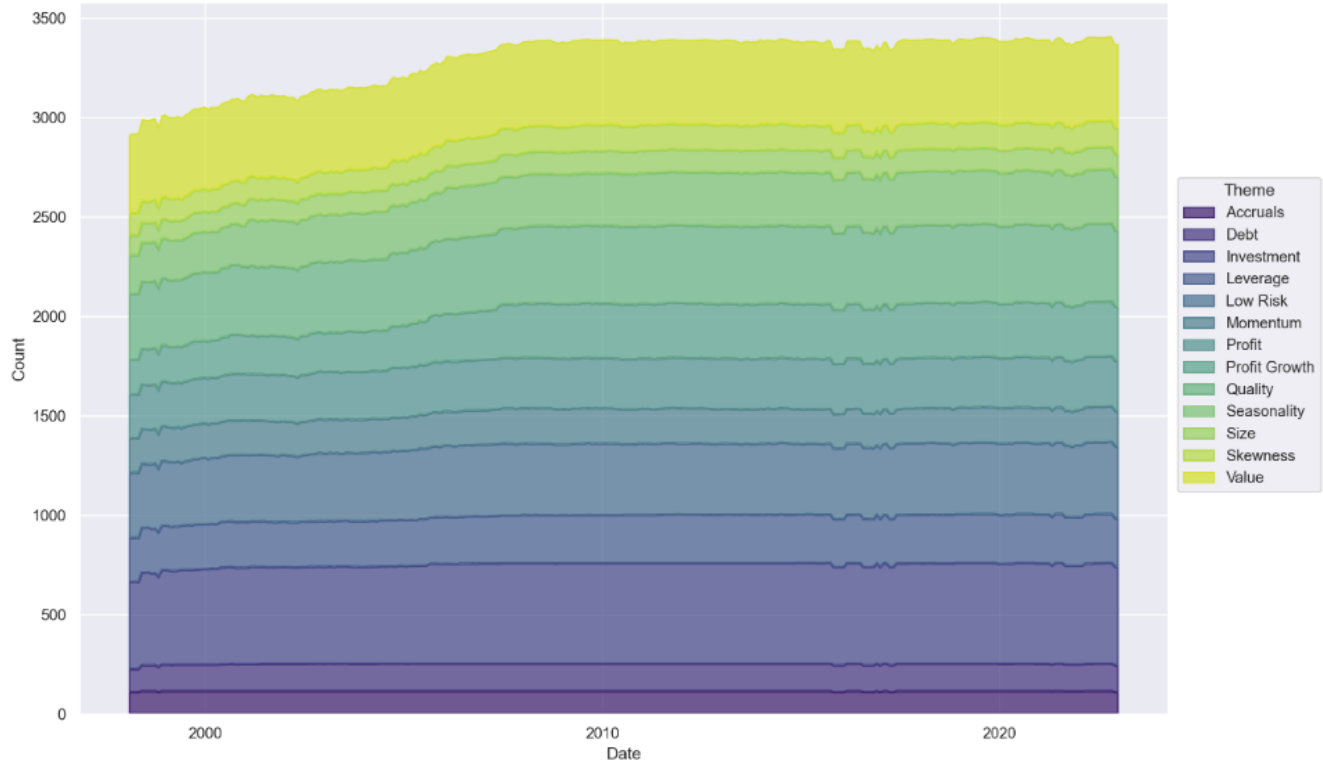


Figure: Number of factors over time: This figure depicts the number of factors available in our sample over time, visually categorized according to the 13 themes defined by Jensen, Kelly, and Pedersen, 2023. At its end, the sample consists of 153 factors in 23 developed countries. Our sample spans the time period from January 1998 to December 2022.

Advanced Factor Momentum: Sharpe Ratios

Annualized Sharpe ratios	Mean	Std	Min	Q25	Median	Q75	Max
Factor Momentum	0.24	0.19	-0.07	0.12	0.17	0.37	0.69
AFM - Regional Sig	0.40***	0.13	0.16	0.31	0.40	0.48	0.70
AFM - Developed Sig	0.51***	0.15	0.24	0.42	0.53	0.59	0.75
AFM - Global Sig	0.44***	0.15	0.17	0.37	0.45	0.51	0.70

Aggregate Portfolio Statistics

	Return	Std	Sharpe Ratio	Skewness	Maximum Drawdown
Panel A: Standard Factor Momentum					
Mean	3.45	13.66	0.24	0.07	-0.40
Std	3.92	6.06	0.19	0.18	0.18
Min	-1.16	8.40	-0.07	-0.23	-0.94
Q25	1.23	10.55	0.12	-0.08	-0.48
Median	3.11	11.85	0.17	0.07	-0.37
Q75	4.26	15.24	0.37	0.16	-0.29
Max	17.89	35.38	0.69	0.45	-0.15
Panel B: Advanced Factor Momentum - Regional Signal					
Mean	4.05 [0.81]	10.18 [-6.10]	0.40 [4.34]	0.17 [1.80]	-0.27 [5.96]
Std	2.05	4.07	0.13	0.30	0.13
Min	1.51	6.75	0.16	-0.20	-0.75
Q25	2.85	8.25	0.31	0.05	-0.28
Median	3.36	9.20	0.4	0.15	-0.25
Q75	4.68	10.37	0.48	0.26	-0.19
Max	10.85	27.23	0.70	1.09	-0.13
Panel C: Advanced Factor Momentum - Developed Signal					
Mean	5.04 [2.49]	10.06 [-6.72]	0.51 [9.09]	0.21 [2.79]	-0.23 [8.54]
Std	2.21	4.11	0.15	0.25	0.14
Min	2.24	6.34	0.24	-0.29	-0.73
Q25	3.73	8.21	0.42	0.15	-0.27
Median	4.35	9.14	0.53	0.21	-0.20
Q75	5.47	10.19	0.59	0.31	-0.14
Max	11.89	27.2	0.75	0.73	-0.08
Panel D: Advanced Factor Momentum - Global Signal					
Mean	4.14 [0.95]	9.44 [-6.64]	0.44 [6.05]	0.15 [1.93]	-0.24 [8.15]
Std	1.90	3.41	0.15	0.22	0.13
Min	1.32	6.12	0.17	-0.28	-0.64
Q25	3.07	7.79	0.37	0.07	-0.28
Median	3.90	8.48	0.45	0.13	-0.21
Q75	4.66	9.61	0.51	0.26	-0.15
Max	10.59	23.14	0.7	0.74	-0.10

Aggregate Portfolio Statistics

	Return	Std	Sharpe Ratio	Skewness	Maximum Drawdown
Panel A: Standard Factor Momentum					
Mean	3.45	13.66	0.24	0.07	-0.40
Std	3.92	6.06	0.19	0.18	0.18
Min	-1.16	8.40	-0.07	-0.23	-0.94
Q25	1.23	10.55	0.12	-0.08	-0.48
Median	3.11	11.85	0.17	0.07	-0.37
Q75	4.26	15.24	0.37	0.16	-0.29
Max	17.89	35.38	0.69	0.45	-0.15
Panel B: Advanced Factor Momentum - Regional Signal					
Mean	4.05 [0.81]	10.18 [-6.10]	0.40 [4.34]	0.17 [1.80]	-0.27 [5.96]
Std	2.05	4.07	0.13	0.30	0.13
Min	1.51	6.75	0.16	-0.20	-0.75
Q25	2.85	8.25	0.31	0.05	-0.28
Median	3.36	9.20	0.4	0.15	-0.25
Q75	4.68	10.37	0.48	0.26	-0.19
Max	10.85	27.23	0.70	1.09	-0.13
Panel C: Advanced Factor Momentum - Developed Signal					
Mean	5.04 [2.49]	10.06 [-6.72]	0.51 [9.09]	0.21 [2.79]	-0.23 [8.54]
Std	2.21	4.11	0.15	0.25	0.14
Min	2.24	6.34	0.24	-0.29	-0.73
Q25	3.73	8.21	0.42	0.15	-0.27
Median	4.35	9.14	0.53	0.21	-0.20
Q75	5.47	10.19	0.59	0.31	-0.14
Max	11.89	27.2	0.75	0.73	-0.08
Panel D: Advanced Factor Momentum - Global Signal					
Mean	4.14 [0.95]	9.44 [-6.64]	0.44 [6.05]	0.15 [1.93]	-0.24 [8.15]
Std	1.90	3.41	0.15	0.22	0.13
Min	1.32	6.12	0.17	-0.28	-0.64
Q25	3.07	7.79	0.37	0.07	-0.28
Median	3.90	8.48	0.45	0.13	-0.21
Q75	4.66	9.61	0.51	0.26	-0.15
Max	10.59	23.14	0.7	0.74	-0.10

Spanning Tests

	α [#]	β_{Mkt}	β_{HML}	β_{SMB}	β_{RMW}	β_{CMA}	β_{MOM}	R^2
	Panel A: Local FF 3 Factor Model							
Factor Momentum	0.26 [9]	-0.06	-0.06	-0.07				0.06
AFM - Regional Sig	0.35 [16]	-0.05	-0.04	-0.07				0.06
AFM - Developed Sig	0.42 [21]	-0.04	-0.05	-0.04				0.05
AFM - Global Sig	0.35 [19]	-0.05	-0.04	-0.04				0.05
	Panel B: Local FF 5 Factor Model							
Factor Momentum	0.23 [8]	-0.06	-0.10	-0.05	-0.04	0.01		0.08
AFM - Regional Sig	0.33 [18]	-0.04	-0.05	-0.03	-0.04	-0.03		0.08
AFM - Developed Sig	0.40 [19]	-0.04	-0.07	-0.03	-0.02	0.02		0.07
AFM - Global Sig	0.35 [18]	-0.04	-0.05	-0.03	-0.02	-0.01		0.07
	Panel C: Local FF 6 Factor Model							
Factor Momentum	0.19 [8]	-0.05	-0.08	-0.05	-0.02	0.01	0.05	0.10
AFM - Regional Sig	0.33 [16]	-0.04	-0.05	-0.04	-0.02	-0.01	0.01	0.09
AFM - Developed Sig	0.42 [18]	-0.04	-0.07	-0.02	-0.01	0.02	-0.01	0.08
AFM - Global Sig	0.34 [16]	-0.04	-0.04	-0.03	-0.02	0.01	0.01	0.09

Table: Risk adjustment: This table reports average coefficients and the average r-squared statistic of time-series regressions of (advanced) factor momentum strategies on local factor models. Panel A shows the Fama French 3-factor model. Panel B shows the Fama French 5-factor model. Panel C shows the Fama French 6-factor model. For each strategy, we run 23 distinct time-series regressions (23 countries) of the respective factor momentum strategy return on its matching local factor model. Additionally, we report the number (#) of statistically significant alphas (based on Newey and West (1987) standard errors) in all 23 regressions.

Signal Double Sorts

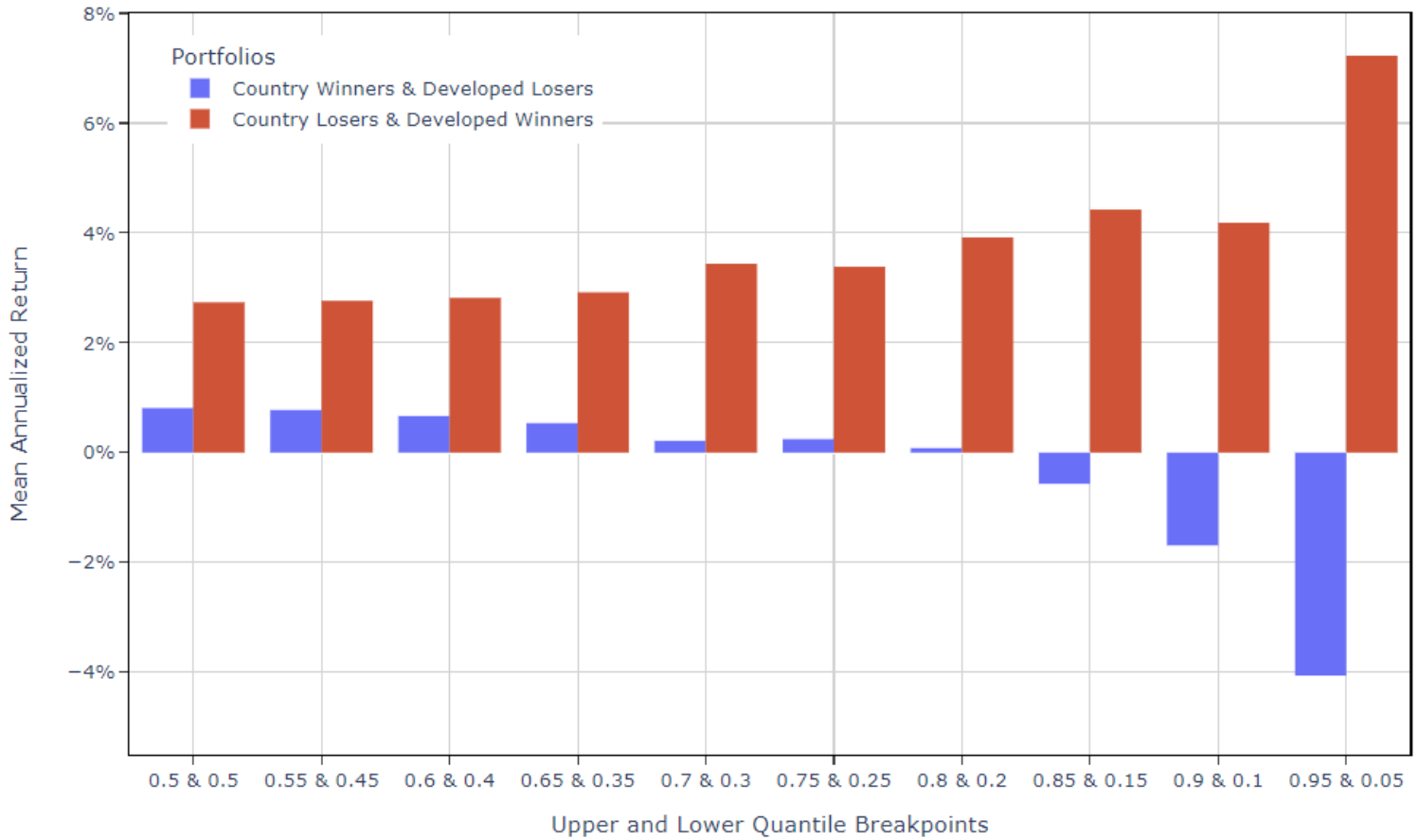
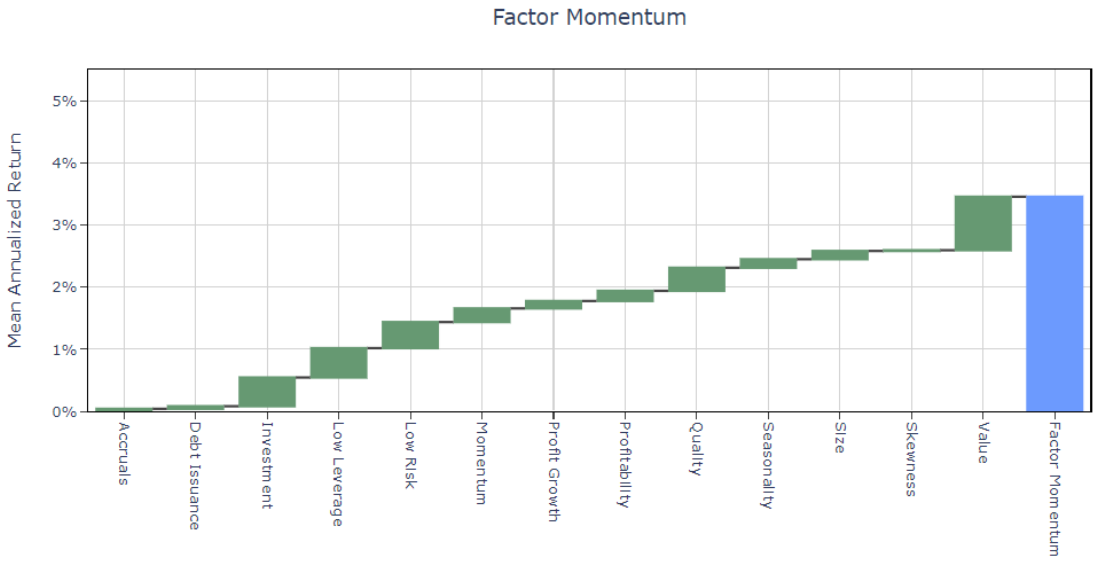
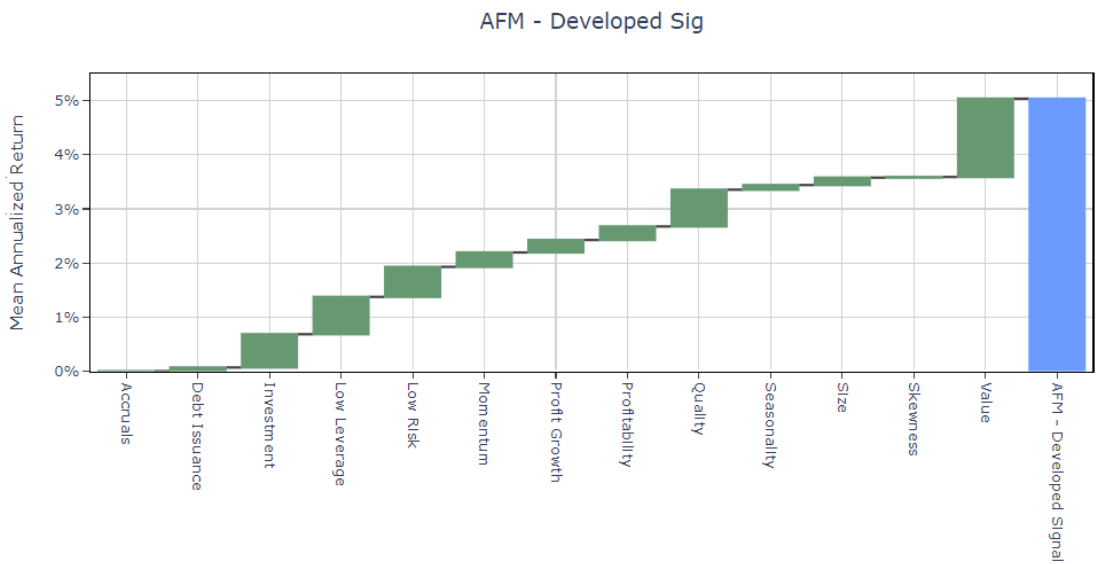


Figure: Annualized portfolio returns from a local/developed signal double sort for increasingly exclusive breakpoints.

Theme-Level Contribution





Conclusion

- Factor Momentum and resulting factor predictability is an international, **not** a **local** phenomenon
- Factors in countries are serially correlated, but are even stronger cross-autocorrelated to regional/global factors
- Predictability is important for investors and academics alike
- These insights can enhance the construction of asset pricing models, improve investment strategies, and offer a more nuanced understanding of global financial markets

Thank you for your attention.

Any comments are most welcome!

References I

Newey, W. K. and West, K. D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica* 55 (3), 703.

Griffin, J. M. (2002). Are the Fama and French Factors Global or Country Specific? *Review of Financial Studies* 15 (3), 783–803.

Fama, E. F. and French, K. R. (2012). Size, value, and momentum in international stock returns. *Journal of Financial Economics* 105 (3), 457–472.

Fama, E. F. and French, K. R. (2017). International tests of a five-factor asset pricing model. *Journal of Financial Economics* 123 (3), 441–463.

Gupta, T. and Kelly, B. (2019). Factor Momentum Everywhere. *The Journal of Portfolio Management* 45 (3), 13–36.

Barillas, F., Kan, R., Robotti, C., and Shanken, J. (2020). Model Comparison with Sharpe Ratios. *Journal of Financial and Quantitative Analysis* 55 (6), 1840–1874.

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

Hollstein, F. (2022). Local, Regional, or Global Asset Pricing? *Journal of Financial and Quantitative Analysis* 57 (1), 291–320.

References II

 Jensen, T. I., Kelly, B., and Pedersen, L. H. (2023). Is There a Replication Crisis in Finance? *The Journal of Finance* 78 (5), 2465–2518.

Country-level Performance: Country Signal

Country	Return	Std	Sharpe Ratio	Skewness	Maximum Drawdown
AUS	1.21	8.40	0.14	0.05	-0.27
AUT	-0.64	9.55	-0.07	-0.09	-0.51
BEL	5.71	12.98	0.44	0.05	-0.37
CAN	3.11	16.03	0.19	0.40	-0.32
CHE	4.56	11.85	0.38	0.17	-0.17
DEU	1.13	10.58	0.11	0.25	-0.44
DNK	3.34	12.18	0.27	0.05	-0.48
ESP	1.22	11.45	0.11	-0.11	-0.44
FIN	17.89	25.85	0.69	0.45	-0.48
FRA	1.08	9.28	0.12	-0.09	-0.29
GBR	4.33	8.96	0.48	0.11	-0.15
HKG	5.63	12.95	0.43	-0.23	-0.30
IRL	4.20	35.38	0.12	-0.23	-0.94
ISR	9.43	16.50	0.57	0.09	-0.28
ITA	1.70	11.86	0.14	0.27	-0.51
JPN	1.55	9.19	0.17	0.14	-0.30
NLD	3.89	14.65	0.27	0.10	-0.45
NOR	1.28	10.95	0.12	-0.06	-0.34
NZL	1.24	10.51	0.12	0.31	-0.39
PRT	-1.16	16.87	-0.07	-0.11	-0.63
SGP	4.02	11.19	0.36	0.15	-0.20
SWE	1.24	15.83	0.08	-0.07	-0.61
USA	3.47	11.29	0.31	0.07	-0.25
Mean	3.45	13.66	0.24	0.07	-0.40

Country-level Performance: Developed Signal

Country	Return	Std	Sharpe Ratio	Skewness	Maximum Drawdown
AUS	3.82	6.34	0.60	0.21	-0.11
AUT	2.24	7.92	0.28	0.14	-0.43
BEL	5.04	8.86	0.57	0.15	-0.30
CAN	2.47	10.17	0.24	-0.29	-0.22
CHE	5.11	9.55	0.54	0.29	-0.18
DEU	4.31	8.20	0.53	0.39	-0.14
DNK	6.98	9.32	0.75	0.16	-0.18
ESP	3.10	8.79	0.35	0.27	-0.23
FIN	9.31	14.27	0.65	0.65	-0.30
FRA	3.91	8.46	0.46	0.15	-0.20
GBR	4.31	7.67	0.56	0.18	-0.10
HKG	6.74	9.14	0.74	0.38	-0.15
IRL	11.89	27.20	0.44	-0.07	-0.73
ISR	7.10	9.44	0.75	0.26	-0.21
ITA	5.07	10.22	0.50	0.32	-0.24
JPN	4.27	7.28	0.59	0.29	-0.12
NLD	4.35	11.29	0.39	0.14	-0.21
NOR	3.64	8.77	0.42	0.17	-0.18
NZL	3.21	7.44	0.43	0.73	-0.10
PRT	4.49	10.85	0.41	-0.14	-0.32
SGP	5.73	8.21	0.70	0.51	-0.08
SWE	3.51	11.99	0.29	-0.24	-0.44
USA	5.21	9.88	0.53	0.25	-0.20
Mean	5.04	10.05	0.51	0.21	-0.23

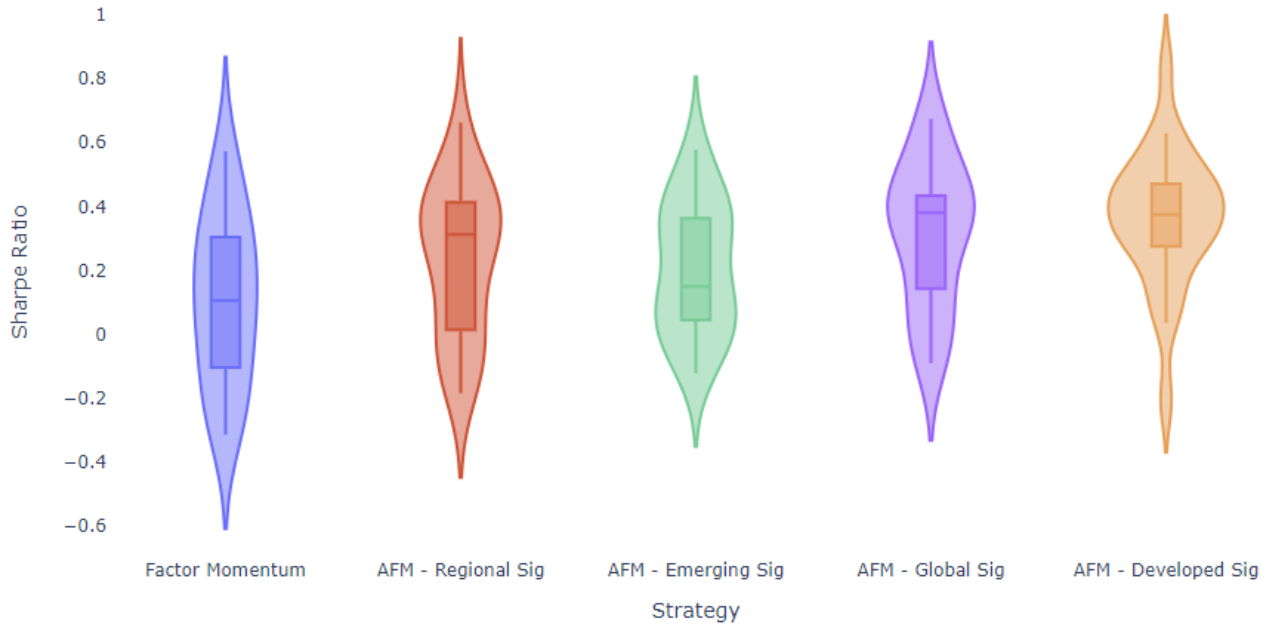
Time Robustness I

Figure: This figure depicts Sharpe ratios in the next 12/23 developed countries over years 1998-2022. In each year we calculate the mean and standard deviations to retrieve year-level Sharpe ratios (for all four factor momentum strategies).

Time Robustness II

Figure: This figure depicts Sharpe ratios in the next 12/23 developed countries over years 1998-2022. In each year we calculate the mean and standard deviations to retrieve year-level Sharpe ratios (for all four factor momentum strategies).

Robustness Test: Emerging Markets



Strategy	Mean	Std	Min	Q25	Median	Q75	Max
Factor Momentum	0.11	0.26	-0.31	-0.08	0.11	0.3	0.57
AFM - Regional Sig	0.23***	0.24	-0.18	0.04	0.31	0.41	0.66
AFM - Emerging Sig	0.21*	0.2	-0.12	0.05	0.15	0.36	0.58
AFM - Global Sig	0.31***	0.23	-0.09	0.15	0.38	0.43	0.67
AFM - Developed Sig	0.37***	0.21	-0.21	0.28	0.38	0.47	0.84

Figure: This figure depicts violin plots for 23 Sharpe ratios corresponding to the performance of country-level factor momentum strategies (emerging markets) that are formed based on four different signals. All strategies are based on cross-sectional 1-month historical factor performance sorts and formed based on a median breakpoint that leads to a strategy that invests in 50% of a country's factors and shorts the other 50%.