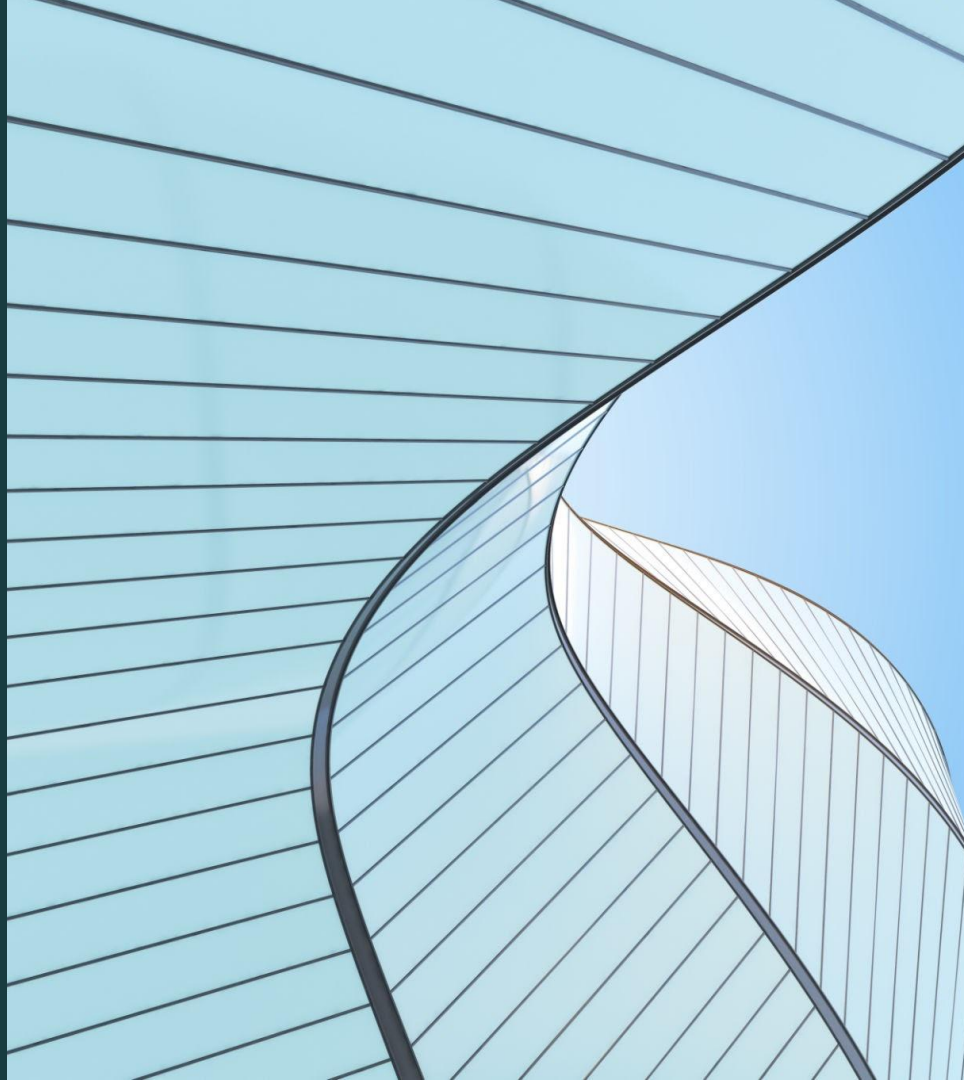
Spring 2025
Quantitative Asset Management

SECTOR RELATIVE SECOND ORDER MOMENTUM STRATEGY

Nicholas Delianedis, Julia Figueros, Sven Hauksson, Pranay Kumar



Portfolio Strategy Overview

- Second-Order Momentum
  - Ranking the change in lagged returns
- Sector-Relative Ranking
- Signals

Second Order Momentum

- Construction
- Utilization

```
df.sort_values(by=['daten', 'permno'])
df['Delta_Ret'] = df.groupby('permno')['ret'].diff()
df['Delta_Ret'] = df['Delta_Ret'].shift(1)
df['Rank_Delta_Ret'] = df.groupby('daten')['Delta_Ret'].rank()
df = df.dropna()
```

Portfolio Strategy Overview

- Second-Order Momentum
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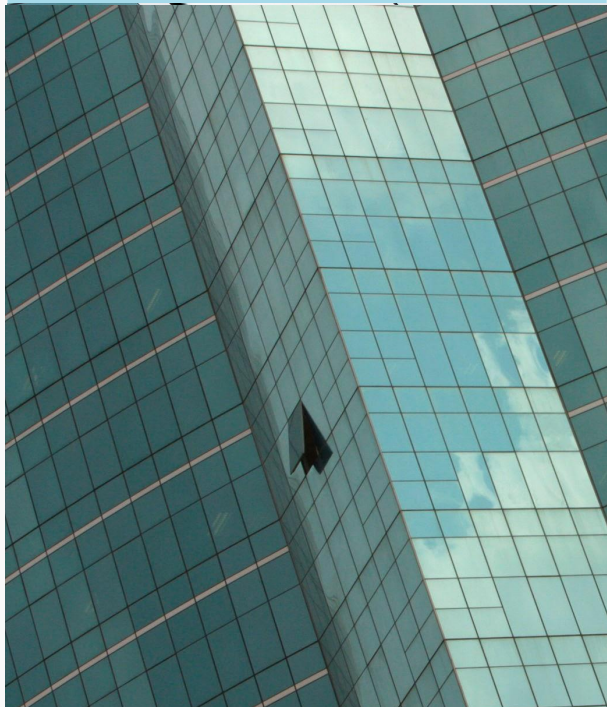
- Sector-Relative Ranking
  - Performance compared to sector
- Signals



Industry Codes (SICCD)

Standard Industrial Classification Code

- What are they?
- Filtering
- Understanding

Industry Group 138: Oil And Gas Field Services

- 1381 Drilling Oil and Gas Wells
- 1382 Oil and Gas Field Exploration Services
- 1389 Oil and Gas Field Services, Not Elsewhere Classified

Division Structure

A. Division A: Agriculture, Forestry, And Fishing
   - Major Group 01: Agricultural Production Crops
   - Major Group 02: Agriculture Production Livestock And Animal Specialties
   - Major Group 07: Agricultural Services
   - Major Group 08: Forestry
   - Major Group 09: Fishing, Hunting, And Trapping

B. Division B: Mining
   - Major Group 10: Metal Mining
   - Major Group 12: Coal Mining
   - Major Group 13: Oil And Gas Extraction
   - Major Group 14: Mining And Quarrying Of Nonmetallic Minerals

C. Division C: Construction
   - Major Group 15: Building Construction General Contractors
   - Major Group 16: Heavy Construction Other Than Building

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SIGNALS

First Order Momentum

Momentum as implemented in PS3

Second Order Momentum

Difference in annual returns as calculated for momentum by month

Sector Adjusted S.O. Momentum

Second order momentum, with returns adjusted by industry

Sector Ranked S.O. Momentum

Sector adjusted second order momentum, but ranked within industry groups

SIGNALS

Blends

Linear mix of first and second order momentum, using weights 80/20, 50/50, and 20/80

Nonlinear Blends

x-1/2x^2

Vol-Adjusted Momentum

First order momentum adjusted for volatility

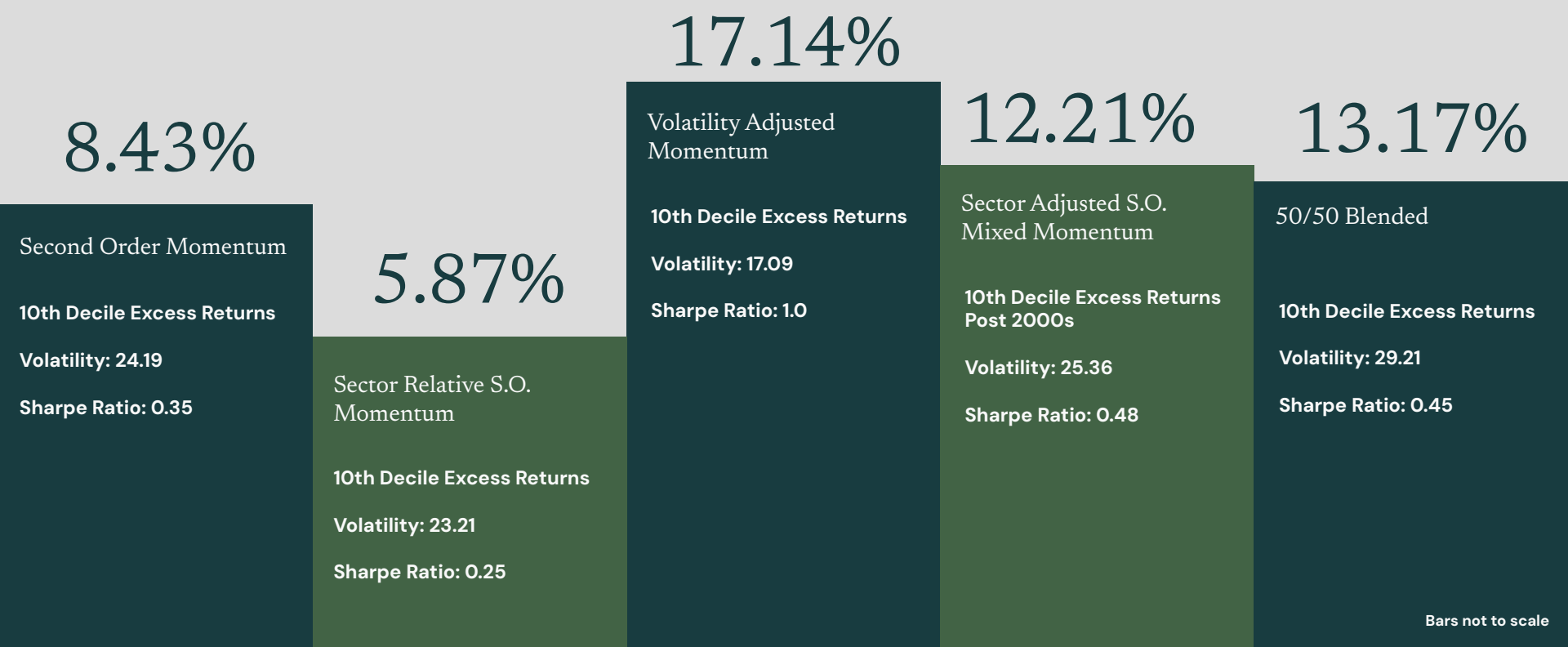
Deciles

- **Daniel and Moskowitz Breakpoints**
  - Even deciles over all exchanges
- **Kenneth French Breakpoints**
  - Breakpoints formed on NYSE, deciles created based on those breakpoints.
- **Used Daniel and Moskowitz**
  - DM breakpoints were used to allow for more sensitive momentum changes to be visible and not overshadowed by NYSE.

FF3 ALPHAS


0.36
First Order Momentum
WML Sharpe Ratio
Excess Returns: 13.15%
Volatility: 36.85
0.35
Vol-Adjusted Momentum
WML Sharpe Ratio
Excess Returns: 6.41%
Volatility: 18.06
0.40
S.O. Mixed Momentum
WML Sharpe Ratio
Excess Returns: 14.28%
Volatility: 35.83
0.38
Sector Adjusted S.O. Mixed Momentum
WML Sharpe Ratio
Excess Returns: 7.49%
Volatility: 19.53
0.25
80/20 Blended
WML Sharpe Ratio
Excess Returns: 9.08%
Volatility: 36.24
Bars not to scale

SELECT SIGNAL RETURNS



Nonlinear Sector-Adjusted Blended Momentum

This signal provided the best overall results for our strategy.

	1	2	3	4	5	6	7	8	9	10	WML
Excess Return	9.26	9.50	7.19	8.50	8.94	8.09	9.68	11.35	11.97	16.87	7.49
Volatility	20.80	19.72	17.86	16.90	16.06	16.14	16.93	17.53	19.19	25.69	19.53
Sharpe Ratio	0.45	0.48	0.40	0.50	0.56	0.50	0.57	0.65	0.62	0.66	0.38

7.49%

WML Excess Return

0.38

WML Sharpe Ratio

Volatility-Adjusted Momentum

This signal provided the best post-2000 results for our strategy.

	1	2	3	4	5	6	7	8	9	10	WML
Excess Return	9.07	11.87	6.77	12.12	6.13	8.89	8.71	8.41	10.02	15.47	6.41
Volatility	21.66	26.30	19.61	37.11	19.00	17.73	18.51	18.38	18.26	17.35	18.06
Sharpe Ratio	0.42	0.45	0.35	0.33	0.32	0.50	0.47	0.46	0.55	0.89	0.35

6.41%

WML Excess Return

0.35

WML Sharpe Ratio

80/20 Ranked Blend

This signal provided the best post-2000 results for our strategy.

	1	2	3	4	5	6	7	8	9	10	WML
Excess Return	5.43	7.47	7.70	9.19	8.60	6.67	8.52	9.65	10.48	13.31	7.88
Volatility	15.78	14.71	14.61	14.13	15.32	14.65	14.96	17.11	19.02	26.91	20.01
Sharpe Ratio	0.34	0.51	0.53	0.65	0.56	0.46	0.57	0.56	0.55	0.51	0.39

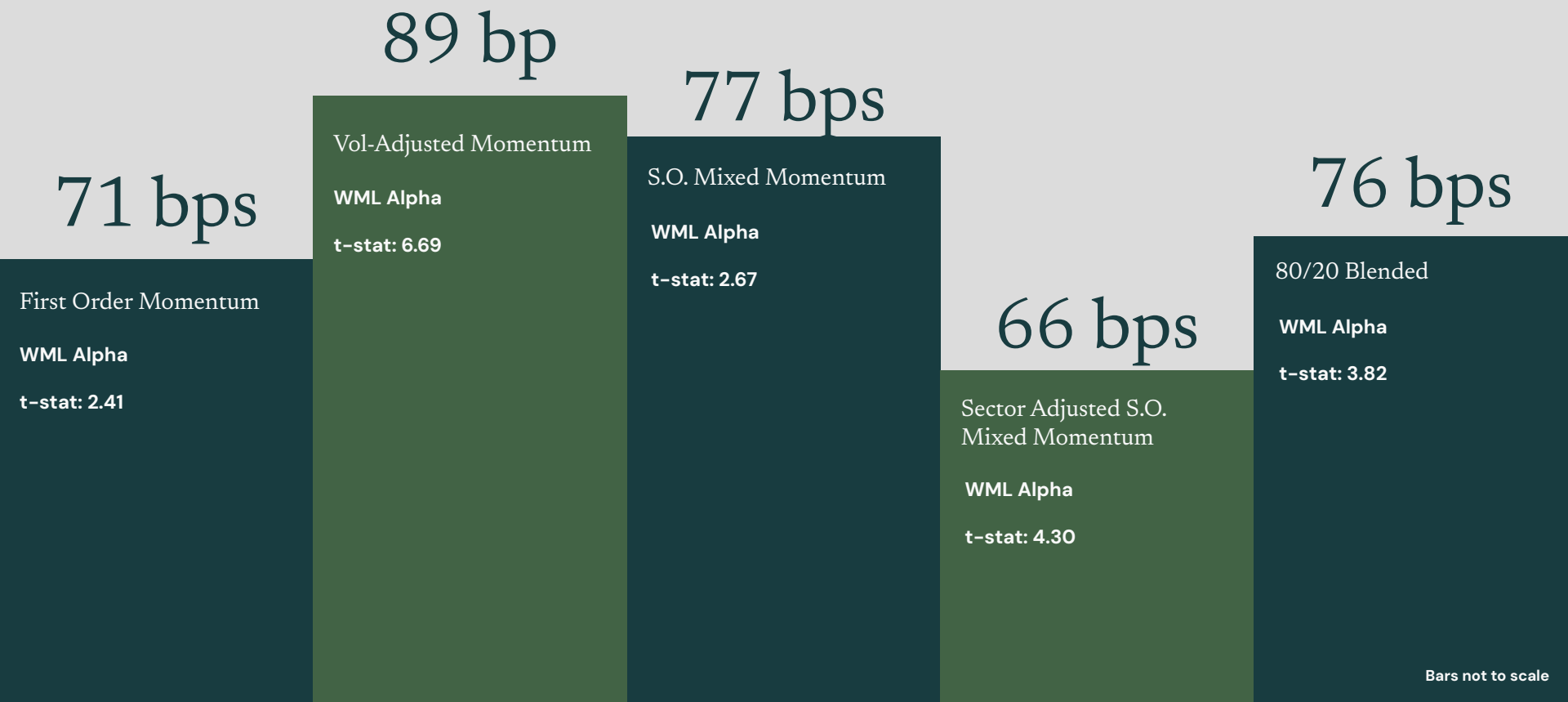
13.31%

Decile 10 Excess Return

0.51

Decile 10 Sharpe Ratio

FF3 ALPHAS


71 bps
First Order Momentum
WML Alpha
t-stat: 2.41
89 bp
Vol-Adjusted Momentum
WML Alpha
t-stat: 6.69
77 bps
S.O. Mixed Momentum
WML Alpha
t-stat: 2.67
66 bps
Sector Adjusted S.O. Mixed Momentum
WML Alpha
t-stat: 4.30
76 bps
80/20 Blended
WML Alpha
t-stat: 3.82
Bars not to scale

80/20 Strategy

- **Identifying Early**
  - Performance improvements show that acceleration identifies early shifts in the momentum

- **Costs and Risk**
  - Volatility
  - Turnover rate

- **Robustness**
  - Consistent performance before and after 2000.
    - Sharpe ratio rose from 0.25 to 0.41

Investor Rationale

- **Implementation**
  - Easy to implement and scale for institutions.
  - Avoids overexposure to any specific industry

- **Benefits**
  - Captures early momentum while filtering noise from market trends
  - Delivers strong alpha (76 bps/month, t = 3.82) by exploiting under-reacted price acceleration

Conclusion

- The strategy presents considerable potential, but may deter more risk-averse investors.
- Good consistent performance over decades
- Easy to extend into other markets

Thank you