EFS04 and 05 Lecture Summary

Overview

This document summarizes the EFS-04 and 05 lectures on Quantitative momentum strategies. These lectures will cover various causes of momentum and how to build strategies based on it.

The lectures cover the following topics -

- Causes of momentum
    - Roll return as a driver of momentum
        - Backwardation vs Contango
        - Arbitrage between future and spot returns
        - Types of momentum
        - Statistical tests for time-series momentum
        - Example of time-series future momentum strategy
        - Example of cross-sectional future momentum strategy
        - Example of cross-sectional stock momentum strategy
    - Event-driven momentum
    - Forced sales and purchases due to funds
- Exit strategies
- Advantages and disadvantages of momentum strategies

Causes of momentum

Momentum refers to the ability of the market to sustain its trend in the future.

Momentum can be caused due to various factors such as -

- Persistence of roll returns in futures
- New information reaches different people at different times. Even if it reaches at the same time, the analysis time is different
- Forced sale or purchases of assets by various funds
- Market manipulation techniques also ignite momentum. Techniques such as -
    - Quote matching
    - Flipping
    - Stop hunting
    - Front-running order flow

Roll return as a driver of momentum

- Total returns in futures can be given as -

Total return = Return of spot price + roll return

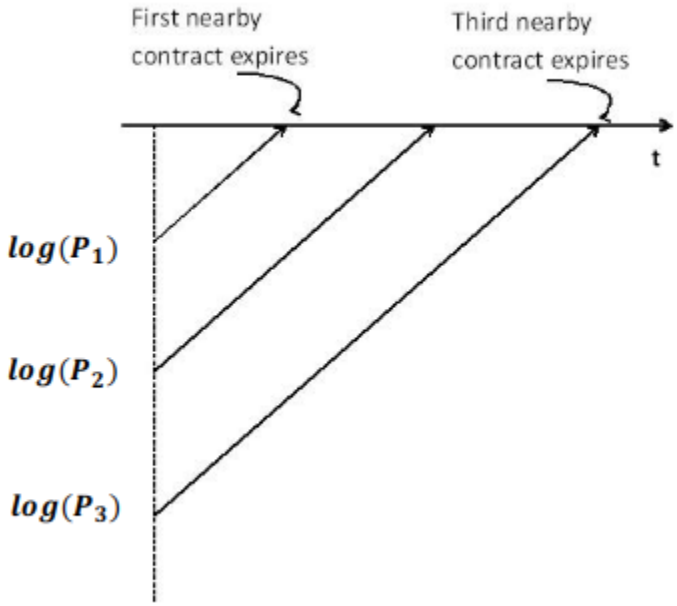
- So, even if the spot price is unchanged, the futures price can still change.
- If roll return is positive, the market is said to be in backwardation.
- If roll return is negative, the market is said to be in contango.

Backwardation vs Contango

Backwardation

- Backwardation is when the current price of the asset is higher than the futures price.

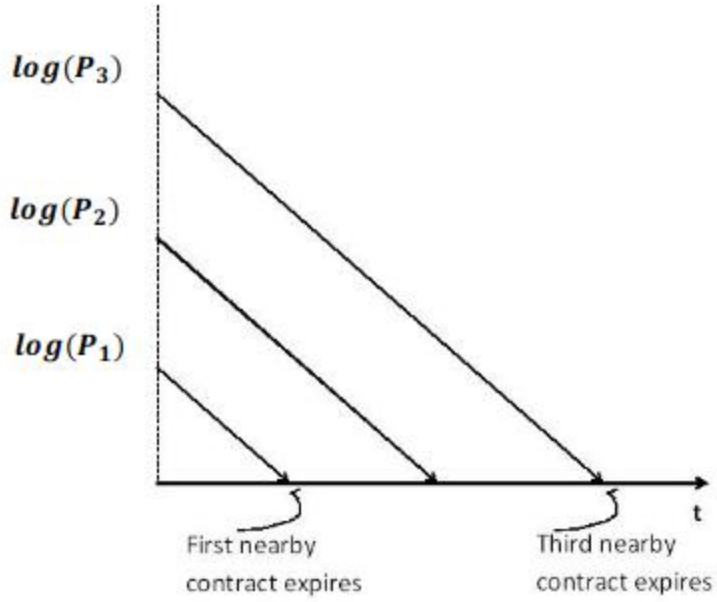
The following snapshot shows the log price vs time-to-maturity plot. This represents backwardation.



Contango

- Contango is when the current price of the asset is lower than the futures price.

The following snapshot shows the log price vs time-to-maturity plot. This represents contango.



Arbitrage between future and spot returns

Forward curves

The forward curve of futures is a plot of prices vs time to maturity at a given point in time.
It's also called the Term structure.

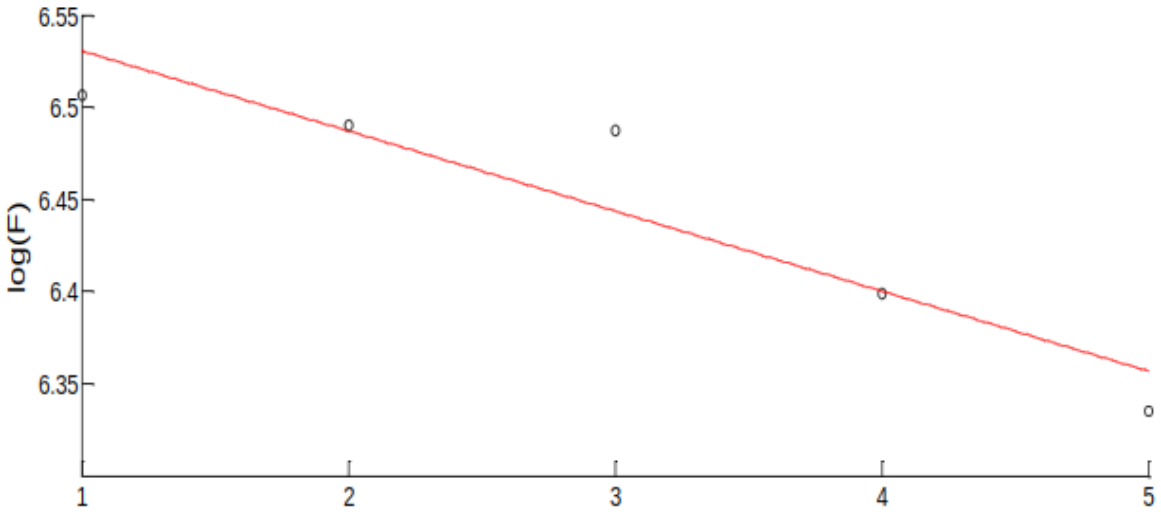
Estimating the spot and roll return

Assume both spot and roll returns are constant over time. Then, the futures price is given by -

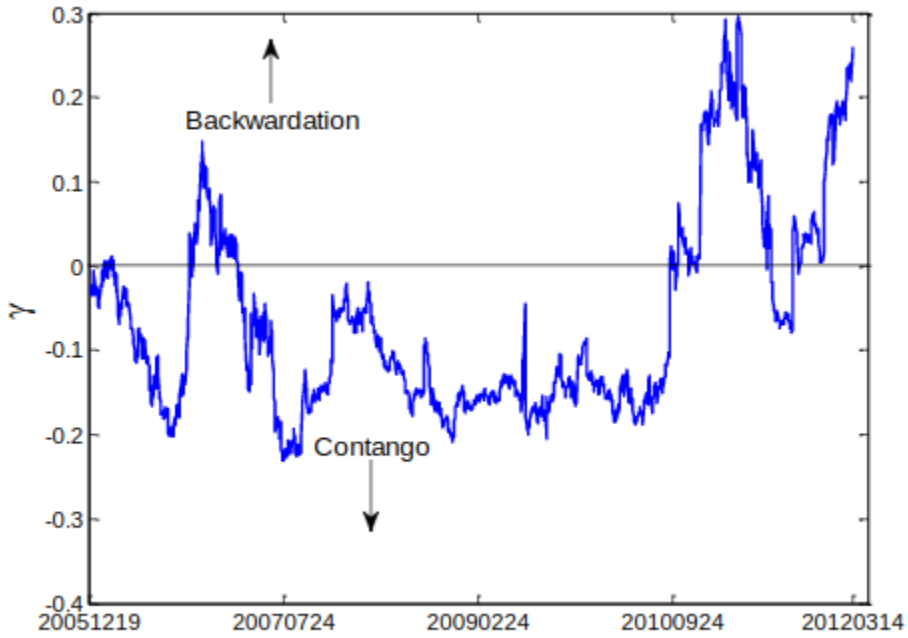
$$F(t,T) = c\ e^{\alpha t} exp(\gamma(t-T))$$

where,
t is the current date
T is the expiration date
Alpha is spot return (constant)
Gamma is roll return (constant)

The snapshot shows the log futures price vs time-to-maturity (Forward curve)



The following snapshot shows the roll return as a function of time.



Types of momentum

Time-series momentum

- In this, past returns of a price series are positively correlated with future returns.
- For example - A stock that went up will go higher.

Cross-sectional momentum

- In this, past relative returns are positively correlated with future relative returns.
- Past returns of an instrument that out (under) perform another instrument will continue to do so.

Roll return and future momentum

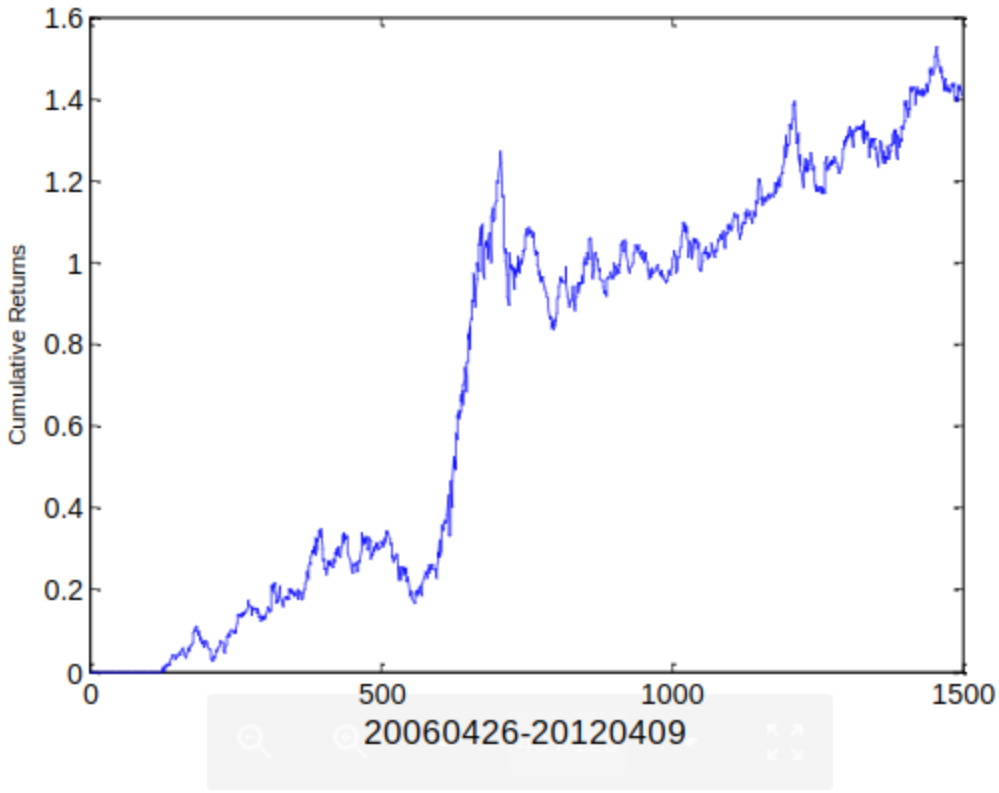
- Roll returns are much less volatile than spot returns.
- If roll returns dominate total returns of the future, it's called time-series momentum.
- Even if spot returns dominate total returns, as long as they are not anti-correlated with roll return, they can be arbitraged away in a long-short portfolio. This is called cross-sectional momentum.

Extraction of roll return

- It can be done by arbitrage between future and spot prices.
- For example - GC (gold futures) vs GLD (Gold Trust ETF)

- Even if there is no readily traded underlying asset, we can still do arbitrage between future and another traded instrument which is highly anti-correlated with the spot return of the future.

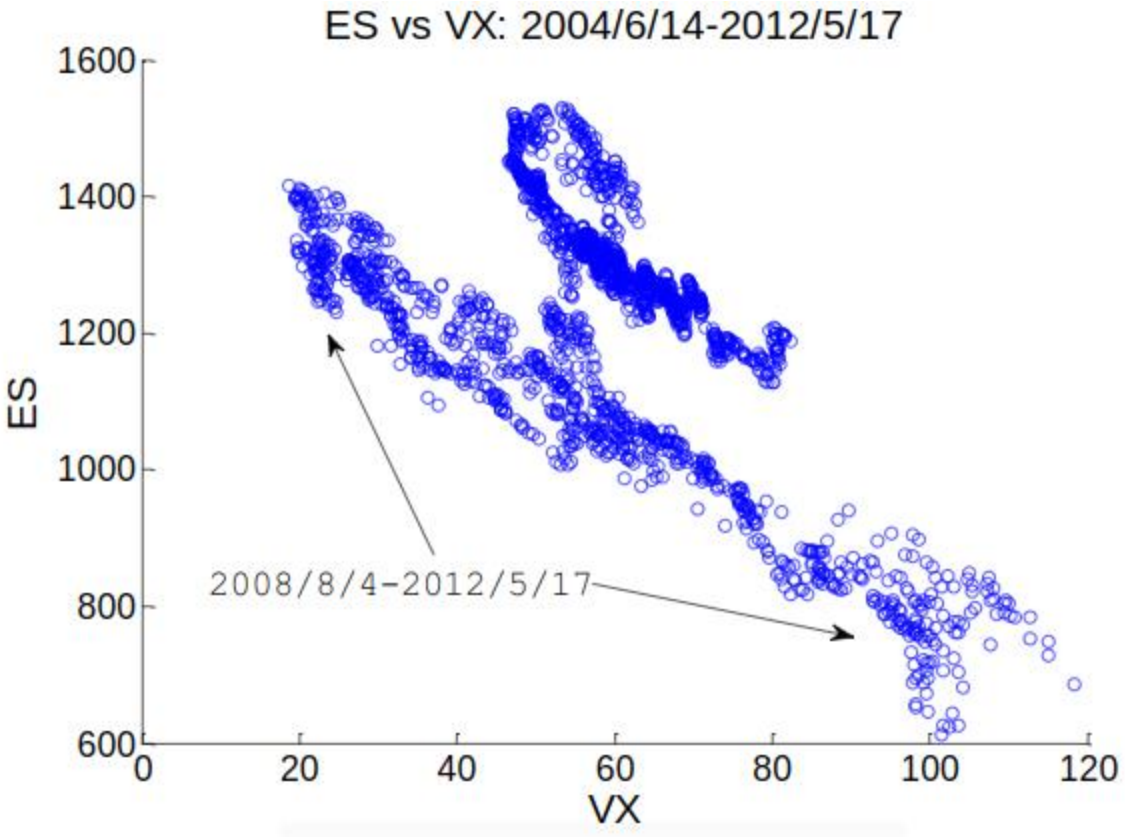
The following snapshot shows the cumulative returns from XLE vs USO arbitrage



Example of time series futures momentum strategy

Volatility Index (VX)

- VX has a high roll return i.e. 50% annualized
- It's highly anti-correlated with ES (correlation around -0.75)
- ES has its own little roll return
- Arbitrage between VX and ES should yield much of the roll return of VX.
- However, we'll have to find a hedge ratio for this opportunity.



Trading strategy

- If VX's roll return > threshold: Buy VX, buy ES
- If VX's roll return < -threshold: Sell VX, sell ES

Other ways to extract future momentum

- In general, it's not easy to find a future that is anti-correlated with spot returns of another future.
- However, time-series and cross-sectional momentum can still be extracted as long as spot returns are uncorrelated or smaller in magnitude than roll returns.

<u>Statistical tests for momentum strategies</u>

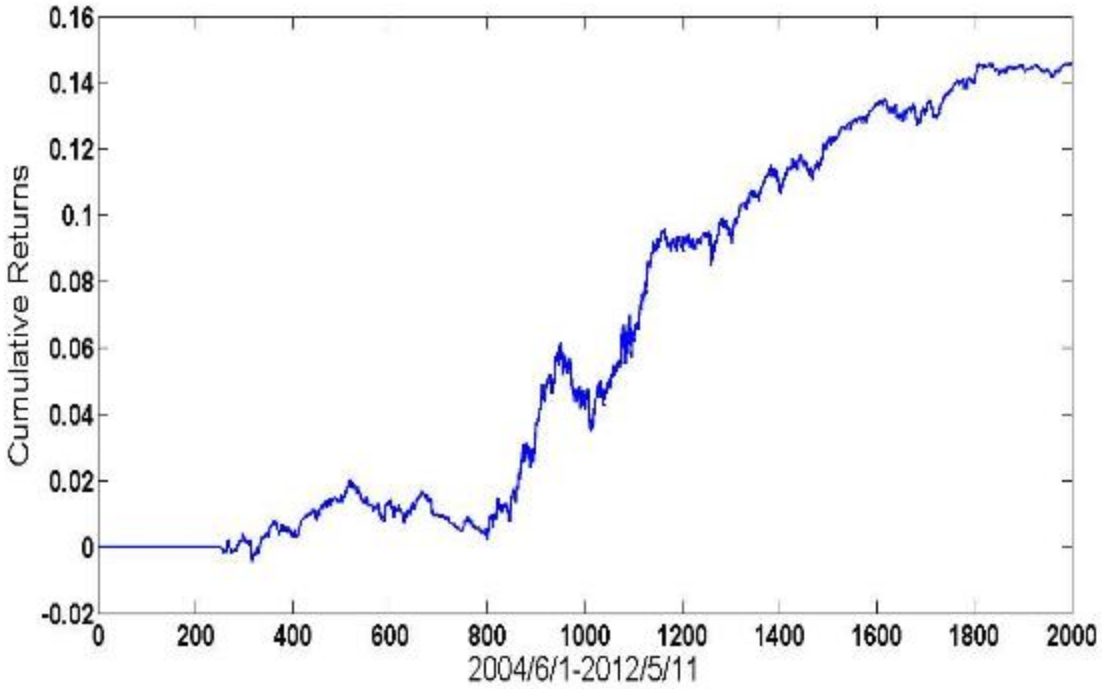
- Test for positive serial correlation of returns.

The following snapshot shows the p-value and correlation coefficient for various lookback periods

Lookback	Holddays	Correlation coefficient	p-Value
25	1	-0.0140	0.5353
25	5	0.0319	0.5276
25	10	0.1219	0.0880
25	25	0.1955	0.0863
25	60	0.2333	0.0411
25	120	0.1482	0.2045
25	250	0.2620	0.0297
60	1	0.0313	0.1686
60	5	0.0799	0.1168
60	10	0.1718	0.0169
60	25	0.2592	0.0228
60	60	0.2162	0.2346
60	120	-0.0331	0.8598
60	250	0.3137	0.0974
120	1	0.0222	0.3355
120	5	0.0565	0.2750
120	10	0.0955	0.1934
120	25	0.1456	0.2126
120	60	-0.0192	0.9182
120	120	0.2081	0.4567
120	250	0.4072	0.1484
250	1	0.0411	0.0857
250	5	0.1068	0.0462
250	10	0.1784	0.0185
250	25	0.2719	0.0238
250	60	0.4245	0.0217
250	120	0.5112	0.0617
250	250	0.4873	0.3269

- Alternative tests are the Hurst exponent and variance ratio test.

The following snapshot shows the cumulative returns of the TU momentum strategy



The following snapshot shows some of the identified instruments that exhibit time-series momentum

Symbol	Lookback	Holding days	APR	Sharpe ratio	Max Drawdown
VX (CFE)	50	5	35.2%	1.09	-33.2%
BR (CME)	100	10	17.7%	1.09	-14.8%
HG (CME)	40	40	18.0%	1.05	-24.0%
TU (CBOT)	250	25	1.7%	1.04	-2.5%

Example of cross-sectional futures momentum strategy

- Cross-sectional momentum in physical commodities futures is also present.
- Spot returns tend to be positively correlated.
- Buy those with positive roll returns and short those with negative roll returns. It should generate net positive returns.

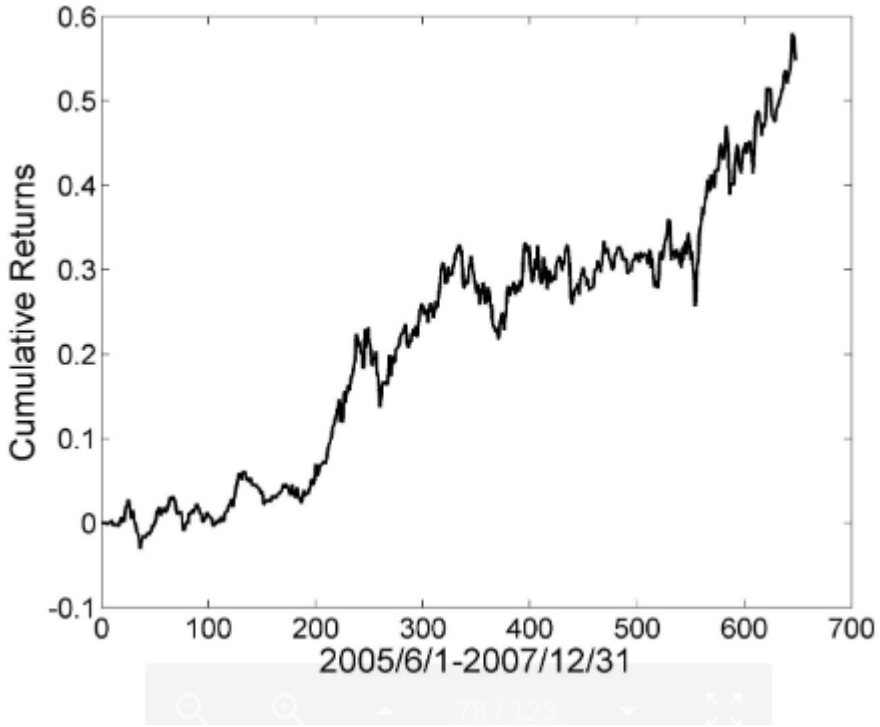
Strategy

- Rank the 1-year return of 52 physical commodities futures every day.
- Buy/short the top/bottom and hold for a month.

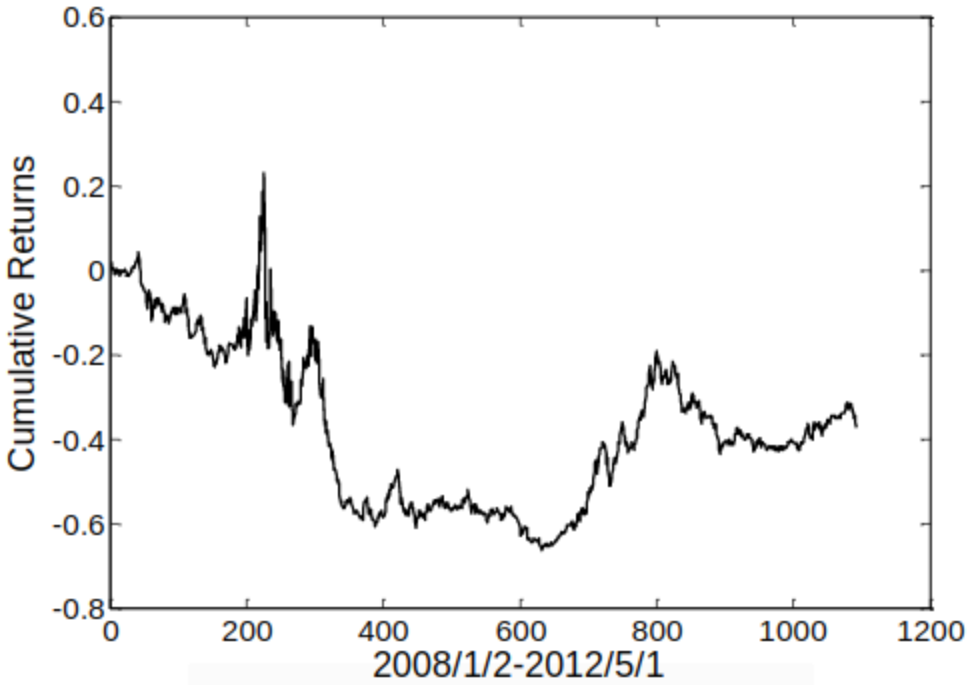
The following snapshot shows the result of the strategy described above.

	APR	Sharpe Ratio
2005/6/1-2007/12/31	18%	1.4
2008/1/2-2009/12/31	-33%	-0.6
2010/1/4-2012/05/01	16%	0.7

The following snapshot shows the cumulative returns of the cross-section futures momentum strategy during the pre-crisis period.



The following snapshot shows the cumulative returns of the cross-section futures momentum strategy during the post-crisis period.



Example of cross-sectional stocks momentum strategy

- Cross-sectional momentum is present in S&P 500 stocks as well.

Total return = Market return + Factor returns + Residual returns

- Factor returns change slowly
- A long-short portfolio will hedge away market return.

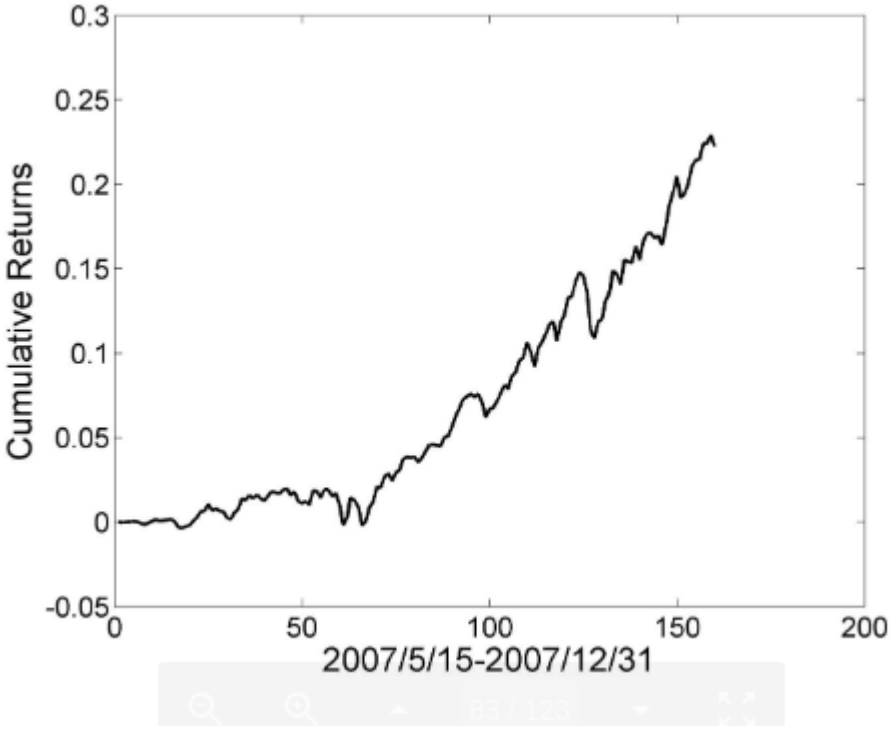
Strategy

- Rank the 1-year return of S&P 500 stocks every day.
- Buy (short) the top (bottom) decile and hold for a month.

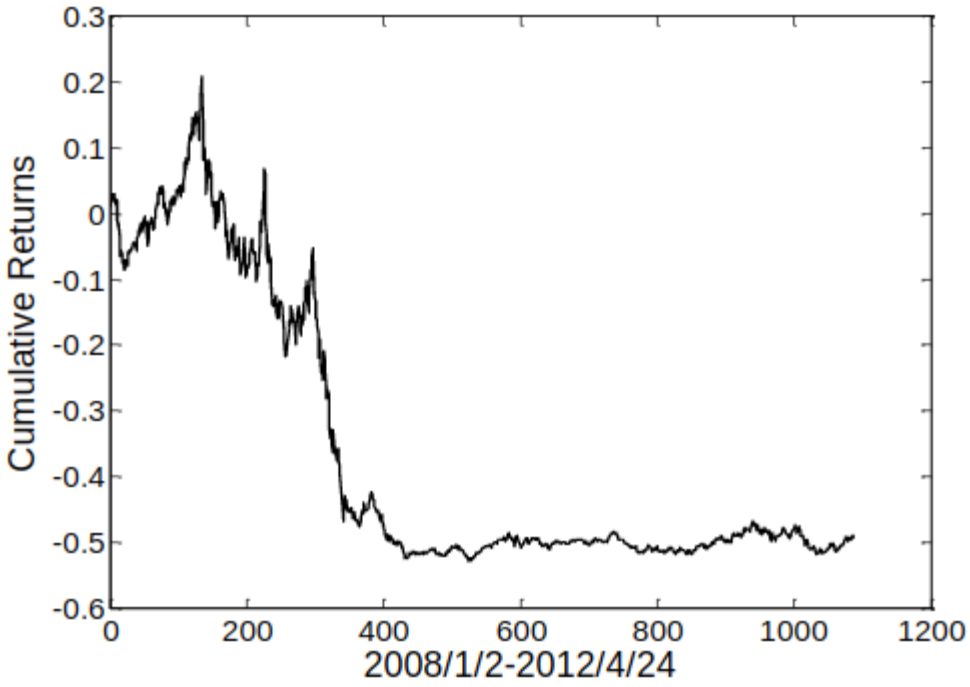
The following snapshot shows the result of the strategy described above.

	APR	Sharpe Ratio
2007/5/15-2007/12/31	37%	4.1
2008/1/02-2009/12/31	-30%	-1.3
2010/1/04-2012/04/24	1%	0.2

The following snapshot shows the cumulative returns of the cross-section stock momentum strategy during the pre-crisis period.



The following snapshot shows the cumulative returns of the cross-section stock momentum strategy during the post-crisis period.



News sentiment

- A new factor is available for stocks.
- Natural language processing algorithms are used to parse and analyze all news feed automatically.
- "Sentiment score" assigned to each story indicating possible price impact.
- Aggregation of sentiment score from a fixed period is predictive of future returns.

Strategy: form a long-short portfolio using sentiment score as a ranking factor.

- Instead of general sentiment, we can identify
- The predictive power of each specific type of event.

Event-driven momentum

- There are some events that drive momentum. For example - Post Earnings Announcement Drift (PEAD)
- Duration of momentum has decreased over the years.

Other events that drive momentum include -

- Earnings guidance
- Analyst ratings change

- Analyst recommendation change
- Same-store sales announcement
- Airline load factors announcement
- Mergers and acquisitions announcement
- Macroeconomic data release
- Interest rate announcement

Forced sales and purchases

- Forced sales or purchases by hedge/mutual/index/exchange-traded funds.
- Contagion also leads to momentum, which is caused due to -
    - risk management (leveraged hedge funds)
    - Investor redemption/subscription (mutual funds)

- The key driver is the need to maintain constant leverage in face of loss and the herding behaviour of retail investors.

Exit strategies

They could be divided as follows -

Time-based
These strategies have their exit positions based on the time.
For example - Gap strategies should exit at market close.

New entry signal
In this, you exit when a new entry signal is identified.
For example - If return goes from positive to a negative, flip position from long to short

Stop loss
If position incurs a loss, it means momentum w.r.t. entry price has reversed: exit is logical.

Trailing stop loss
Momentum w.r.t. recent high has reversed: exit is logical

Advantages and disadvantages of momentum strategies

Advantages

- Ease of risk management

    - Stop loss is logical
    - Loss -> Momentum reversed -> Flatten or take opposite position
- Diversification
    - Futures exhibit momentum due to roll returns.
    - Futures markets are more diversified than equities.

Disadvantages

- Futures momentum often requires a long holding period.
- Event-driven momentum duration can shorten over time.
- Momentum crashes - underperformance for a prolonged period in aftermath of a financial crisis.