

# Lecture 4

## Autocorrelation-based Trading Strategies

### Momentum and Long-Term Reversal

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# Overview of Lecture 4

## Autocorrelation in financial asset returns

- 1 Momentum
- 2 Long-term reversal

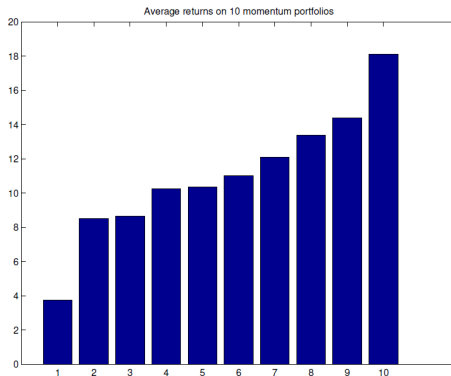
# Momentum Anomaly in Stocks

- Can we exploit violations of weak market efficiency?
- there is a small amount of positive autocorrelation in individual monthly stock returns
  - ▶ At shorter horizons of less than 12 months, stock returns tend to be weakly positively autocorrelated.
- (in theory) this can be exploited to construct profitable trading strategies

# Momentum Anomaly in Stocks

- Ken French posts momentum portfolios on his web site
  - ▶ The portfolios at  $t$  are constructed monthly using NYSE prior ( $t - 2$  to  $t - 12$ ) return decile breakpoints.
- this is called (cross-sectional) **momentum trading**
  - ▶ first discovered by Werner de Bondt, a Belgian economist now at DePaul University in Chicago, and Richard Thaler, of the University of Chicago Booth School of Business. See De Bondt and Thaler (1985).

# Momentum in US Stock Returns



Average returns on momentum portfolios. Source: data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (2-12) return decile breakpoints. Sample: 1927-2013.

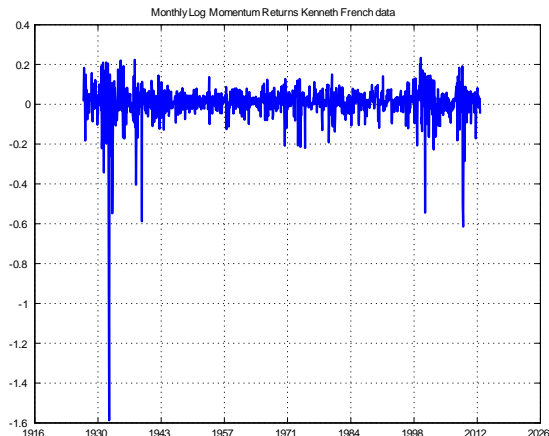
# Momentum Sorting

- **Cross-sectional momentum**, by sorting stocks into portfolios based on past performance, basically exploits (small) positive autocorrelation at short horizons between 1 and 12 months.
  - ▶ To learn more about the time-series origins of cross-sectional momentum, see Moskowitz, Ooi, and Pederson (2012).

# Momentum Factor Structure

- momentum stocks have a factor structure:
  - ▶ high momentum stocks co-move
  - ▶ low momentum stocks co-move
- this risk cannot be diversified away
- some of this may be tail risk: Daniel, Jagannathan, and Kim (2012).
- not a free lunch
- maybe momentum returns compensate for tail risk

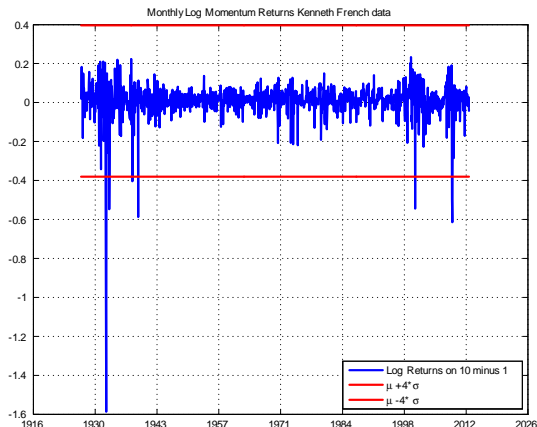
# Momentum Risk



Log Returns on Portfolio 10 minus 1. data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (2-12) return decile breakpoints. Sample: 1927-2013.



# Tail Risk in Momentum



Log Returns on Portfolio 10 minus 1. data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (2-12) return decile breakpoints. Sample: 1927-2013.  $\sigma$  is 0.0971.  $\mu$  is 0.0079. The skewness is -6.39. The kurtosis is 86.66.

# Momentum Factor Structure

- This momentum strategy works well across several asset classes.
- Asness, Moskowitz, and Pedersen (2013) document the pervasiveness of momentum effects in
  - ▶ currencies,
  - ▶ commodities,
  - ▶ bonds.

# Mean-Reversion Betas of Monthly Log Returns

Define:  $r_{t+1}(k) \equiv r_{t+1} + r_{t+2} + \dots + r_{t+k}$

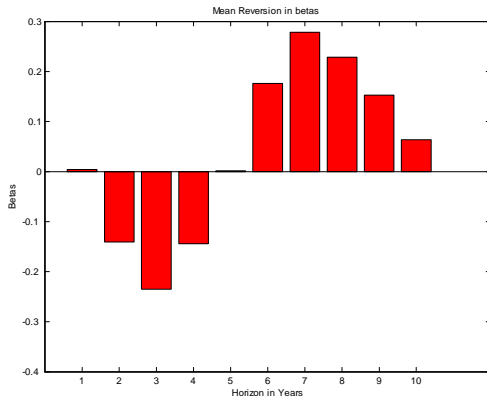
- compute  $\beta_k$  in

$$r_t(k) = \alpha_k + \beta_k r_{t-k}(k) + \varepsilon_t$$

- negative  $\beta_k$  means mean reversion
- positive  $\beta_k$  means mean aversion

# Mean-Reversion Betas of Monthly Log Returns

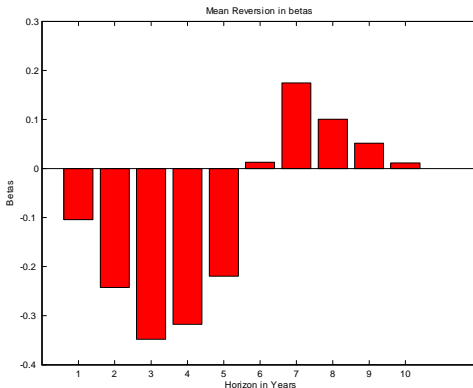
- high returns followed by low returns up to 5 years



This figure plots  $\beta_k$  for Monthly log excess returns on VW-CRSP Index in  $r_t(k) = \alpha_k + \beta_k r_{t-k}(k) + \varepsilon_t(k)$ . 1926-2012. Monthly data.

# Mean-Reversion Betas of Monthly Log Returns

- high returns followed by low returns up to 5 years



This figure plots  $\beta_k$  for Monthly log excess returns on EW-CRSP Index in  $r_t(k) = \alpha_k + \beta_k r_{t-k}(k) + \varepsilon_t(k)$ . 1926-2012. Monthly data.

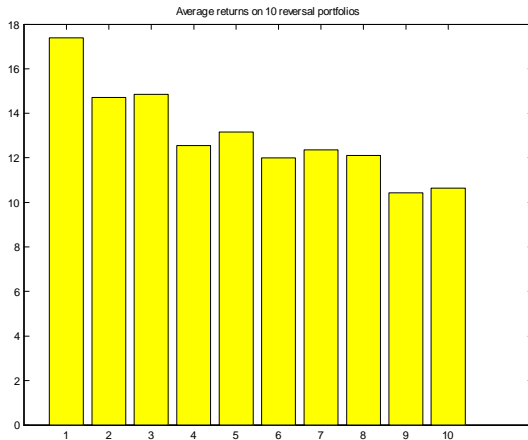
# Less Risky for the Long-Run

- Some evidence of mean reversion in stock returns at investment horizons that exceed one year.
  - ▶ Fama and French (1988) documented evidence of mean-reversion in stock returns using variance ratios (also see Poterba and Summers (1988)).
  - ▶ Cochrane (1999) summarizes the evidence on long-run mean-reversion in returns on stocks (pp. 63-64).
  - ▶ Pastor and Stambaugh (2012) point out that there is a lot of statistical uncertainty about the mean reversion in stock returns.
- Mean reversion implies that stocks are less risky for long-run investors.

# Long-Term Reversals in Stocks

- cross-sectional trading strategy that exploits individual stock returns reversals
- there is a small amount of negative autocorrelation in individual monthly stock returns at longer horizons
  - ▶ At horizons in excess of 12 months, stock returns tend to be weakly negatively autocorrelated.
- this can be exploited to construct profitable trading strategies
- French posts LT reversal portfolios on his web site
  - ▶ The portfolios at  $t$  are constructed monthly using NYSE prior ( $t - 13$  to  $t - 60$ ) return decile breakpoints.
- this is called (cross-sectional) **LT reversal trading**

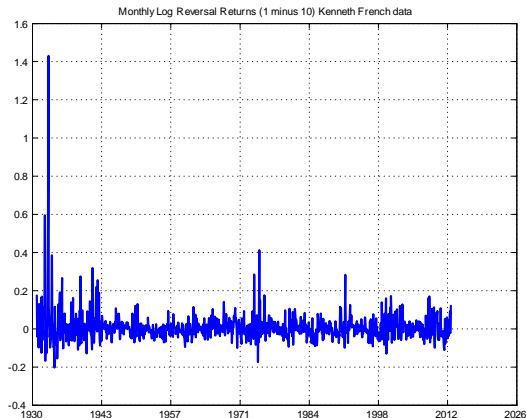
# Long-Term Reversals in Stocks



Average returns on reversal portfolios. Source: data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (13-60) return decile breakpoints. Sample: 1931-2013.

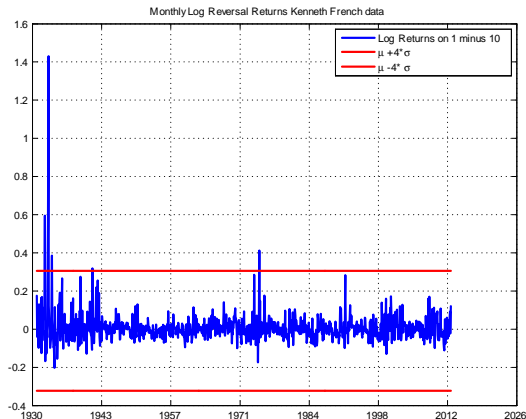


# Reversal Risk



Source: Log Returns on Portfolio 1 minus 10. data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (13-60) return decile breakpoints. Sample: 1927-2013.

# Little Tail Risk in LT Reversals



Source: Log Returns on Portfolio 1 minus 10. data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (13-60) return decile breakpoints. Sample: 1927-2013.  $\sigma$  is 0.0971.  $\mu$  is 0.0079. The skewness is 7.46. The kurtosis is 86.66.

# Long-Term Reversals and Value

- LT reversal is closely related to 'value'
  - ▶ returns on portfolios sorted by B/M ratios are correlated with returns on portfolios sorted by returns over past 5 years
- This LT reversal/value strategy works well across several asset classes.
- Asness, Moskowitz, and Pedersen (2013) document the pervasiveness of LT reversal/value effects in
  - ▶ currencies,
  - ▶ commodities,
  - ▶ bonds.
- LT reversal returns are negatively correlated with momentum returns!
- adding momentum and LT reversals increases the efficiency of the portfolio

# Over- and Underreaction

- behavioral interpretation (Barberis, Shleifer, and Vishny (1998))
  - ▶ **under-reaction** of investors to news is responsible for positive autocorrelations at horizons up to 12 months: news is slowly incorporated into prices
  - ▶ **over-reaction** of investors is responsible for negative autocorrelations at horizons after 12 months: securities that have experienced good news become overpriced.

# Conclusion

- stock returns have:
  - ① positive autocorrelation at horizons of less than one year
    - ★ exploited by momentum trading strategies
  - ② negative autocorrelation at horizons of more than one year
    - ★ exploited by reversal trading strategies
- In the short-run (daily to a month) there is also "Short-term Reversal" – negative autocorrelations.

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