

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

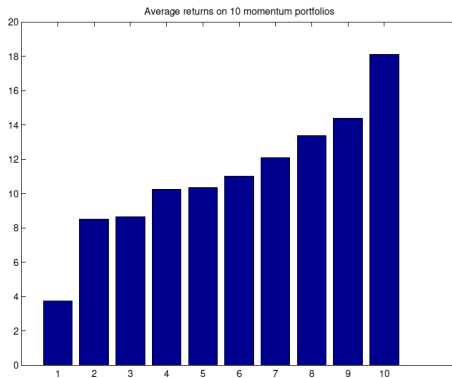
Momentum Anomaly in Stocks

- 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.

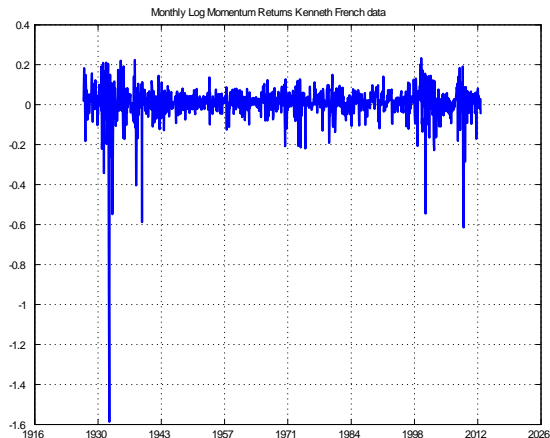
Momentum Sorting

- **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

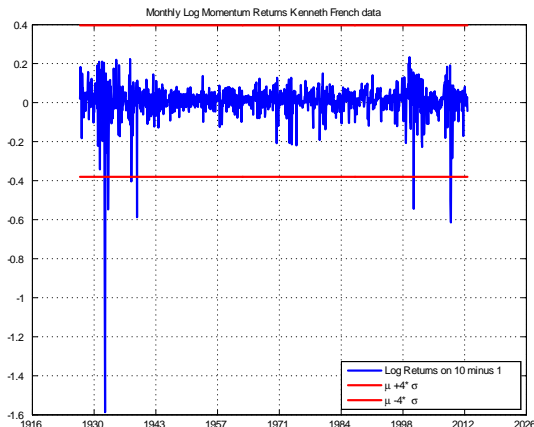
- momentum stocks have a factor structure:
 - ▶ high momentum stocks co-move
 - ▶ low momentum stocks co-move
- this risk cannot be diversified away
- some of this may be tail risk: Daniel, Jagannathan, and Kim (2012).
- not a free lunch
- maybe momentum returns compensate for tail risk

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. σ is 0.0971. μ 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: $r_{t+1}(k) \equiv r_{t+1} + r_{t+2} + \dots + r_{t+k}$

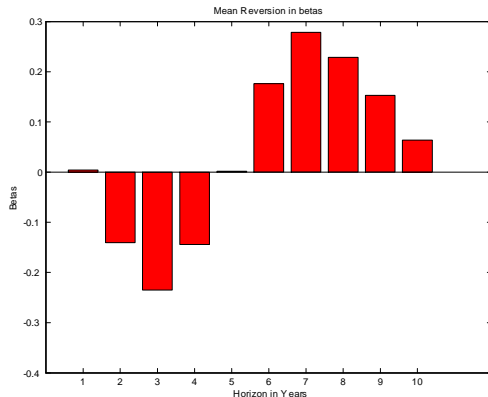
- compute β_k in

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

- negative β_k means mean reversion
- positive β_k means mean aversion

Mean-Reversion Betas of Monthly Log Returns

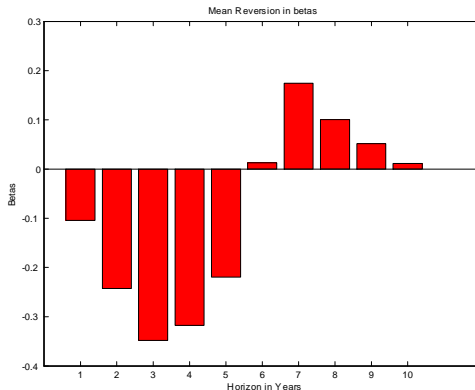
- high returns followed by low returns up to 5 years



This figure plots β_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 β_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.

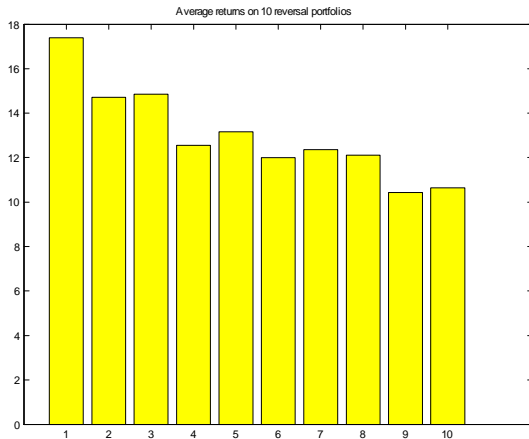
Less Risky for the Long-Run

- 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

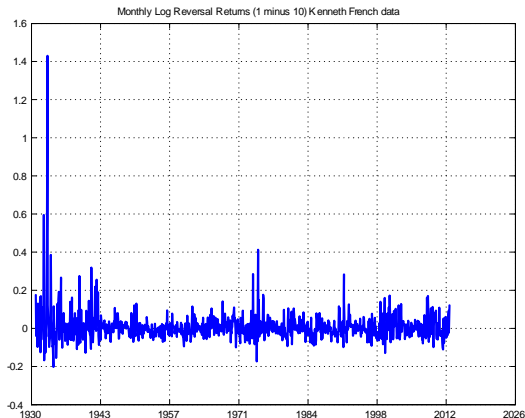
- cross-sectional trading strategy that exploits individual stock returns reversals
- there is a small amount of negative autocorrelation in individual monthly stock returns at longer horizons
 - ▶ At horizons in excess of 12 months, stock returns tend to be weakly negatively autocorrelated.
- this can 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



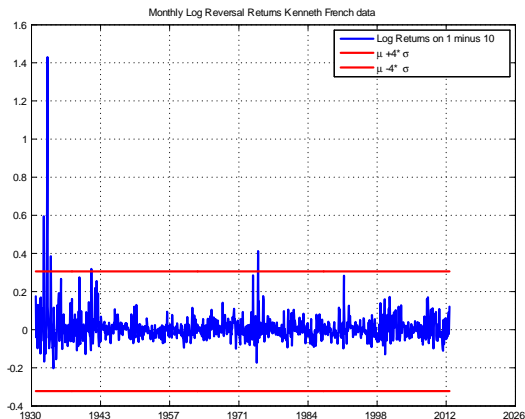
Average returns on reversal portfolios. Source: data from Kenneth French's website. The portfolios are constructed monthly using NYSE prior (13-60) return decile breakpoints. Sample: 1931-2013.

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. σ is 0.0971. μ 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.

References

- Asness, C. S., T. J. Moskowitz, and L. H. Pedersen (2013). Value and momentum everywhere. *The Journal of Finance* 68(3), 929-985.
- Barberis, N., A. Shleifer, and R. Vishny (1998). A model of investor sentiment. *Journal of Financial Economics* 49(3), 307-343.
- Cochrane, J. H. (1999). Portfolio advice for a multifactor world. *Economic Perspectives*, Federal Reserve Bank of Chicago 23(3).
- Daniel, K., R. Jagannathan, and S. Kim (2012, June). Tail risk in momentum strategy returns. National Bureau of Economic Research, Working Paper Series.
- De Bondt, W. F. M. and R. Thaler (1985). Does the stock market overreact? *The Journal of Finance* 40(3), 793-805.
- Fama, E. F. and K. R. French (1988). Permanent and temporary components of stock prices. *Journal of Political Economy* 96(2), pp. 246-273.

References

Grossman, S. J. and J. Stiglitz (1980). On the impossibility of informationally efficient markets. *American Economic Review* 70(3), 393-408.

Ljung, G. M. and G. E. P. Box (1978). On a measure of a lack of fit in time series models. *Biometrika* 65(2), 297-303.

Moskowitz, T. J., Y. H. Ooi, and L. H. Pedersen (2012). Time series momentum. *Journal of Financial Economics* 104(2), 228-250.

Pastor, L. and R. F. Stambaugh (2012). Are stocks really less volatile in the long run? *The Journal of Finance* 67(2), 431-478.

Poterba, J. M. and L. H. Summers (1988). Mean reversion in stock prices: Evidence and implications. *Journal of Financial Economics* 22(1), 27-59.