Momentum and Reversal: Does What Goes Up Always Come Down?

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Motivation and Contribution

- Momentum Portfolio buys past winners and sells past losers
- Formerly shown that profits accrue empirically for 6 to 12 months.
- Some studies suggest that momentum is followed by reversal

Does momentum, though, necessarily imply reversals?

Motivation and Contribution

Connection between Momentum and Reversal

- No pervasive link between short-term momentum and long-run reversal
- Momentum portfolios with true momentum do not have long-run reversals
- Momentum portfolios with reversal in short run continue with reversal in long run.
- Then, apparent link occurs when portfolios are merged

Motivation and Contribution

Connection between Momentum and Reversal

- Characteristics of stocks exhibiting momentum
- Potential sources of momentum

Literature

Momentum followed by Reversals

- Jegadeesh and Titman, 1993
- Chan, Jegadeesh, and Lakonishok, 1996

Long-Run Reversals Not Significant

- Fama and French, 1996

Studies that jointly explain momentum and reversals together

- Daniel, Hirshleifer, Subrahmanyam, 1998
- Barberis, Shleifer, and Vishny, 1998
- Hong and Stein, 1999

Evidence to the contrary

- Rouwenhorst, 1998

Research Question and Hypothesis

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1. Portfolios of relative strength should experience both momentum and reversal patterns
2. Momentum and reversal patterns should happen consecutively
3. Strong momentum should predict stronger reversals

Key Findings

- Realized Momentum Portfolios less likely to exhibit reversal than expected by random chance

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- MAX (MIN) portfolios display momentum (reversal) but no reversal (momentum).
    - Results hold controlling for illiquidity, asset growth, investment/sales, return on assets

Key Findings

- Realized Momentum Portfolios less likely to exhibit reversal than expected by random chance
- Portfolio of stocks which has momentum in first 6 months does not significantly possess reversal for as long as five years
- Reversals keep unwinding - have significant reversal returns in 12-24 month period
- MAX (MIN) portfolios display momentum (reversal) but no reversal (momentum).
  - Results hold controlling for illiquidity, asset growth, investment/sales, return on assets
- Some potential sources of momentum do not explain MAX portfolio

Roadmap

1. Are Momentum Patterns Linked?
2. Identifying Stocks with Momentum versus Reversal
3. Understanding Sources of Momentum

Are Momentum Patterns Linked? - Data

- All CRSP stocks (share code 10, 11) on NYSE, Amex, and Nasdaq
- January 1965 thorugh December 2010

Define a stock as *winner* (*loser*) if prior six month return is higher (lower) than the average prior six month return of all stocks.

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Are Momentum Patterns Linked? - Data

Typical WML portfolio has returns consistent with prior studies: momentum followed by reversals

Are Momentum Patterns Linked? - Data

	0–6 months	6–12 months	12–24 months	24–36 months	36–48 months	48–60 months
Panel A: All stocks monthly Fama–French three factor alphas						
Winner	0.36	−0.04	−0.20	−0.18	−0.10	−0.19
	3.64	−0.51	−2.55	−2.43	−1.20	−2.44
Loser	−0.30	−0.12	0.01	−0.06	−0.09	−0.05
	−2.16	−0.99	0.14	−0.68	−1.08	−0.64
Winner−loser	0.65	0.08	−0.22	−0.12	−0.01	−0.14
	3.96	0.55	−1.99	−1.32	−0.17	−1.68
Panel B: All stocks monthly raw returns						
Winner	1.07	0.57	0.42	0.41	0.45	0.39
	3.43	1.97	1.49	1.60	1.75	1.59
Loser	0.57	0.68	0.78	0.57	0.46	0.53
	1.67	2.10	2.71	2.18	1.91	2.59
Winner−loser	0.50	−0.11	−0.36	−0.16	−0.00	−0.15
	2.76	−0.75	−3.63	−1.73	−0.06	−1.73

Figure 1: Standard Momentum Portfolio Returns

Are Momentum Patterns Linked? - Test 1

- Separate momentum portfolio into two subcomponents
  - Realized Momentum
  - Contrarian

Are Momentum Patterns Linked? - Test 1

−6 to 0 months	0 to 6 months	12 to 24 months	−6 to 0 months	0 to 6 months	12 to 24 months
High 43.7%	High 46.4%	High 41.4%	Low 56.3%	High 41.6%	High 41%
		Low 59.6%			Low 59%
	Low 53.6%	High 40.2%		Low 58.4%	High 38.9%
		Low 59.8%			Low 61.1%

Figure 2: Fraction of Stocks that Follow Mom. and Rev. Patterns

Are Momentum Patterns Linked? - Result 1

On average, 46% of realized momentum stocks exhibit some reversal, which is statistically significantly less than the 50% we would expect if there were no relation between the momentum and reversal.

But, 50% of securities in contrarian portfolio experience reversals in 12-24 month period.

- Then, stocks that do not contribute to momentum are more likely to reverse.

Are Momentum Patterns Linked? - Test 2

What about magnitude of reversals?

- Consider return continuation and reversals as anomalous
- Use Fama-French three factor-adjusted returns to get size of alpha

Are Momentum Patterns Linked? - Results 2

	Realized momentum portfolio		Contrarian portfolio		Realized minus contrarian	
Time	Winner−loser	*t*-stats	Winner−loser	*t*-stats	Returns	*t*-stats
Panel A: Lo and MacKinlay (1990) methodology						
0–6 months	8.14	24.21	−7.07	−29.01	15.21	27.94
6–12 months	0.79	4.31	−0.32	−2.47	1.10	5.11
12–24 months	0.18	0.89	−0.24	−2.78	0.26	1.99
24–36 months	−0.19	−1.36	−0.12	−1.62	−0.07	−0.51
36–48 months	−0.04	−0.42	0.02	0.27	−0.07	−0.57
48–60 months	−0.15	−1.15	−0.10	−1.40	−0.05	−0.45
Panel B: Jegadeesh and Titman (1993) methodology						
0–6 months	8.78	24.7	−7.53	−25.91	16.32	27.3
6–12 months	1.07	4.68	−0.13	−0.82	1.20	4.81
12–24 months	0.11	0.61	−0.23	−1.99	0.34	2.27
24–36 months	−0.18	−0.89	−0.11	−1.17	−0.07	−0.40
36–48 months	−0.03	−0.23	0.07	0.63	−0.10	−0.63
48–60 months	−0.18	−0.98	−0.13	−1.01	−0.06	−0.44

Figure 3: Do Stocks that Exhibit Mom. Reverse?

Are Momentum Patterns Linked? - Summary

If momentum and reversal patterns are linked, a winner (loser) from the formation period will over- (under-)perform in the intermediate term, and then go on to under- (over-)perform.

- Significantly less portion of realized momentum stocks reverse
- Contrarian stocks more likely to reverse
- Significant positive (negative) alpha for realized momentum (contrarian) portfolio

Identifying Stocks with Mom versus Rev - Method

If we can identify at the time of portfolio formation, those securities that are likely to experience momentum or reversal, we may be able to better understand the sources of these return patterns.

- Form size and book-to-market ratio-based portfolios that differ in expected returns
- High Risk stocks: high book-to-market, low market capitalization (small value)
- Low Risk stocks: low book-to-market, high market capitalization (large growth)

Identifying Stocks with Mom versus Rev - Method

- Put into three (tercile) groups based on market capitalization and book to market ratio:
  1. High Risk - high risk stocks according to one measure and medium risk for the other
  2. Low Risk - low risk stocks according to one measure and medium risk for the other
  3. Medium Risk - All other stocks

Identifying Stocks with Mom versus Rev - Method

MAX Portfolio:

- Highest Risk tercile winners
- Lowest Risk tercile losers
- Buys high B/M and small winners
- Sells low B/M and large losers

Min Portfolio:

- Lowest Risk tercile winners
- Highes Risk tercile losers

Neutral: - All other stocks

Identifying Stocks with Mom versus Rev - Method

- After sorting, look at monthly raw returns
- Adjust for risk

Identifying Stocks with Mom versus Rev - Results

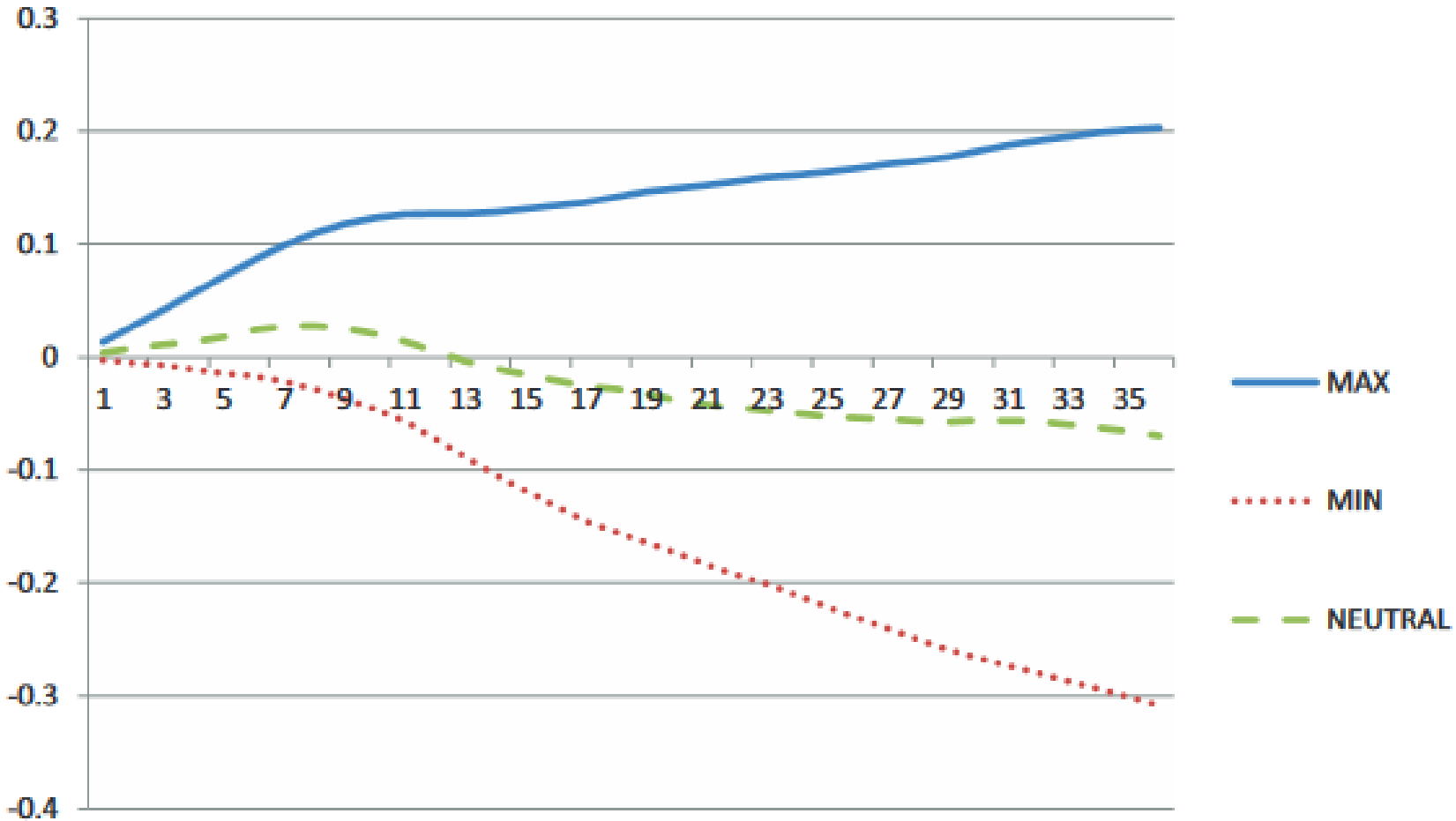

Figure 4: Average Event Time Cumulative Raw Returns

Identifying Stocks with Mom versus Rev - Results

Portfolio	0–6 months	6–12 months	12–24 months	24–36 months
Panel A: Lo and MacKinlay (1990) methodology				
MAX	1.35	0.80	0.60	0.51
winners	4.00	2.57	2.03	1.99
MAX	0.04	0.31	0.58	0.58
losers	0.13	1.05	2.08	2.17
MAX	1.31	0.49	0.02	−0.06
	6.43	2.56	0.11	−0.48
MIN	0.78	0.30	0.21	0.31
winners	2.64	1.08	0.78	1.17
MIN	0.96	0.96	0.94	0.64
losers	2.61	2.78	3.12	2.44
MIN	−0.18	−0.66	−0.73	−0.33
	−0.74	−3.20	−4.63	−2.30
NEUTRAL	1.00	0.53	0.45	0.40
winners	3.13	1.85	1.63	1.56
NEUTRAL	0.59	0.76	0.81	0.49
losers	1.62	2.18	2.63	1.81
NEUTRAL	0.41	−0.23	−0.36	−0.09
	2.02	−1.31	−2.98	−1.00

Identifying Stocks with Mom versus Revl - Results

Use multiple models for generating risk-adjusted returns:

- Fama-French 3-factor alphas
- Rolling Regressions - Fama-Frence 3-factor
- Conditional Fama-French
- Fama-French 5-factor
- Pastor-Stambaugh 4-factor
- Characteristic-matched returns (3x3 and 10x10 size and book-to-market sorts)
- Charhart four-factor

No matter what the test, results are consistent with using standard FF 3-factor alpha

Identifying Stocks with Mom versus Rev - Results

Portfolio	0–6 months	6–12 months	12–24 months	24–36 months
Panel A: Fama–French three-factor alphas				
MAX	1.18	0.53	0.10	−0.03
	6.28	3.37	0.58	−0.25
MIN	0.25	−0.28	−0.48	−0.27
	1.11	−1.43	−3.52	−2.13

Figure 6: Risk Adjust Returns

Identifying Stocks with Mom versus Rev - Results

- All but three tests had positive returns in MAX portolio up to one year
  - All had six month positive return
- Only Carhart four-factor alphas had negative return in first six months for MIN
  - Every model had negavite alpha for MIN in 12-24 months

Identifying Stocks with Mom versus Rev - Results

- Highest positive return in MAX was Pastor-Stambaugh alpha (1.21)
- Lowest was Carhart Four-Factor (0.40)
- Lowest negative return in MIN was Carhart Four-Factor (-0.49)
- Highest negative return in MIN was Fama-French Five-Factor (-0.25)

Understanding Sources of Momentum

Within these portfolios, what can explain some of the persistent returns from momentum?

Look at relation to:

1. Behavioral Bias

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2. Investor Sentiment
3. Liquidity Constraints
4. Macroeconomic factors

Behavioral Bias

Market States - lagged returns of overall market

- Proxy for behavioral bias
- Aggregrate Investor Confidence
- Regress cumulative returns of momentum portfolio on risk factors
- Examine relation between residuals of regression and past market returns and its square

Behavioral Bias

- Standard momentum portfolio returns are explained by lagged market returns
- MAX portfolio returns not explained by lagged market returns
- Lagged Market Returns explain MIN portfolio

Then, lagged market returns are not an important determinant of MAX returns

Investor Sentiment Index

- Use sentiment index
- Average 6 months prior to portfolio formation
- Regress momentum portfolio returns on avg sentiment with FF 3-factor

Sentiment Index is correlated with standard momentum portfolio (nonsignificance at 10% level) Not significant for MAX portfolio

Market Illiquidity and Arbitrage Constraints

Momentum returns should be higher in liquid markets (Avramov, Cheng, and Hameed, 2014)

- Regress momentum portfolio returns on market illiquidity and FF 3-factors.
- Significant negative correlation between illiquidy and returns for standard portfolio
- Negative but nonsignificant for MAX and MIN portfolio

Macroeconomic Factors

Test for undiscovered risk factor, such as business cycle

- Estimate predicted returns using macro factors (Chen, Roll, and Ross, 1986)
  1. change in monthly industrial production
  2. unexpected inflation
  3. change in expected inflation
  4. term premium
  5. default premium

Macroeconomic Factors

- Macro Factors explain a large portion of momentum returns
- Significant Returns in MAX Portfolio still remain

Understanding Sources of Momentum

Portfolio	0–6 months	6–12 months	12–24 months	24–36 months
Panel A: Controlling for past market return and market return squared				
MAX	1.04	0.66	0.39	0.21
	4.84	3.24	2.02	1.34
MIN	0.04	−0.33	−0.46	−0.42
	0.14	−1.35	−3.24	−2.58
Panel B: Controlling for Baker and Wurgler (2006) investor sentiment index				
MAX	1.30	0.63	0.14	−0.01
	6.87	4.20	0.79	−0.08
MIN	0.34	−0.25	−0.52	−0.29
	1.61	−1.25	−3.62	−2.28
Panel C: Controlling for market illiquidity				
MAX	1.27	0.39	−0.02	−0.24
	4.79	1.71	−0.11	−1.32
MIN	0.41	−0.31	−0.40	−0.19
	1.31	−1.23	−2.09	−1.13
Panel D: Alpha over returns predicted by Chen, Roll and Ross five factors				
MAX	1.00	0.14	−0.20	−0.14
	4.92	0.69	−1.12	−1.01
MIN	−0.34	−0.68	−0.53	−0.24
	−1.15	−2.81	−3.21	1.50

Figure 7: Controlling for Market Factors

Summary

- Stocks displaying momentum in first six months do not significantly reverse
- Contrarian stocks in first six months reverse 12-24 months after
- Then, portfolios appear to link momentum and reversal
- Returns on MAX and MIN portfolios not explained by other market factors
- MAX returns not explained by other potential sources of momentum

Extension

1. What explains positive abnormal returns of MAX portfolio? Why is MIN explained? Ommitted Risk Factor?
2. Properly accounts for crashes?