

STRONG AND WEAK MOMENTUM COMPONENTS:

evidence from international market indices

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This paper provides a simple technique to modify momentum strategies to yield larger profits. Past long-term returns are used to split the conventional momentum strategy into strong and weak components. Our analysis shows that the early-stage momentum strategy consistently produces larger profits than both the late-stage momentum strategy and the pure momentum strategy. Given the widespread interest in momentum strategies, the early-stage momentum approach should be of interest to both practitioners and researchers.

The momentum anomaly has proven to be one of the most pervasive anomalies in financial markets with a vast literature proposing either rational explanations or explanations based on investor overreaction or underreaction. The momentum strategy of Jegadeesh and Titman (1993, 2001) involves buying past strong performers (winners) and selling past weak performers (losers), where performance is measured by returns over the past three to 12 months. Recent leading articles highlight the continuing importance of the momentum effect in international stock returns. Fama and French (2012) find strong momentum returns in North America, Europe and Asia Pacific, while Asness et al. (2013) document value and momentum effects across eight diverse markets and asset classes.

In a study of US stocks, Chan and Kot (2006) show that past long-term returns can be used to produce more-powerful momentum strategies. The rationale behind their approach is based on the assumption that momentum occurring just after a reversal in long-term returns will be stronger and will persist for longer than momentum that does not follow such a turning point in the recent past. Their approach can be interpreted as using the long-term contrarian effect of DeBondt and Thaler (1985, 1987) to either boost or hinder momentum profitability.

In this paper we modify the Chan and Kot (2006) approach and simply split the traditional momentum portfolios into two based on past long-term performance. Our approach is then applied to developed market and emerging market equity

indices. The 'early-stage' momentum strategy buys short-term winners with relatively poor long-term returns and sells short-term losers with relatively good long-term returns. These indices appear to have experienced a recent reversal in their long-term performances, and so are said to be early in any such reversal. Thus we combine the continuation of the momentum effect with the reversal feature of the contrarian effect to create an enhanced momentum strategy. In contrast, the 'late-stage' momentum strategy buys short-term winners with relatively good long-term returns and sells short-term losers with relatively poor long-term returns. This strategy's profitability will not be assisted by the presence of a contrarian effect. Our analysis shows that the early-stage strategy outperforms the traditional momentum strategy; while the late-stage strategy underperforms the momentum strategy.

Data and methodology

Monthly total returns data are obtained from Datastream for 44 Morgan Stanley Capital International (MSCI) market indices. These returns are calculated from prices with reinvested gross dividends (excluding withholding taxes) and cover the period January 1970 to April 2013. Returns are measured in US dollars to facilitate the interpretation of results across markets. Table 1 shows the summary statistics for the sample including the monthly mean return and standard deviation for each country. The sample size is 520 months for the developed market countries and up to 304 months for the emerging market countries. To differentiate the performance of indices in various global settings, the countries

are grouped into 18 developed markets (Panel A) to be consistent with other index based studies (e.g. Balvers and Wu 2006) and 26 emerging markets (Panel B) based on MSCI's own classification.

In this paper, we compare and contrast the traditional single-sort momentum strategy with the double-sort early-stage and late-stage momentum strategies for both groups of indices. Portfolios are formed for the developed and emerging markets separately, using the same technique for each.

For traditional (also called 'pure') momentum strategies, indices are ranked at the beginning of each month based on their past six-month returns. Each month, indices with the lowest 25 per cent of past six-month returns are assigned to the short-term loser portfolio S1, while indices with the largest 25 per cent of past six-month returns are assigned to the short-term winner portfolio S4. The arbitrage momentum portfolio (S4-S1) buys the short-term winners and sells the short-term losers.

For the early-stage and late-stage strategies, each month the short-term winner and loser portfolios are split in half based on the relative magnitude of their component indices' long-term past 60-month returns. S1L1 denotes the portfolio composed of the 50 per cent of indices in short-term loser portfolio S1 with the lowest past 60-month returns, while S1L2 denotes the portfolio with the remaining indices from S1 (those losers with relatively large past 60-month returns). Similarly, S4L1 denotes the portfolio with the 50 per cent of indices in short-term winner portfolio S4 with the lowest past 60-month returns, while S4L2 denotes the portfolio with the remaining 50 per cent of indices in winner portfolio S4 (winners with the highest past 60-month returns).

The early-stage momentum strategy buys the short-term winners with relatively poor long-term past returns and sells the short-term losers with relatively good long-term returns (S4L1-S1L2). The late-stage momentum strategy buys the short-term winners with relatively good long-term past returns and sells the short-term losers with relatively poor long-term returns (S4L2-S1L1). Early-stage indices are more likely to have experienced a recent price reversal whereas late-stage indices have experienced price continuation over a long period. Early-stage indices are considered to be 'early' in any such price reversal whereas late-stage indices are 'late' in a price continuation.

TABLE 1: Descriptive statistics

Panel A: Developed countries		
Country	Mean %	SD %
Australia	1.05	7.04
Austria	0.92	6.84
Belgium	1.11	5.97
Canada	0.96	5.74
Denmark	1.21	5.72
France	1.03	6.61
Germany	1.01	6.43
Hong Kong	1.69	10.15
Italy	0.71	7.49
Japan	0.95	6.20
Netherlands	1.12	5.63
Norway	1.24	7.97
Singapore	1.28	8.31
Spain	0.96	6.86
Sweden	1.35	7.06
Switzerland	1.08	5.34
UK	1.02	6.41
US	0.89	4.49
AVERAGE	1.09	6.68
Panel B: Emerging countries		
Country	Mean %	SD %
Argentina	2.14	15.52
Brazil	2.51	14.67
Chile	1.64	7.11
China	0.51	10.34
Colombia	1.74	9.07
Czech Republic	1.26	8.44
Egypt	1.60	9.70
Hungary	1.54	11.15
India	1.13	8.95
Indonesia	1.92	14.21
Israel	0.69	6.97
Jordan	0.39	5.29
Korea	1.15	10.89
Malaysia	1.07	8.21
Mexico	2.00	9.01
Morocco	0.95	5.52
Pakistan	1.14	10.79
Peru	1.77	9.32
Philippines	1.15	9.04
Poland	1.92	14.02
Russia	2.33	15.82
South Africa	1.25	7.90
Sri Lanka	1.10	10.47
Taiwan	1.04	10.42
Thailand	1.36	10.89
Turkey	2.23	16.36
AVERAGE	1.44	10.39

Note: This table provides descriptive statistics for the return data of the 18 MSCI developed market and 26 MSCI emerging market indices from their first available months (January 1970 for the developed market indices and January 1988 or later for the emerging market indices) until April 2013, obtained from Datastream. Mean refers to the average monthly returns. SD refers to the standard deviation of monthly returns.

We calculate portfolio returns for holding periods of three, six, nine and 12 months. Following Jegadeesh and Titman (1993, 2001), we employ the overlapping portfolio method where for a six-month holding period, for example, one-sixth of the portfolio is updated each month. Also, we follow Balvers and Wu (2006) and allow a one-month gap between the end of the formation period and the start of the holding period.

Results

Table 2 (refer to the following page) presents the results of the early-stage and late-stage momentum strategies for the developed (Panel A) and emerging markets (Panel B). Each panel reports the average monthly returns of the short (S1L2), long (S4L1) and arbitrage (S4L1-S1L2) portfolios of the early-stage strategy, and the short (S1L1), long (S4L2) and arbitrage (S4L2-S1L1) portfolios of the late-stage strategy, together with their associated t -values. To allow comparisons with the traditional momentum approach, Table 2 also presents the results of the pure momentum strategy arbitrage portfolio (S4-S1) in the final two rows of the table.

TABLE 2: Profitability of the early-stage, late-stage and momentum strategies

		Panel A: Developed markets				Panel B: Emerging markets			
Strategy	Portfolio	Holding months				Holding months			
		3	6	9	12	3	6	9	12
Early-stage	S1L2	0.79	0.65	0.69	0.79	0.90	0.77	0.88	0.89
		(2.93)	(2.46)	(2.66)	(3.04)	(1.70)	(1.52)	(1.74)	(1.80)
	S4L1	1.47	1.43	1.33	1.22	1.60	1.64	1.55	1.42
		(5.40)	(5.49)	(5.15)	(4.76)	(3.31)	(3.56)	(3.47)	(3.26)
Late-stage	S4L1-S1L2	0.68	0.78	0.64	0.43	0.70	0.87	0.67	0.53
		(2.94)	(3.77)	(3.38)	(2.38)	(1.41)	(1.99)	(1.68)	(1.47)
	S1L1	0.97	0.91	0.98	1.00	1.70	1.35	1.39	1.47
		(3.55)	(3.52)	(3.91)	(4.10)	(3.22)	(2.65)	(2.79)	(3.01)
Mom.	S4L2	1.29	1.40	1.39	1.26	1.66	1.53	1.24	0.95
		(4.49)	(4.98)	(5.00)	(4.56)	(3.49)	(3.20)	(2.56)	(2.00)
	S4L2-S1L1	0.32	0.49	0.41	0.25	-0.04	0.18	-0.15	-0.51
		(1.29)	(2.13)	(1.94)	(1.27)	(-0.07)	(0.40)	(-0.35)	(-1.32)
	S4-S1	0.50	0.64	0.53	0.34	0.33	0.51	0.24	-0.02
		(2.58)	(3.65)	(3.29)	(2.30)	(0.84)	(1.44)	(0.75)	(-0.08)

Note: This table presents the average monthly returns in percentages of the short, long and arbitrage portfolios of the early-stage and late-stage strategies. First, each month t , indices are ranked based on their six-month returns from month $t-7$ to $t-1$ month. The 25 per cent of indices with the largest past six-month returns are grouped in the winner S4 portfolio, while the 25 per cent of indices with the smallest past six-month returns are grouped in the loser S1 portfolio. Within the short-term winner S4 and short-term loser S1 portfolios in each month t , indices are further classified based on their past 60-month returns. S1L1 denotes the portfolio composed of the 50 per cent of indices in the short-term loser portfolio S1 with the lowest past 60-month returns, while S1L2 denotes the portfolio with the remaining indices from S1. Similarly, S4L1 denotes the portfolio with the 50 per cent of indices in short-term winner portfolio S4 with the lowest past 60-month returns, while S4L2 denotes the portfolio with the remaining 50 per cent of indices in winner portfolio. The arbitrage early-stage portfolio (S4L1-S1L2) is long S4L1 and short S1L2. The arbitrage late-stage strategy portfolio (S4L2-S1L1) is long S4L2 and short S1L1. These portfolios are equally weighted and held for three, six, nine or 12 months. The monthly return for each holding period comes from employing Jegadeesh and Titman's (1993) overlapping portfolio methodology. S4-S1 refers to the corresponding pure momentum arbitrage portfolio. T-statistics are presented in parentheses.

The results of the early-stage momentum strategy for the developed markets (Panel A) and the emerging markets (Panel B) shows positive average monthly returns for all holding periods. In particular, the six-month holding period early-stage strategy applied to the developed markets earns a significant return of 0.78 per cent per month (t -stat 3.77), and it earns 0.87 per cent per month (t -stat 1.99) when applied to the emerging markets. These returns are larger than the corresponding momentum S4-S1 return of 0.64 per cent per month (t -stat 3.65) for the developed markets and the insignificant 0.51 per cent per month (t -stat 1.44) for the emerging markets for the same holding period.

In contrast, as expected, the late-stage strategy underperforms the corresponding early-stage strategy for all holding period lengths and for both developed and emerging markets. In the developed markets' case, the late-stage strategy profit is only significant with a six-month holding period. The results for the emerging markets in Panel B of Table 2 show insignificant late-stage profits for all holding periods, with three out of the four late-stage strategies showing negative returns.

Risk-adjusted analysis

To assess whether strategy profits are simply a reward for bearing risk, we employ the same international two-factor model used by Balvers and Wu (2006) to risk-adjust raw returns. The two-factor model contains a market factor and a value minus growth factor (VMG) as follows:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p, wld} (R_{wld,t} - R_{f,t}) + \nu_{p, vmg} VMG_t + \epsilon_t^1$$

The dependent variable $R_{p,t} - R_{f,t}$ is the monthly excess return of a portfolio of interest, whether it's the long, short or the arbitrage portfolio of a strategy, where $R_{p,t}$ represents the monthly US dollar return of portfolio p at time t and $R_{f,t}$ the monthly risk-free rate at time t represented by the one-month US T-bill return. The independent variables are as follows: $R_{wld,t} - R_{f,t}$ corresponds to the excess return on the MSCI World market portfolio at time t and VMG_t or Value minus Growth is the return on the MSCI World Value Index minus the return on the MSCI World Growth Index at time t . These monthly indices were obtained from Datastream. The coefficients β_p and ν_p are the regression loadings corresponding to the factors of the model, while the intercept α_p (or simply alpha) represents the risk-adjusted abnormal return of the portfolio over the estimation period. The t -values corresponding to the regression coefficients

TABLE 3: Risk-adjusted early-stage, late-stage and momentum profits

Strategy	Portfolio	Panel A: Developed markets			Panel B: Emerging markets		
		Annualised raw return	α_p	Adj. R^2	Annualised raw return	α_p	Adj. R^2
Early-stage	S1L2	0.078	-0.039	66.9%	0.092	0.002	42.9%
			(-2.09)			(0.03)	
	S4L1	0.172	0.057	65.7%	0.197	0.113	41.0%
(2.89)			(2.62)				
Late-stage	S4L1-S1L2	0.094	0.095	-0.3%	0.104	0.111	0.2%
			(3.66)			(2.14)	
	S1L1	0.109	-0.003	57.4%	0.162	0.075	36.6%
(-0.15)			(1.55)				
Mom.	S4L2	0.168	0.053	61.8%	0.184	0.095	45.3%
			(2.42)			(2.16)	
	S4L2-S1L1	0.059	0.056	3.8%	0.022	0.020	0.1%
(2.03)			(0.37)				
Mom.	S4-S1	0.076	0.075	1.0%	0.061	0.064	-0.3%
			(3.51)			(1.52)	

Note: This table presents the two-factor regression results for the monthly returns of the early-stage, late-stage and momentum portfolios with six-month holding periods. For the early-stage strategy, S1L2 is the portfolio of short-term losers that have the best long-term performance, and S4L1 is the portfolio of short-term winners that have the worst long-term performance. For the late-stage strategy, S1L1 is the portfolio of short-term losers that have the worst long-term performance and S4L2 is the portfolio of short-term winners with the best long-term performance. For the momentum strategy, S4 is the portfolio of short-term winners and S1 is the portfolio of short-term losers. The two-factor regression model is:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{wt} - R_{ft}) + \alpha_p VMG_t + \epsilon_{pt}$$

where $R_{wt} - R_{ft}$ is the excess return on the MSCI World Market portfolio and VMG_t is the value growth factor represented by the return on the MSCI World Value Index minus the return on the MSCI World Growth Index. Annualised Raw Ret. is the annualised unadjusted return for the respective portfolio. The t-statistics presented in parentheses are corrected for heteroskedasticity using White's (1980) test.

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Table 3 reports the annualised regression alphas for the long, short and long-short early-stage and late-stage portfolios with six-month holding periods, together with their associated t-values. The results for the corresponding pure momentum strategy's arbitrage (S4-S1) portfolio are also displayed. Table 3 also reports the annualised average raw returns for each portfolio so that the impact of the risk adjustment can be assessed.

The developed markets' results in Panel A of Table 3 show that the arbitrage early-stage alpha is a significant 9.5 per cent per year (t-stat 3.66) which is larger than the risk-adjusted pure momentum profit of 7.5 per cent per year (t-stat 3.51). The alpha of the late-stage strategy of 5.6 per cent per year (t-stat 2.03) is considerably smaller than the early-stage alpha. The emerging markets' early-stage risk-adjusted return in Panel B of Table 3 is a significant 11.1 per cent per year (t-stat 2.14). In contrast, the corresponding pure momentum strategy alpha is an insignificant 6.4 per cent per year (t-stat 1.52), as is the late-stage strategy alpha of 2.0 per cent per year (t-stat 0.37). Overall, Table 3 shows that

the early-stage strategy outperforms both the pure momentum and the late-stage strategies, and that the two-factor model does not succeed in explaining the momentum strategies' profits.

Although size is not expected to be a factor in explaining momentum in MSCI indices because they are composed of large liquid stocks, we also investigated whether the Fama-French US three-factor model could explain momentum profits. The results for the alphas are qualitatively very similar to the results reported in Table 3. For example, the arbitrage three-factor early-stage alpha is a significant 8.9 per cent (t-stat 3.30) in the developed case and 10.4 per cent (t-stat 1.97) in the emerging markets' case. An interesting feature of the results in Table 3 is that the long side of every strategy has a significant alpha, indicating that the short-term winners are the main drivers of the abnormal momentum profits.

Discussion and conclusion

Our results at the market index level are consistent with Chan and Kot's (2006) study of US stocks. Past long-term returns can be used to split the conventional momentum strategy into strong and weak components. The early-stage momentum

strategy consistently produces larger profits than both the late-stage momentum strategy and the pure momentum strategy. While the early-stage strategy provides relatively small improvements over pure momentum in the developed markets case, the early-stage strategy performs exceptionally well for the emerging markets. For emerging markets, recent winners that have poor long-term returns outperform recent losers with good long-term returns on an average annualised basis by 10.4 per cent per year. In contrast, recent winners outperform recent losers on an average annualised basis by only 6.1 per cent per year. The stronger raw profit results for the early-stage strategy survive risk-adjustment, producing an annualised alpha of 11.1 per cent per year.

This paper has provided a simple way to modify momentum strategies to yield larger profits. Given the widespread interest in momentum strategies, the early-stage momentum approach should be of direct interest to both practitioners and researchers. As only large liquid stocks are included in MSCI indices, professional investors have the option of investing directly in these stocks or in the exchange traded funds that are available for all 18 MSCI developed market indices and for 23 out of the 26 emerging market indices.

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Note

1 The monthly returns for the Ibbotson and Associates one-month T-bill risk-free rate were downloaded from Kenneth French's website: www.mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library

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