

Uncovering Sector Momentums

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When it comes to stock markets, “momentum” generally refers to the continuation or reversal in returns. A “momentum strategy” is a trading strategy used to generate profits from momentums. For example, let’s look at return continuation. Suppose we find that stocks that do well (poorly) over a six-month horizon tend to continue their good (poor) performance in the subsequent three-month period. Then a meaningful momentum strategy would be to short the losers and long the winners over three-month periods, and re-balance the portfolio, say, every month.

Researchers have looked into momentums in individual stocks, industries, and international stock market indexes.¹ By and large, they found performance continuation over the medium term: stocks

A look at return variations offers a practical guide momentum investment strategies

that performed well (poorly) during the previous three to 12 months tend to continue their good (poor) performance over the same holding period. They also found “winner-loser reversals” over a three- to five-year investment horizon: stocks that performed poorly in the previous three to five years tend to have higher returns than those that have performed well in the same period.

SUMMARY STATISTICS FOR MONTHLY RETURNS

TABLE 1	Sub-Group	Maximum %	Minimum %	Average %	Rank of	Standard	Average/	Rank of
					Average %	Deviation %	STD	Average/STD
	1. Metals & Minerals	23.74	-30.63	0.598	13	6.939	0.086	13
	2. Gold & Silver	54.65	-35.04	1.080	1	10.531	0.103	10
	3. Oil & Gas	29.06	-25.36	0.842	3	7.269	0.116	9
	4. Paper & Forest Products	22.59	-29.34	0.604	12	6.775	0.089	12
	5. Consumer Products	17.48	-22.25	0.838	4	4.863	0.172	2
	6. Industrial Products	23.72	-22.40	0.799	6	5.570	0.143	4
	7. Real Estate & Construction	56.85	-24.37	0.757	8	8.919	0.085	14
	8. Transportation & Environmental	20.62	-25.09	0.836	5	6.772	0.124	8
	9. Pipelines	20.05	-16.99	0.495	14	5.008	0.099	11
	10. Utilities	25.45	-15.88	0.616	11	4.113	0.150	3
	11. Communications & Media	19.35	-21.88	1.071	2	5.243	0.204	1
	12. Merchandising	21.96	-21.03	0.646	10	4.961	0.130	6
	13. Financial Services	17.72	-28.11	0.715	9	5.195	0.138	5
	14. Conglomerates	24.63	-22.02	0.778	7	6.070	0.128	7

Note:
1. All statistics are for monthly returns for the sample period of January 1961 to December 1999.
2. STD: standard deviation.

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The Data

This study looks at the momentum behaviour of the 14 subgroups of the TSE300 Composite Index (TSE300). This study covers the 14 sectors/subgroups of the TSE300. Table I contains the summary statistics for the monthly returns, covering the period from January 1961 to December 1999. In terms of average returns, the top three sectors are Gold & Silver, Communications & Media, and Oil & Gas. But in terms of return per unit of risk measured by the ratio of average return over the standard deviation, the top three are Communications & Media, Consumer Products, and Utilities. The only sector to top the groups by both measures is Communications & Media. By contrast, Metals & Minerals and Paper & Forest Products are the unambiguous losers. Pipelines also fared poorly over the years. Both Gold & Silver and Utilities exhibit, respectively, the highest and lowest return variations.

The Background

To fix notation, let R_{it} stand for the monthly return for group i ($i = 1, 2, \dots, 14$) and month t ($t = 1, 2, \dots, 468$). For each month t , we rank the performance of the 14 sectors over the past k months as of time $t - 1$, and form a momentum portfolio by going short the below-average sectors and long the above-average sectors. This portfolio will be held for m months. We will call k the evaluation period and m the holding period.

This procedure is repeated every month. For the self-financing portfolio, the sector weights are

$$w_{it}(k) = \frac{1}{14} [R_{i,t-1}(k) - R_{m,t-1}(k)]$$

$$\text{where } R_{m,t-1}(k) = \frac{1}{14} \sum_{i=1}^{14} R_{i,t-1}(k)$$

is the cross-sectional average at time $t - 1$ over the past k months. The weights are proportional to the deviation from the average. The profits over the m holding months is weighted average of the sector returns:

$$\pi_t(m) = \sum_{i=1}^{14} w_{it}(k) R_{i,t+m}(m).$$

To arrive at a meaningful measure of return for a zero-cost portfolio, we follow the convention and define the aggregate investments at time t as

$$I_t(m) = \sum_{i=1}^{14} |w_{it}(k)|.$$

The “return” can then be calculated as the profits divided by the holding period and by the average amount of investments: $\pi_t(m) / [0.5 \times m \times I_t(m)]$. This measure can be interpreted as the per-month profits for every dollar invested in the momentum strategy. Multiplied by 100, it can also be interpreted as the percentage return per month. Thereinafter, we report the percentage returns.

MOMENTUM STRATEGIES BASED ON ALL 14 SUBGROUPS

TABLE 2			H-month-1	H-month-3	H-month-6	H-month-12	H-month-24	H-month-36
	E-Month-1	Return	0.579	0.365	0.270	0.339	0.063	0.045
	t-value	2.721***	1.624*	1.204	1.331*	0.222	0.168	
	Return/STD	0.126	0.075	0.056	0.062	0.011	0.008	
E-Month-3	Return	0.679	0.534	0.446	0.480	0.071	0.074	
	t-value	2.907***	2.195**	1.840**	1.838**	0.248	0.265	
	Return/STD	0.135	0.102	0.086	0.086	0.012	0.013	
E-Month-6	Return	0.681	0.668	0.694	0.490	0.051	0.062	
	t-value	2.813***	2.917***	2.914***	1.905**	0.171	0.220	
	Return/STD	0.131	0.136	0.136	0.090	0.008	0.011	
E-Month-12	Return	1.053	0.851	0.648	0.278	-0.103	-0.049	
	t-value	4.214***	3.542***	2.589***	1.092	-0.345	-0.168	
	Return/STD	0.198	0.166	0.122	0.052	-0.017	-0.008	
E-Month-24	Return	0.224	0.060	-0.060	-0.218	-0.231	-0.232	
	t-value	0.888	0.241	-0.234	-0.871	-0.719	-0.815	
	Return/STD	0.042	0.011	-0.011	-0.042	-0.035	-0.040	
E-Month-36	Return	0.160	0.091	0.025	-0.083	-0.228	-0.293	
	t-value	0.662	0.384	0.101	-0.294	-0.688	-1.016	
	Return/STD	0.032	0.019	0.005	-0.014	-0.034	-0.051	

Note:

1. Sample period is from January 1961 to December 1999 with 468 monthly observations.

2. E-month-k: evaluation period of k months. H-month-m: holding period of m months. STD: standard deviation.

3. Momentum strategy is self-financing: short the loser groups and long the winner groups. Returns are per month, percentage returns. See the text for details of portfolio weight calculations and return calculations.

4. t-values are adjusted for auto-correlations in returns using the method of Newey and West (1987).

***: significant at 1%, **: significant at 5%, *: significant at 10%, all for one-tailed test.

Momentum Returns for the Overall Sample

Table 2 reports returns for strategies with evaluation and holding periods of 1, 3, 6, 12, 24, and 36 months. Each percentage return has a corresponding t-value and a ratio of return over the standard deviation.

There are several observations to make here. First, when the evaluation and holding periods are of equal length, we observe return continuation for up to 24 months and, beyond that, we see return reversals. This is consistent with previous findings for individual stocks.

Second, the best strategy is not necessarily the one with equal evaluation and holding periods. To appreciate this, first notice that the statistically significant returns all occupy the upper left corner of the table, and the best strategy covers a total length anywhere between two months and 18 months. Many profitable and reliable strategies do not have equal evaluation and holding periods. By comparing the pair-wise returns for the evaluation/holding period combinations at the upper left corner of the matrix, we see that, given the same length of return continuation (e.g., nine months), using a longer evaluation period and a shorter holding period (e.g., six months and three months) is much more reliable and profitable than using a shorter evaluation period and a longer holding period (e.g., three months and six months).

Strategies using a 12-month evaluation period seem to dominate the rest.

Since the essence of a momentum strategy is to short losers and long winners, it is interesting to find out if the strategy is more profitable when only the extreme winners and losers are included. To this end, we repeat the calculations using only one winner and one loser, two winners and two losers, etc. By and large, the conjecture was indeed confirmed. For brevity, we report in Table 3 the case where the portfolio contains only one loser and one winner.

Table 3 exhibits the overall pattern of Table 2, although the momentum profits are, on average, much larger. For instance, when the evaluation period is six months, the profits almost double. Interestingly, in this case, the t-values and return/risk ratios are actually higher than their counterparts for the full portfolio case. For other cases, the t-values and return/risk ratios are generally lower, reflecting the bigger variation in profits. But the significant improvements in returns and the minor setbacks in the t-values and return/risk ratios do seem to justify holding a smaller, less diversified portfolio.

So far, we have been examining overlapping holding period returns. As a robustness check, we repeat the calculations in Table 2 for non-overlapping holding periods and see if the results would still stand up. It turns

MOMENTUM STRATEGIES BASED ON ONLY THE TOP WINNER AND THE BOTTOM LOSER

		H-month-1	H-month-3	H-month-6	H-month-12	H-month-24	H-month-36
E-Month-1	Return	0.603	0.272	0.341	0.501	0.140	0.134
	t-value	1.463*	0.661	0.814	1.063	0.258	0.268
	Return/STD	0.068	0.031	0.038	0.050	0.012	0.013
E-Month-3	Return	0.939	0.657	0.634	0.747	0.100	0.124
	t-value	2.198**	1.546*	1.504*	1.617*	0.198	0.253
	Return/STD	0.102	0.072	0.070	0.076	0.009	0.012
E-Month-6	Return	1.381	1.332	1.323	0.816	0.084	0.184
	t-value	3.239***	3.179***	2.952***	1.684**	0.154	0.357
	Return/STD	0.151	0.148	0.138	0.079	0.007	0.017
E-Month-12	Return	1.585	1.291	0.995	0.476	-0.234	-0.121
	t-value	3.654***	3.026***	2.236***	1.014	-0.438	-0.250
	Return/STD	0.171	0.142	0.105	0.048	-0.021	-0.012
E-Month-24	Return	0.003	-0.280	-0.432	-0.521	-0.486	-0.402
	t-value	0.007	-0.618	-0.935	-1.062	-0.927	-0.843
	Return/STD	0.000	-0.029	-0.045	-0.051	-0.045	-0.042
E-Month-36	Return	0.035	-0.049	-0.093	-0.315	-0.372	-0.325
	t-value	0.082	-0.115	-0.204	-0.588	-0.645	-0.613
	Return/STD	0.004	-0.006	-0.010	-0.029	-0.032	-0.031

Note:

1. Sample period is from January 1961 to December 1999 with 468 monthly observations.

2. E-month-k: evaluation period of k months. H-month-m: holding period of m months. STD: standard deviation

3. Momentum strategy is self-financing: short the bottom loser group and long the top winner group. In other words, the portfolio consists of only two sectors / groups at all times.

Returns are per-month, percentage returns. See the text for details of portfolio weight calculations and return calculations.

4. t-values are adjusted for auto-correlations in returns using the method of Newey and West (1987).

***: significant at 1% , **: significant at 5% , *: significant at 10% , all for one-tailed test.

out that both the size of the profit and its t-value are comparable to the overlapping case.

Compositions of Winner and Loser Portfolios

But are the momentum portfolios dominated by a few sectors? Recall that the momentum strategy assigns bigger weights to the extreme winners and losers. If a particular sector has a higher variation, then it is possible (but not necessary) that this sector will be in the extreme winner or loser category more often.² To investigate this matter, we do the following calculations for a particular evaluation/holding period combination. First, over the whole sample period for each sector, we count the number of months for which the sector is among the top three winners, and the number of months for which it is among the bottom three losers. We call this number the sector's frequency of residency in winner or loser portfolios. Second, we rank the 14 sectors by the residency frequency. Lastly, we calculate the correlation coefficient between the winner and loser residency frequencies for the same sector. For brevity, we only report in Table 4 the results for combinations with equal evaluation and holding periods.

Strikingly, a few sectors do dominate the momentum portfolio. For instance, Gold & Silver and Real Estate & Construction very frequently reside in extreme winner and loser portfolios. In contrast, the presence of Consumer Products and Industrial Products in the extreme portfolios is the least frequent. The above observations remain valid across different evaluation/holding period combinations. Moreover, the correlation coefficient is quite high between the residency frequencies, which means that a sector is equally likely to be in the extreme winner and loser portfolios.

Table I shows that Gold & Silver and Real Estate & Construction indeed have the highest standard deviation. But standard deviations for Consumer Products and Industrial Products are not the lowest. Overall, we see that momentum returns are largely driven by sectors with large return variations. This offers a practical guide to choosing sectors for momentum investment strategies.

Momentum Returns for Sub-Samples

Here, we divide the whole sample period into three equal sub-sample periods, covering respectively 1961-1973, 1974-1986, and 1987-1999. We repeat the

FREQUENCY OF SUBGROUPS' RESIDENCY IN WINNER AND LOSER PORTFOLIOS

TABLE 4	SECTOR / SUBGROUPS														ρ
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Panel A: Evaluation / holding periods: one month															
W-Month	121	181	120	117	58	60	152	109	99	81	72	67	78	83	0.84
W-Rank	3	1	4	5	14	13	2	6	7	9	11	12	10	8	
L-Month	107	165	132	98	63	62	125	134	78	83	105	70	83	93	
L-Rank	5	1	3	7	13	14	4	2	11	10	6	12	9	8	
Panel B: Evaluation / holding periods: three months															
W-Month	122	172	114	135	55	59	163	94	91	92	70	65	82	72	0.77
W-Rank	4	1	5	3	14	13	2	6	8	7	11	12	9	10	
L-Month	90	152	145	98	67	66	140	128	79	77	104	69	88	83	
L-Rank	7	1	2	6	13	14	3	4	10	11	5	12	8	9	
Panel C: Evaluation / holding periods: six months															
W-Month	114	166	114	126	46	60	153	112	87	104	60	84	79	63	0.71
W-Rank	5	1	4	3	14	13	2	6	8	7	12	9	10	11	
L-Month	88	165	123	83	64	64	149	132	69	77	127	73	89	65	
L-Rank	7	1	5	8	14	13	2	3	11	9	4	10	6	12	
Panel D: Evaluation / holding periods: twelve months															
W-Month	129	149	98	139	51	63	150	80	81	113	63	90	67	59	0.60
W-Rank	4	2	6	3	14	12	1	9	8	5	11	7	10	13	
L-Month	91	154	97	93	60	68	150	131	59	71	144	76	77	61	
L-Rank	7	1	5	6	13	11	2	4	14	10	3	9	8	12	

Note:
1. Sample period is from January 1961 to December 1999 with 468 monthly observations.
2. W-Month: number of months the sector / subgroup is in the top three winner portfolios. W-Rank: ranking of the number of months the sector / subgroup is in the top three winner portfolios. L-Month: number of months the sector / subgroup is in the bottom three loser portfolios. L-Rank: ranking of the number of months the sector / subgroup is in the bottom three loser portfolios.
3. The last column shows the correlation between the winner and loser ranks.
4. See Table 1 for the sub-group headings.

calculations for each sub-sample period. For brevity, we only provide a brief summary below. First, for all three sub-samples, the profits over a total period of 12 to 18 months (i.e. sum of evaluation and holding periods) remain positive, as is the case for the overall sample. But the t-value and return/risk ratio vary across sub-samples.

Second, the time horizon for return reversals seems to vary across sub-samples. For example, the behaviour for the period of 1961 to 1973 is very similar to that of the overall sample period. However, for the sample period of 1987 to 1999, return continuation tends to last much longer, and reversal is seen only for the six-year horizon.

Third, generally, in terms of all three measures (i.e., return, t-value, and return/risk ratio), the ranking among sample periods takes the following descending order: 1961-1973, 1961-1999, 1987-1999, and 1974-1986.

As revealed earlier, the relative level of standard deviations determines which sectors are in the extreme winner/loser portfolios. It turns out that the overall level of standard deviations (across all sectors) determines the overall profitability of the momentum strategy. To illustrate this point, we calculate and report in Table 5 the return standard deviation for the three sub-sample periods, together with that for the overall sample period from Table 1. The median standard deviation (across sectors) ranks in ascending order of 1961-1973, 1961-1999, 1987-1999, and 1974-1986, exactly corresponding to the

overall return ordering. The lower the overall standard deviation, the better the momentum strategy's performance. Intuitively, when the overall level of return variation is low, the momentum portfolio will remain relatively stable, enabling a persistent return accumulation.

Systematic Risk for Momentum Portfolios

As shown in Table 2, when we adopt a 12-month evaluation period, the statistically significant returns range from 0.648 per cent to 1.053 per cent per month, or from 7.78 per cent to 12.64 per cent per year. If the momentum portfolio's systematic risk is close to zero, then the profit size is very decent. To shed light on this issue, we estimate the beta for each strategy/portfolio by regressing the holding period returns on the corresponding TSE300 returns with the Newey-West adjustment for autocorrelations.

It turns out that betas are higher and more significant for portfolios with longer evaluation and holding periods. For strategies that produce significant, positive returns, betas range from -0.008 to 0.164, many of which are not statistically significant. More telling are the low R-squares, the highest of which is 0.018. The results collectively suggest that, for most of the profitable momentum portfolios, systematic risk is either zero or close to zero.

Transaction Costs and Short Selling Requirements

Our momentum strategy calls for forming a portfolio every month. But since we are dealing with the same

STANDARD DEVIATIONS FOR THE SUB-SAMPLES AND THE OVERALL SAMPLE

Sector/Subgroup	1961 - 1973		1974 - 1986		1987 - 1999		1961 - 1999	
	Standard Deviation	Rank	Standard Deviation	Rank	Standard Deviation	Rank	Standard Deviation	Rank
1. Metals & Minerals	0.0500	(1)	0.0771	(4)	0.0716	(3)	0.0673	(2)
2. Gold & Silver	0.0776	(1)	0.1189	(4)	0.1028	(3)	0.1013	(2)
3. Oil & Gas	0.0590	(1)	0.0870	(4)	0.0627	(2)	0.0707	(3)
4. Paper & Forest Products	0.0603	(1)	0.0708	(4)	0.0656	(3)	0.0658	(2)
5. Consumer Products	0.0366	(1)	0.0542	(4)	0.0483	(3)	0.0470	(2)
6. Industrial Products	0.0462	(1)	0.0547	(3)	0.0595	(4)	0.0538	(2)
7. Real Estate & Construction	0.0956	(4)	0.0847	(2)	0.0697	(1)	0.0848	(3)
8. Transportation & Environmental	0.0523	(1)	0.0720	(4)	0.0719	(3)	0.0662	(2)
9. Pipelines	0.0405	(1)	0.0589	(4)	0.0450	(2)	0.0488	(3)
10. Utilities	0.0275	(1)	0.0389	(3)	0.0470	(4)	0.0389	(2)
11. Communications & Media	0.0497	(1)	0.0524	(4)	0.0501	(2)	0.0508	(3)
12. Merchandising	0.0443	(1)	0.0543	(4)	0.0436	(2)	0.0477	(3)
13. Financial Services	0.0439	(1)	0.0514	(3)	0.0535	(4)	0.0498	(2)
14. Conglomerates	0.0594	(3)	0.0605	(4)	0.0568	(1)	0.0589	(2)
Median	0.0499	(1)	0.0597	(4)	0.0582	(3)	0.0564	(2)

Note:
The table reports standard deviations for monthly returns. "Rank" is the rank of the standard deviation among the sample periods in ascending order, i.e., 1 indicates the lowest, 2 the second lowest, ... and 4 the highest.

14 subgroups, we are modifying only a portion of the portfolio. For instance, for each month in a six-month holding period strategy, we are adding a new portfolio and dropping an old one. Five stay intact. In effect, we are only modifying about 1/6 of the overall portfolio each month, which means each sector is being turned over twice a year. With a gross profit of 7.78 per cent per year, the break even transaction cost is $7.78 \text{ per cent} / 2 = 3.89 \text{ per cent}$, which is extremely high. Even if we assume a management fee of 2.5 per cent per year at the high end for a mutual fund, and assume that the strategy is carried out using sector funds, then the break even momentum profit is 5 per cent per year, which still makes our strategies profitable.

With sector Exchange Traded Funds (ETFs), short selling can be easily done. In the U.S., the American Stock Exchange trades nine sector ETFs. In Canada, unfortunately, not all 14 subgroups of the TSE300 have corresponding ETFs. At the time of writing, Barclays Global Investors offered four sector ETFs which cover Energy, Financial, Information Technology, and Gold. Nonetheless, for institutional fund managers, tracking each sector with a few key stocks and implementing the strategy by trading individual stocks is a realistic possibility. If and when ETFs are available for all subgroups of the TSE300, then our strategy will be accessible to all investors.

Conclusion

Momentums do prevail among the 14 sectors of the TSE300. For the sample period of 1961 to 1999, the best momentum strategy is the one covering a total period of up to one-and-a-half years. In many cases, the per-month return is higher than one per cent, especially when the momentum portfolio contains only the extreme winner and loser sectors. Furthermore, given the average length of return continuation, a longer evaluation period (about 12 months) coupled with a shorter holding period (three or six months) seems to be the optimal strategy.

The relative level of return variations determines which sectors will contribute more to the momentum portfolio's return; the overall level of return variations determines the profitability of the momentum strategy. Intuitively, the former means that the chance for a sector to be an extreme winner or loser is higher

if its returns vary more than other sectors'; the latter means that when the overall level of return variation is low, there will be a higher chance for the momentum portfolio to be stable and generate consistent positive returns.

All told, there seems to be tremendous potential in the Canadian market for sector momentum investment strategies. This should draw serious attention from all fund managers. ■

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Endnotes

1. DeBondt and Thaler (1985, 1987), Jegadeesh and Titman (1993), and Moskowitz and Grinblatt (2000) examined the U.S. market, while Foerster, Prihar and Schmitz (1995), Kan and Kirikos (1996), and Cleary and Inglis (1998) looked into the Canadian market. Rouwenhorst (1998), and Chan, Hameed and Tong (2000) studied the international markets.
2. It is not necessarily true because, in order to be in the extreme winner and loser portfolio, a reasonable return continuation must also be present.
3. Effective May 1, 2002, the TSE300 index was renamed to S&P/TSX index. The index composition and sector grouping will change. But the insights offered in this study remain valid.

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