Reducing Turnover and Transaction Costs With a New Class of Equity Reversal Signals Based on Volatility Differences

Anthony A. Renshaw, PhD
Axioma, Inc.
June 2017

Summary

Short-term momentum (STM) is, perhaps, the most well-known equity reversal signal, but is limited in its real world application due to turnover and transaction costs. In this paper, we present three new equity reversal signals. Each new signal exhibits prototypical reversal behavior, and two of them exhibit roughly half the turnover associated with STM.

In addition to introducing these new reversal signals, we also demonstrate how the signals can be improved. First, the signals can be filtered using Axioma's profitability factor, which effectively distinguishes those assets likely to exhibit a strong reversal, from those that are less likely to revert. Second, the signal strength and turnover of two of the signals can be substantially improved by using risk models created using Axioma's Risk Model Machine that have risk horizons even longer than Axioma's standard risk horizons. These results provide portfolio managers with a new class of effective equity signals that can be tuned to that portfolio manager's environment and investment philosophy.

Introduction

Short-term momentum (STM), defined as the asset return over the preceding 20 trading days, is a well-known equity reversal signal. Assets with large, positive STM usually under-perform in the following month, while assets with low STM normally recover and out-perform in the following month. In other words, an over-reaction in one month is normally followed by a correction in the subsequent month, reverting the stock price towards its previous mean.

The STM reversal has been studied extensively since at least 1990 (Jegadeesh, 1990; Lehmann, 1990; and Lo and Mackinlay, 1990). Further research on STM has included explanations and models of the effect, including the impact of the bid-ask spread, liquidity, and investor psychology (Jegadeesh and Titman, 1995; Chan, 2003; Subrahmanyam, 2005; de Groot, et al, 2011).

Among equity risk factors and signals, STM has one of the strongest historical performance records. The statistical significance of the factor is high, and the cumulative performance is usually the strongest, albeit negative, among all equity factors. However, it can be difficult to profit from the STM signal because of trading costs. Tracking the signal requires turning over the entire portfolio every month since every winner (high STM) becomes a loser (low STM) and vice versa.

The purpose of this paper is to examine a new class of equity reversal signals derived from equity risk models. We examine the four different signals shown in Table 1. The first, Total Return, is simply STM. The second, Specific Return, is the cumulative specific return of the preceding 20 days. The third, Total Risk, is computed as the difference in total asset risk predicted by two factor risk models with different risk prediction horizons. The fourth, Specific Risk, is the difference in specific risk for each asset predicted by two factor risk models with different risk prediction horizons. In both Total Risk and Specific Risk, the difference in risk is defined as the short horizon risk minus medium horizon risk.

Table 1. The four reversal signals examined herein.

Signal	Description	# of Risk Models Needed
Total Return (SMT)	Cumulative total (price plus dividends) return over the preceeding 20 trading days. Commonly known as Short-Term Momentum (STM).	0
Specific Return	Cumulative specific return over the preceeding 20 trading days.	1
Total Risk	Difference in asset total risk, short horizon risk minus medium horizon risk.	2
Specific Risk	Difference in asset specific risk, short horizon risk minus medium horizon risk.	2

We define the two Risk signals so that the scores have the same sign as the most recent (shortest horizon) risk prediction change. If an asset total or specific risk is increasing, then that increase will be reflected most quickly and strongly in the shorter horizon risk model. As defined in Table 1, such an asset will have a large positive signal. Conversely, a large negative signal indicates a falling level of asset total or specific risk, picked up most strongly by the short horizon risk model.

The three new signals—Specific Return, Total Risk, and Specific Risk—require access to a factor risk model: one factor risk model for Specific Return and two factor risk models of different prediction horizons for Total Risk and Specific Risk. The signals are defined and work with both fundamental and statistical factor risk models.

The need for one or two factors risk models may explain why such signals have not been studied previously, especial for the two Risk signals. Except for customers of Axioma, which supplies multiple risk horizon models to all of its customers, very few portfolio managers have access to two, high quality factor risk models of different risk horizons. Note that it is important that the two, different horizon risk models be consistent with each other. If the two risk models are not consistent, such as might occur if they are created by different commercial risk model providers, then small differences in coverage, data quality, and modeling assumptions are likely to have an important impact on the quality of the reversal signal. One could, of course, create internal, home-grown factor risk models with different risk horizons, but most portfolio managers have neither the time nor resources for such an effort[1].

Specific Return is a straightforward extension of the traditional STM signal, and its efficacy is not a surprise. However, the other two signals, Total Risk and Specific Risk, represent a new class of reversion signals based on differences in risk. The evidence presented here suggests that assets whose risk has increased in the recent past (a large, positive risk signal) will under-perform, while assets whose risk has decreased in the recent past (a large, negative risk signal) will out-perform. While prior research has examined the historical out-performance of low volatility stocks (e.g., the low volatility phenomenon; see, for example, Soe, 2012), we are not aware of prior research that has examined the performance of stocks whose volatility has recently changed, regardless of whether those stocks are high or low volatility. The research presented here indicates that the market rewards stocks whose risk predictions are decreasing.

The turnover associated with the Risk signals is substantially less than the turnover associated with the Return signals, in some cases half as much. This is not a surprise because the risk prediction horizons are longer than the 20-day horizon used for the Return signals. For the Axioma risk models examined here, the short horizon half-life is 60 trading days and the medium horizon half-life is 125 trading days, and both use up to four years of data in their volatility estimates. Given these long histories and weightings, the resulting signal is more stable over time, leading to less turnover. This is attractive, as the reduced turnover makes it easier to take advantage of the signal in practice.

We study the performance of all four signals over time. In addition, we examine two approaches for improving the signals.

First, we examine the performance of the four signals with respect to Axioma's profitability factor, which gives a measure of the quality of a company's cash flows (Asness, et al., 2014; Novy-Marx, 2013). In the case of reversal signals, it is easy to imagine that the strength of the reversal performance may depend on such a metric. For stocks that have under-performed (low signal) but whose quality is high, the reversal might be

[1] Axioma provides its proprietary Risk Model Machine to automate the construction of custom risk models of different horizon, type, and factors in a consistent manner using Axioma's standard equity risk models as an initial risk model input.

expected to be strong (a case of genuine market over-reaction). For stocks that have under-performed (low signal) and have low quality, it might be that the reversal may be weak or non-existent (a case of the market correctly identifying an asset with poor prospects). The data supports this hypothesis.

Second, we examine the signals using two longer horizon risk models (the standard, Axioma, medium horizon 25-day half-life and a longer, custom risk model with a 250-day half-life) constructed using Axioma's Risk Model Machine. The signals with the longer half-lives still exhibit strong reversal performance with even less turnover. These results suggest that the risk model signals examined may be profitable after transaction costs when using longer horizon risk models.

Baseline Performance Results

For our initial study, we use each signal to define five, cap-weighted quintile portfolios over either the Russell 1000 or Russell 2000 indexes. Equal weighted portfolios exhibit similar behavior reversal characteristics, but embed a size bias into the results. For each quintile and each signal, we perform a backtest with monthly rebalancings from 3/31/82 to 3/31/17 (421 rebalancings).

Table 2 shows the Information Ratios (IRs) and average round trip, monthly turnover for the five quintiles for each signal computed, using Axioma's fundamental factor risk models (AXUS4-MH and AXUS4-SH). Table 3 shows the IRs and average round trip, monthly turnover for the five quintiles for each signal computed, using Axioma's statistical factor risk models (AXUS4-MH-S and AXUS4-SH-S). The risk half-life for the short horizon model is 60 trading days, while the risk half-life for the medium horizon model is 125 trading days. In both tables, the specific return of the short horizon risk model is used for Specific Return. Results using the medium horizon specific return are similar.[2]

Table 2. The IRs and average round trip, monthly turnover for the five quintiles for each signal using Axioma's fundamental factor risk models (AXUS4-MH and AXUS4-SH).

Information Ratios	Russell 1000						Russell 2000				
Signal	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)		Q1 (LO)	Q2	Q3	Q4	Q5 (HI)
Total Return	0.00	0.54	0.22	-0.23	-0.46		0.04	0.48	0.65	-0.11	-0.69
Specific Return	0.41	1.37	-0.19	-0.40	-1.04		0.41	1.45	0.52	-0.56	-1.18
Total Risk	0.06	0.33	0.25	0.00	-0.33		0.01	0.65	0.53	0.15	-0.83
Specific Risk	0.37	0.41	0.32	-0.26	-0.48		0.52	0.76	0.54	-0.07	-0.87

Ave. Mthly Turnover	Russell 1000						Russell 2000				
Signal	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)		Q1 (LO)	Q2	Q3	Q4	Q5 (HI)
Total Return	169%	162%	156%	159%	168%		165%	163%	154%	156%	158%
Specific Return	165%	159%	153%	154%	162%		162%	161%	149%	154%	154%
Total Risk	91%	124%	131%	122%	94%		80%	120%	127%	119%	91%
Specific Risk	70%	107%	111%	106%	82%		72%	110%	119%	110%	82%

[2] Axioma's fundamental short horizon risk models include both STM and medium term momentum factors, while Axioma's fundamental medium horizon risk models only include medium term momentum. Tests with custom risk models with identical factor sets indicate that this discrepancy does not substantially effect the performance of the signals.

Table 3. The IRs and average round trip, monthly turnover for the five quintiles for each signal using Axioma's statistical factor risk models (AXUS4-MH-S and AXUS4-SH-S).

Information Ratios	Russell 1000					Russell 2000				
Signal	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)
Total Return	0.00	0.54	0.22	-0.23	-0.46	0.04	0.48	0.65	-0.11	-0.69
Specific Return	-0.06	0.40	-0.03	-0.17	-0.22	0.37	0.54	0.27	-0.29	-0.72
Total Risk	0.05	0.29	-0.12	-0.12	-0.08	0.08	0.10	-0.28	-0.06	0.07
Specific Risk	0.42	0.25	0.32	0.00	-0.56	0.54	0.83	0.48	0.24	-0.96

Ave. Mthly Turnover	Russell 1000					Russell 2000				
Signal	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)
Total Return	169%	162%	156%	159%	168%	165%	163%	154%	156%	158%
Specific Return	22%	41%	48%	43%	27%	20%	40%	47%	45%	30%
Total Risk	68%	71%	64%	57%	65%	51%	51%	53%	45%	45%
Specific Risk	69%	110%	118%	109%	84%	72%	111%	120%	115%	86%

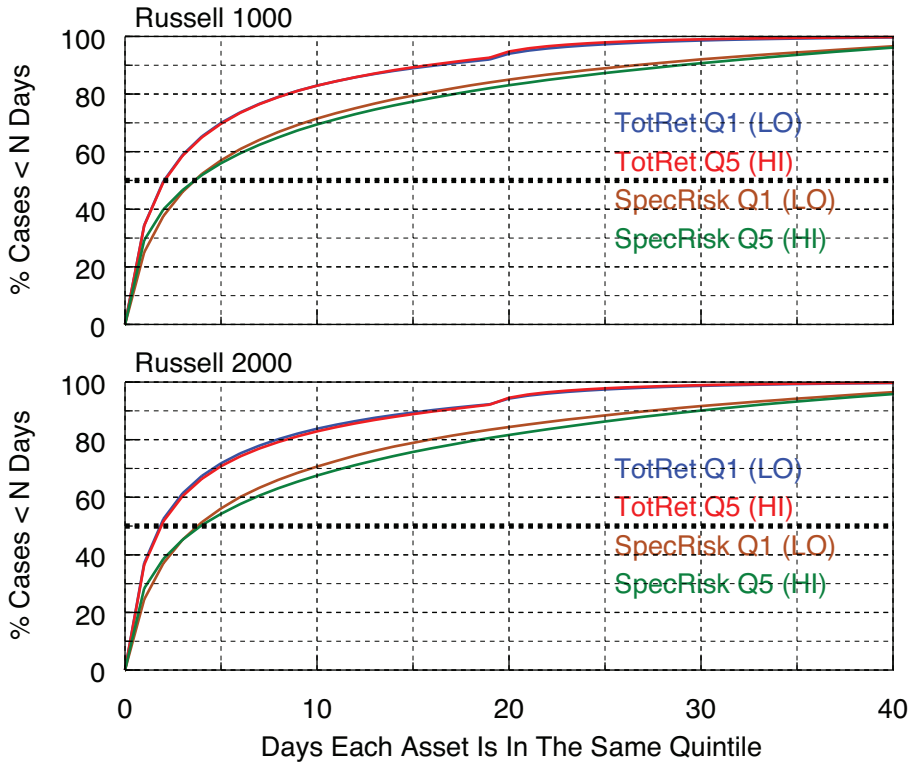
In both tables, Q1 generally has positive IRs, while Q5 generally has negative IRs. This is the anticipated reversal performance. Of course, there are exceptions and, in several cases, the IRs are not significantly different from zero. Overall, however, the table supports the reversal hypothesis.

Curiously, Q2 consistently has higher IRs than Q1, often by a substantial amount. This suggests that the low signal performance may include both stocks that will revert and out-perform, as well as stocks that have recently under-performed and will continue to under-perform. We examine that hypothesis more closely in the subsequent section on profitability.

The turnover for the two Risk signals is a little more than half of the turnover associated with the two Return signals. For the statistical risk model, the turnover is generally a bit less. This reduction in turnover represents one of the practical advantages of the new Risk signals.

Next, we compute the number of days each asset remains in a given quintile. Fig. 1 shows the average fraction of assets that remain in a given quintile for less than a given number of trading days. We see that for the Total Return signal, 50% of the names remain in Q1 or Q5 for only one or two days. For the Specific Risk signal, 50% remain in Q1 or Q5 up to four days, approximately twice as long. This longer expected duration in a given quintile explains the lower observed turnover.

Figure 1. The cumulative fraction of assets that remain in the quintile less than a fixed number of trading days. Blue: Q1, Total Return; red: Q5 Total Return; brown: Q1 Specific Risk; green: Q5 Specific Risk.



In order to test the similarity of the four signals, Table 4 shows the Spearman rank correlation between each signal, averaged over the rebalances. Due to the large rank correlations (0.77 to 0.90), we conclude that the two return signals are highly correlated, and the two risk signals are highly correlated. While not identical, they are driven by similar underlying information. However, the rank correlation between the Return and Risk signals is quite low, indicating that the Risk signals are different from the Return signals.

Table 4. The average, cross sectional Spearman rank correlation of the signals with each other.

	Russell 1000				Russell 2000			
	Total Return	Specific Return	Total Risk	Specific Risk	Total Return	Specific Return	Total Risk	Specific Risk
Total Return	1				1			
Specific Return	0.77	1			0.81	1		
Total Risk	-0.11	-0.07	1		-0.06	-0.03	1	
Specific Risk	0.01	0.02	0.79	1	0.02	0.03	0.90	1

Next, we examine how stable the signals have been over time. Figs. 2 and 3 show the rolling, trailing three-year IRs for Q1 and Q5 over time for each of the four signals. Fig. 2 is for the Russell 1000, while Fig. 3 is for the Russell 2000.

Generally, the Q1 IR (blue) is positive, while the Q5 IR (red) is negative. Over many time windows, the two Q1 and Q5 IRs move in opposite directions, indicating that both sides (LO and HI) of the reversal work well. Prior to 2000, the signal strengths were often quite large, especially the negative IRs for Q5. In recent years, the signal IRs have been weaker and, in some cases, such as the Specific Return signal for the Russell 1000, have not performed consistently well. Over the last three years, the most effect signals were Total Return and Specific Risk.

Figure 2. Rolling, trailing, three-year IRs over the Russell 1000 for each of the four signals. Blue: Q1; red: Q5.

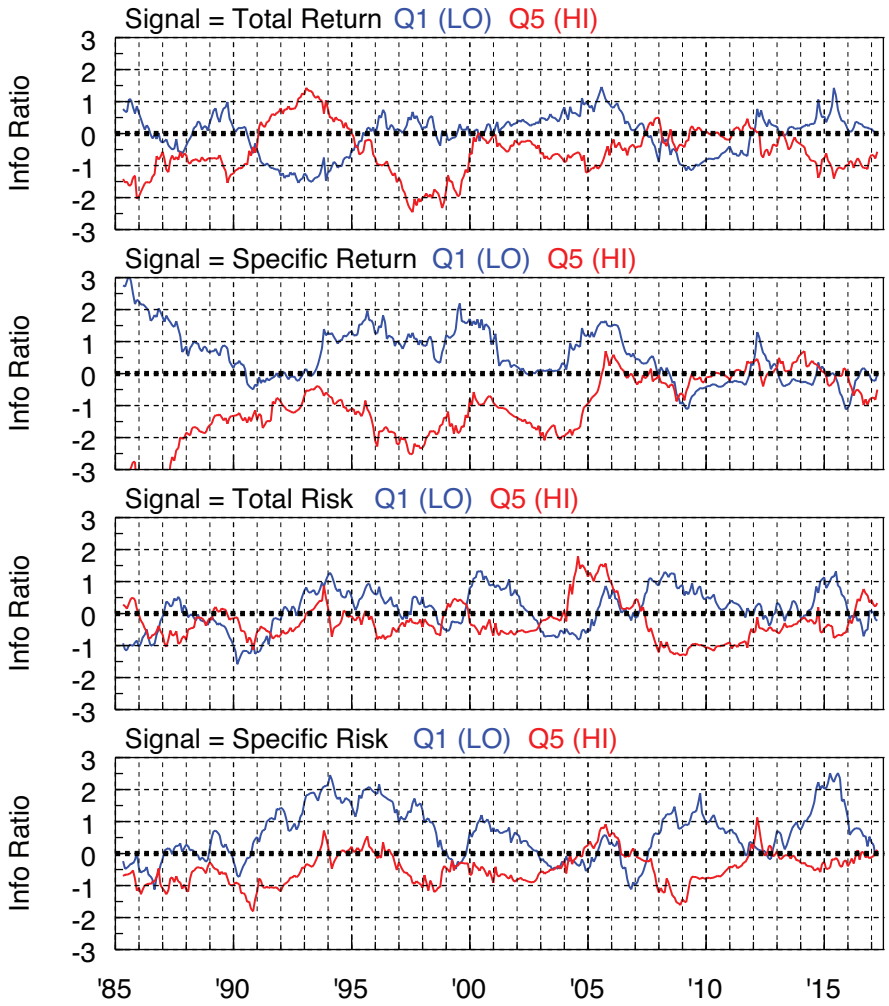
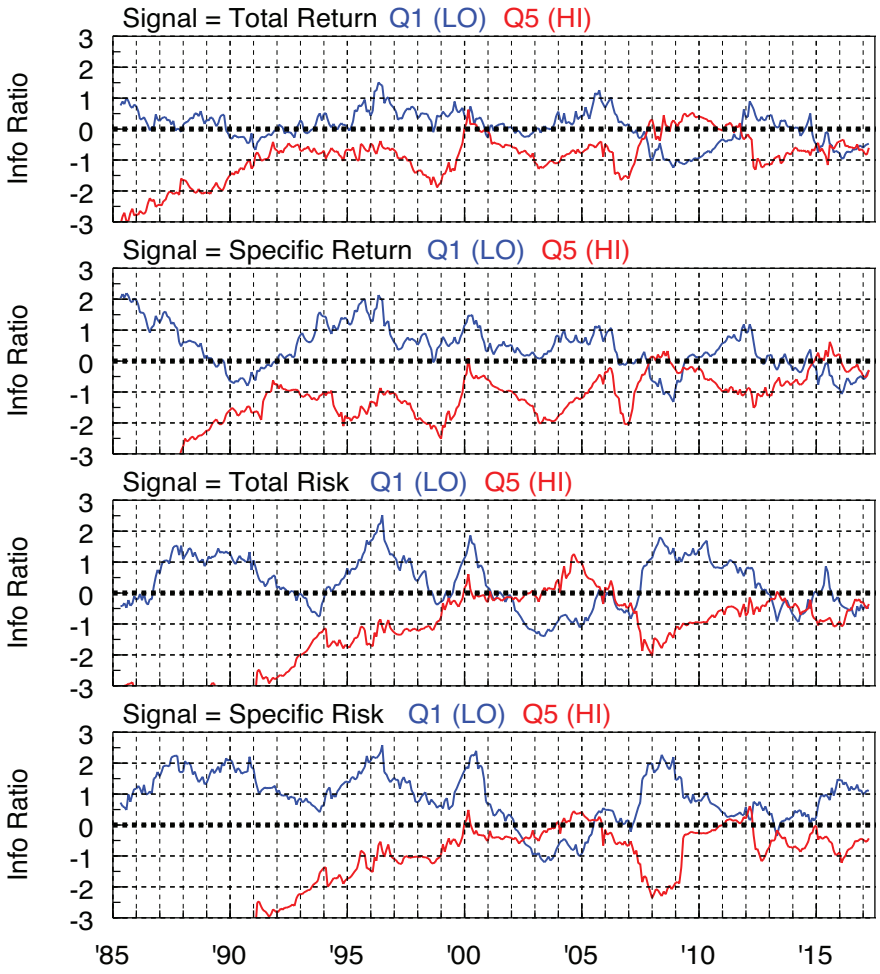


Figure 3. Rolling, trailing, three-year IRs over the Russell 2000 for each of the four signals. Blue: Q1; red: Q5.



Signal Improvement #1: Interaction with Profitability

In this section, we follow up on the observation that many Q2s exhibit large positive IRs. A potential explanation of the observed Q1 and Q2 IRs would be a competing signal that describes the future prospects of an asset. Then, among the Q1 assets, some will have sound future prospects and will exhibit a strong reversal, while other assets will be genuinely distressed that will not reverse.

We test this hypothesis using Axioma's profitability factor, which is a composite of six underlying descriptors: return-on-equity, return-on-assets, cash flow to assets, cash flow to income, gross margin, and sales-to-assets. We create 25 different portfolios, one for each combination of a signal quintile and a profitability quintile. Tables 5 and 6 show the IRs for each of the 5 X 5 quintile grids of profitability versus the four signals. Table 5 shows results for the Russell 1000 and Table 6 shows results for the Russell 2000.

In each table, positive IRs are highlighted in blue. As is evident from the color of the tables, the blue cells dominate the lower triangle of each grid. That is, assets with Q1 or Q2 signal scores, but Q4 or Q5 profitability scores, generally have substantial positive IRs. Assets with Q4 or Q5 signal scores and Q1 or Q2 profitability scores generally have large negative IRs. These results suggest that filtering on profitability—in addition to one of the four signals described here—may be effective and can notably enhance the signal.

Table 5. IRs for the Russell 1000 for quintile portfolios based on both the four signals and profitability. Positive IRs are highlighted in blue.

	Q1 Total Return	Q2 Total Return	Q3 Total Return	Q4 Total Return	Q5 Total Return
Q1 Profitability	-0.20	0.06	0.11	-0.40	-0.52
Q2 Profitability	-0.23	0.50	-0.07	-0.25	-0.68
Q3 Profitability	0.16	0.33	0.02	-0.22	-0.65
Q4 Profitability	0.07	0.31	0.18	-0.30	-0.26
Q5 Profitability	0.25	0.43	0.36	0.12	-0.14

	Q1 Specific Return	Q2 Specific Return	Q3 Specific Return	Q4 Specific Return	Q5 Specific Return
Q1 Profitability	-0.22	0.08	-0.41	-0.43	-0.76
Q2 Profitability	0.29	0.21	-0.06	-0.29	-0.63
Q3 Profitability	0.52	0.28	-0.06	-0.28	-0.63
Q4 Profitability	0.21	0.87	-0.05	-0.40	-0.74
Q5 Profitability	0.53	0.95	0.06	0.17	-0.22

	Q1 Total Risk	Q2 Total Risk	Q3 Total Risk	Q4 Total Risk	Q5 Total Risk
Q1 Profitability	-0.28	0.04	-0.14	-0.52	-0.42
Q2 Profitability	-0.31	-0.02	0.15	-0.17	-0.46
Q3 Profitability	-0.08	-0.05	0.31	-0.03	-0.21
Q4 Profitability	0.00	0.24	0.09	0.12	-0.30
Q5 Profitability	0.26	0.21	0.21	0.47	0.14

	Q1 Specific Risk	Q2 Specific Risk	Q3 Specific Risk	Q4 Specific Risk	Q5 Specific Risk
Q1 Profitability	-0.19	-0.11	-0.27	-0.52	-0.45
Q2 Profitability	-0.11	-0.07	-0.01	-0.27	-0.34
Q3 Profitability	0.30	0.09	-0.03	-0.12	-0.26
Q4 Profitability	0.38	0.13	0.28	0.12	-0.72
Q5 Profitability	0.33	0.32	0.46	0.07	0.17

Table 6. IRs for the Russell 2000 for quintile portfolios based on both the four signals and profitability. Positive IRs are highlighted in blue.

	Q1 Total Return	Q2 Total Return	Q3 Total Return	Q4 Total Return	Q5 Total Return
Q1 Profitability	-0.69	-0.86	-0.62	-0.89	-0.80
Q2 Profitability	-0.19	0.10	0.14	-0.14	-0.64
Q3 Profitability	0.42	0.67	0.42	-0.15	-0.78
Q4 Profitability	0.66	0.90	0.65	-0.15	-0.69
Q5 Profitability	0.74	0.84	1.02	0.58	-0.13

	Q1 Specific Return	Q2 Specific Return	Q3 Specific Return	Q4 Specific Return	Q5 Specific Return
Q1 Profitability	-0.57	-0.55	-0.72	-0.92	-0.96
Q2 Profitability	0.01	0.49	0.17	-0.34	-0.95
Q3 Profitability	0.64	1.02	0.31	-0.39	-0.94
Q4 Profitability	0.96	1.24	0.42	-0.17	-0.74
Q5 Profitability	1.10	1.15	0.72	0.36	0.02

	Q1 Total Risk	Q2 Total Risk	Q3 Total Risk	Q4 Total Risk	Q5 Total Risk
Q1 Profitability	-0.65	-0.42	-0.54	-0.88	-0.99
Q2 Profitability	-0.17	0.26	0.22	-0.04	-0.98
Q3 Profitability	0.23	0.44	0.26	0.19	-0.52
Q4 Profitability	0.38	0.48	0.31	0.22	-0.28
Q5 Profitability	0.84	0.82	0.90	0.64	0.02

	Q1 Specific Risk	Q2 Specific Risk	Q3 Specific Risk	Q4 Specific Risk	Q5 Specific Risk
Q1 Profitability	-0.54	-0.29	-0.58	-0.91	-1.06
Q2 Profitability	0.01	0.08	0.24	-0.17	-0.80
Q3 Profitability	0.55	0.35	0.35	0.26	-0.64
Q4 Profitability	0.87	0.59	0.35	-0.02	-0.34
Q5 Profitability	1.42	0.99	0.61	0.52	-0.01

Signal Improvement #2: Cross Sectional Regression.

The results presented have utilized cap-weighted quintiles. An alternative analysis of the signals can be constructed using cross-sectional regression. Using Axioma's Risk Model Machine software, we perform a cross sectional regression for every trading day from 2/3/82 to 3/31/17 using the factors in Axioma's US equity, fundamental factor, medium horizon risk model (AXUS4-MH), which includes 13 style factors, 68 industry factors, and a market (intercept) factor. We then do additional regressions adding one of the four signals to the regression as an additional, z-scored, style factor.

Table 7 shows percent of days in which the the absolute T-statistic is greater than two for each of the original style factors and each of the additional signals. Table 8 shows the annualized returns for each of the style factors and the additional four signals over the entire time period.

Table 7. The percent of days in which the the absolute T-statistic is greater than two for each of the original style factors and the additional Return or Risk signal.

Factor	Orig	Total Return	Specific Return	Total Risk	Spec Risk
Dividend Yield	19%	19%	19%	19%	19%
Earnings Yield	22%	22%	22%	22%	22%
Exchange Rate Sensitivity	21%	21%	21%	21%	21%
Growth	22%	22%	22%	22%	22%
Leverage	21%	21%	21%	21%	21%
Liquidity	40%	40%	40%	39%	40%
Market Sensitivity	64%	64%	64%	64%	64%
Medium-Term Momentum	47%	48%	47%	47%	47%
Profitability	22%	22%	22%	22%	22%
Size	61%	61%	61%	59%	59%
Value	24%	23%	24%	23%	24%
Volatility	48%	48%	48%	44%	45%
Total Return		58%			
Specific Return			47%		
Total Risk				30%	
Specific Risk					27%

Table 8. The annualized, cumulative factor return for each signal.

Factor	Orig	Total Return	Specific Return	Total Risk	Spec Risk
Dividend Yield	0.00%	-0.10%	-0.19%	-0.02%	0.07%
Earnings Yield	3.06%	2.90%	2.60%	3.17%	3.03%
Exchange Rate Sensitivity	0.38%	0.31%	0.24%	0.34%	0.38%
Growth	-0.32%	-0.62%	-0.41%	-0.40%	-0.36%
Leverage	-0.23%	-0.43%	-0.25%	-0.40%	-0.29%
Liquidity	2.09%	1.80%	1.31%	1.86%	2.35%
Market Sensitivity	-2.52%	-3.01%	-2.46%	-2.83%	-2.31%
Medium-Term Momentum	3.30%	5.18%	4.81%	3.50%	3.10%
Profitability	4.63%	5.25%	4.35%	4.59%	4.56%
Size	-5.97%	-4.98%	-4.90%	-6.56%	-4.03%
Value	2.43%	1.71%	1.81%	2.17%	2.32%
Volatility	-5.86%	-5.45%	-4.67%	-6.33%	-4.30%
Total Return		-25.44%			
Specific Return			-15.01%		
Total Risk				1.37%	
Specific Risk					-3.02%

The percent of days in which absolute T-statistic is greater than two for the four signals is robust and significant. The values for the four signals— 58%, 47%, 30%, and 27% —are not as strong as Market Sensitivity (the factor with the largest value), but larger than many other style factors. Total Return has the highest average significance, while Specific Risk has the lowest.[3]

Interestingly, when looking at the long-term returns, the two Return signals have large, negative annual returns (-25.4% and -15.0%), while the two risk signals are smaller, and Total Risk is not reversal (Total Risk is not a reversal because its average annual return is positive). Nevertheless, regardless of the sign, the returns are large in magnitude when compared with the other style factor returns.

Figure 4. Cumulative returns for each signal computed using Axioma's Risk Model Machine.

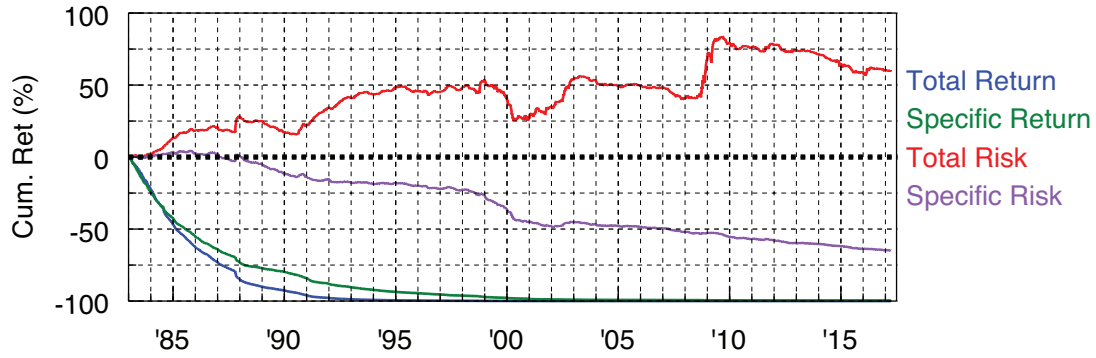


Fig. 4 shows the cumulative returns for the four signals as computed using Axioma's Risk Model Machine, from 1/28/83 to 3/31/17. The two Return signals are consistently negative, and are essentially -100% from the early 1990's onwards. The Specific Risk signal has also been consistently negative, but to a more modest degree. The Total Risk Signal has generally been positive, but has been negative since 2010.

These results indicate that the four signals are statistically significant, even within the context of a multi-factor regression.

As a final test, we use Axioma's Risk Model Machine to build a risk model with a half-life twice as long as Axioma's Medium Horizon Risk Model (250 trading days instead of 125 trading days). We then compute the four signals using the difference of Axioma's standard Medium Horizon Risk Model (AXUS4-MH) and the new 250-day half-life risk model. The performance and monthly turnover of the Russell 1000 and Russell 2000 quintiles are shown in Table 9.[4]

[3] The average Volatility Inflation Factors (VIFs) for the four signals ranges from 1.04 (Specific Return) to 1.65 (Total Risk), indicating that all four signals have little colinearlity with the other style factors in the regression.

[4] For these results, the backtest is from 12/31/82 to 3/31/17, slightly less than the previous results.

Table 9. The IRs and average round trip, monthly turnover for the five quintiles for each signal using longer horizon risk models (AXUS4-MH minus a 250-day half-life risk model).

Information Ratios	Russell 1000					Russell 2000				
Signal	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)
Total Return	-0.01	0.53	0.22	-0.23	-0.45	0.04	0.47	0.64	-0.12	-0.67
Specific Return	0.50	1.15	0.08	-0.46	-1.06	0.42	1.44	0.50	-0.61	-1.18
Total Risk	0.77	0.01	-0.03	-0.09	-0.36	0.74	0.87	0.69	-0.49	-1.09
Specific Risk	0.65	0.07	-0.07	-0.32	-0.20	0.84	0.93	0.66	-0.67	-1.09

Ave. Mthly Turnover	Russell 1000					Russell 2000				
Signal	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)	Q1 (LO)	Q2	Q3	Q4	Q5 (HI)
Total Return	169%	162%	156%	159%	168%	165%	163%	154%	156%	158%
Specific Return	170%	161%	154%	154%	166%	166%	162%	150%	155%	158%
Total Risk	30%	60%	54%	56%	39%	29%	55%	65%	59%	35%
Specific Risk	30%	63%	60%	56%	39%	29%	57%	66%	60%	34%

The results in Table 9 show that the three new signals strongly out-perform the standard STM (Total Return) signal in terms of IR. In addition, the monthly round-trip turnover of Q1 and Q5 have now been reduced to 30%, a substantial decrease from the 160% that occurs for STM. Because of this substantially reduced turnover, the Risk signals computed with longer horizon risk models may out-perform even after transaction costs are included.

Conclusion

The principal contribution of this paper is the introduction of a new class of reversal signals, represented by the two Risk signals, Total Risk and Specific Risk. Each of these signals exhibits reversal behavior, with roughly half the turnover associated with the Return signals. Unlike classic short-term momentum (e.g., Total Return), computation of these signals requires two factor risk models, fundamental or statistical, with different prediction horizons. The Risk signals are distinct from the traditional Return signals and represent a new avenue for investigation.

Another important contribution of this paper is the recognition that all four reversal signals (Total Return, Specific Return, Total Risk and Specific Risk) can be effectively further filtered using Axioma's profitability factor. The profitability factor distinguishes assets that are likely to exhibit a strong reversal from those that are less likely to revert. In addition, the use of longer horizon risk models enhances the two Risk signals while substantially reducing the turnover of the signal.

References

Asness, C. S., Frazzini, A, and Pedersen, L. H., "Quality minus junk," *CFA Digest,* 44(1), 2014.

Chan, W. S., "Stock price reaction to news and no-news: drift and reversal after headlines", *Journal of Financial Economics,* 70, 223-260, 2003.

de Groot, W., Huij, J., Zhou, W., "Another look at trading costs and short-term reversal profits", *Journal of Banking & Finance,* 2011.

Jegadeesh, N., "Evidence of predictable behavior of security returns", *Journal of Finance,* 45(3): 881-98, 1990.

Jegadeesh, N., Titman, S., "Short horizon return reversals and the bid-ask spread", *Journal of Financial Intermediation,* 4 (2): 116-32, 1995.

Lehmann, N. B., "Fads, martingales, and market efficiency", *Quarterly Journal of Economics,* 105(1):1-28, 1990.

Lo, A.W., Mackinlay, A. C., "When are contrarian profits due to stock market overreaction?", *Review of Financial Studies,* 3 (2):175-205, 1990.

Novy-Marx, R., "The other side of value: the gross profitability premium." *Journal of Financial Economics,* 108(1), 1-28, 2013.

Soe, A. M., "The Low Volatility Effect: A Comprehensive Look", Soe, Aye M., The Low Volatility Effect: A Comprehensive Look (August 1, 2012). Available at SSRN: https://ssrn.com/abstract=2128634 or http://dx.doi.org/10.2139/ssrn.2128634, 2010.

Subrahmanyam, A., "Distinguishing Between Rationales for Short-Horizon Predictability of Stock Returns", *Financial Review,* 40, 11-35, 2005.

Acknowledgements

Axioma

Flexible is better.®

Contact us to learn more about how Axioma can bring more information and insights to your investment process.

United States and Canada: +1-212-991-4500
Europe: +44-207-856-2424
Asia: +852-8203-2790

Sales: sales@axioma.com
Client Support: support@axioma.com
Careers: careers@axioma.com