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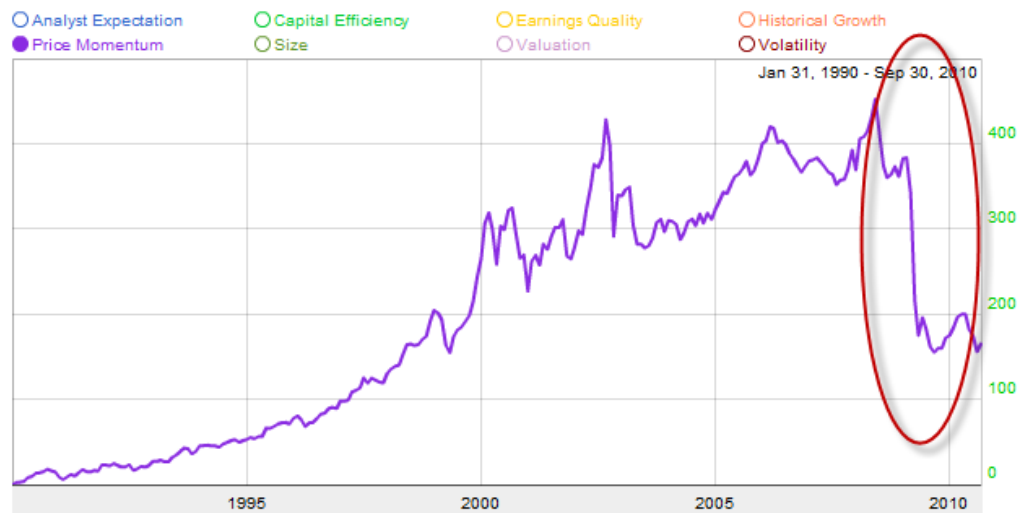
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Another Brick in the Wall: The Historic Failure of Price Momentum

In 2009, investors witnessed the cataclysmic failure of Price Momentum strategies. Now that accounts of this failure have been on the books for some time, we review these events in a historical context and further analyze the fundamental relationships that affect this strategy.

Cumulative Q1-Q5 Return Spread by Style



Source: Capital IQ's Alphaworks

The failure of Price Momentum has prompted a number of questions from practitioners interested in the strategy, some of which include the following:

- Within a historical context, how pronounced has this recent failure been?
- When Price Momentum fails, what is the strategy's subsequent performance?
- What factors are concurrent or predictive of the performance of Price Momentum?

This month, we analyze the historical performance of Price Momentum, on both a one-month and trailing twelve-month bases. We then look at the impact of volatility on Price Momentum to see if the past changes in the VIX can be used to predict the performance of Price Momentum. Specifically, underperformance of Price Momentum is associated with declines in the VIX. We find that Price Momentum shows signs of serial correlation, while the VIX shows signs of mean reversion.

Finally, using Capital IQ's Alphaworks tools, we find that Price Momentum profitability shows signs of sensitivity to the risk environment, with the best payoffs in normal and low risk periods.

1 Another Brick in the Wall

The historical popularity of the Price Momentum anomaly, like Pink Floyd, is almost universally recognized.

Yet Price Momentum hit a brick wall in 2009. March and April of 2009 represent the first and fifth worst months for Price Momentum in the S&P500 since 1968. In addition, the Top-Bottom Quintile spread for Price Momentum in the S&P 500 from April 2009 to July 2010 has averaged a disappointing -95 bps/month. These extreme periods of negative performance have left many investors, hopeful for a rebound or mean-reversion, disappointed. In fact, the periods ending October 2009 and January 2010 were the two worst 12-month periods since 1968.

This month, we analyze the historical performance of Price Momentum, on both a one-month and trailing twelve month bases. We then look at the impact of volatility on Price Momentum to see if the past changes in the VIX can be used to predict the performance of Price Momentum.

Our study utilized the S&P500 monthly from January 1968 to August 2010. For purposes of this paper we define Price Momentum as the trailing twelve month excess return to the universe (12MPmo). There are numerous definitions of Price Momentum in the literature and in use by practitioners but the most basic definition was used for illustrative purposes. The analysis involving the VIX is from 1990 to present, also monthly.

THE LONG AND SHORT OF IT: PRICE MOMENTUM WORKED

We begin by analyzing the distribution of Price Momentum over both long-term, trailing twelve-month, and short-term, one-month, holding periods. As Charts 1 and 2 demonstrate, we find that the distribution of Price Momentum is negatively skewed with positive mean and median for both twelve-month and one-month horizons, respectively.

Price Momentum is negatively skewed with positive mean and median for both 12M and 1M horizons

Chart 1

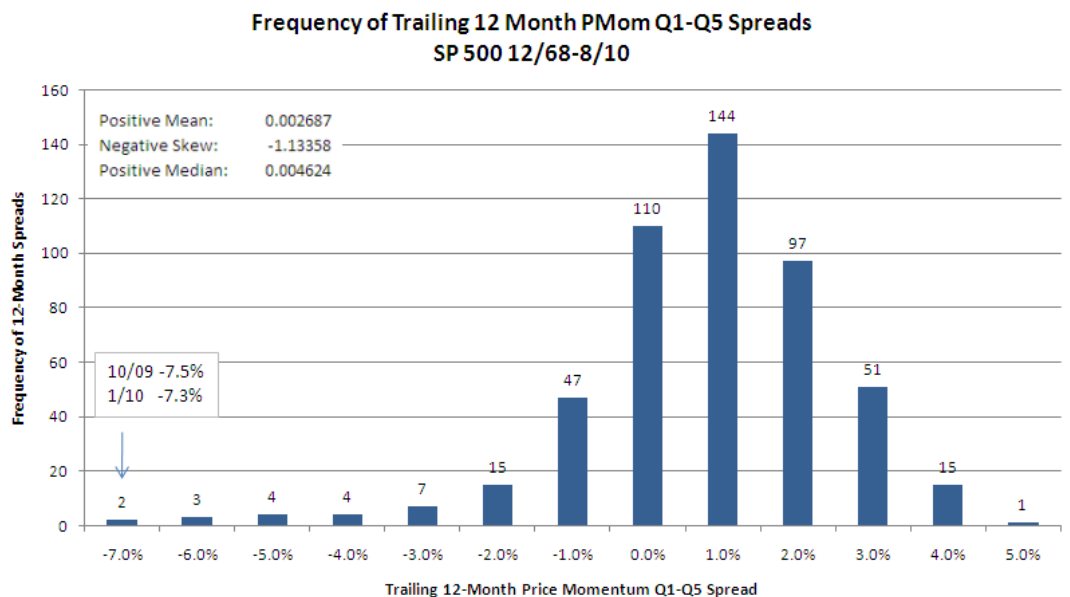
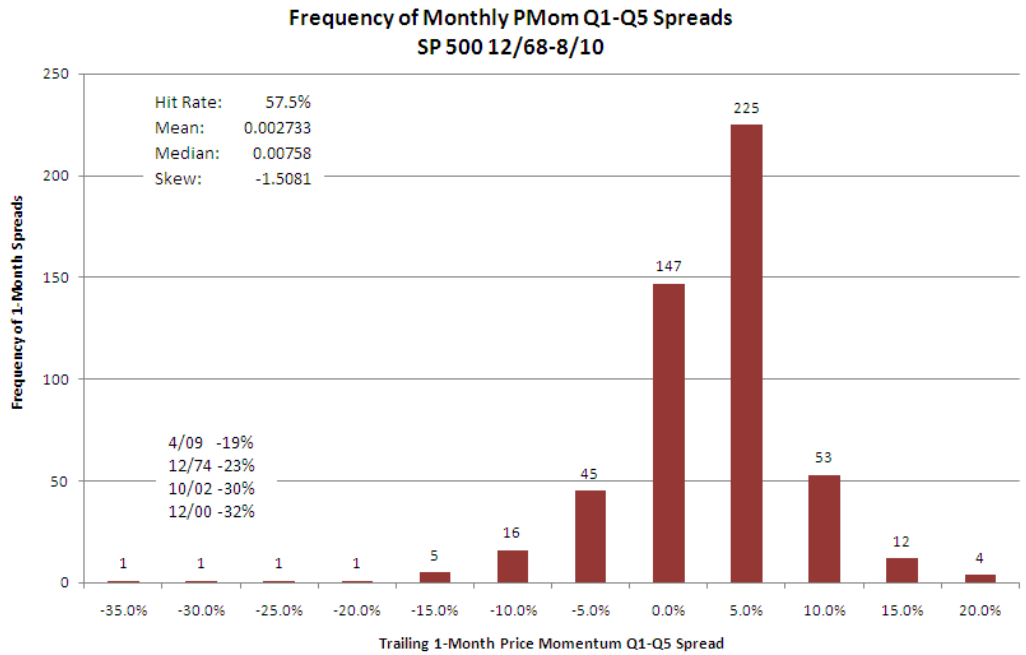


Chart 2 also shows that the historical performance is also similar, realizing positive returns 57.5% of the time.

Chart 2



The next logical question for investors may be how has Price Momentum performed following particularly strong and weak periods? Table 1 shows the subsequent performance of Price Momentum following periods of extreme positive and negative realizations. Table 1 suggests that there may be some weak mean reversion following extreme over/under-performance. Unfortunately, the first and fifth worst months for this strategy came, back-to-back, in March and April of 2009.

Table 1: Five Best and Worst Months for Pmom

Table 1 suggests there may be some weak mean reversion following extreme performance

	Top-Bottom Spread (Q1-Q5)	Info. Coefficient	Next Month's Spread
1/31/2000	18%	28%	-10%
5/31/2008	17%	53%	-7%
8/31/2001	16%	39%	-14%
11/30/1998	15%	51%	9%
5/31/2002	15%	43%	7%
4/30/2009	-19%	-43%	3%
12/31/1974	-23%	-47%	-2%
10/31/2002	-30%	-58%	9%
12/31/2000	-32%	-60%	6%
3/31/2009	-40%	-64%	-19%

Obviously a trend following strategy will fail given a seemingly discrete shift in the underlying factors that drive the trend. It is this type of scenario that was the impetus of the catastrophic failure of Price Momentum in March of 2009, when the market sentiment flipped from fear to greed.

2 The Impact of Volatility

If trend following strategies are prone to failure during periods of structural change, then identification of the inflection points is tantamount. In order to assess whether there was a structural shift in the market we turned to the Chicago Board of Options Exchange Volatility Index (VIX), which is a logical measure of market regimes.

PRICE MOMENTUM AND VIX: AN INVERSE RELATIONSHIP

As Table 2 shows, we find that there is a seemingly inverse contemporaneous relationship between changes in the VIX and Price Momentum performance. The relationship seems particularly pronounced for periods of underperformance of Price Momentum as it seems to be strongly related to negative changes in the VIX.

Table 2: Five Best and Worst Trailing 12 Months for Pmom

Periods of underperformance seem strongly related to changes in the VIX

	Top-Bottom Spread (Q1-Q5)	Avg IC	Next 12M	12M Chg in VIX
5/31/2008	4%	12%	-5%	1.6
6/30/2002	4%	9%	-4%	3.78
5/31/2002	4%	6%	-3%	0.92
5/31/2000	4%	7%	-3%	2.56
6/30/2008	4%	16%	-5%	0.43
11/30/2009	-6%	-15%	-	-15.49
9/30/2009	-6%	-14%	-	-34.28
12/31/2009	-7%	-15%	-	-23.16
1/31/2010	-7%	-20%	-	-21.73
10/31/2009	-8%	-17%	-	-24.59

Looking across just those months for which we have subsequent next twelve-month data, we find similar evidence of the perverse relationship between VIX and Price Momentum, as seen in Table 3.

Table 3: Worst 12 Months with Subsequent Data

Inverse relationship between VIX and Price Momentum holds over longer horizons

	Top-Bottom Spread (Q1-Q5)	Avg IC	Next 12M	12M Chg in VIX
5/31/2003	-3%	-4%	-3%	-5.93
9/30/2003	-4%	-11%	2%	-8.42
4/30/2009	-4%	-1%	3%	18.67
7/31/2003	-4%	-9%	-1%	-13.15
1/31/2001	-4%	-10%	12%	-1.35
6/30/2003	-4%	-7%	2%	-12.51
6/30/2009	-5%	-7%	-11%	3.41
5/31/2009	-5%	-10%	-6%	4.97
8/31/2003	-5%	-12%	6%	-21.06
7/31/2009	-5%	-6%	-5%	5.27

We then partition each month into High, Med (Normal), and Low Risk environments across the March 1990 to July 2010 time period. As Table 4 demonstrates, Price Momentum's strength is derived from periods of normal and low risk, as measured by the VIX.

Table 4: Pmom Payoff - SP500 Monthly 3/90 - 7/10

VIX	Avg Monthly	Monthly		
	<u>Alpha</u>	<u>Std Dev</u>	<u>T-Stat</u>	<u>P-Value</u>
High	-1.1%	0.106	-0.968	34%
Med	1.2%	0.053	2.111	4%
Low	0.5%	0.027	1.680	10%

While the contemporaneous relationship between the VIX and Price Momentum is interesting, a far more useful outcome would be if the past changes in the VIX could be used to predict future performance of Price Momentum.

In order to determine if (positive) changes in VIX can be used to predict future (negative) changes in Price Momentum we ran a regression using each month's top-bottom quintile spread against the trailing one month change in the VIX. The regression was set up so that a dummy variable is equal to one if the trailing one-month change in the VIX is negative and zero otherwise. The beta coefficient and the associated t-stat are then examined:

**Table 5: Monthly Regression on Prior Month's Chg in VIX
March 1990 - July 2010**

	<u>n</u>	<u>Intercept</u>	<u>T-Stat</u>	<u>Beta1</u>	<u>T-Stat</u>
SP500	245	0.01	1.15	-0.01	-1.14
R2000	245	0.02	2.67***	-0.03	-2.52***

*** Significant at the 99% Confidence Level

Changes in VIX are a harbinger of Price momentum under-performance

The negative sign on Beta 1 and the associated significant t-stat in Table 5 suggest that for smaller cap stocks (as defined by the Russell 2000) the past changes in the VIX are predictive of a negative subsequent return to following a Price Momentum strategy. The results are similar, but not statistically significant for the S&P 500. This provides an important insight for practitioners. Namely that risk measures, specifically the change in VIX when VIX is high, may be useful in alerting us to Price Momentum strategy underperformance.

INTERACTION OF THE LEVEL AND THE CHANGE IN VIX

Given the dual observation that price momentum performs well in regimes of normal and low levels of VIX, and performs poorly when VIX declined in the prior month, we were interested to investigate how these two opposing effects interacted with each other.

To study this, we segmented our time period into six regimes, determined by high, medium, and low VIX levels, and whether the VIX level increased or decreased in the prior month. We then calculated the t-stat of the mean of the 1 month forward Q1-Q5 spread for price momentum; the results from the Russell 2000 are displayed in Table 6 on the following page.

The Increasing/Decreasing VIX level segments are based on whether the VIX level increased or decreased in the one-month prior. The high, medium, or low VIX level is determined at the start of the

observation period, and the t-stat is based on the on the subsequent one month Q1-Q5 price momentum spread.

Table 6: T-statistic of Mean 1 Month Pmom Q1-Q5 Spread

Russell 2000, 3/31/1990 - 7/31/2010

VIX Level	1 Month Prior Change in VIX	
	Increasing	Decreasing
High	1.713	-1.964
Med	3.269	1.291
Low	3.023	1.724
	3.485	-0.709

The negative effect of declining VIX is limited to when VIX is at a relatively high level

As expected, the t-stats for medium and low VIX regimes are statistically significant. Yet we find that the negative effect of declining VIX is limited to when VIX remains at a relatively high level. The only combination in which Price Momentum underperforms is when VIX declined in the one month prior period yet remained at a high level. A possible explanation of this could be that investors are trying to avoid missing the turnaround – exiting defensive positions, taking profits on recent winners, and taking a fresh look at recent dogs.

MEAN REVERSION IN PRICE MOMENTUM AND THE VIX

The results to this point suggest that when the VIX is at high level and then falls, Price Momentum subsequently fails. The next step is to apply a test of mean reversion.

In the event that the VIX demonstrates mean reversion, investors may want to avoid the strategy in periods of elevated VIX, and re-renter the strategy after the VIX has declined to more normal levels. In order to test for mean reversion the Jegadeesh test is used:

$$r_t - \mu = \beta(k) \sum_{j=1}^k (r_{t-j} - \mu) + \varepsilon_t,$$

Where, r_t is the monthly return, μ is the unconditional mean, and k is the holding period of lagged returns.

As Table 7 shows, there is short-term continuation, or serial correlation, for Price Momentum strategies as evidenced by the positive coefficient for $k=1$, i.e., one month.

Table 7: Jegadeesh Test for Mean Reversion - SP500 1/90 to 7/10

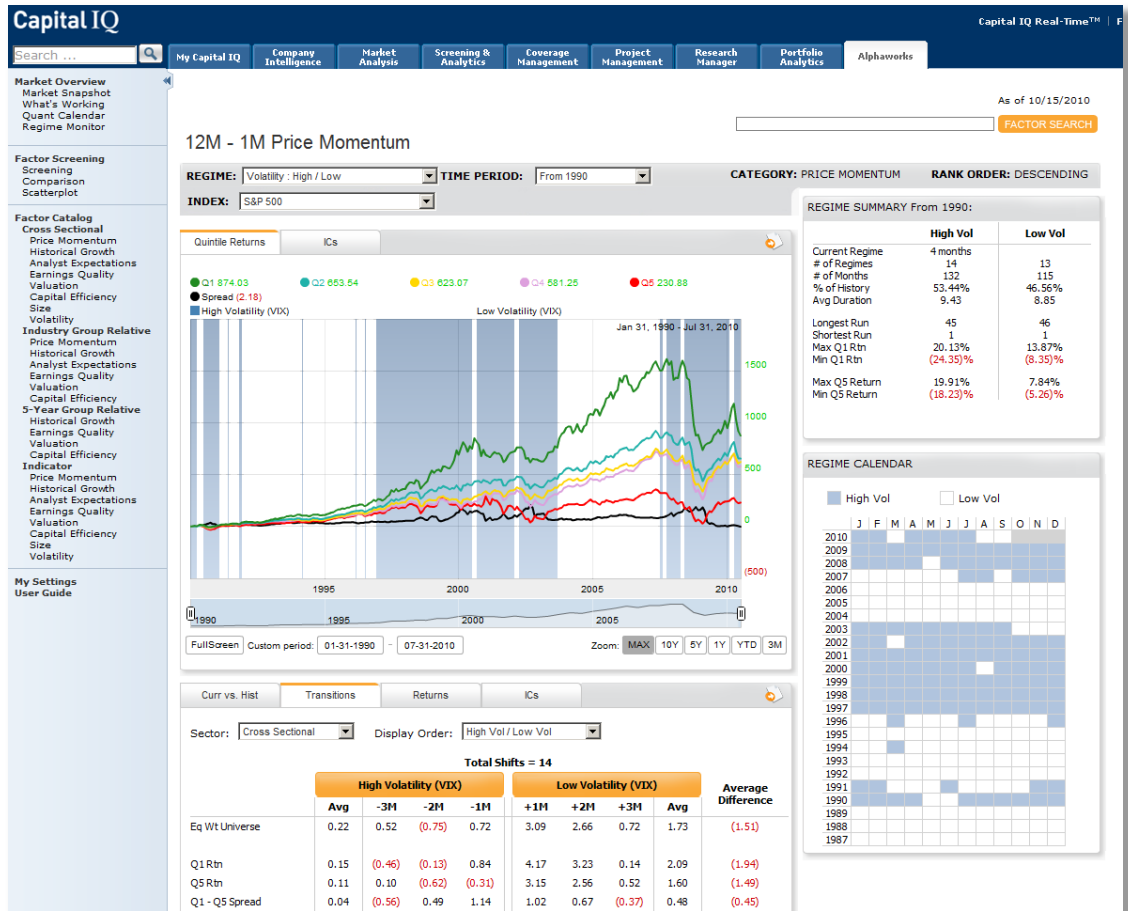
Price Momentum		k =				
		<u>1</u>	<u>3</u>	<u>6</u>	<u>9</u>	<u>12</u>
Coeff		0.09	-0.01	0.01	-0.01	0.00
T-Stat		2.01	-0.30	0.29	-0.42	-0.29
P-Value		5%	77%	77%	67%	77%
VIX						
Coeff		-0.07	-0.13	-0.12	-0.10	-0.06
T-Stat		-1.01	-3.30	-3.42	-3.29	-2.23
P-Value		31%	0%	0%	0%	3%

In contrast, the negative coefficient and significant t-stats on the VIX show strong mean reversion for periods longer than 1-month. The results are also suggestive of mean reversion for a holding period of one-month, though not statistically significant.

Our tests for mean reversion suggest positive serial correlation of PMom over the next one month

ALPHAWORKS CONFIRMS THE EVIDENCE

Finally we leverage our CapitalIQ's Alphaworks on-line factor library, which allows in depth analysis of a library of over 400+ stock selection signals. One function of this tool allows the user to specify a factor, time period, and regime, in order to analyze the strategy performance. Below is a screen shot of Alphaworks analysis of Price Momentum, in this case the lagged twelve-month momentum, for high and low VIX.



3 Summary

Without question, the recent underperformance of Price Momentum has felt and indeed has been, unprecedented. The negative skew to Price Momentum payoffs suggests that negative outliers will occur. History does not paint an encouraging picture for those who are hoping to quickly 'get some performance back'. Though we are all "wishing you {alpha} were here", this is not the way Price Momentum seemingly works as there is no evidence that the strategy's performance is mean reverting.

This study shows that VIX, as a measure of market risk, provides an indication as to when the Price Momentum strategy is likely to fail. In periods of elevated VIX, the performance of the strategy is the weakest as subsequent mean reversion leads to a regime switch which is coincident with, or the cause, of the Price Momentum strategy failure. Tools such as Capital IQ's Alphaworks provide a clean, fast way of slicing and examining numerous strategies over various regimes.

There is a bright side. The VIX currently at 20 is right in the middle of the historical normal range of 15-22, suggesting that the strategy should resume its profitability and again "shine on you crazy diamond" so long as risk levels remain moderate.

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