PIMCO

Value Cashes When Momentum Crashes

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Executive Summary

- We construct a value-momentum portfolio using a novel approach utilizing the correlation between the rankings of value and momentum signals.
- This rank correlation enables us to form a dynamically weighted value-momentum portfolio that has performed well.
- The logic of why the rank correlation combines value and momentum strategies well is that it underweights momentum when it disagrees with value the most. When this disagreement has been extreme in the past, it has resulted in a momentum "crash."
- The rank correlation predicts the returns of value and momentum better than the value spread.

Value investors seek to buy securities at a depressed valuation to gain from higher expected future returns, whereas momentum investors anticipate upward price pressure on securities that have already gone up in price. These contrasting investment strategies can be exploited in a systematic fashion, but combining them in the same portfolio can be challenging: A security that is attractive from a valuation point of view is often unattractive from a momentum point of view. We propose a way to systematically combine value and momentum signals in portfolios with the potential to outperform. This is of considerable interest in today's markets because with the underperformance of value strategies in recent years, investors are looking for ways to combine value with other factors. This paper illustrates an approach for doing so in a sensible manner for value and momentum factors.

Equation 1 illustrates why combining value and momentum is challenging. The current price in the denominator of a valuation metric (a fundamental-to-price (F/P) ratio) depends on the past 12-month momentum return, causing the cross-sectional value and momentum equity signals to go in the opposite direction. A negative 12-month return anticipates poor momentum performance, but this makes the valuation metric F/P high, indicating cheapness and higher expected return:

$$\frac{F_t}{P_t} = \frac{F_t}{(1 + r_{t-12,t})P_{t-12}}. \quad (1)$$

In an extreme scenario where the 12-month momentum return explains the cross-sectional variation of the valuation metric, these signals are in full disagreement. In this fully offsetting scenario, combining value and momentum signals would result in perfect "hedging" – and a portfolio with exposure to neither value nor momentum.

We solve this problem by constructing a value-momentum portfolio that uses the cross-sectional rank correlation of value and momentum signals. This correlation, on average, is negative (stocks that score cheap are likely to have negative momentum), but the magnitude of this correlation varies over time. We form a dynamically weighted value-momentum portfolio that underweights momentum when the cross-sectional correlation of value and momentum scores is highly negative. The portfolio increases the weight on momentum when the correlation is close to zero or positive. We document that such a combination has performed well in history. The logic of why the rank correlation combines value and momentum strategies well is that it underweights momentum when it disagrees with value the most. We show that when value and momentum signals are in disagreement, the momentum strategy performs poorly because it has a high and negative exposure to value. We document that when this disagreement has been extreme in the past, it has resulted in a momentum "crash." This dark side of the momentum strategy contrasts with a bright side of the value strategy, albeit one with high volatility. We show that the rank correlation captures the return patterns of momentum better than other signals proposed in prior studies, such as the "value spread,"[1] and market beta, and it can be used as an instrument to estimate a conditional beta with respect to the value portfolio. Furthermore, we show that the negative skewness of momentum is driven by a regime in which value and momentum investors disagree the most. The disagreement between value and momentum investors ignites a rebound in cheap loser stocks, causing the option-like payoff. These results should be of interest to investors and risk managers whose portfolios are exposed to value and momentum.

Section 1 of this paper investigates value and momentum dynamics over time. Section 2 builds a simple allocation approach into value and momentum portfolios. Section 3 predicts returns using the rank correlation. Section 4 concludes that the rank correlation can be used to allocate capital to value and momentum portfolios. The appendix studies the events around extreme negative correlation between the momentum and value signals.

1 For more on the value spread, see Cohen, Polk and Vuolteenaho (2003).

1. VALUE AND MOMENTUM DYNAMICS OVER TIME

The MSCI World Index is the universe of equities analyzed in this paper. The data sample runs from 1995 to 2019. Value and momentum signals are constructed using Compustat fundamentals and stock prices. At the end of each month, we sort companies within each industry group based on value metrics (book-to-market, earnings yield, dividend yield and EBITDA-to-enterprise-value) and momentum (the past -11-month return lagged by one month). We measure disagreement between value and momentum investors by computing a correlation of value and momentum signals (ranks).

VALUE AND MOMENTUM STRATEGIES EXPLAINED

MOM: Long/short momentum portfolio

MOM refers to a long/short strategy in which a portfolio is constructed by sorting companies using the past-11-month return lagged by one month. The portfolio buys the 11-month winner stocks and sells the 11-month loser stocks based on ranking stocks in three portfolios.

VAL: Long/short value portfolio

VAL refers to a long/short strategy in which a portfolio is constructed by sorting companies using their valuation metrics (book-to-market, earnings yield, dividend yield and EBITDA-to-enterprise-value). The portfolio buys attractive value stocks, and sells expensive growth stocks based on ranking stocks in three portfolios.

A number of researchers have studied momentum, starting with the seminal paper of Jegadeesh and Titman (1993). Asness (1997) discusses the negative interaction of value and momentum. Grundy and Martin (2001) argue that momentum has a time-varying market beta. Barroso and Santa-Clara (2015) and Daniel and Moskowitz (2016) find that momentum returns are negatively skewed and that momentum crashes; Daniel and Moskowitz (2016) show that a momentum crash results from an option-like payoff to past-loser stocks. In contrast to Grundy and Martin (2001), Daniel and Moskowitz (2016) find that hedging market beta exposure does not result in an improved momentum portfolio. Barroso and Santa-Clara (2015) show that the market

component explains only 23% of the total risk of momentum. They argue that using market beta to hedge does very little to manage momentum risk because most of the risk is specific to momentum and does not arise from market beta. These authors show that the momentum strategy can be improved by managing its total volatility.

Barroso and Santa-Clara (2015) point out that it would be easier to understand the positive momentum performance if momentum had a high exposure to risk. They study the risk exposure of momentum to the Fama and French (1993) risk factor portfolios. They regress momentum (MOM) returns on the market, size (small-minus-big) and value (VAL) portfolio returns, and show that all of these beta-risk estimates are negative, indicating that the momentum strategy has very low exposure to common risk factors.

We follow Barroso and Santa-Clara (2015) and study the risk of our version of the momentum strategy. We find very similar results, although our portfolio construction differs from their approach. Regression 1 in Exhibit 1 shows that momentum (MOM) has negative and statistically significant beta-risk exposure to market portfolio and value (VAL) (-0.14 and -0.68, respectively). The R-squared of this regression is 0.29. Because our universe is based on large caps and midcaps, we do not include a small cap long/short portfolio.

Exhibit 1: Regress momentum on market, VAL, and conditional VAL beta

$$r_{MOM,t} = \alpha + \beta_1 r_{MKTR,t} + \beta_2 r_{VAL,t} + \beta_3 \rho_{t-1} r_{VAL,t} + \varepsilon_t$$

Regression	Statistic	Intercept	β_1	β_2	β_3	*R*-squared
1	Coefficient	0.01	-0.14	-0.68		0.29
	T-statistic	4.15	-2.93	-5.90		
2	Coefficient	0.01	-0.12	0.34	3.58	0.44
	T-statistic	3.50	-2.49	1.56	5.30	

Source: PIMCO calculations based on Compustat and MSCI data

We use a new measure, the cross-sectional rank correlation between value and momentum signals, and show that it helps explain the return dynamics between value and momentum. To construct this measure, we first rank stocks at each point in time with respect to their value and momentum metrics. We then compute the correlation of these ranks at each point in time. This rank correlation varies over time based on how much value and momentum overlap, as illustrated in Equation 1 in the introduction, and it measures the degree of disagreement between value and momentum investors. This measure is related to the covariance between value and momentum returns.

Regression 2 in Exhibit 1 shows that when we use the rank correlation as an instrument to estimate a time-varying value exposure ($\rho_{t-1} r_{VAL,t}$), this interaction term subsumes the negative static beta of -0.68 on value. Now the value static beta of 0.34 is no longer statistically significant, and the momentum portfolio return is better explained by a conditional beta based on the rank correlation between momentum and value signals. The statistically significant slope of 3.58 shows that the magnitude of the exposure to value is enhanced by either a highly negative correlation between momentum and value signals or variation in the volatilities. The R-squared of this regression is 0.44.

Barroso and Santa-Clara (2015) note that market beta explains only a small fraction of the variation in momentum; they hypothesize that most of the momentum risk is specific to momentum. When we estimate a univariate regression on the conditional value beta, we get an R-squared of 0.40. In contrast, a static market beta regression has an R-squared of 0.05. This shows that most of the predictable variation in momentum is driven by a conditional beta on the value strategy.

Exhibit 2 sheds more light on this phenomenon by breaking the full-sample descriptive statistics of the value and momentum portfolio performance into five rank-correlation-of-signals regimes. In the most negative rank correlation regime, we observe a positive annualized value return of 6.17% and a negative annualized momentum return of -5.36%. At the other extreme, where the rank correlation is close to zero, both value and momentum returns are highly positive: 11.0% and 15.4%. The rank correlation between the value and momentum signals lines up well with the return correlation, although the realized return correlation has a wider spread than the rank correlations would indicate.

Exhibit 2: Value, momentum and rank correlation (1995–2019)

Sample	Rank corr	Average return (%)		Stdev (%)		Skewness		Return corr	Realized MOM loading on VAL
Regime	ρ_{t-1}	$ret_{VAL,t}$	$ret_{MOM,t}$	$\sigma_{VAL,t}$	$\sigma_{MOM,t}$	$SKEW_{VAL,t}$	$SKEW_{MOM,t}$	$\rho_{VAL,MOM}$	
1	-0.43	6.17	-5.36	10.62	14.46	0.32	-2.57	-0.81	-1.11
2	-0.34	-2.67	2.70	5.53	8.59	-0.12	-0.33	-0.69	-1.07
3	-0.26	5.96	0.01	7.68	8.72	1.67	-0.24	-0.68	-0.77
4	-0.16	6.67	3.18	6.13	8.50	1.34	-0.25	-0.29	-0.40
5	-0.02	11.00	15.40	6.20	10.16	-0.07	0.91	0.22	0.36
Full: 1 to 5	-0.24	5.41	3.15	7.52	10.45	0.69	-0.43	-0.50	-0.69
Partial: 2 to 5	-0.20	5.22	5.28	6.55	9.12	0.93	0.22	-0.30	-0.42

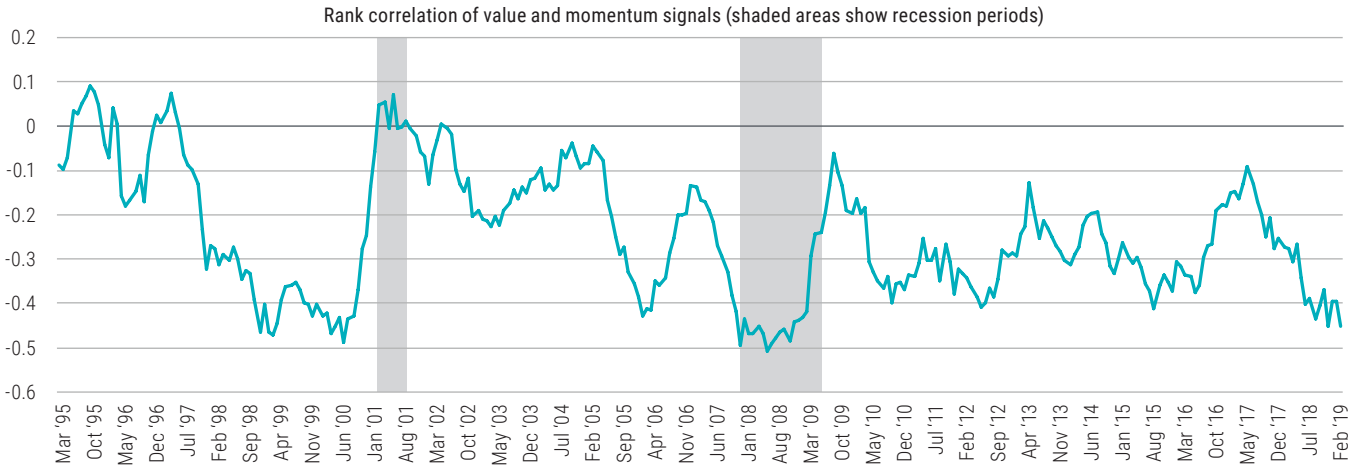
Source: PIMCO calculations based on Compustat and MSCI data

The negative return and skewness of the momentum portfolio, dubbed a "momentum crash," is described in Barroso and Santa-Clara (2015) and Daniel and Moskowitz (2016). Regime 1 captures this well: The momentum portfolio has an average annualized return of -5.36% and a negative skewness of -2.57. In all other regimes, the momentum returns are above zero and skewness, on average, is positive at 0.22. Skewness is negative but close to zero in Regimes 2, 3 and 4; only Regime 5 shows a positive skewness, 0.91.

The last column of Exhibit 2 shows that the momentum portfolio return loads negatively on value returns in all regimes but Regime 5. The wide spread in this loading between Regimes 1 and 5 is mostly explained by the wide range in the realized return correlation between value and momentum. This loading cannot be explained by the volatility between value and momentum. In Regime 1, momentum volatility is low relative to value volatility, whereas in Regime 5 momentum volatility is relatively higher than value volatility.

Exhibit 3 plots the rank correlation over time. It is evident that the rank correlation between value and momentum signals exhibits some pattern related to the business cycle. The rank correlation declined toward the end of the dot-com bubble in the 1990s, to as low as -0.49. The rank correlation was particularly low, about -0.5, just before and during the financial crisis of 2008–2009. In March 2019, the rank correlation between value and momentum was at a low of -0.45, indicating a disagreement between value and momentum investors.

Exhibit 3: Value and momentum rank correlation over time (1995–2019)



Source: PIMCO calculations based on Compustat, MSCI and NBER data

Exhibit 4 illustrates the rank correlation of momentum and value in June 2008 and September 2009. Exhibit 5 shows that during the 18-month period ended in June 2008, the momentum portfolio returned 22.09%, while the value portfolio did poorly, returning -15.45%. In June 2008, momentum and value signals were strongly negatively related, with a correlation of -0.51. At this point, the past-winner portfolio concentrated on growth stocks and the past-loser portfolio focused on value stocks.

Exhibit 4: Value and momentum ranks in June 2008 and September 2009

Source: PIMCO calculations based on Compustat and MSCI data from June 2008 and September 2009

Consequently, it was attractive for value investors to go against momentum, and investors started to underweight momentum. From July 2008 to September 2009, the value portfolio returned 22.81% and the momentum portfolio reversed, returning -33.28%. By September 2009, the rank correlation between momentum and value had increased to -0.06. Because value and momentum were practically independent, underweighting momentum was no longer justified. In the 18 months after September 2009, value returned -1.06% and momentum returned 2.16%.

Exhibit 5: Performance of value and momentum portfolios (2007–2011)

(USD value-weighted returns)

Portfolio	18 months ended June 2008	July 2008 to Sep 2009	18 months after Sep 2009
Value attractive	-10.31%	-5.09%	23.20%
Value unattractive	5.62%	-20.91%	24.66%
VAL	**-15.45%**	**22.81%**	**-1.06%**
Past winners	6.86%	-26.80%	24.00%
Past losers	-13.07%	1.59%	21.16%
MOM	**22.09%**	**-33.28%**	**2.16%**

Source: PIMCO calculations based on Compustat and MSCI data

In addition to the financial crisis, we analyzed four time periods around the months in which the rank correlation reached extremely low levels (June 2000, February 2006, June 2012 and October 2015). In each of these periods, the return pattern was similar: The momentum portfolio showed a large positive return during the 18 months preceding the event and a sharp reversal after the event. The appendix illustrates this in detail.

2. COMBINING THE VALUE AND MOMENTUM SIGNALS

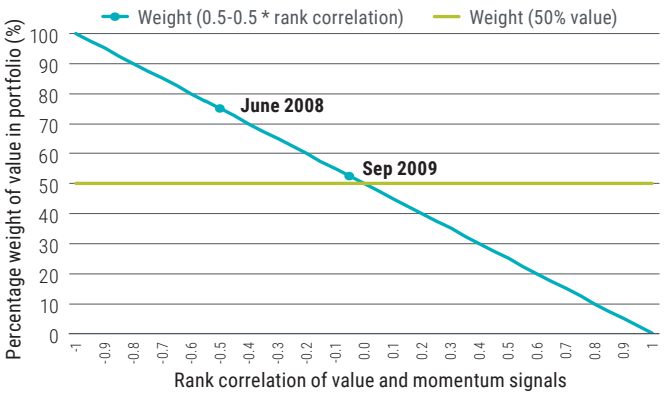
In the previous section, we showed that the rank correlation drives the way MOM loads on VAL. With this information, we can allocate capital to value and momentum strategies, using a simple linear relation on the rank correlation. At each point in time, we weight value and momentum signals using the rank correlation, as in Equation 2:

$$W(V) = 0.5 * (1 - \rho_{t-1})$$
$$W(M) = 0.5 * (1 + \rho_{t-1}). \quad (2)$$

The above logic states that when the value and momentum signals are in full disagreement, $\rho_{t-1} = -1$, we allocate 100% to value. When the rank correlation is zero, we allocate 50-50 to value and momentum signals. This weighting scheme is

illustrated in Exhibit 6. We have chosen this weighting scheme for its simplicity to illustrate the benefit of using the rank correlation in combining value and momentum. Our finding is not specific to this weighting scheme, and it can be used in a more general way. For example, adding a little bit of momentum to value using the rank correlation improves the value strategy.

Exhibit 6: Weighting scheme based on cross-sectional rank correlation



Source: PIMCO calculations based on Compustat and MSCI data

In Exhibit 7, we combine momentum and value signals into a composite signal, then construct an integrated portfolio.[2] The first two columns show the performance of stand-alone value and momentum portfolios. The third column shows value-weighted and equally weighted portfolio return performance for a 50-50 weighting of value and momentum signals. These portfolios have returned 5.80% and 7.26% over time, with Sharpe ratios of 0.91 and 0.89, respectively. The fourth column in Exhibit 7 shows the portfolio performance for our rank correlation allocation between value and momentum signals. Here the value portfolio weight based on the rank correlation is $0.5 * (1 - \rho_{t-1})$. This strategy has a 50-50 weighting to the value rank and the momentum rank when the rank correlation is zero. When the rank correlation between value and momentum declines, we allocate more to value and reduce the weight to momentum. This strategy has higher returns than the naive strategy: 6.91% for the value-weighted and 8.30% for the equally weighted rank correlation strategies, with much improved Sharpe ratios of 1.01 and 1.15, respectively.[3] For both equal and value weights, our weighting scheme results in a strategy that has a better Sharpe ratio than stand-alone value and momentum or a 50-50 weighting between value and momentum. The reason is that our approach avoids momentum when value and momentum investors disagree, and thus avoids the momentum crash.

Exhibit 7: Performance of VAL and MOM portfolios (USD returns)

Portfolios are combined using value and momentum signals in two ways. The portfolio is constructed as a composite by combining the value and momentum ranks, and creating an integrated value-momentum portfolio.

Annualized statistics	100% VAL	100% MOM	50% VAL + 50% MOM	Rank correlation weights
Value-weighted portfolio				
Average return (%)	5.45	3.21	5.80	6.91
Standard deviation (%)	7.53	10.47	6.39	6.87
Sharpe ratio (%)	0.72	0.31	0.91	1.01
Equally weighted portfolio				
Average return (%)	6.69	3.04	7.26	8.30
Standard deviation (%)	7.29	12.13	8.13	7.21
Sharpe ratio (%)	0.92	0.25	0.89	1.15

Source: PIMCO calculations based on Compustat and MSCI data from May 1995 to April 2019

2 We use an integrated approach to combine value and momentum because it utilizes capital in a more efficient way than summing up portfolios. However, when we apply the rank correlation approach to value and momentum portfolio weights, the Sharpe ratios improve in a similar fashion. These results are not shown in this paper.

3 We are interested in how to allocate capital in the global investment universe. We have also run the analysis on subuniverses, and the results they are largely similar. These results are not shown in this paper.

3. RETURN PREDICTABILITY USING THE RANK CORRELATION

In Exhibit 8, we forecast returns with the rank correlation. We find that the rank correlation helps to project a three-month excess return in the momentum portfolio, with a statistically significant positive slope. The rank correlation is weaker at predicting the value portfolio return because the expected return of the value portfolio depends more on the valuation metric and less on the past performance of the momentum portfolio. The rank correlation predicts momentum strongly because the expected return on momentum depends on how much it negatively coincides with value; the expected return on value depends less on how much it coincides with momentum. When the momentum portfolio has had a very high return, it starts to negatively overlap with value, reducing momentum's expected return. At this point, the momentum portfolio has been very profitable and the value portfolio may have been losing. Going forward, however, the expected return is low for the momentum portfolio and high for the value portfolio.

Exhibit 8: Time-series return regressions on value and momentum correlation (1995-2019)*

Regression	Int	ρ_{t-1}	BM spread	R-squared
$ret_{VAL,t}$	0.02	0.03		0.01
	(3.37)	(1.02)		
$ret_{VAL,t}$	0.01	0.03	0.05	0.01
	(0.55)	(1.07)	(0.79)	
$ret_{MOM,t}$	0.04	0.11		0.09
	(4.47)	(3.41)		
$ret_{MOM,t}$	0.04	0.11	0.01	0.09
	(3.53)	(3.37)	(0.11)	

Source: PIMCO calculations based on Compustat and MSCI data from May 1995 to April 2019

* The table shows a regression of three-month excess returns on the rank correlation between the value and momentum signals and the value spread based on the book-to-market ratio. Portfolios are built based on value and momentum signals. The long/short value portfolio (VAL) is constructed by purchasing the cheapest tercile and selling the most expensive tercile. The long/short momentum portfolio (MOM) is created by purchasing the past-winners tercile and selling the past-losers tercile.

One might think the results could be explained by the valuation of the momentum strategy. For this reason, we control for a value spread, using book-to-market in the regression. Exhibit 8 shows that the rank correlation predicts the momentum portfolio return even after controlling for the value spread.[4] The valuation of the momentum strategy can be important, but the degree of overlap of the momentum and value signals is the trigger that causes the momentum strategy to reverse.

4. CONCLUSION

Value investors invest based on valuation, but momentum investors invest based on inertia. When momentum investors push prices of momentum stocks too far from fundamentals, past-winner stocks become overvalued and past-loser stocks are undervalued. This attracts money from value investors and causes a value-driven reversal in momentum. Our novel use of the rank correlation between the value and momentum signals provides a simple metric to measure the degree of disagreement between value and momentum investors. The data show that the rank correlation predicts momentum returns and works as an instrument for conditional beta on value. This simple metric may help in the decision to allocate capital to value and momentum portfolios.

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4 Barroso and Santa-Clara (2015) use momentum return volatility to manage momentum strategy risk. We also controlled for the past six- and 12-month momentum return volatility and found that the rank correlation predicts the momentum returns better than the volatility. These results are not shown.

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APPENDIX

Exhibit 9: Performance of value and momentum portfolios around periods of extreme negative correlations and reversals

Panel A: June 2000–March 2001

Portfolio	18 months ended July 2000	Aug 2000 to Mar 2001	18 months after Mar 2001
Value (cheap)	25.82%	0.11%	-19.67%
Growth (expensive)	15.16%	-27.37%	-31.14%
VAL	7.10%	35.70%	16.33%
Past winners	17.56%	-25.10%	-20.97%
Past losers	11.17%	-14.33%	-37.64%
MOM	4.38%	-12.89%	22.89%

Panel B: February 2006–January 2007

Portfolio	18 months ended Feb 2006	Mar 2006 to Jan 2007	18 months after Jan 2007
Value (cheap)	35.76%	21.51%	-12.37%
Growth (expensive)	28.69%	11.06%	1.12%
VAL	5.44%	9.29%	-13.80%
Past winners	40.91%	16.43%	2.54%
Past losers	28.27%	17.70%	-14.94%
MOM	10.18%	-1.01%	19.74%

Panel C: June 2008–September 2009

Portfolio	18 months ended June 2008	July 2008 to Sep 2009	18 months after Sep 2009
Value (cheap)	-10.31%	-5.09%	23.20%
Growth (expensive)	5.62%	-20.91%	24.66%
VAL	-15.45%	22.81%	-1.06%
Past winners	6.86%	-26.80%	24.00%
Past losers	-13.07%	1.59%	21.16%
MOM	22.09%	-33.28%	2.16%

Panel D: June 2012–May 2013

Portfolio	18 months ended June 2012	July 2012 to May 2013	18 months after May 2013
Value (cheap)	-3.28%	25.29%	22.30%
Growth (expensive)	-0.43%	16.59%	20.62%
VAL	-2.48%	7.50%	1.27%
Past winners	2.80%	18.04%	24.53%
Past losers	-5.99%	27.07%	19.34%
MOM	7.12%	-7.46%	4.53%

Panel E: September 2015–May 2017

Portfolio	18 months ended Sep 2015	Oct 2015 to June 2017	18 months after June 2017
Value (cheap)	-4.26%	32.82%	-1.09%
Growth (expensive)	-0.34%	22.75%	2.45%
VAL	-3.88%	8.21%	-3.86%
Past winners	-0.39%	21.77%	7.20%
Past losers	-5.68%	26.56%	-3.93%
MOM	5.08%	-4.44%	11.29%

Source: PIMCO calculations using Compustat and MSCI data from May 1995 to April 2019

The analysis contained in this paper is based on hypothetical modeling. No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to those shown. Hypothetical or simulated performance results have several inherent limitations. Unlike an actual performance record, simulated results do not represent actual performance and are generally prepared with the benefit of hindsight. There are frequently sharp differences between simulated performance results and the actual results subsequently achieved by any particular account, product, or strategy. In addition, since trades have not actually been executed, simulated results cannot account for the impact of certain market risks such as lack of liquidity. There are numerous other factors related to the markets in general or the implementation of any specific investment strategy, which cannot be fully accounted for in the preparation of simulated results and all of which can adversely affect actual results.

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