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The Hidden Value of Streaky Returns in Stock Portfolios

Executive Summary

Return streams that can perform well or poorly for an extended period of time — so called streaky returns – are more difficult to stick with and comprehend. These additional complexities associated with streaky returns suggest they should be avoided, all else equal. But all else is not equal. The marketplace tends to compensate this additional complexity risk with a higher-than-normal risk-adjusted return, suggesting streaky returns should be embraced by investors.

This insight is confirmed using the most comprehensive long-short stock selection factor database from Jensen, Kelly, and Pedersen (2023): a portfolio of factors exhibiting “high streakiness” realize a long-run Sharpe ratio that is approximately double that of "low streakiness" factors.

PSG
Portfolio Solutions Group

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About the Portfolio Solutions Group

The Portfolio Solutions Group (PSG) provides thought leadership to the broader investment community and custom analyses to help AQR clients achieve better portfolio outcomes.

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Introduction

Streaky return factors, which are return streams that can perform well or poorly for extended periods, are challenging for investors to comprehend and stick with. Their short-term persistence often leads investors to fall prey to behavioral biases. When a factor underperforms for an extended period, it's easy to doubt its validity due to loss aversion, often leading to premature exits. Conversely, recency bias can make investors overly confident in the factor after a strong streak, potentially leading to ill-timed entries. In short, the streakiness of the factor makes it harder to know when to stay invested or cut losses. This uncertainty can make it emotionally challenging to hold the position, especially if peer or market pressure builds up to abandon the strategy.

In theory, capturing the true behavior of streaky factors requires a longer horizon. However, in practice, investors often lack sufficient data to make informed decisions based on longer horizons. This presents greater complexity when considering streaky returns from a risk management perspective, as short horizons (for example, monthly returns) understate their true long-term risk.

These complexities, both in terms of return predictability and risk, might suggest avoiding streaky returns. However, our findings indicate that return streams exhibiting these complexities realize above-average risk-adjusted returns. In other words, the marketplace compensates investors willing to bear the complexity risk associated with streaky returns. Using the long-short stock selection factor database from Jensen, Kelly, and Pedersen (JKP), we document that a portfolio of factors exhibiting "high streakiness" realizes a long-run Sharpe ratio that is approximately double that of a portfolio of "low streakiness" factors.[1]

Our research suggests streaky returns should be embraced by investors. However, in practice, earning this premium will be difficult as it requires strong conviction, a long-term mindset, and patience — qualities needed to hold a return stream that is harder to comprehend and at times, harder to stick with.

[1] The JKP factors, developed by Jensen, Kelly, and Pedersen, make up a comprehensive set of 153 characteristics or factors clustered into 13 themes, as detailed in their 2023 paper "Is There a Replication Crisis in Finance?" These factors are constructed from data across 93 countries and are designed to analyze and capture various financial characteristics and their impacts. The JKP factors are used to study the performance of different financial metrics and their influence on market behavior, providing valuable insights for financial analysis and investment strategies.

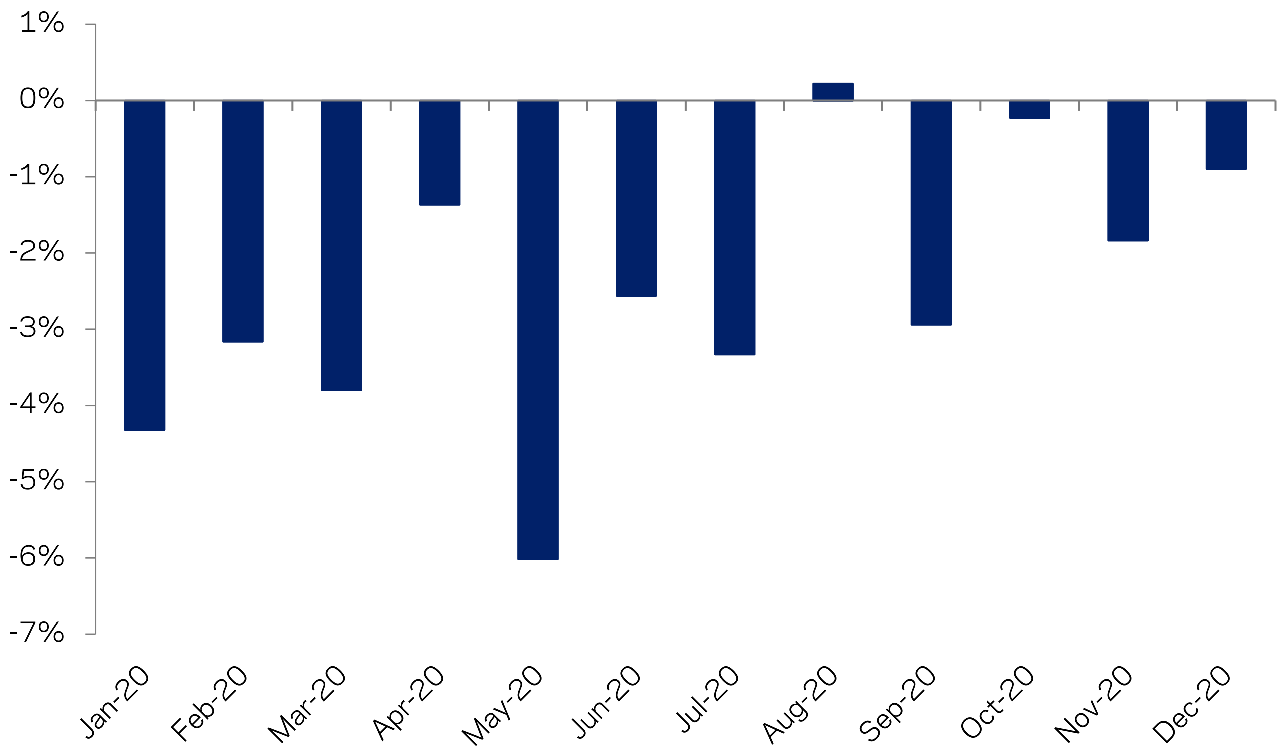
What Does Streakiness Look Like in Practice?

Let's start with a concrete example demonstrating the properties of a streaky return stream. A streaky return is one that experiences long-lived shocks, where positive or negative shocks tend to persist, leading to extended periods of outperformance or underperformance. This property is exhibited by the free cash flow-to-price (FCF-to-price) long-short factor, one of the 153 stock selection factors from the JKP database.[2]

During 2020, the factor consistently underperformed (**Exhibit 1**). Is this because FCF-to-price is a bad signal, or is this because FCF-to-price experienced a negative shock which persisted? The answer is unclear during this time period, which demonstrates why streaky returns are more difficult to stick with and comprehend.

Exhibit 1: Free Cash Flow to Price Factor Suffered Poor Returns in 2020

Monthly returns of the FCF-to-price long-short factor, January 1, 2020 – December 31, 2020



Sources: AQR, Jensen, Kelly, and Pederson (2023). Past performance is not a guarantee of future performance. Performance shown is gross of fees. Hypothetical data has certain inherent limitations, some of which are disclosed in the appendix.

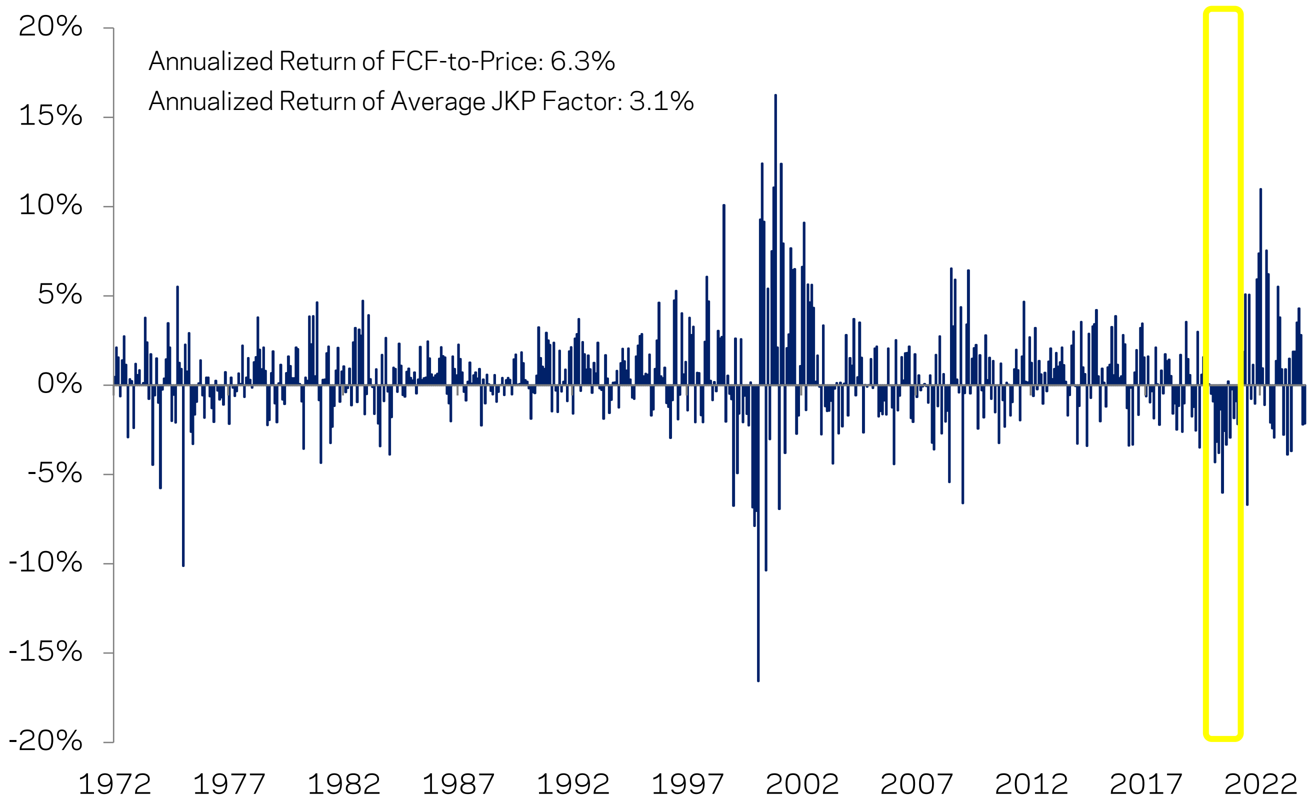
[2] Free cash flow-to-price is the accounting ratio used to determine long and short positions on individual stocks within the long-short factor portfolio. By buying "cheap" high FCF-to-price stocks and shorting "expensive" low FCF-to-price stocks, the factor captures the spread between value and growth stocks (Lakonishok et al. 1994).

However, over a longer timeframe, we can see that the FCF-to-price long-short factor realized an above average return — roughly double the average return of the typical long-short factor[3] (**Exhibit 2**).

With 20/20 hindsight, the underperformance during 2020 was due to a negative shock persisting, and sticking with the complex, streaky FCF-to-price would have been compensated over the long run.

Exhibit 2: FCF-to-Price Realized Above Average Expected Returns[4]

Monthly returns of the FCF-to-price long-short factor, January 1, 1973 – December 31, 2023



Sources: AQR, Jensen, Kelly, and Pederson (2023). The yellow box encloses the period between January 1, 2020 - December 31, 2020, during which FCF-to-price experienced underperformance, or a "bad streak." Past performance is not a guarantee of future performance. Performance shown is gross of fees. Hypothetical data has certain inherent limitations, some of which are disclosed in the appendix.

[3] The typical long-short factor refers to factors in the JKP database of 153 stock selection factors dating back to 1973.

[4] FCF-to-price realized an annualized average return of 6.3%, compared to 3.1% across all JKP factors. The 3.1% average return across JKP factors is scaled to the volatility of the FCF-to-price factor for the purposes of comparison.

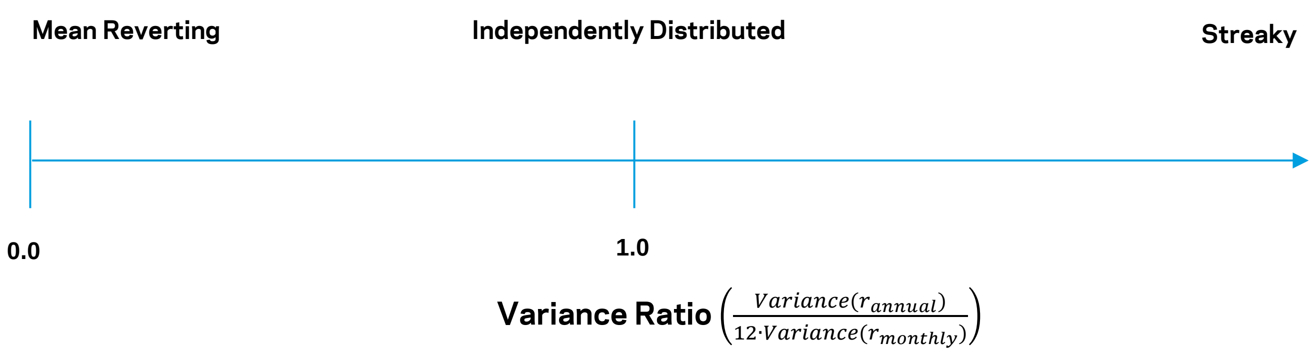
Measuring Streakiness with the Variance Ratio

It is common practice amongst investors to use short horizon returns to measure long horizon risk by scaling the variance of the short horizon returns (e.g., variance of monthly returns ×12). This practice, however, implicitly assumes that short horizon returns are independently distributed over time, meaning that a current shock has no impact on future returns. For return streams that experience long-lived shocks, i.e. "streaky" returns, short horizon risk underestimates true long horizon risk. This is a fundamental property of persistent or streaky return streams. A better measure for these returns would be long horizon risk derived from longer-horizon returns (e.g., the variance of annual returns).

Return streams can be independent over time, persistent, or mean-reverting. For independently distributed returns, risk estimated using long horizon returns and short horizon returns will be identical. In other words, the variance ratio — defined as the variance of annual returns divided by the variance of monthly returns × 12 — will be equal to one (Lo and MacKinlay, 1988).

However, if returns are persistent or "streaky", long horizon risk will exceed the short horizon risk, resulting in a variance ratio greater than one. Conversely, for mean-reverting return streams, the variance ratio falls below one because the short-run measures do not capture the risk-reducing effect of reversals — where bad short-term performance is offset by higher expected future returns. For these reasons, the variance ratio will serve as our objective measure of streakiness.

Exhibit 3: The Significance of a Variance Ratio[5]



Sources: AQR, Lo and MacKinlay (1988). For illustrative purposes only.

[5] The variance ratio could more generally be represented as $\frac{Variance(r_k)}{k \cdot Variance(r_1)}$ where k represents the length of the period the variance ratio is calculated for. This analysis focuses on k = 12, meaning the variance ratio compares the variance of 12-month, or annual returns, to the variance of monthly returns scaled by 12, or annualized monthly returns.

Which Investment Themes Exhibit Properties of Streakiness?

Now that we have our objective measure of streakiness, the variance ratio, it's natural to ask which investment themes tend to exhibit high levels of "streakiness." To answer this question, we studied the most comprehensive long-short stock selection factor database from JKP.

This database contains 153 long-short factors dating back to 1973 and spanning 13 broad investment themes: accruals, debt issuance, investment, low leverage, low risk, momentum, profit growth, profitability, quality, seasonality, short-term reversal, size, and value.

Exhibit 4: Debt Issuance, Accruals, and Profitability Among Themes Exhibiting Streakiness

Variance Ratio Distribution Across Themes, January 1, 1973 – December 31, 2023

	Variance Ratio			Sharpe Ratio	
More Streaky ↑	0.2 Quantile	Median	0.8 Quantile	Median (Annual)	Median (Ann. Monthly)
Debt Issuance	1.1	1.8	2.0	0.6	0.7
Accruals	1.3	1.6	1.7	0.4	0.6
Profitability	1.3	1.5	1.7	0.3	0.3
Low Leverage	1.2	1.4	1.7	0.0	0.0
Investment	1.1	1.4	1.6	0.4	0.4
Profit Growth	1.0	1.4	1.6	0.3	0.4
Value	1.2	1.4	1.5	0.3	0.4
Size	1.2	1.2	1.3	0.0	0.0
Quality	1.0	1.2	1.4	0.4	0.4
Seasonality	1.0	1.1	1.5	0.2	0.2
Low Risk	1.0	1.0	1.0	0.1	0.1
Momentum	0.8	1.0	1.2	0.3	0.3
Short-Term Reversal	0.8	0.9	1.4	0.1	0.1

Sources: AQR, Jensen, Kelly, and Pedersen (2023). Annual Sharpe ratios were calculated using annual or 12-month returns and annualized monthly Sharpe ratios were calculated using monthly returns scaled by 12. Each theme analyzed is an equal-weighted portfolio of its relevant factors. Note that factors are dollar neutral but may contain positive or negative equity beta. Past performance is not a guarantee of future performance. Performance shown is gross of fees. Hypothetical data has certain inherent limitations, some of which are disclosed in the appendix.

When examining the 13 investment themes, we find that debt issuance, accruals, and profitability have the highest median variance ratios, indicating the highest degree of streakiness (**Exhibit 4**).

Interestingly, the majority of investment themes display some level of streakiness. Only low risk, momentum, and short-term reversal have median variance ratios of 1.0 or less.

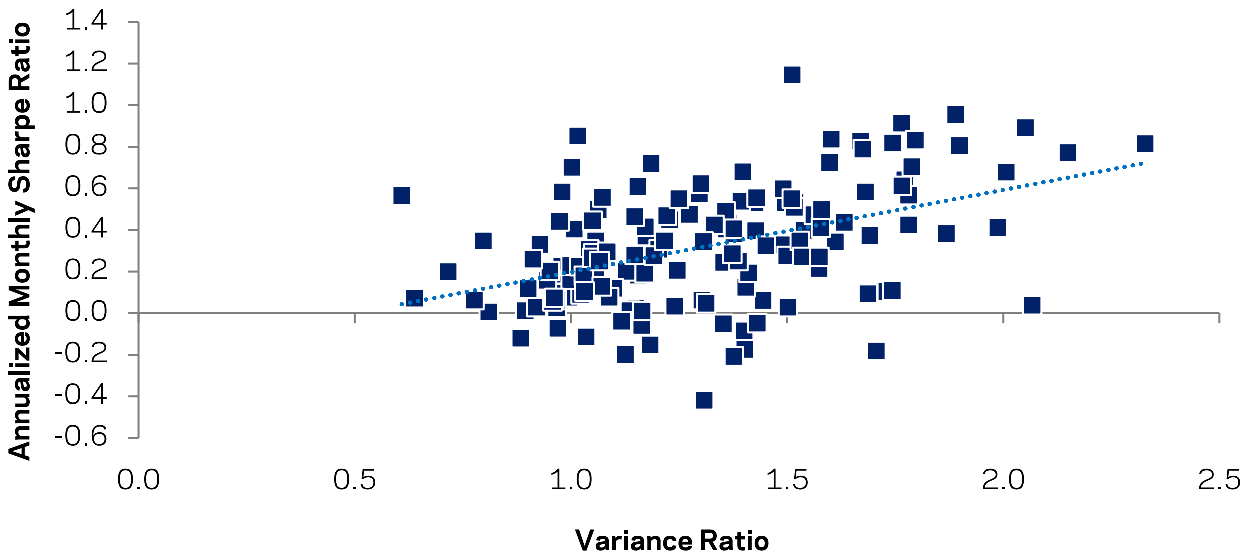
Do Streaky Returns Earn Higher Sharpe Ratios?

Streaky returns are harder to stick with and comprehend, but these additional complexities could be compensated in the marketplace. We investigate this hypothesis by running a cross-sectional regression of the 153 factors' annualized monthly Sharpe ratios on its variance ratios, our measure of "streakiness." When looking across the 153 long-short factors, do we find that higher variance ratio factors realize higher monthly annualized Sharpe ratios? Yes. There is a clear economically and statistically significant positive relationship between risk-adjusted return and the variance ratio (**Exhibit 5**)

Exhibit 5: Higher Variance Ratio Factors Realized Higher Risk-Adjusted Returns

January 1, 1973 – December 31, 2023

A: Plotting Variance Ratios and Annualized Monthly Sharpe Ratios of JKP Factors



B: In-Sample Regression Results for Annualized Monthly Sharpe Ratios

			Variance Ratio	
	Intercept	t-statistic	Beta	t-statistic
Annualized Monthly SR	**-0.20**	-2.38	**0.40**	6.39

Sources: Jensen, Kelly, and Pedersen (2023). Annualized monthly Sharpe ratios were calculated using monthly returns scaled by 12. For illustrative purposes only.

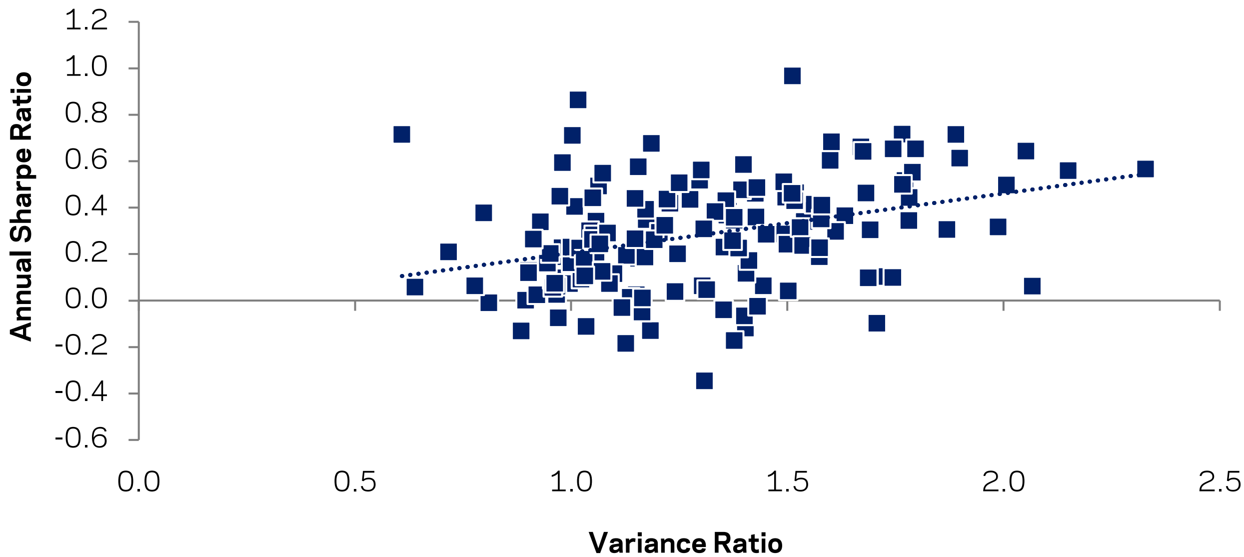
While annualized monthly Sharpe ratios are the most common risk-adjusted return metrics used by investors, they are less appropriate when studying the impact of persistence on the risk/return relationship. Why? Short-run measures of risk, such as annualized monthly volatility (or variance), understate the true long-term risk of a streaky return stream. In theory, the streaky return could have an elevated annualized monthly (i.e. short-term) Sharpe ratio while simultaneously having a normal annual (i.e. long-term) Sharpe ratio — because the denominator of the annual (i.e. long-term) Sharpe ratio will appropriately reflect the additional riskiness of a persistent factor return.

To test whether streaky returns are compensated with higher Sharpe ratios after properly accounting for their higher long-term risk, we rerun the cross-sectional regressions from before but use annual (i.e. long-term) Sharpe ratios, instead of annualized monthly (i.e. short-term) Sharpe ratios, as our dependent variable. While the annual Sharpe ratio results are somewhat attenuated, we still find an economically and statistically significant positive relationship between long-term risk-adjusted returns and the variance ratio (**Exhibit 6**).[6]

Exhibit 6: Higher Variance Ratio Factors Realized Higher "Annual" Risk-Adjusted Returns

January 1, 1973 – December 31, 2023

A: Plotting Variance Ratios and Annual Sharpe Ratios of JKP Factors



B: In-Sample Regression Results for Annual Sharpe Ratios

			Variance Ratio	
	Intercept	t-statistic	Beta	t-statistic
Annual SR	-0.05	-0.68	**0.26**	4.68

Sources: Jensen, Kelly, and Pedersen (2023). Annual Sharpe ratios were calculated using annual or 12-month returns. Past performance is not a guarantee of future performance. Performance shown is gross of fees. Hypothetical data has certain inherent limitations, some of which are disclosed in the appendix.

[6] The results are robust for variance ratios with longer time horizon. We also find a similar relationship when isolating factors within each investment theme. Additionally, we tested splitting the sample period into non-overlapping sub-periods to ensure that results did not weaken over time and while we observe a modest reduction in significance, the results remain strong.

Do the Results Hold Up Out of Sample? Yes.

In the previous section, we documented the positive in-sample relationship between long-term risk-adjusted returns and degree of streakiness (as proxied by the variance ratio). In this section, we investigate whether the relationship holds out-of-sample.

Instead of running one full-sample cross-sectional regression, we form top, middle, and bottom variance ratio (VR) portfolios by looking backwards annually and sorting factors by variance ratio into top, middle, and bottom terciles using an expanding window.

Consistent with the in-sample results, we find that the out-of-sample top tercile variance ratio portfolio (i.e., high streakiness) realizes a significantly higher short- and long-term Sharpe ratio when compared to the bottom tercile variance ratio portfolio. The portfolio holding the "highest streakiness" factors realizes a long-run Sharpe ratio that is approximately double that of the "low streakiness" factor portfolio (**Exhibit 7**).

Both the in-sample and out-of-sample evidence support the hypothesis that the marketplace compensates investors willing to bear the complexity risk associated with streaky returns.

Exhibit 7: Portfolio Holding the Highest Variance Ratio (VR) Factors Outperforms[7]

Variance Ratio-Sorted Portfolio Results, January 1, 2004 – December 31, 2023[8]

	Bottom VR	Middle VR	Top VR[9]
Average Variance Ratio	0.93	1.20	1.63
Annual Sharpe Ratio	0.29	0.45	0.56
Annualized Monthly Sharpe Ratio	0.23	0.68	0.85

Sources: Jensen, Kelly, and Pedersen (2023). Bottom, middle, and top VR refer to hypothetical portfolios of factors realizing bottom, middle, and top tercile variance ratios (VRs). All portfolios are rebalanced at the end of each year, when variance ratios can be updated with new returns data added to the expanding sample. Past performance is not a guarantee of future performance. Performance shown is gross of fees. Hypothetical data has certain inherent limitations, some of which are disclosed in the appendix.

[7] The annualized monthly volatility and worst drawdown for the bottom VR portfolio were 5.2% and -16.8%, respectively. For the top VR portfolio, they were 1.8% and -6.4%, respectively.

[8] Sample selected began in 2004 so that at least 30 years of variance ratio data informed each portfolio's construction.

[9] Differences between the annual and annualized monthly Sharpe ratios of the top and bottom VR portfolios were statistically significant at t-statistics of 2.67 and 2.78. A long-short VR factor (i.e. long the top VR portfolio and short the bottom VR portfolio) has statistically significant and economically meaningful alpha versus Fama-French factors plus momentum (from the Ken French Data Library).

Conclusion

Return streams that recover less quickly from shocks, i.e. streaky returns, are harder to stick with and comprehend. Streaky returns may go through longer periods of underperformance after experiencing a negative shock that persists, which make them more challenging to maintain exposure to. Furthermore, streaky returns have higher long-run risk (i.e., unconditional volatility) and therefore, generate fewer “effective” observations over time, complicating statistical analysis and intuitive understanding.

Yet, this very "complexity risk” may earn investors an additional risk premium, leading to above average risk-adjusted returns. In our analysis, we find that streakier long-short factors realize higher Sharpe ratios, whether we use short horizon (monthly) returns or long horizon (twelve-month) returns to measure volatility. In other words, markets appear to compensate investors for bearing the uncertainty and discomfort of investing in streaky factors.

The optimal response for investors is not to shun streaky strategies but to embrace them, provided they do so thoughtfully. That means conducting rigorous research to verify that the strategy offers genuine long-term compensation despite its drawdowns, adopting a truly long-term horizon, and mitigating the emotional strain through diversification.

Ultimately, success with streaky return streams hinges on a deeper level of understanding and a willingness to look beyond short-term underperformance, recognizing the potential for higher rewards in the long run.

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