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Momentum in Japan: *The Exception That Proves the Rule*

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Since their power for choosing U.S. stocks was documented in the early to mid-1990s (Jegadeesh and Titman [1993] and Asness [1994]), the success of momentum strategies has become one of the strongest empirical regularities in finance. Momentum has joined size (Banz [1981]) and value (Rosenberg, Reid, and Lanstein [1985], Fama and French [1992, 1993, 1996], and Lakonishok, Shleifer, and Vishny [1994]) as one of the "big three" anomalies, or risk factors, of modern investing.

Any empirically successful trading strategy, meaning one that has produced significant positive returns in the past, may be the result of one of three explanations: 1) exposure to a priced risk, 2) some market inefficiency, or 3) simple data mining. While journals are full of debate over the first two possibilities, it is the third we are concerned with here, in particular as it might apply to momentum. We can never fully eliminate the chance that any empirical result is caused by random chance uncovered by data-mining researchers. But this worry can be progressively minimized with successful out-of-sample tests.

Momentum and value have handily survived such tests. In the ensuing near two decades since they first came to the forefront of finance, both value and momentum strategies have shown consistent out-of-sample success when examined across geography, asset class, security type, and time (an eclectic subset of work includes Asness, Liew, and Stevens [1997], Fama and French [1998], Asness, Moskowitz, and Pedersen [2010], De Groot, Pang, and Swinkels [2010], Blitz and Van Vliet [2008], and Okunev and White [2001]).

There is, however, one very notable exception. Quite a few authors have pointed out that momentum is an empirical failure for stock selection in Japan (Asness, Moskowitz, and Pedersen [2010], Fama and French [2010], Griffin, Ji, and Martin [2003], and Rouwenhorst [1998]). In both academic and practitioner circles this result causes quite a bit of angst as many worry about how large a blow this is to our overall confidence in momentum strategies.

This article examines the failure of momentum in Japan and asks the very basic question: Do we care? That is, how damaging are the Japanese findings to a belief that momentum strategies have a healthy ex ante positive expected return outside and inside Japan? Does this documented exception prove the rule or expose it as flawed?

Our central finding is that the results in Japan are no blow to believers in momentum, not even a glancing one. In fact, we argue they are ultimately supportive. First, we document and confirm the basic finding—value and momentum work everywhere, except for momentum in Japan. Next, we show that given the success of both value and momentum strategies around the world (we limit ourselves to value- and momentum-based stock selection in four major developed regions), the ex ante chance that one strategy in one region has delivered poor results, akin to those for momentum in Japan, is quite high. In other words, the true p-value of the Japanese finding is unimpressive.[1]

Furthermore, because value and momentum are negatively correlated, we argue that it is difficult and unproductive to study one without including the other. These two factors are best studied as a system. In this context, we find that an ex post Sharpe ratio optimizer that can invest in value and momentum would still invest heavily in the Japanese momentum strategy, despite its seemingly poor performance. Next, we explore further the intuition behind the importance of the negative correlation between value and momentum. Finally, using a three-factor model, we find that momentum in Japan is actually a success. The three-factor model intercepts are significantly positive, and comparable to other countries—meaning net of value, size, and market exposure—momentum strategies in Japan have added considerable return over this period.

In sum, we find the univariate failure of momentum, which has occurred only in Japan, to be no blow to our belief in the power of momentum strategies. The global (and indeed within Japan) results for momentum, particularly when considered as a system with the well-known value effect, are powerful and almost unscathed by the oft-noted weak results in Japan.

DATA DESCRIPTION

Factor construction and data sources follow those of Asness, Moskowitz, and Pedersen [2010]. International equity returns are from DataStream and are aggregated across four regions: the U.S., the U.K., Europe (excluding the U.K.), and Japan. We choose these four regions to be economically meaningful (as opposed to, say, having each non-U.K. European country enter separately). The data cover the 29½-year period from July 1981 to December 2010, the longest period over which we have both value and momentum for all four regions. More detail on the source of these returns and their construction are provided by Asness, Moskowitz, and Pedersen [2010].

We obtain the value and momentum portfolios in each of these markets in the same manner as Asness, Moskowitz, and Pedersen [2010]. Each month we divide each market's stocks into three equal groups based on their value or momentum rankings. Momentum is defined as the past 12-month return on each security, skipping the most recent month's return, which means to form a portfolio in January 2011 we use January–November 2010 returns, skipping December. Value is defined as book-to-market equity where book is updated with a 6-month lag to ensure the data are available for construction, and market is the current price at the month's start.[2,3] Security returns are then value weighted within each group. The spread in returns between the portfolios representing the top and bottom third of securities captures the value and momentum premia within each market and asset class.

We restrict our universe to the top 90% of market capitalization in each of the four markets. This is a fairly conservative large-capitalization restriction. For example, in the U.S. for December 2010, we have 707 firms in our sample—midway between the large-cap Russell 1000 and the very large-cap S&P 500. We use value weighting and a large-cap universe to ensure that implementation drags on our gross-of-trading-cost results are small. In fact, our size restrictions would allow the reasonable use of equal-weighted portfolios held long and short. We view the equal-weighted results as a robustness check, and they confirm (at higher individual Sharpe ratios for each strategy) all the results presented in this article. Exhibit 1 reports the number of stocks, and various other statistics (all in USD), for the four regions in our sample at the end of our sample period.

We are left with eight key series that form the core of this article: the returns to a large-capitalization liquid dollar-balanced long–short value strategy (or factor) within each of the four regions, and the returns to a similarly constructed momentum strategy (or factor) within each of the four regions, all monthly from July 1981 through December 2010. Note that these are all

EXHIBIT 1
Statistics for Sample (Year-end 2010)

	Number Stocks	Average Size (mm)	Value-Weighted Size (mm)	Minimum Size (mm)
U.S.	707	15,900	76,162	2,407
U.K.	115	19,517	87,028	2,382
Europe	395	13,940	51,839	1,891
Japan	554	5,098	24,837	636

zero investment portfolios, so both return and excess return over cash are the same.

THE BASIC EVIDENCE

We start with the value strategy. Exhibit 2 details the results to the value long–short strategy in each of the four regions, and in the "All" region that puts equal dollars (rebalanced monthly) in each of the four. We report the average annualized returns, annualized standard deviations, Sharpe ratios achieved, and the *t*-statistics (against a mean of zero) associated with those Sharpe ratios.

Basically, a value strategy has worked around the world. It is not statistically significant on its own in the U.S. and is borderline in Europe,[4] however, the All region turns in a very strong 0.57 Sharpe ratio and 3.12 *t*-statistic. Note that the Japan region turns in the strongest value results, even stronger than the more-diversified All region (the importance of this strong result for value in Japan will be apparent later in the article). Now, we will examine the momentum strategy.

All the momentum strategies are positive, but momentum in Japan is far and away the weak sibling. It achieves a Sharpe ratio of effectively zero for 29½ years.[5] The All region survives its exposure to weak Japan with a Sharpe ratio of 0.38 and a *t*-statistic of 2.06 (note this analysis includes, and the results survive, some very poor results for momentum in the spring of 2009).

Essentially, this flat result in Japan is what many have noted as the failure of the momentum strategy in Japan and what has caused much hand-wringing in quantitative finance circles.[6] Interestingly, value and momentum in the U.S., over the large-cap value-weighted portfolios we study, are better but also unimpressive when viewed alone. They have not performed as badly as momentum in Japan, however, and have not attracted nearly the same attention.[7]

EXHIBIT 2
Value Strategy Results
July 1981–December 2010

	U.S.	U.K.	Europe	Japan	All
Average Return	1.8%	5.1%	3.9%	10.5%	5.3%
Standard Deviation	12.7%	13.5%	11.2%	14.7%	9.3%
Sharpe Ratio	0.14	0.38	0.35	0.71	0.57
***t*-statistic**	0.78	2.07	1.90	3.87	3.12

As a final preliminary, in each of the regions we look at a portfolio that invests 50% in that country's value long–short strategy and 50% in that country's momentum long–short strategy, rebalanced to 50/50 monthly (note that momentum has a long history of realizing higher volatility per dollar than value, therefore, ex post, and perhaps predictably ex ante, this portfolio is actually slightly more momentum than value).

Each region, including Japan, turns in a statistically significant performance when we examine a portfolio of value and momentum; in fact, Japan's performance is considerably better than that of the U.S. The All region is particularly strong because, of course, it is diversifying by value and momentum and by region. In particular, note that even though Japan has 50% of its dollars, and more than half its ex post risk in the 0.03 Sharpe ratio momentum strategy, its 50/50 portfolio Sharpe ratio is quite strong.

Of course, in Japan, and each region, the 50/50 strategies are benefiting from the negative correlation of value and momentum. These correlations are quite negative and are clearly driving much of the large benefits of including both value and momentum, as indicated by the greatly superior Sharpe ratios reported in Exhibit 4 compared to those reported in Exhibits 2 and 3. Next, in Exhibit 5, we list these negative correlations (calculated using monthly returns) for each region and the combined All region.

EXHIBIT 3
Momentum Strategy Results
July 1981–December 2010

	U.S.	U.K.	Europe	Japan	All
Average Return	3.7%	8.3%	7.4%	0.7%	5.0%
Standard Deviation	16.6%	17.2%	15.3%	20.2%	13.2%
Sharpe Ratio	0.22	0.48	0.48	0.03	0.38
***t*-statistic**	1.21	2.63	2.62	0.19	2.06

EXHIBIT 4
50/50 Value/Momentum Strategy Results
July 1981–December 2010

	U.S.	U.K.	Europe	Japan	All
Average Return	2.8%	6.7%	5.7%	5.6%	5.2%
Standard Deviation	6.8%	8.0%	6.9%	8.6%	5.2%
Sharpe Ratio	0.40	0.84	0.82	0.65	1.01
***t*-statistic**	2.19	4.56	4.46	3.54	5.46

EXHIBIT 5
Value/Momentum Correlation
July 1981–December 2010

U.S.	–0.59
U.K.	–0.47
Europe	–0.50
Japan	–0.55
All	–0.63

SIMULATIONS

We start by asking a simple question. Because we only observe ex post returns, what are the chances that the poor results for momentum in Japan are just bad luck? Also, can simulations shed light on our contention that value and momentum are best viewed as a system?

Basic Simulations

To begin, we fix the variance-covariance matrix of the eight strategies (value and momentum in each of the four regions) to match the ex post 29½-year historical realization. Then, we fix the mean return for each of the eight strategies such that it yields an ex ante 0.35 Sharpe ratio, which is the average realized Sharpe ratio across the eight strategies. We then draw 10,000 multivariate normal runs for the eight strategies over 29½ years. We make special use of two historical Sharpe ratios. The historical Sharpe ratio of momentum in Japan is 0.03, the lowest we observed, and the historical Sharpe ratio of value in Japan is 0.71, the highest we observed.

For a 0.35 Sharpe ratio strategy, viewed alone, to realize ex post a 0.03 Sharpe ratio over 29½ years is a –1.74 standard deviation event. Realizing less than or equal to a 0.03 Sharpe ratio has a p-value of 4.1%. Even viewed alone, ignoring the fact that it "has not worked in Japan" and focusing instead on the statistical significance of this failure, the Japanese momentum statistical event is not particularly earthshaking.[8]

The more relevant question is, assuming eight strategies (i.e., value and momentum in all four regions and each with an ex ante Sharpe ratio of 0.35), what are the chances that one or more would come in below a 0.03? Running this simulation, we find the answer is 26%, which is a p-value nobody would write a word about (unless we count the present instance). In other words, under the hypothesis that all eight strategies are equally good, the Japanese results are not at all shocking.

Simulations Considering Value and Momentum as a System

As a forerunner to the rest of this article, which views value and momentum as a system, we can ask another question. We have noted that Japan's value strategy has historically delivered the highest Sharpe ratio. Because value and momentum are negatively correlated, when one is ex post high, we should expect the other to be ex post low. We next ask, in what fraction of our simulations do the high and low Sharpe ratios occur within the same region? The answer is 30% of the time. If we replace our correlation matrix with a diagonal matrix (preserving their different empirical volatilities), this probability falls to 15%. Given the negative correlations of value and momentum, it becomes far more likely to see the high and low Sharpe ratios within one region, in simulation and in real life.

Finally, using our simulations one more time to argue that value and momentum are a system, and given that their negative correlations must be viewed together, we ask, how often, when any region's value strategy realizes a Sharpe ratio of greater or equal to 0.73 (Japan's historical figure), do we see a momentum Sharpe ratio in that same region of less than or equal to 0.03? The answer is 29% of the time. Conditional on the strong value returns in Japan, the almost nonexistent Japanese momentum returns are, again, very far from shocking. The puzzle of why momentum is so weak in Japan can be dismissed as random, as we did earlier in the article, or we can go further and rephrase it as completely unsurprising given the fact that value is so strong in Japan.[9]

EX POST OPTIMAL PORTFOLIOS

Value and momentum's highly negative correlation suggests that these two factors are best studied as a system. Toward that end, we now consider, in each region, the optimal combination of value *and* momentum strategies.

For each region, Exhibit 6 reports the Sharpe ratio of the value strategy, the Sharpe ratio of putting 50% into value and 50% into momentum rebalanced monthly, the weight put in value (the weight in momentum is 100% minus the weight in value) by an optimizer tasked with maximizing the realized Sharpe ratio (this is an in-sample exercise), and finally the Sharpe ratio of this ex post optimal portfolio. The All region puts 25% of its

Exhibit 6

July 1981–December 2010 Ex Post Optimal Accounts of Value and Momentum

	U.S.	U.K.	Europe	Japan	All
Sharpe Ratio of Value	0.14	0.38	0.35	0.71	0.57
Sharpe Ratio of 50/50	0.40	0.84	0.82	0.65	1.01
Optimal % in Value	54%	54%	55%	70%	58%
Sharpe of Optimal Portfolio	0.41	0.85	0.83	0.88	1.17

capital each month in each of the four regions' ex post optimal mix of value and momentum.

For clarity, we can elaborate using the U.S. as an example. The historical Sharpe ratio of a strategy that goes long U.S. value stocks and shorts U.S. growth stocks, as described in the preceding data section, is 0.14. The Sharpe ratio of a portfolio that invests half of its assets each month into the value portfolio and the other half into a similarly constructed momentum long–short portfolio is 0.40. The weight an ex post optimizer chooses to invest in value if not restricted to a 50/50 allocation, but choosing the weights to maximize the realized Sharpe ratio over the 1981–2010 period, is 54% (and implicitly 46% in momentum). Finally, the Sharpe ratio of this ex post optimal 54/46 portfolio is 0.41.

For the U.S., the U.K., and Europe, the optimal weight in value is between 54% and 55%. For these countries, the Sharpe ratio of the optimal portfolio is generally very close to that of the 50/50 portfolio and is more than double the Sharpe ratio of a pure value portfolio. But what about in Japan where momentum is a much heralded failure? There the ex post optimal amount of value is 70%. The improvement in the Sharpe ratio is not the more-than-double amount of the other countries in the study, but it is nontrivial, moving from 0.71 to 0.88. Even switching to the 50/50 portfolio barely nudges down–from 0.71 to 0.65 the Sharpe ratio of that achieved by a 100% value allocation. The 50% value/50% momentum allocation means well more than 50% of the ex post volatility comes from momentum, because momentum has realized considerably more ex post volatility value per dollar in the region of the world where momentum delivers no return and where value is the strongest in the world. And yet, even in Japan, the 50/50 allocation is almost as good as an all value allocation. An optimizer with full foresight wants to put 30% into the "failed" Japanese momentum strategy. Some failure!

FURTHER ANALYSIS OF CORRELATIONS

Exhibit 7 shows the rolling 12-month return to the Japanese value and momentum strategies. The negative correlation we observed earlier at the monthly level clearly shows up at the annual level. Exhibit 8 shows the rolling 12-month return to the 50/50 portfolio of Japanese value and momentum.

The worst 12-month return for Japanese value is −61%. When looking at these large numbers recall that they are additive spread returns, so a −50% followed by a −50% is −100%, not −75% like in compounded portfolios,

Exhibit 7

Rolling 12-Month Value and Momentum in Japan

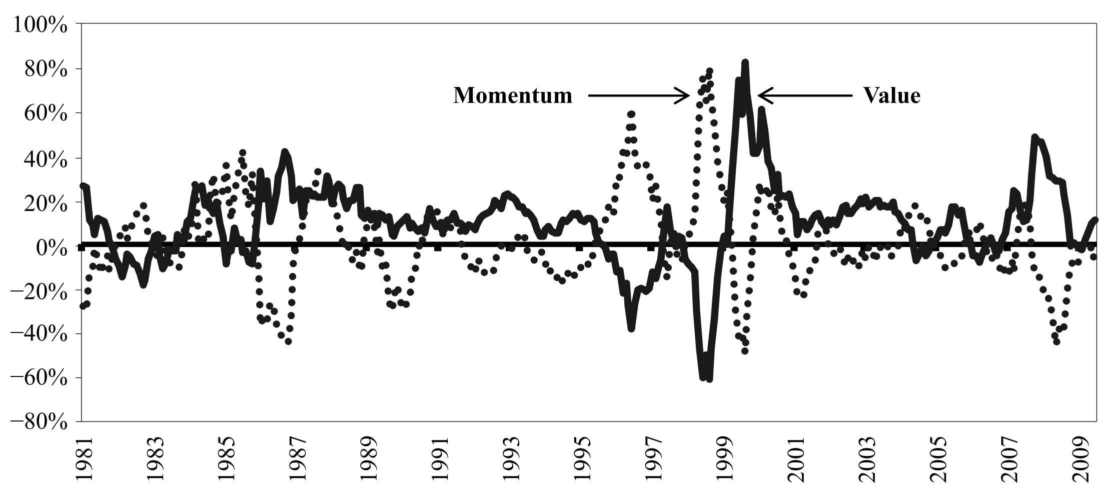
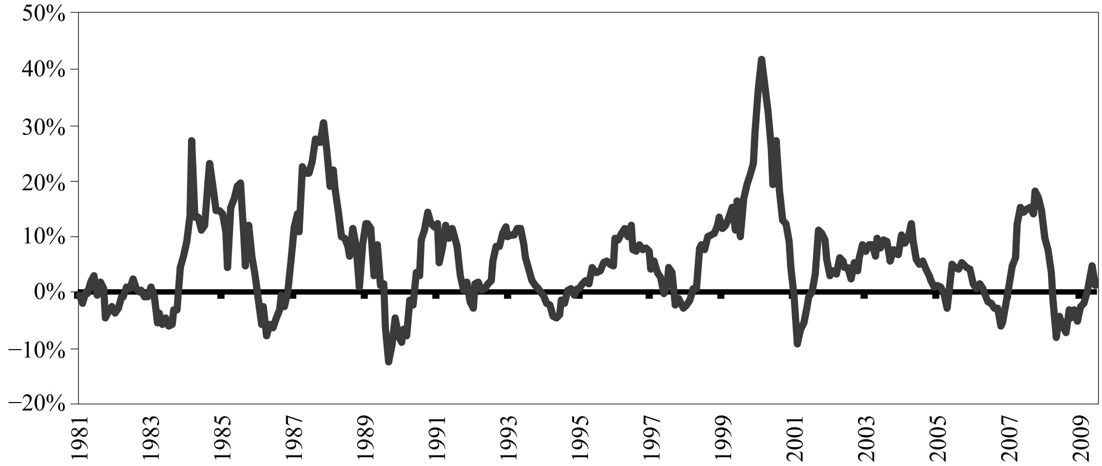


EXHIBIT 8

Rolling 12-Month 50/50 Portfolio of Value and Momentum in Japan



which generates some large numbers. The worst return for Japanese momentum, despite it having a lower average return and higher volatility than value, is not as bad at −49%. Of course, the real point is the 50/50 combination strategy. The worst 12-month return for this portfolio is a comparatively tiny −13%. Of course, this is simply an illustration of the power of diversification and a −0.55 correlation, but perhaps an edifying one.

One way to view these results is that value has been on a 29½-year tear in Japan. Japanese momentum has been −0.55 correlated to value over this period. For momentum to "only" make a tiny bit of money, as opposed to losing quite a lot of money, means it is a valuable component in a diversified portfolio.

It is simple to show that if you have two investment strategies with Sharpe ratios $SR1$ and $SR2$, and correlation ρ, the optimal weight in asset 1 is[10]

$$W1 = \frac{SR1 - \rho \times SR2}{(SR1 + SR2)(1-\rho)}$$

Consider the simple case where $SR1$ is positive and $SR2$ is zero. Then the formula reduces to

$$W1 = \frac{1}{(1-\rho)}$$

$$W2 = 1 - W1 = \frac{-\rho}{(1-\rho)}$$

The intuition for $W2$ is straightforward. We assume strategy 2 has a zero Sharpe ratio, so if it is also uncorrelated to the first positive Sharpe ratio asset, it is ignored (held at zero weight). If it is positively correlated, it is held short as a hedging asset. Finally, if negatively correlated, it is held long, again as a hedging asset. Now, if $\rho = -0.55$, like it does for value and momentum in Japan, we get $W2 = 35\%$. This basically reproduces our optimization results, except for the zero assumption for $SR2$ versus the whopping historical 0.03 for Japanese momentum, and the fact that real-life value and momentum volatilities are not perfectly equal. To repeat, the intuition is simple. A zero Sharpe ratio does not seem that impressive, until we find that it is achieved with a −0.55 correlation to an asset with a positive Sharpe ratio. Then, it is very impressive indeed (obviously the package is more impressive the higher the positive Sharpe ratio and the more negative the correlation) because it is an excellent hedge for a strategy that already does well on its own.

The next section makes this idea, that momentum has actually added a lot to the highly successful Japanese value strategy, even more explicit.

THREE-FACTOR REGRESSION INTERCEPTS

For quite a few years now, the standard way empirical finance evaluates historical strategy performance is in the context of a factor model. The industry-standard approach is the Fama–French three-factor model (Fama and French [1993, 1996]), which regresses the historical

EXHIBIT 9

Momentum Regressed on Three-Factor Model of Market, Size, and Value, July 1981–December 2010

	U.S.	U.K.	Europe	Japan	All
Intercept	7.0%	11.1%	10.8%	9.3%	10.6%
***t*-statistic**	$\boxed{2.83}$	$\boxed{3.88}$	$\boxed{4.33}$	$\boxed{2.98}$	$\boxed{5.40}$
Market Beta	−0.17	0.03	−0.06	−0.07	−0.06
***t*-statistic**	−3.62	0.62	−1.70	−1.83	−1.78
Size Beta	0.12	−0.03	−0.14	−0.28	0.03
***t*-statistic**	1.47	−0.43	−1.69	−3.98	0.39
Value Beta	−0.83	−0.61	−0.63	−0.70	−0.91
***t*-statistic**	−14.39	−10.05	−9.66	−10.73	−14.55

Note: The intercept is reported as an annualized percent.

excess returns in question on the excess returns of the market, a long–short small-minus-large factor, and a long–short value-minus-growth factor. The loadings measure the strategy's factor bets and the intercept measures the economic value of the strategy over making the same factor bets with costless index funds. Exhibit 9 presents the three-factor results for the momentum strategy in each of the four regions regressed on market excess returns and on small-minus-large and value-minus-growth factors. We highlight the all-important intercept *t*-statistics with a box.[11,12]

The size of momentum's intercept in Japan is economically and statistically large (and is better than the intercept in the U.S. market). Quite simply, viewed through the prism of modern finance, momentum has actually worked very well in Japan. Considerable performance, both economically and statistically significant, has been generated by momentum net of the standard three-factor adjustment.

CONCLUSION

If we hypothesize that momentum has similar predictive power around the world, equal to the historical average of value and momentum over each of the four regions we studied, then the ex post "failure" of Japanese momentum is not at all statistically impressive with a p-value of about 26%. Viewed as one of eight possibly efficacious strategies around the world, we cannot come close to rejecting that momentum's Sharpe ratio in Japan is ex ante equal to momentum and value's average Sharpe ratio everywhere. In other words, there is a significant chance that the much ballyhooed failure of momentum in Japan is just random noise.

Furthermore, our defense of momentum in Japan goes beyond simply citing statistical significance. For the last 29½ years, a Sharpe ratio–maximizing Japanese investor with access to the value strategy would actually have been better off with a lot of momentum in his portfolio. Finally, viewed as a system along with negatively correlated value strategies and when using a version of the Fama–French three-factor model, we can easily reject, at standard significance levels, the hypothesis that momentum's success in Japan is the result of chance. Using the three-factor model, momentum is not simply "not a failure" in Japan, but a strong empirical success.

Let us pause for a moment and note how at odds our argument is with the practical world of real-life portfolio management. In practice, managers as well as individual strategies that do not perform over, say, three to five years are at the least considered quite suspect and often tossed on the scrap heap. Yet, here we argue in favor of a strategy that viewed alone has been inept for almost 30 years. We argue for it based on the success of quite similar strategies elsewhere, its power as a hedge for another successful strategy, and an appreciation of the power of random chance. This does not mean that every strategy or manager should be given a 30-year benefit of the doubt. But it does illuminate how at odds real-world time horizons can be with time horizons that actually mathematically matter.

To sum up simply, we show that when viewed properly momentum works fine in Japan. Everyone move along, nothing to worry about here.

ENDNOTES

I would like to thank Dana M. D'Auria, Andrea Frazzini, Jacques Friedman, Jared Kizer, Ronen Israel, John Liew, Toby Moskowitz, Fraser Murray, Lars Nielsen, Aldo Pascarella, Lasse Pedersen, and Nathan Sosner for exceptionally helpful comments, and Sarah Jiang for the same, and superb research assistance.

[1]The p-value in this case is the probability we would find Japanese momentum to be as bad, or worse, than we do if the true mean return for momentum in Japan was similar to that found ex post in other countries; 5% or lower is a commonly used level where something is called "significant."

[2]Asness and Frazzini [2011] studied the difference between using updated market price to calculate book-to-market ratios versus using a lagged price that matches the

timing of the book data. Versions of value that lag price, such as the Fama–French HML, look more like 80% value and 20% momentum than they do like pure value. Thus, using the lagged value measures, it is harder to see the importance of adding some momentum to value in Japan, because the lagged value measures already add momentum to the strategy. The key simulation result in this article, that the true p-value of momentum's "failure" in Japan is not impressive, is not affected by this choice.

[3]We do lag the price by one day to avoid loading on the short-term contrarian strategy that is possibly an artifact of the bid–ask spread. Also, for the three-factor regressions reported in Exhibit 9, we tested explicitly adding the one-month contrarian strategy to each regression and found the results essentially unchanged.

[4]Keep in mind, to be conservative, we use a very large-cap formulation where many anomalies are known to be weaker. See Israel and Moskowitz [2011] for further discussion of these results, analyzing both value and momentum among different size stocks.

[5]For comparison with another study, the Fama and French [2010] Exhibit 1 presents the results for momentum in Japan over only large-cap stocks (the analogue to what we do in our study). They found a t-statistic of 0.32 over 239 months. That translates to a Sharpe ratio of 0.07 versus our Sharpe ratio of 0.03. The time periods and construction methods are not precisely the same, but the similarity in result is comforting.

[6]Results in Japan pre- and post-1990 are essentially the same, making the dramatic change in the Japanese market from long-term bullish to bearish not a potential explanation for momentum's failure.

[7]This is also perhaps due to value and momentum's testability and success over a longer period in the U.S., and the fact that the Fama–French HML includes both smaller stocks and a bit of the momentum strategy (see Asness and Frazzini [2011]) as compared to our value strategy that uses up-to-date unlagged price. The Fama–French HML generates a 0.42 Sharpe ratio over this same period, but averages value's performance among large and small stocks. Among large-cap stocks, such as those we use in this article (similar although not precisely the same cut), the Fama and French data actually yield a Sharpe ratio of only 0.10 for value over the period, but 0.65 for small stocks (see the Ken French website, which is our source for the data). In separate bivariate regressions of this article's U.S. value strategy on the Fama–French large-cap and small-cap value strategies, we obtain a 0.87 coefficient and a 17.7 t-statistic on the Fama–French large-cap value strategy, and 0.05 and a 1.0 t-stat on the Fama–French small-cap value strategy. In other words, as a reasonableness check, our results look very much like the Fama–French large-cap value strategy, which also looks weak but positive over this period.

[8]Similarly, the empirical (not simulation) t-statistic of the mean of Japanese momentum versus the equal-weighted average of the other three momentum strategies is only –1.65, and Japanese momentum versus the equal-weighted average of the other seven strategies (value and momentum) is only –1.34.

[9]Of course, we can only show that random chance is a strong possibility, we cannot dismiss causality. For example, Chui, Wei, and Titman [2000, 2010] offered explanations for momentum's weakness in Japan (and other parts of Asia) that include momentum being weaker in countries with less individualism, and momentum being weaker in civil versus common law countries.

[10]This formula is for equal volatility strategies. It does not perfectly apply to our empirical results because the momentum portfolio is more volatile than the value portfolio, although the intuition carries through quite well.

[11]The value-minus-growth factor is the "value" factor of this article. The market factor is the cap-weighted return on our universe of stocks (the 90% of market cap we use for this article) over cash, and the small-minus-large factor is constructed like momentum and value in this article but using market capitalization at the end of the prior month (and requiring each firm to have value and momentum factors). Because we restrict our universe to large-capitalization stocks to begin with, our size factor is very weak.

[12]We are employing "local" versions of the three-factor model. Fama and French [2010] discussed the difference between local and global models. An exception is that our All region strategy in Exhibit 9 is analyzed using global versions of the RHS factors (equal-weighted averages of the region factors); it is not just an average of other results in the exhibit but a separate global test.

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