Allianz Global Investors

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Systematic Equity: An active approach to avoiding the hidden risks of factor investing

Executive summary

Factor investing has emerged as a well-established investment discipline, bolstered by a wealth of academic research that substantiates its effectiveness in achieving excess returns. This approach involves selecting securities based on specific characteristics, or "factors," such as value, size, momentum, and quality, which empirical studies have shown to be linked with superior performance over time. By systematically targeting these factors, investors can potentially enhance their portfolios and navigate the complexities of the financial markets with greater precision and confidence.

Dr. Michael Heldmann, CFA
CIO Systematic Equity

However, factor-based portfolios also contain hidden risks that may cause results to fall short of investors' needs and expectations. To identify and quantify these risks, we developed a research method, which we call "Time to Outperformance" (TTO). This methodology allows us to gauge (based on history) how long it takes for any given factor to outperform the broad market with a high degree of confidence.

Our TTO analysis shows that single-factor performance can be erratic and inconsistent, with outperformance from risk premia often being concentrated in good times and underperformance concentrated in bad times over the course of the market cycle. Also, unintentional exposure to significant macro risk factors (e.g., interest- rate sensitivity) can overwhelm positive excess returns from risk premia even when that specific factor is in favor. Further, the analysis suggests that while combining multiple factors can reduce these risks, simply shifting to a multi-factor strategy does not go far enough in shortening the time to outperformance and producing a more consistent return profile.

Our findings, of course, do not invalidate the concept of factor investing. To the contrary, they

KEY TAKEAWAYS

- Many institutions have turned to factor-investing strategies in search of excess returns over the long run, especially in large, liquid asset classes. But factor-based portfolios also contain hidden risks that may cause results to fall short of investors' needs and expectations.
- We developed a methodology to better identify those risks: "Time to Outperformance". This tool allows us to gauge (based on history) how long it takes for any given factor to outperform the broad market with a high degree of confidence.
- While our findings confirm that factor risk premia are real and can benefit investors, they also indicate that single-factor performance can be erratic and inconsistent. Combining multiple factors can reduce these risks, but not enough to produce a more consistent return profile.
- The good news for investors: A holistic approach to factor combination that uses strategic portfolio construction and active management of factor exposures can mitigate inherent risks and significantly enhance information ratios and reduce time to outperformance.

deepen our belief that these factors—especially when strategically combined—can be an effective and efficient way to deliver much needed excess returns to institutional investors. Our analysis, however, does show that investors should approach factor investing with caution, ensuring that they take hidden risks fully into consideration when formulating, implementing, and deploying their factor- investing strategies.

This very challenge was, in fact, the next step in our pursuit of an optimal strategy to factor investing. The good news for investors: A holistic approach to factor combination that uses strategic portfolio construction and active management of factor exposures can mitigate inherent risks and allow investors to reliably harvest the risk premium associated with factor-based investing, significantly reducing time to outperformance, regardless of the timing of the initial investment.

In this context, the remainder of this paper provides an overview of the potential benefits of factor investing in an institutional portfolio, exposes the hidden risks inherent to this investment approach, delivers a deep-dive into our newly developed TTO method to assess those risks, and explores a more refined and active approach to factor-based portfolio management that, in our view, better meets institutional investors' needs for returns and risk mitigation.

Rise of factor investing

The shift from active strategies to passive investments has become a dominant trend in institutional investing.

As passive strategies make up a growing share of assets within their portfolios, institutions need new sources of outperformance in order to hit total portfolio return targets. This need explains, at least in part, the growing popularity of factor-based investing (also known as "smart beta"), as these strategies provide investors with an alternative to traditional active strategies, especially in asset classes where many have decided to receive just index-like returns.

Risk premia are in fact abstract concepts that are proxied by individual, or combinations of, factors that explain or drive long-term investment performance. For example, the risk premium Value may be proxied by individual factors, such as (but not exclusive to) price-to-book value or dividend yield, or a combination of the two. There is abundant academic research showing that equity portfolios based on factors provide a high level of confidence that they will outperform the market in the long run. The roots of this research can be traced to Benjamin Graham, who examined the drivers of stock performance in the 1930s, and others such as Ray Ball, who explored the effects of earnings surprises on subsequent stock prices in the 1960s. This research has continued to present day with notable work being done on risk premia, such as Value, Momentum, Small Cap, and Low Volatility (Exhibit 1).

The research demonstrates the existence of risk premia associated with individual factors that can be harvested for excess returns over time to an investor's benefit. By adding exposure to a given factor, investors assume additional risk relative to the benchmark, which creates opportunity for outperformance. By allocating assets among factors, investors can gain exposures to proven sources of excess returns and increase their confidence in outperforming the benchmark.

Exhibit 1: Academic research shows the existence of risk premia that can be harvested by investors to potentially outperform over time

Investment style	Risk premium explanation	Long-term excess return benefit
Value	Value stocks are typically more cyclical, more highly leveraged and less profitable than average stocks, which creates the potential for mispricings.	As investors often over discount earnings potential of value companies, investors may exploit this factor to their advantage.
Earnings revisions	Earnings revisions strategies entail strong mean-reversion risk at market turnarounds.	Investors may benefit from exposure to this factor by exploiting anchoring and herding biases.
Small cap	Small-cap stocks are typically more cyclical, more highly leveraged, less profitable and less liquid than larger-cap average stocks.	Investors may reap benefits from exposure to this factor by exploiting the pricing inefficiencies in the space.
Momentum	Momentum strategies entail strong mean-reversion risk at market turnarounds.	Investors may benefit from exposure to this factor by exploiting anchoring and herding biases.
Low volatility	Low beta stocks may fail you when you need them most: in turbulent markets as betas converge to one in crisis.	Investors with long-term horizons and high tolerance for periods of underperformance may benefit from exposure to this factor.

Source: Allianz Global Investors.

Factor investing: Hidden risks

Despite these benefits proven by ample academic research, factor-based portfolios also contain inherent risks that can cause results to fall short of investors' expectations. Some of these risks are unrecognized by many of the investors now adding these strategies to their portfolios as a means of generating excess returns.

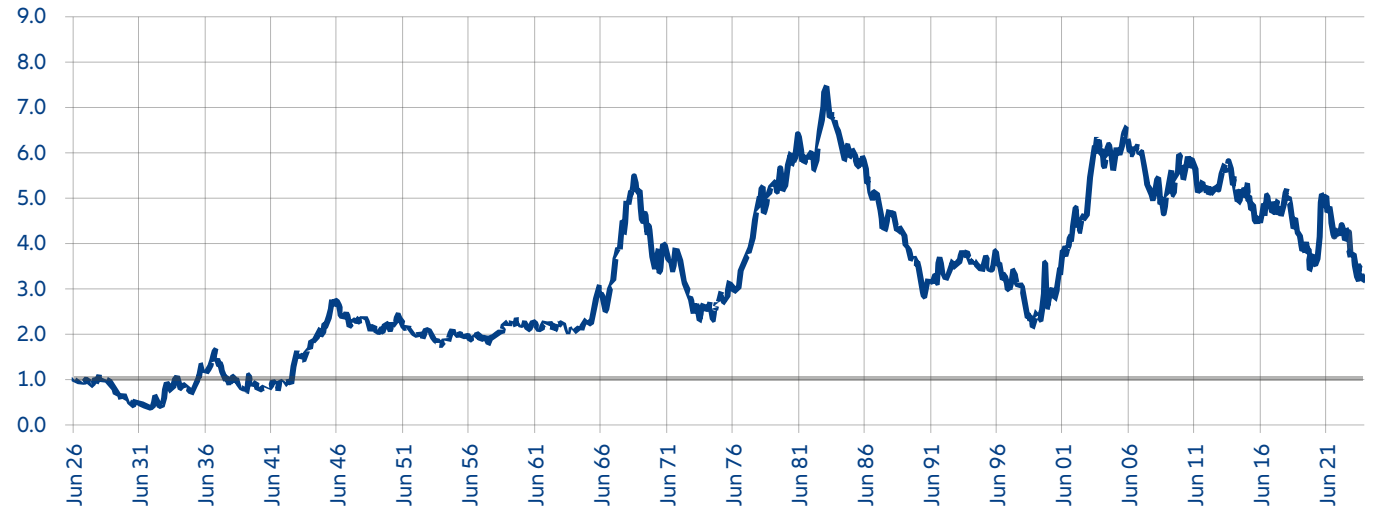
If risk premia demonstrably generate excess returns over the long term—and there is a rich academic history documenting this—why is there not a greater number of market participants investing in them? The simple answer is that although risk premia may produce strong outperformance over decades, they are unstable and inconsistent, meaning that excess returns will vary significantly over time. Over the course of the market cycle, outperformance related to risk premia can be concentrated in good times and underperformance concentrated in bad times. Meanwhile, unintentional exposure to significant risk factors such as interest-rate sensitivity, sector exposures, oil price movements, and other macro-oriented factors can overwhelm positive excess returns from risk premia over short- and medium-term periods, even when that specific factor is in favor.

As a result, excess returns from factor-based portfolios can be unpredictable. Investors can experience long periods of underperformance. These periods—which at times are measured in years, even decades, as opposed to months— mean that results often will fail to meet the needs of investors relying on these strategies to produce the returns required to achieve their targets in a given period of time.

Unstable and even erratic returns

US small-cap equities offer a clear example of how these often-unrecognized risks can undermine results for investors. There is a widespread agreement that small caps offer some magnitude of risk premium relative to the equity risk of the overall market. To quantify that risk premium, we accessed data from the Center for Research in Security Prices, LLC[1]. to examine small-cap stock relative performance over a long history (Exhibit 2). For the analysis, we utilized the methodology set forth by Fama-French in 2015 and annual portfolio rebalancing[2].

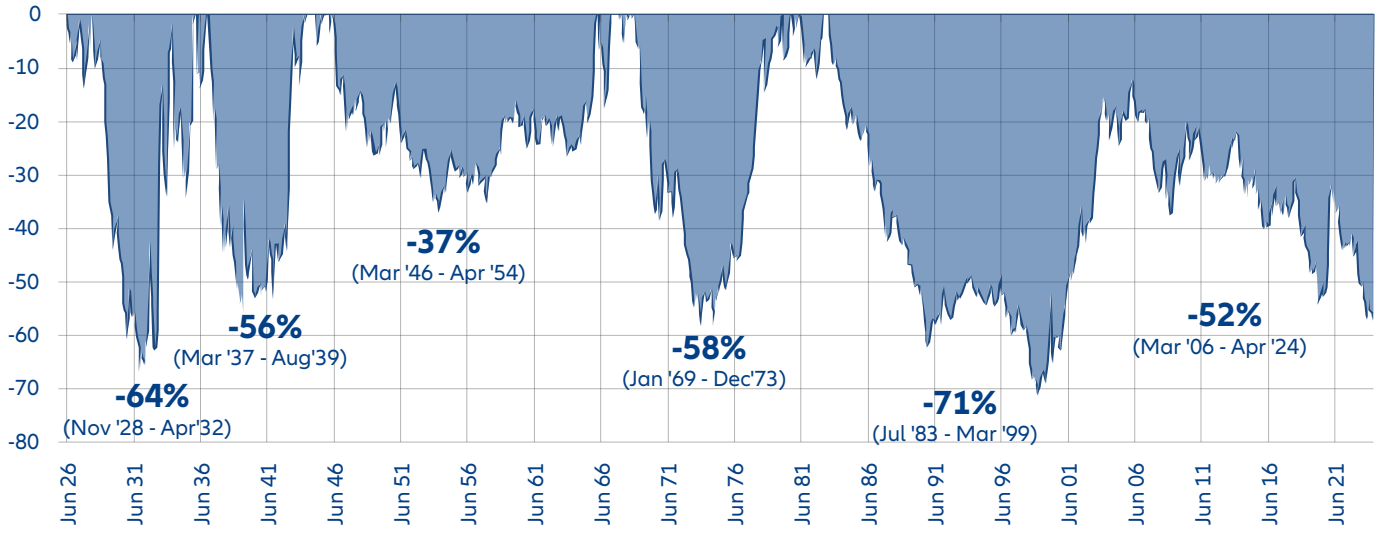
Exhibit 2A: Factor-investing relative returns, such as US small cap equities, can be erratic and experience significant periods of underperformance



Using the Fama-French methodology, we sorted the CRSP universe of US stocks into five size (market cap) groups using quintile breakpoints. Next, we selected the smallest quintile by size to focus our analysis of the Small Cap factor behavior. We then compared the results of that select cohort to the benchmark, which, in this case, is represented by the value-weighted University of Chicago's Booth School of Business' Center for Research in Security Prices (CRSP) US stock universe.
Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors

1 The Center for Research in Security Prices, LLC is a wholly-owned subsidiary of the University of Chicago. CRSP retains a strong affiliation to the both the University of Chicago and its Booth School of Business.
2 See Fama, Eugene and French, Kenneth, "A Five Factor Asset Pricing Model". Journal of Financial Economics 116 (2015) 1-22.

Exhibit 2B: Factor-investing relative returns, such as US small cap equities, can be erratic and experience significant periods of underperformance



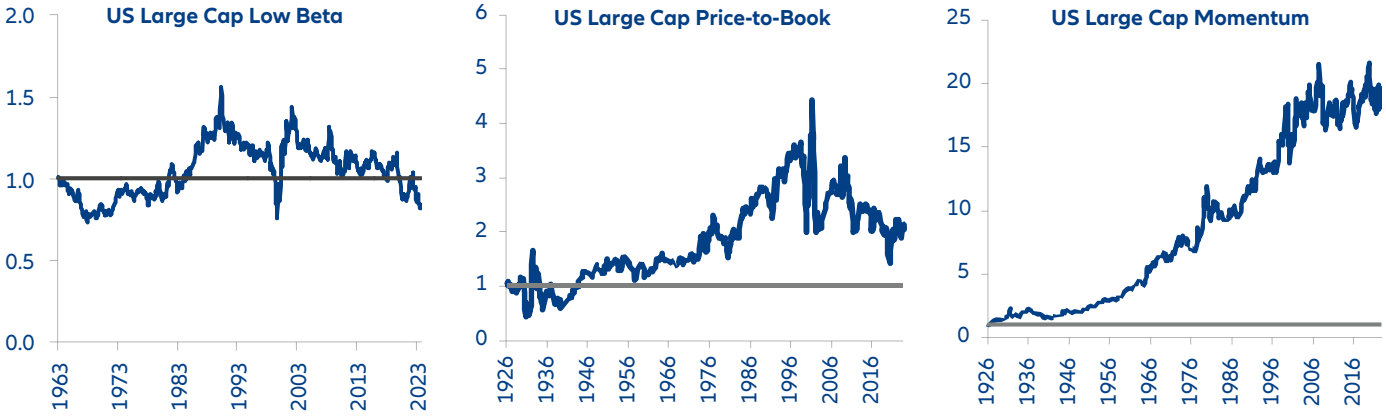
Using the Fama-French methodology, we sorted the CRSP universe of US stocks into five size (market cap) groups using quintile breakpoints. Next, we selected the smallest quintile by size to focus our analysis of the Small Cap factor behavior. We then compared the results of that select cohort to the benchmark, which, in this case, is represented by the value-weighted University of Chicago's Booth School of Business' Center for Research in Security Prices (CRSP) US stock universe.
Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors

The results show annualized excess return of **1.31%** over the broad equity market. Importantly, these results are without transaction costs, which for small caps can be consequential. At initial glance, this is an impressive level of outperformance over such a long period.

However, the analysis also yields more problematic findings. First, we find a high degree of instability in the relative returns across the period. Second, investors experience extended periods of significant underperformance—including returns that stayed a daunting 71% below those of the benchmark in the period from July 1983 through March 1999. Throughout the entire analyzed period, the information ratio for the small-cap cohort is a paltry 0.07.

Extending the same analysis to other factors shows clearly that, despite unique return profiles, they all share the common traits of instability of relative returns and extended periods of underperformance relative to the broad equity market (Exhibit 3).

Exhibit 3: Like US small caps, other widely recognized investing factors experience extended periods of underperformance



Using the Fama-French methodology, we sorted the CRSP universe of US stocks into five size (market cap) groups using quintile breakpoints. Next, we selected the quintile of largest stocks to focus our analysis of individual factor behavior. We ranked stocks within that quintile based on the factor criteria below and compared the results to the benchmark, which, in this case, is represented by the value-weighted CRSP US stock universe.

- Low Beta: Lowest quintile of beta calculated using trailing 5 years of monthly returns.
- Momentum: Top quintile of stocks with highest 12-month stock price return as of 1-month prior to measure date.
- Price-to-Book Value: Lowest quintile of stock price relative to book value.

Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors

TTO: A methodology to measure the efficacy of factor investing

To better understand the benefits of factor investing, we developed a measure that we call "Time to Outperformance" (TTO). This measure seeks to assess and quantify the risk posed by the return instability and extended periods of underperformance of factor-based portfolios. In essence, this methodology allows us to gauge (based on history) how long it would take for a given factor to outperform the average stock universe with a high degree of confidence.

We utilized a rolling-windows analysis to check for the stability of the relative returns time series, and elected a somewhat conservative target of 80% for the degree of confidence for the factor to outperform the broad market.[3]

Hence, the TTO measure represents the shortest rolling window where at least 80% of all observations outperform the market in the analyzed period. In other words, the TTO allows us to assess the amount of time required for any factor to reach the 80%-outperformance level of confidence, regardless of the timing of initial investment, based on historic performance.

As previously, we conducted our analysis using data from CRSP and Fama-French for the equity universe in the United States. We made a deliberate choice to limit the scope of our exercise to US data because it enabled us to extend the historic window of our analysis considerably—to as far back as 1926 for some factors. The results—shown in Exhibit 4—were surprising.

Exhibit 4: The Time to Outperformance (TTO) for single factors can be very long and potentially destabilizing for institutional investors

Single factors	Period[4]	Relative Return (p.a.)	Information Ratio	TTO at 80% Outperformance Confidence Level
Small Caps	06-1926 - 04-2024	1.31%	0.07	17.5 yrs
Large Cap Low Beta	06-1963 - 04-2024	-0.33%	-0.04	33.4 yrs
Large Cap P/B	07-1926 - 04-2024	0.81%	0.05	19.3 yrs
Dividend Yield	06-1927 - 04-2024	0.81%	0.08	12.3 yrs
Large Cap Momentum	12-1926 - 04-2024	3.42%	0.37	4.1 yrs
Large Cap Operating Profitability	07-1963 - 04-2024	1.02%	0.20	23.6 yrs
Large Cap Low Investment	07-1963 - 04-2024	2.20%	0.29	7.2 yrs

Using the Fama-French methodology, we sorted the CRSP universe of US stocks into five size (market cap) groups using quintile breakpoints. Next, we selected the quintile of largest stocks to focus our analysis of individual factor behavior, with the exception of the Small Cap factor, which is the smallest quintile by size. We ranked stocks within that top market-cap quintile based on the factor criteria below and compared the results to the benchmark, which, in this case, is represented by the value-weighted CRSP US stock universe.

- Dividend Yield: Highest quintile based on the dividend per share/stock price.
- Momentum: Top quintile of stocks with highest 12-month stock price return as of one month prior to measure date.
- Price-to-Book Value: Lowest quintile of stock price relative to book value.
- Low Investment: Lowest quintile total asset growth over previous 12 months.
- Profitability: Top quintile gross profit to total asset ratio.
- Low Beta: Lowest quintile of beta calculated using trailing five years of monthly returns.

Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors

3 Here's a more detailed technical explanation of our approach: We studied the relative performance of a factor on rolling windows with varying time periods. We started with a rolling window of one month, and calculated the ratio of observed positive relative returns to negative relative returns in all rolling windows possible for the given track record, shifting the window repeatedly by one month. This ratio is the "hit ratio" for a one-month rolling window. Then, we extended the period to two months and, again, calculated the hit ratio for all possible two-month rolling windows. Similarly, we kept extending the rolling window until we covered the whole track record with just one window. In general, the hit ratio will be close to 50% for short rolling windows, and it will approach 100% for very long rolling windows and factors that show an outperformance over the full track record. As we extended the rolling window, we elected to capture the shortest rolling window where the hit ratio was at least 80%. This is what we call "Time to Outperformance," since it is the minimal amount of time one has to wait for the factor to outperform in 80% of the cases.

4 The different time periods for measurement are based on the availability of data for the various factor measurements from CRSP and Compustat.

These categories are representative of the major strategies used in factor portfolios, as investors tend to see them as "buckets" for potential grouping. For example, we view Price-to-Book Value (P/BV) and Dividend Yield as measures of Value to represent cyclical and defensive value. Low Investment and Operating Profitability are common factors used to harvest the Quality risk premium.

Although all of these strategies demonstrate positive average relative returns on an annualized basis, they also produce low information ratios due primarily to large tracking errors. Even more interesting are the results from our TTO analysis. In the best-case result, the Dividend Yield factor produces a TTO of 12.7 years . In other words, during the analyzed 79 -year period, an investor would have to wait an average of 12.7 years to achieve an 80% likelihood of outperformance. The TTO for other factors such as small cap, profitability, and price to book was worse (or longer), especially for Low Beta, which shows a TTO value of over 33 years for the same outperformance confidence level.

The allure of factor investing's excess returns is dramatically diminished when faced with the sobering reality of how long it could take to achieve those results. We believe that a decade- plus is too long a period for any asset owner to wait to have a high-degree of confidence that their investment will achieve the desired performance objective (e.g., generate excess returns relative to the broad market). The results of our TTO analysis suggest investors should approach single-factor investing with an abundance of caution and realistic expectations for the probable shape of their excess-return pattern.

Multi-factor approaches: Better, but still not good enough

We next employed the TTO analysis to determine if combining factors in a composite or multi-factor strategy can improve results by increasing the stability of the return profile and minimizing the extended periods of underperformance that seem to characterize single-factor portfolios. The result: Even the most rudimentary approaches to factor combination can produce significant improvements in information ratios and TTO. However, these gains will likely still fall far short of meeting investor expectations (Exhibit 5).

For example: Creating a multi-factor portfolio with equal weighting to Diversified Value (an equal combination of the Dividend Yield and Price-to-Book Value factors) and Momentum produced the most remarkable improvements over singe-factor approaches, bringing TTO down to 1.9 years.

This combination works well due to the low-to-negative correlation between Value and Momentum over most periods. Other combinations, such as Value and Quality, also improved results relative to single-factor portfolios, but still produced TTO figures of approximately 3 to 8 years.

Further, investors hoping for an even higher degree of certainty from their multi-factor portfolios will have to wait even longer still. Adjusting the degree of confidence in outperformance to 90% increases the TTO for these multi- factor portfolios to a low of 6.3 years and a high of 14.6 years. Said another way: Despite the diversification advantages of combining Value and Momentum, there was still a 10% chance that an investor would have had underperformance even after waiting for as long as 6.3 years!

A holistic approach to factor combination

The TTO analysis demonstrates that single-factor investing is risky from a relative-return standpoint. The unreliability of returns over limited time periods and extended stretches of underperformance severely degrade the utility of single- factor-based portfolios for institutional investors seeking to meet short- and medium-term funding targets.

Common methods of combining factors do not adequately address these issues. However, the fact that multi-factor portfolios can deliver meaningful improvements in information ratios and TTO relative to single-factor portfolios suggests that a more refined approach to factor combination could go further in mitigating these risks.

Such an approach would employ a holistic and more active process in both the construction and management of the multi-factor portfolio. In this light, we developed our own process to better identify, assess, and exploit the risks inherent to factor investing to an investor's benefit. This process entails: Taking advantage not only of diversification among risk premia, but also among factors within the risk premia themselves. Definitions of risk premia are not set in stone. Rather than hewing to standard definitions when constructing a multi-factor portfolio, investors can improve results and shorten TTO by allocating among multiple factors within each risk premium. For example, traditional definitions of the Value risk premium are based on Price-to-Book Value ratio. However, investors can create diversification benefits by expanding that definition and adding allocations to factors such as Dividend Yield, Cash Flow Yield, and Enterprise Value/ Earnings Before Interest Tax Depreciation and Amortization (EV/EBITDA). Diversification benefits could be enhanced further by incorporating allocations to other risk premia, such as Quality. Investors should seek additional opportunities to generate diversification benefits across the portfolio by broadening

other traditional risk premia definitions; i.e., incorporating factors such as Earnings Revisions into the Momentum risk premium.

Avoiding stock overlap. Because individual stocks sometimes exhibit characteristics associated with more than one risk premium, multi-factor portfolios often feature risk premia overlap. For example, a single stock can exhibit Value characteristics and also have positive Momentum.

At first glance, this might seem like an attractive feature. If an investor is looking to benefit from the diversification benefits of multiple risk premia and factors, why not choose stocks with multiple exposures? In reality, these overlap stocks are subject to significant event risk due to overcrowding, as demonstrated to some extent in the performance of the US market in 2019 and also in major equity events such as the "quant meltdown" in 2007. Like single-factor portfolios, multi-factor portfolios with high levels of stock overlap do outperform the market over a long-term horizon, but with lower information ratios due to higher instability. The key to optimizing outcomes is to maintain some exposure to these overlap stocks as a means of achieving efficient exposure to the individual risk premiums, but to dynamically limit their total weighting to improve portfolio stability and avoid event risk.

Exhibit 5: Combining factors can shorten Time to Outperformance, but the approach is still likely to fall short of most investors' needs

Composite factor	Period	Relative Return (p.a.)	Information Ratio	TTO at 80% (in yrs)	TTO at 90% (in yrs)
US Large Cap Quality	06-1963 - 04-2024	1.71%	0.37	4.6	6.6
US Large Cap Diversified Value	07-1927 - 04-2024	2.06%	0.19	10.1	14.6
US Multi Factor (Value & Momentum)	07-1926 - 04-2024	2.88%	0.56	1.9	6.3

Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors

Neutralizing unrewarding risk factors. There are hundreds of risk factors in equity investing, but only a handful carry a risk premium. Neutralizing unrewarding risk factors is integral to the success of a multi-factor strategy. Unrewarding risk factors tend to be mean reverting and/or have negligible or negative information ratios. These tend to be macro-economic factors, such as interest-rate sensitivity, commodity and currency fluctuations, and economic-sentiment indicators. These risk factors contribute significant noise (tracking error) to performance and may even wipe out longer-term gains from rewarding factors. The solution is to identify significant risk factors and dynamically constrain their effect to negligible levels. This can be accomplished by employing a barbell structure that creates an overweight of the extremes. For example, implementing an overweight to the stocks that will most benefit from a rise in oil prices, overweighting stocks that should benefit from a fall in oil prices, and underweighting the middle.

Employing a dynamic process. Executing on all the above elements requires a dynamic investment process capable of capitalizing on diversification among risk premia and underlying factors, minimizing stock overlap, neutralizing unrewarding factors and incorporating fundamental analysis on an ongoing basis. An adaptive approach to factor definition, risk modelling, and portfolio construction is essential in developing a more refined method of factor combination.

We have deployed this process in the portfolios we manage for more than 25 years, and, as a result, have been able to dramatically increase stability

of returns, enhance Information Ratio, and reduce TTO. As shown in Exhibit 6, our Holistic Multi-Factor approach compares well with other portfolios analyzed in this paper. Since inception in 1999, our strategy has been able to significantly enhance Information Ratio (0.67) while sharply enhancing time to outperformance: We have been able to achieve a TTO with an 80% confidence level of 3.4 years against 7.8 years for a combo of Value and Momentum. Improvements were even more dramatic when we ran the analysis at a 90% level of confidence.

Also, an additional word on comparisons: As previously mentioned, we deliberately chose to use US stock data for our analysis as it offered the longest available history. Likewise, we followed the same rationale for selecting our global strategy[5] to exemplify the efficacy of our multi-factor process, as this strategy offers our longest track record. Although we concede the US vs. Global universe dichotomy, there are similar, demonstrable patterns of relative returns between the two universes, due, in large part, to the fact that the US accounts for more than half of the weight of the universe, which makes for a fair comparison and warrants statistical significance to our analysis.

Exhibit 6: A Holistic Multi Factor approach can dramatically enhance Information Ratio and shorten Time to Outperformance

Composite factor	Period	Relative Return (p.a.)	Information Ratio	TTO at 80% (in yrs)	TTO at 90% (in yrs)
US Large Cap Quality	01/1999 – 04/2024	1.17	0.22	6.7	7.2
US Large Cap Diversified Value	01/1999 – 04/2024	1.10	0.11	22.7	22.9
US Multi Factor (Value & Momentum)	01/1999 – 04/2024	1.37	0.31	7.8	16.8
Holistic Multi Factor Approach	**01/1999 – 04/2024**	**1.13**	**0.67**	**3.4**	**8.3**

*) Data represents the AllianzGI Best Styles Global Developed Equity composite, which incepted on January 1, 1999. The performance shown above is gross and does not reflect the deduction of investment advisory fees. Past performance is not indicative of future results. The data above is supplemental information and supplements the Best Styles Global Developed Equity GIPS compliant composite presentation provided at the end of this document.
Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors.

Conclusion

Despite hidden risks, multi-factor strategies still offer investors a strong source of potential excess returns. Risk premia associated with factor investing are real, and can be harvested over time to the benefit of investors and their portfolios.

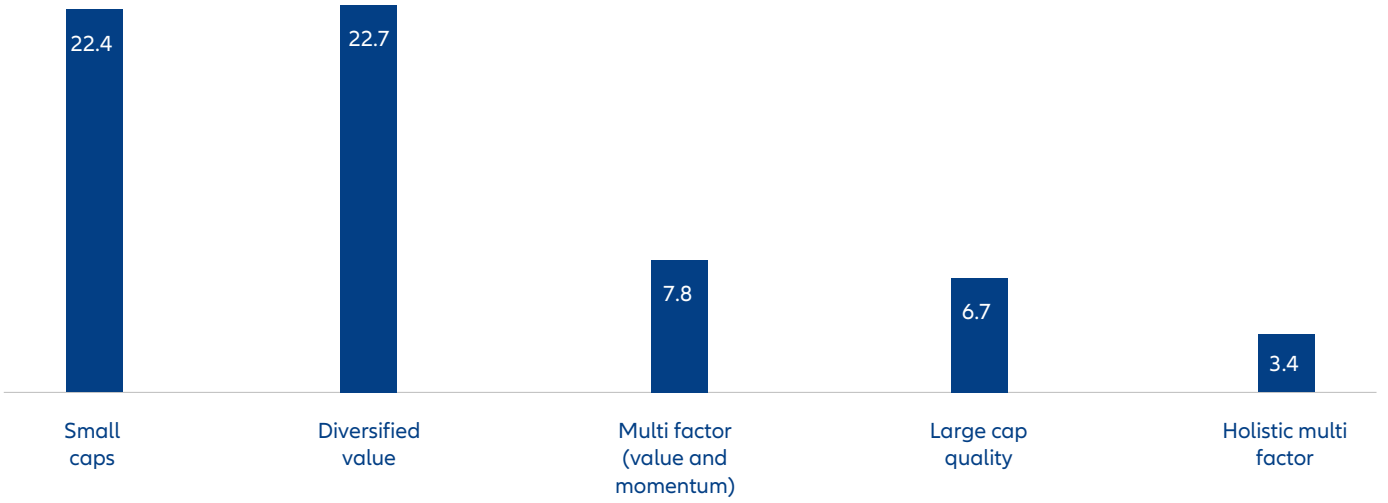
The key to success resides on how to combine factors properly.

From that perspective, our research suggests that investors can sharply mitigate hidden risks as well as shorten Time to Outperformance through a more refined approach—one that employs strategic portfolio construction and active management.

Such a strategy allows for proper diversification among and within risk factors, while seeking to neutralize unrewarding risk factors and avoid stock overlap. Our approach to factor investing incorporates input from fundamental analysis and employs a dynamic process with an adaptive approach to factor definition.

Empirical evidence accumulated by our team over close to two decades shows that this approach to factor investing can reliably improve Information Ratios and dramatically shorten Time to Outperformance, allowing for investors to confidently harvest the risk premium associated with factors in a reliable and consistent fashion (Exhibit 7).

Exhibit 7: A refined approach to factor combination can enhance the stability of returns and reduce troubling periods of underperformance



As of April 30, 2024. The data above is supplemental information and supplements the Best Styles Global Developed Equity GIPS compliant composite presentation provided at the end of this document.
Source: Center for Research in Security Prices, LLC, Compustat, and Allianz Global Investors.

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