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SMART BETA STRATEGIES: A NEW HYPE OR A LASTING PHENOMENON

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Abstract

The cap-weighted indices are typically plagued with price noise, a portfolio overweight in large-capitalization stocks, and an absence of a self-correcting mean reversion mechanism. Market-cap-weighted indices merely reflect stock prices in a buy-and-hold portfolio, inhibiting a self-correcting mean reversion mechanism. Furthermore, markets are rarely in equilibrium, leading to aggravated price noise. In the last two decades, smart beta equity strategies-(which can carry names such as strategic beta or alternative beta) have become a topic of common interest among academia and global asset management practitioners as they have been acknowledged as a potential remedy to these problems. Smart beta strategies broadly vary according to their choice of factor tilt and the metrics they use to select stocks, their return objectives, their portfolio weighting methodology, and their rebalancing frequency. This study explores smart beta strategies' theoretical foundations, evolution, and future growth trajectory. According to our empirical findings, smart beta strategies showed some fatigue in delivering positive long-term performance relative to their benchmarks. Besides strategies favoring a tilt towards momentum factor, smart beta factor strategies registered a mediocre long-term performance. We pointed out the crowding effect (a by-product of the herding behavior) as the probable cause lying at the heart of this underperformance. It is pretty shocking that once the cornerstone of factor investing, the value factor has lost its appeal considerably due to massive drawdowns and the associated drought in portfolio returns. We expect to see further empirical research in the field testing the robustness of the systematic risks related to factors.

Keywords: Smart Beta, Strategic Beta, Alternative Beta, Fundamental Indexation

INTRODUCTION

Smart beta is a rules-based investment management methodology that aims to harvest risk premia on common equity risk factors-(other than market beta) while beating the risk-adjusted return of traditional market-cap-weighted indices. Perhaps some proponents may even see smart beta strategies as the answer to the well-researched and documented shortcomings of market capitalization-based equity indices.

The cap-weighted indices are typically plagued with price noise, a portfolio overweight in large-capitalization stocks, and an absence of a self-correcting mean reversion mechanism. Market-cap-weighted indices are a mere reflection of stock prices in a buy-and-hold portfolio, and markets are rarely in a state of equilibrium. Therefore, market value weights often incorporate a significant amount of price noise. For instance, price bubbles in US equity markets led to some unwanted sectoral bias in favor of telecom-(before 2000) and financials-(before 2008). As market-cap indices mimic a buy-and-hold portfolio, a self-correcting mean reversion mechanism does not exist. Hence, overvalued stocks can become overweighted within the index due to the inherent market capitalization weighting mechanism. In addition to this flaw, value stocks are also underrepresented under this scheme, further aggravating the problem. These shortcomings carry the potential of undermining the validity of the risk-return payoff of the traditional CAPM model, which uses the cap-weighted index as the market proxy, as evidenced by the CAPM tests.

In the last two decades, smart beta equity strategies-(which can carry names such as strategic beta or alternative beta) have become a topic of common interest among academia and global asset management practitioners. Smart beta strategies differ markedly according to their performance objective and the portfolio construction methodology. Some smart beta strategies are based on a single factor, while others employ a multi-factor approach. Some of them-(long-only smart beta strategies) aims to deliver a relative return to their parent benchmark. In contrast, some others aim to provide an absolute return using long-short strategies. Some use a simple asset weighting methodology, while others use highly sophisticated and often proprietary and therefore unique risk-based optimization systems for asset weighting. Hence, it can be asserted that smart-beta strategies broadly vary according to their choice of factor tilt and the metrics they use to select stocks, their return objectives, their portfolio weighting methodology, and their rebalancing frequency. This study explores smart beta strategies' theoretical foundations, evolution, and future growth trajectory.

LITERATURE REVIEW

The pioneering asset pricing model for stock returns, the Capital Asset Pricing Model (CAPM), was initially developed by Sharpe (1964) and Treynor (1961) and clarified and extended by Lintner (1965) and Mossin (1966). Harry Markowitz's (1952) "Modern Portfolio Theory" and James Tobin's (1958) "Theory of Liquidity Preference" have laid out the foundations for the Sharpe-Lintner CAPM.

In his seminal study, Markowitz (1952) illustrated that an investor's preference for uncertain portfolio returns could be represented by a mean-variance frontier, where the set of feasible portfolios for each expected return level has the lowest variance. According to Markowitz (1952), the efficient frontier is the portion of the mean-variance frontier that offers the highest expected returns for each variance level. Markowitz showed that investors' portfolio choices on the efficient frontier relate to their perception of risk aversion. Tobin (1958) demonstrated that the distribution of investors' wealth between cash and the optimal bond portfolio depends on their risk preferences.

CAPM requires a portfolio's expected return and risk to be linearly related, and the risk premiums on assets are proportional compared to their betas. CAPM framework defines risk in two categories; systematic risk and idiosyncratic risk. CAPM beta is the measure of the systematic risk that cannot be eliminated via diversification. CAPM dictates that investors should be compensated with returns for bearing this undiversifiable risk. According to CAPM, the market portfolio has the highest ratio of risk premium to its standard deviation. Therefore, no passive investor/manager can attain a better risk-adjusted return than the market portfolio.

Among other factors, the mean-variance efficiency of the market portfolio under the CAPM framework requires either the existence of unrestricted risk-free borrowing and lending(the Sharpe-Lintner CAPM) or unrestricted short selling of risky assets (the Black (1972) version of CAPM). Hence, the absence of unrestricted risk-free borrowing and lending and restrictions on short sales of risky assets put the efficient portfolio hypothesis at risk. Pointing out the discrepancies between real-life settings and the unrealistic assumptions of the CAPM framework, many academic studies challenge the CAPM prediction that (1) the market portfolio is mean-variance efficient, (2) there is a linear relationship between the expected returns on all assets and their market betas, and (3) no other variable has marginal explanatory power other than market beta.

A large body of academic research, which has been prevalent for over 40 years, has shown that common risk factors other than market beta can explain long-term equity portfolio performance. Theoretical studies on stock price anomalies were first conducted

fifty years ago. Numerous empirical tests on the CAPM framework reveal that not only the risk-return trade-off does not hold, but several variables other than beta add to the explanation of expected returns provided by market beta. For instance, Black, Jensen, and Scholes (1972) and Haugen and Heines (1972) documented that a positive relationship between risk and return across stocks is not plausible. Basu (1977) reported that low price/earnings portfolios earned more than that implied by their levels of risk, contrary to the predictions by the CAPM, and the high price/earnings portfolios earned less than that indicated by their levels of risk. Banz (1981) pointed out a visible size effect favoring small-capitalization stocks. When stocks are sorted according to their market capitalization, average returns on small stocks are considerably higher, contrary to what CAPM suggested. Statman (1980) and Rosenberg, Reid, and Lanstein (1985) documented that the relation between average return and the book-to-market ratio (B/M, the ratio of the common shareholder equity to its market capitalization) puts another blow to the CAPM conviction that the market portfolio is mean-variance efficient. High B/M stocks have registered high average returns as compared to their betas, and low B/M stocks have registered lower average returns than implied by their betas. Bhandari (1988) showed that the expected returns on common stocks are positively related to the debt/equity ratio, controlling for beta and firm size.

Academic Research on Common Risk Factors

Numerous academic studies argue that common equity risk factors can explain long-term portfolio performance. The pioneering work of Ross's (1976) "Arbitrage pricing theory" (APT) asserts that the expected return of a financial asset can be attributed to various macroeconomic factors. Ross's (1976) original model was named the "multi-factor model," which helped to popularize "factor" as a financial term. According to Ross (1976), a factor can be any variable that affects the expected return of an asset. Ross (1976) did not specify the factors to construct a factor model, leaving the challenge to empirical researchers. Another study amplifying this line of work was Barr Rosenberg and Vinay Marathe's (1976) theory. Rosenberg et al. (1976) found a direct relationship between macroeconomic events' effects on individual securities and microeconomic characteristics-essentially common factors. These factors could be industry membership, financial structure, or growth orientation.

Overwhelmingly, academic literature on CAPM considers the market the most critical equity factor. Beyond the market, any factors deemed necessary in explaining stock returns and risk should host some important traits like robustness over time and a broad explanatory

power over stocks. Research on common risk factors focused on three main categories: macroeconomic, statistical, and fundamental.

Chen, Ross, and Roll (1986) presented a multi-factor model incorporating a set of economic state variables that was assumed to have systematic influences on stock market returns. In their model, the macroeconomic state variables are selected as: the change in industrial production, the change in expected inflation, the change in unexpected inflation, and the risk premium on bonds (change in excess return in long-term corporate bonds over long-term government bonds) and the risk premium on term structure (change in excess return in long term government bonds over short term government bonds). They have found several macroeconomic variables to be significant in explaining expected stock returns. Most notably, industrial production, changes in the risk premium on bonds, twists in the yield curve, and relatively more weakly, changes in unanticipated inflation and changes in expected inflation during periods of high volatility were among these significant systematic macroeconomic factors.

Statistical factor models employ various maximum-likelihood and principal-components-based factor analyses (PCA) on cross-sectional and time-series security return data to identify the prevalent factors in returns.

On the other hand, fundamental factors seem to allure finance academia and asset management practitioners on a much grander scale. Fundamental factors often capture common stock characteristics like industry membership, country membership, and fundamental and accounting metrics used in stock valuations. The fundamental factors that were profoundly researched and therefore became popular among finance academia and practitioners were: Value, Growth, Size, and Momentum. In the last decade, growing interest in the field yielded some additions to this family of factors like low volatility, high yield, and quality.

A seminal study in this line of work was Eugene Fama and Kenneth French's research in the 90s. Fama and French (1992) showed that size, earnings-price, debt-equity, and book-to-market ratios captured covariances (systematic risks) missed by the market return. Fama and French's (1992) findings also confirm the evidence presented in numerous studies by Reinganum (1981), Stambaugh (1982), and Lakonishok and Shapiro (1986) that the relation between average return and beta tends to become flat, contrary to the convictions of CAPM. Fama and French (1993) proposed a three-factor model to capture the variation in average return for portfolios formed on size and book-to-market equity. The three-factor model used the "market" (based on the traditional CAPM model), the size factor (large vs. small-capitalization stocks), and the value factor (low vs. high book to market) as systematic risk

factors. The three-factor model successfully captured covariation in returns missed by the market return. It also picked up much of the size and value effects in average returns left unexplained by the classical CAPM framework.

Carhart (1997) added a momentum factor (the difference between the returns on diversified portfolios of short-term winners and losers) to the Fama-French three-factor model to reflect the momentum effect of Jegadeesh and Titman (1993) that was left unexplained by the three-factor model and the CAPM.

Fama and French (2015) added profitability and investment factors to the three-factor model to form a five-factor model, thereby capturing the cross-sectional variation in expected returns primarily related to profitability and investment left unexplained by the three-factor model. Their findings suggest that a five-factor model performs better than the three-factor model. However, the five-factor model fails to capture low average returns on small stocks with high investment and low profitability.

Researchers have studied diverse common equity factors in the past decades, ranging from financial statement measures like earnings revisions and accruals to technical indicators like volatility and relative strength (momentum). Out of these studies, the exceptional outperformance of low volatility stocks is worth mentioning as one of the puzzling anomalies in the equity markets. Significantly, the extraordinary volatility experienced during the last two global financial crises has amplified interest in low volatility anomalies. Among researchers that studied this anomaly, Fama and French (1992) showed a negative relationship between risk and returns, while Haugen and Baker (1991) observed a significant reduction in volatility with no apparent reduction in returns for US minimum variance portfolios. These studies have provided the foundation for introducing a low-risk investing approach to capitalize on the underlying systematic risk.

Various studies documented that common equity factors have exhibited excess returns above the market. Fama and French (1992) found that the average small-cap portfolio (averaged across all sorted book-to-market portfolios) earned monthly returns of 1.47%, while the average large-cap portfolio's returns were 0.90% from July 1962 to December 1990. The average high book-to-market portfolio (across all sorted-size portfolios) registered a monthly return of 1.63% compared to 0.64% for the average low book-to-market portfolios. In addition to historically exhibiting excess returns above the market, common equity factors were documented to account for a significant portion of mutual and institutional active fund returns. Empirical studies by Malkiel (1995), Gruber (1996), Wermers (2000, 2003), and Jones and Wermers (2011) confirm that the median active manager hardly

outperforms the cap-weighted benchmark if fees are considered. It is also shown that the outperformance on rare occasions can only be observed briefly and is not persistent.

Various studies also well documented that a substantial portion of active managers' returns over cap-weighted benchmarks come from tilts in portfolios toward well-known common equity factors such as Value and Size. Fama and French (2010) showed that mutual funds in the CRSP universe have underperformed in aggregate relative to the Fama-French factor benchmarks by the costs in expense ratios from 1984 to 2006. Ang, Goetzmann, and Schaefer's (2009) seminal study on the Norwegian Government Pension Fund's active returns also found that a significant portion of the fund's small active return can be attributed to systematic factors. Furthermore, Bender, Hammond, and Mok (2013) documented that nearly 50% of US institutional fund excess returns can be attributed to traditional Fama-French factors.

Another important line of work championing to replace market cap allocations with factor allocations was Arnott, Hsu, and Moore's (2005) groundbreaking study on fundamental indexation. Regarding a pool of CAPM tests rejecting the mean-variance efficiency of the cap-weighted indexes, Arnott et al. suggested that more efficient indexes exist. To back their claim, they assert that "Fundamental" equity market indexes carry the potential to deliver superior mean-variance performance as compared to cap-weighted equity market indexes. They documented that the fundamentals-weighted, non-capitalization-based indexes that use gross revenue, equity book value, gross sales, gross dividends, and cash flow as weights consistently provide higher returns and lower risks than the traditional cap-weighted equity market indexes while retaining many of the benefits of traditional cap-weighted indexing. When it was first introduced, the fundamental indexation technique received a warm welcome from the investment community. However, there existed some serious verbal opponents to their arguments as well. Among the opposition camp, Jun and Malkiel (2007) argued that the outperformance of fundamental indexation over that of traditional cap-weighted indices was simply due to a loading on factor tilts-namely the size and value "risk" factors and not originating from the strategy's ability to arbitrage the inefficiency of cap-weighted indexing. Burton Malkiel was a staunch proponent of traditional index investing at the time. His stance, however, changed dramatically back in 2017. He expressed that his old criticisms of smart-beta funds stemmed from the fact that they have relatively high expense ratios and tax consequences have been ignored. As these flaws have been rectified over time, he openly stated that he is no longer a staunch critic of fundamental indexation.

SMART BETA STRATEGIES

Types of Smart Beta Strategies

Smart beta strategies have been tested for decades for their persistency and have proven to be more efficient than market cap indices from a risk-return standpoint. Their returns are equal to or considerably higher than standard indices, while volatility and drawdowns are systematically lower. Smart beta strategies can either aim to capture a relative return performance compared to a benchmark (long-only strategies) or opt for an absolute return objective (long-short strategies). A long-only smart beta strategy involves constructing a portfolio tilted towards a common risk factor with the expectation that it will deliver a much higher return than its pre-determined benchmark. Although they are much simpler to implement than long-short alternatives, their benefits can be limited due to significant market exposure. Typically, smart beta strategies involve an investible smart-beta index either tilted towards a single factor or a group of factors (multi-factor factor indices). Hence, smart beta indices can use alternative index construction techniques to target one or more risk premia. A smart beta index might use the same constituents as the benchmark price index (weighted by size) but assign different weightings to its constituents to tilt the index portfolio towards the underlying common risk factor(s).

In contrast to a long-only strategy, a long-short strategy targets absolute returns, which are not measured against benchmarks. In these strategies, returns are generated irrespective of the general equity market conditions, which leads to greater exposure to the targeted common equity risk factor. Long-short smart beta strategies are often associated with hedge funds as they involve considerable leverage due to short positions. Long-short strategies may also include derivatives and other complex tools to capture absolute returns and therefore has a limited public audience. Due to the limited appeal of hedge fund products to retail and conservative institutional investors, smart beta strategies mainly flourished through the use of exchange-traded funds-(ETF). ETFs' rules-based, transparent and low-cost structure has paved the way for success for long-only smart beta strategies in tapping the factor investing universe.

Analysts consider smart beta a highly disciplined and rules-based form of active management. Smart beta exchange-traded and mutual funds are linked to indexes that make active bets via their factor traits against the broad market-cap-weighted benchmarks. They differ from active management because, unlike active managers, smart-beta funds cannot make portfolio adjustments. As their strategies are embedded into their benchmarks, from that perspective, they are strictly passive.

Smart Beta Index Providers and the Size of the ETF Industry

According to a report from Burton-Taylor International Consulting, the unabated boom in ETF assets helped index providers to enjoy a hefty revenue stream. The report shows that the index providers registered a record USD 5bn in revenue in 2021, and more than two-thirds of that revenue went to the three largest index providers. Among the trio, Morgan Stanley Capital International-(MSCI) took the lead collecting USD 1.3bn in revenue last year, and S&P Dow Jones Indices and FTSE Russell followed with USD 1.1bn and USD 1.1bn, respectively. The sector registered a 23 percent increase in revenue in 2021 compared to 2020. In the last five years, the sector's compounded annual growth rate was 11.7 percent, showing the sizeable fund flows targeting the ETF schemes in the US.

There were 8,500 ETFs globally with USD 10tn in assets, and US-domiciled ETFs had USD 7.3tn in assets as of December 31, 2021, according to Morningstar Direct. On the other hand, the smart beta ETFs accumulated USD 1.326tn assets under management as of July 31, 2021. Morningstar Direct reported that during the past three years, net new inflows into smart beta ETFs reached USD 224bn.

The Risk-Adjusted Return Performance of Smart Beta ETFs - A Case Study on MSCI

Although smart beta strategies have been stress tested for decades regarding their persistency in delivering a positive risk-adjusted return, some of the factors that were built around a theoretical risk premium may experience prolonged droughts. Some investment styles may fail at select macroeconomic backdrops and therefore remain out of favor, while others may flourish. Hence, we put to the test whether smart beta strategies have delivered a statistically significant positive risk-adjusted return compared to their benchmark in the long run. We used MSCI's proprietary smart beta indices as secondary data for the US and global equity markets between May 2001 and May 2022. Tables 1 and 2 show the return statistics for the select MSCI smart beta indices for the US and the global equity markets. As depicted by the statistics, the long-term risk-adjusted return performance of MSCI smart beta indices is far from satisfactory and even dismal in the case of US equity markets. The excessive volatility in excess returns can be blamed for this dismal performance. Apart from MSCI ACWI Momentum Index, where the excess returns are statistically significant, the global smart beta indices also registered a relatively poor performance. It is remarkable that once the cornerstone of factor investing, the value factor seems to manifest itself as a model for a prolonged drought in portfolio returns with its minute excess returns.

Table 1. The Return Statistics for MSCI Smart Beta Indices for the US Equity Markets

MSCI Indices between May 2001 - May 2022	Ending Index Value Base Index Value=100	Mean Return	St. Deviation Of Return	Geometric Mean Return	Mean Exc.Ret. vs. Reference-(pps)	Geo.Mean Exc.Ret. vs. Reference-(pps)	t-Statistic for Exc.Ret.	
US Equity Markets								
USA Standard (Large+Mid Cap) - **REFERENCE MARKET PORTFOLIO**	494.76	9.23%	16.62%	7.91%	-	-	-	
USA EQUAL WEIGHTED Standard (Large+Mid Cap)	580.75	10.34%	18.79%	8.74%	0.83	0.77	1.107	
MSCI USA HDY INDEX Standard (Large+Mid Cap)	539.08	9.26%	13.91%	8.35%	0.44	0.41	0.025	
USA MINIMUM VOLATILITY (USD) Standard (Large+Mid Cap)	547.08	9.17%	12.37%	8.43%	0.52	0.48	-0.035	
USA MOMENTUM Standard (Large+Mid Cap)	702.42	11.35%	17.48%	9.73%	1.82	1.68	1.413	
USA QUALITY Standard (Large+Mid Cap)	647.26	10.20%	14.01%	9.30%	1.39	1.29	0.910	
USA RISK WEIGHTED Standard (Large+Mid Cap)	650.02	10.50%	15.98%	9.32%	1.41	1.31	1.256	
USA VALUE WEIGHTED Standard (Large+Mid Cap)	498.34	9.50%	18.41%	7.95%	0.04	0.03	0.301	

Source: MSCI Data.
Note: *** p<0.01, ** p<0.05, * p<0.10.

Table 2. The Return Statistics for MSCI Smart Beta Indices for the Global Equity Markets

MSCI Indices between May 2001 - May 2022	Ending Index Value Base Index Value=100	Mean Return	St. Deviation Of Return	Geometric Mean Return	Mean Exc.Ret. vs. Reference-(pps)	Geo.Mean Exc.Ret. vs. Reference-(pps)	t-Statistic for Exc.Ret.	
Global Equity Markets								
ACWI Standard (Large+Mid Cap) - **REFERENCE MARKET PORTOLIO**	406.52	8.42%	17.91%	6.91%	-	-	-	
ACWI QUALITY Standard (Large+Mid Cap)	606.60	10.04%	15.24%	8.96%	2.06	1.92	1.349	
ACWI EQUAL WEIGHTED Standard (Large+Mid Cap)	528.04	10.07%	20.22%	8.25%	1.34	1.25	1.168	
ACWI MINIMUM VOLATILITY (GBP) Standard (Large+Mid Cap)	515.51	8.92%	13.06%	8.12%	1.22	1.14	0.293	
ACWI HIGH DIVIDEND YIELD Standard (Large+Mid Cap)	451.30	8.76%	16.79%	7.44%	0.53	0.50	0.300	
ACWI MOMENTUM Standard (Large+Mid Cap)	713.65	11.73%	19.28%	9.81%	2.90	2.72	2.416	**
ACWI RISK WEIGHTED Standard (Large+Mid Cap)	603.51	10.34%	17.72%	8.94%	2.03	1.90	1.425	
ACWI VALUE WEIGHTED Standard (Large+Mid Cap)	408.89	8.73%	19.88%	6.94%	0.03	0.03	0.330	

Source: MSCI Data.
Note: *** p<0.01, ** p<0.05, * p<0.10.

CONCLUSION

The Future of Smart Beta Strategies

Bender, J., Briand R., Melas D., and Subramanian R.A. (2013) bring up the question of persistency in risk premia excess returns in their seminal piece of literature review. According to Bender et al., two rivaling lines of thought have different explanations regarding the dynamics behind the "persistency" of factor returns. The first camp, which has firm adherence to the "systematic risk" perspective, presumes that a factor may persist indefinitely, provided that the underlying factor's return is the compensation for bearing its undiversifiable risk. The second line of thought favors the "behavioral bias" perspective, which sees that a factor can persist as long as investors willingly carry on with the behavioral biases in question and rational investors are hesitant to step in and arbitrage away the inefficiencies due to unfavorable cost-benefit trade-off. Melas, Briand, and Urwin (2011) point out that extreme popularity can crowd common equity factors by investors eager to capitalize on inefficiencies. With such pent-up demand, investors inevitably experience lower factor returns over time due to crowding. Hence, whatever camp an asset manager is in, it is straightforward that persistency in returns is very hard to maintain. The herd behavior in the asset management industry can swiftly eradicate mispricing opportunities.

Another reason for the crowding effect could be the substantial shift in the asset management industry from active to passive investment strategies. The shift toward passive investing is amplified by an increase in indexed investing, which carries the potential to dramatically change the valuations, returns, and liquidity of financial assets that are included in indexes. Anadu, Kenechukwu, Mathias Kruttli, Patrick McCabe, Emilio Osambela, and Chae Hee Shin (2018) argued that the unabated shift to passive management might have several effects on financial stability. Anadu et al. warned that some passive investing strategies, such as those used by long-short strategies, may amplify market volatility. They pointed out the detrimental effects of increased asset-management industry concentration. Finally, they brought to our attention the "index-inclusion" effects on assets in the indexes that may lead to more significant covariation in asset returns and liquidity.

Finally, it is vital to note that a prolonged period of accommodative monetary policies may end. An across-the-board increase in global interest rates, even a gradual one, will significantly affect asset valuations and liquidity. We have shown via a case study that although there is still a robust demand for factor investing products, the long-term risk-adjusted return potential of factor investing does not present itself as a flawless arbitrage mechanism. Perhaps, this was due to an overcrowded marketplace overflowing with funds hunting for yield. On the

other hand, the anticipation of rising interest rates may still work in favor of factor investing once again, as there are many defensive factor strategies at hand to cater to the needs of a stagflationary macroeconomic backdrop.

We see that empirical research in the field is both scarce and somewhat biased, perhaps due to the affiliations to the asset management industry. As the industry is getting bigger and at the same time becoming more concentrated, some clouding in judgments in sponsored academic studies seems inevitable. Hence, further unbiased empirical research (not sponsored by and connected to the asset management industry) is needed to uncover the actual dynamics underscoring the underperformance phenomena. It is especially crucial to see if overcrowding of investments leads to an arbitrage effect that helps to minimize mispricing spots and therefore acts as a means to test the robustness of systematic risks associated with risk factors.

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