BlackRock.

Systematic investing

Designed for a new frontier in data availability

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Summary

- Alternative data often refers to unstructured data, or data that defies the ability to be processed by traditional means due to its size and complexity. For this reason, big data holds a potentially limitless number of insights available to those equipped with the skill and capabilities to unlock them. For investors, this ability to "unlock" insights from the huge volume, high velocity and diverse collection of data sources has advanced the sensibility around a systematic approach in today's market.

- Systematic investing has been around for decades, with a long history and evolution, that began by optimizing the tradeoff between risk and expected return. A systematic approach employs the most recent forecasting techniques — statistical and economic analysis — which now includes the use of machine learning and artificial intelligence, rigorous thinking and economic intuition, applied on ever-transforming sources of data.

- A world of systematic investment opportunity is waiting to be uncovered in the next generation of alternative investments. If history repeats itself, systematic investing may transform the way we invest, as well as investor access to these assets, the same way systematic investing revolutionized investing in public markets.

- In this paper, we explore the origins of systematic investing, from first identifying the trade-off between risk and return to construct optimal investment portfolios, to the pure systematic alpha strategies of today that rely on an explosion of new and unstructured data.

Systematic origins

Systematic investing has a long history. At a high level, it applies systems, analysis, structure, and understanding — built on a foundation of available data — to the challenge of successfully managing investments. A hallmark of systematic investing is that it makes explicit the trade-off between risk and return in constructing optimal investment portfolios.

Some of these elements appear, for example, in Graham and Dodd's classic 1934 book, *Security Analysis*, written in the aftermath of the 1929 stock market crash. But all the elements finally began to converge with Harry Markowitz's *Portfolio Selection* in 1952 and subsequently the development of the Capital Asset Pricing Model (CAPM) by William Sharpe in 1964.[1] Markowitz proposed a mathematical definition of risk as the standard deviation of return, and suddenly investing was transformed into a precise optimization problem: Build investment portfolios (adjust the holdings) to trade off expected return against risk. Sharpe's CAPM explicitly connected an asset's expected return to a related risk measure, its covariation with the overall market. Those developments created a rigorous framework for investing. In 1971, they jumped from academia to practice with the launch of the first index fund by a division of Wells Fargo, a predecessor that is now part of BlackRock.[2] In 1990, Markowitz and Sharpe shared the Nobel prize in economic sciences.

Forecasting returns, systematically

In addition to index strategies, investors applied systematic insights in security selection to build portfolios that aimed to outperform the market — or in other words, to generate alpha. There were several differentiated features compared to traditional fundamental-based investing. First, the datasets had broad coverage across all types of stocks, rather than traditional fundamental approaches which used country-level or sector-specific insights. Second, although certain data might be publicly available, new methods of analyzing the data became a way to systematically generate alpha. Later, more proprietary datasets were used. Systematic alpha strategies were also informed by economic intuition — in fact, the reason behind the forecasting power of many quantitative alpha insights was that they were due to risk, market structure, investors' behavior, or market inefficiencies.[3]

The first systematic alpha strategies in the 1980s used accounting information: Balance sheets, earnings statements, and cashflow statements. Researchers found that valuation ratios, like price-to-book or earnings-to-price, forecasted both stocks' risk and returns. By 1985, Wells Fargo Investment Advisors had launched U.S. Alpha Tilts & Timing, a systematically managed active U.S. equity fund that attempted to outperform the S&P 500 Index by overweighting value, momentum, and smaller-sized stocks relative to the benchmark. Optimization methods balanced the return forecasts from these characteristics against the risk of deviating from the benchmark.

Fundamental vs systematic approaches

	Systematic	Fundamental
Breadth	Large, up to thousands of stocks	Narrower, with as few as a dozen stocks
Applicability of investment insights	Across sectors and countries	Within a sector or within a country
Unique research and insights	Machine learning and AI, proprietary data	On-the-ground company visits and communication with company management
Portfolio construction	Optimizes risk and return as part of the investment process	No optimization
Deviation from benchmark or tracking error	Generally smaller, 1-3% tracking error	Generally larger, up to or above 10-15% tracking error

Source: BlackRock, as of November 2023.

From those beginnings, it was off to the races. Index funds expanded to individual investors in the 1980s and 1990s — eventually surpassing retail active mutual funds.[4] Systematic active strategies also expanded significantly over this time, first from U.S. equities to UK and Japanese equities, and then to all traded equities.[5] The strategies also expanded from equities to currencies to fixed income. Beyond the expansion to new markets and new asset classes, systematic investing also evolved through the identification of new and useful data for predicting returns, for example analyst earnings forecasts and fundamental-based, non-price momentum measures. By 2007, at least $800 billion was invested in these strategies.

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1 Treynor (1961), Lintner (1965), and Mossin (1966) were on roughly the same track at the same time. **2** Bernstein. *Against the Gods: The Remarkable Story of Risk.* 1998.
3 Ang. *Asset Management: A Systematic Approach to Factor Investing.* 2014. **4** Wigglesworth. Trillions. 2021. **5** Kahn. *The Future of Investment Management.* 2018.

The current landscape of systematic investing

Today, systematic equity strategies can be categorized into *factor-based strategies* and *pure alpha strategies*.

Factor investing

Factor-based strategies (also called style factor investing) rely on some of the same initial return ideas of the original quantitative models in the 1980s — value, momentum, small size — plus return forecasts based on earnings quality and low volatility. These characteristics generate returns through risk premia, structural impediments, or behavioral anomalies.

A large academic literature, recognized by the Nobel prizes of Eugene Fama and Robert Shiller in 2013, has explored the economic rationales behind factor-based strategies. For example, value firms have historically exhibited higher returns than growth firms partly because value firms are more inflexible and hold more physical capital than growth firms, which causes value firms to tend to underperform during late-stage economic cycles. Investors willing to stay the course receive a premium for bearing cyclical losses in value strategies.[6] Stocks with high volatilities or high betas have historically underperformed the market because certain investors overweight more risky stocks to meet high return targets. This pushes up the prices of high volatility stocks, decreasing their expected returns.[7] As an example of behavioral biases, investors tend to under-react to information causing a continuation of trending prices — both up and down.[8] The economic intuition behind these style factors is the reason that these sources of return have persisted and remain compelling investments, even though some of them have diminished since their discovery.[9]

Factor styles

	Definition	Common metrics
Value	Cheap stocks relative to intrinsic or fundamental value	Price-to-book, Price-to-earnings
Size	Stocks with small market capitalization	Market cap
Momentum	Stocks with positive price trends	Past returns over the last 6- to 12-months
Quality	Stocks with high quality earnings	Earnings variability, accruals, profitability
Low volatility	Stocks with low volatilities	Standard deviation of idiosyncratic volatility

Source: BlackRock, as of November 2023.

A recent advance in factor investing is to time factors. Factors vary over the business cycle, with more defensive factors like quality and minimum volatility outperforming in late business cycles and contractions, while pro-cyclical factors like value and size outperforming during early-stage recoveries. Momentum tends to do well when expansionary trends are more well established. Valuation and sentiment indicators also forecast factor returns.[10]

Systematic researchers have also used more proprietary insights to complement, or in some cases replace, traditional factor metrics. With a very challenging environment for value over 2018-2020, researchers explored other estimates of fundamental value instead of accounting book or asset values. Newer measures of fundamental value aim to capture intangible capital, which is not usually observed in accounting statements — like patents and trademarks.[11] Some new non-financial quality metrics include carbon emissions and corporate culture.[12]

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6 See Cochrane (1996) and Zhang (2005). **7** See Ang, Hodrick, Xing, and Zhang (2006) and Baker, Bradley (2011). **8** See Hong and Stein (1999). **9** See Mclean and Pontiff (2016), Ang, Hogan, and Shores (2017), and Ang (2023). **10** See Hodges, Hogan, Peterson, and Ang (2017). **11** See Lee, Teng, Wei, and Zhang (2019) and Hsu, Li, Teoh, and Tseng (2022). **12** See Chan, Hogan, Schwaiger, and Ang (2020) and Kazden, Schwaiger, Wendt, and Ang (2021).

Systematic alpha

Pure alpha strategies rely on the explosion of new and unstructured data, plus the latest advances in machine learning and AI to forecast returns. Systematic alpha strategies aim to generate performance in excess of market index and style factors.

In contrast to style factors, the performance of pure alpha strategies is expected to decay, sometimes to zero, because they are based on informational advantages that are often temporary: Identifying return-relevant insights other investors have yet to discover or opportunities in inefficient markets that have not yet been arbitraged away.[13] There are two information advantages for systematic pure alpha strategies: Unique data or unique ways to analyze data.

Proprietary data are not available to all market participants. Some examples of proprietary data sources include broker reports, foreign languages sources, point-of-interest building or infrastructure information, or biographic information of company managers. At some future time, these data may become available to more market participants which will cause the efficacy of pure alpha strategies based on these types of proprietary data to decrease.

Even if the data becomes public, proprietary methods of analyzing that information may continue to generate alpha. Put another way, cutting-edge techniques, which are not used by most market participants, can represent an information advantage. While large language models (LLMs) have recently captured the attention of the public with the release of ChatGPT in November 2022, using LLMs for return prediction is not yet in the toolkit of most investors. In BlackRock Systematic, LLMs are applied on broker reports to estimate sentiment — an evolution of natural language processing techniques that began in 2013 with simple counting of positive or negative words. The chart below illustrates the volume of BlackRock's Systematic Equity team's machine-read broker reports over time.

+100K broker reports machine read monthly
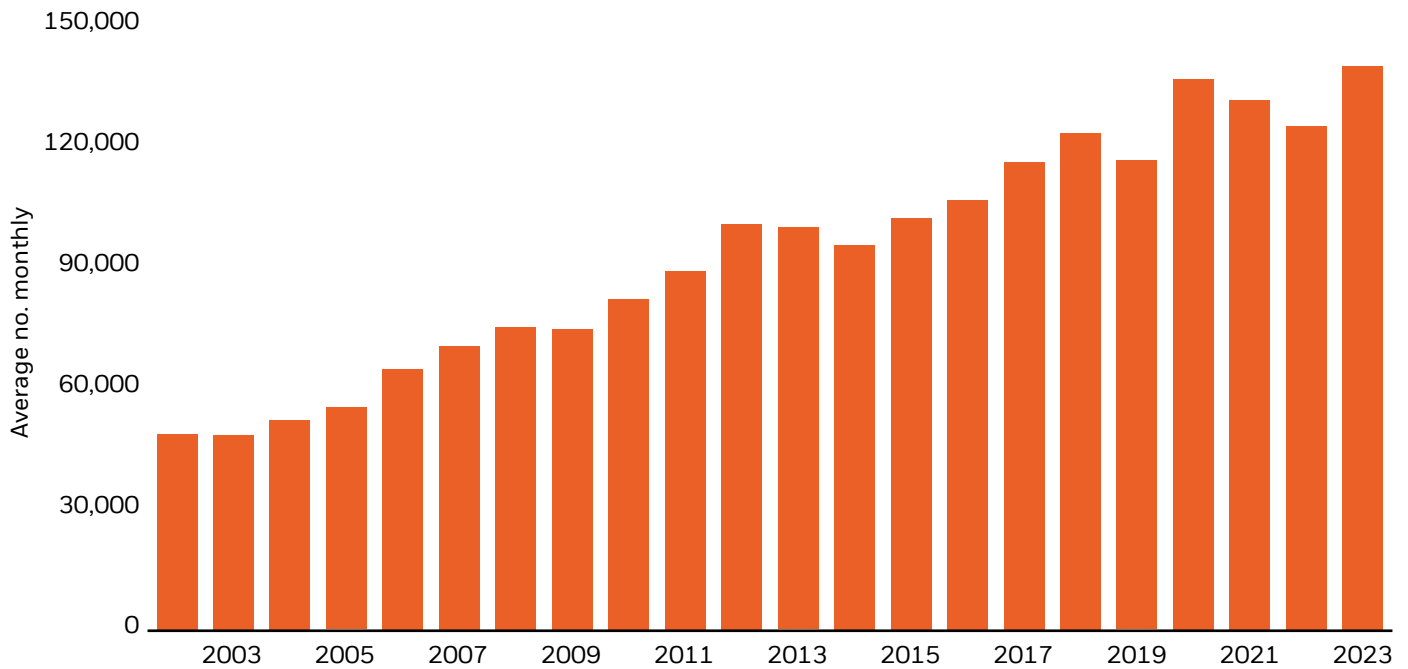
Source: BlackRock, as of August 2023.

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13 Grinold and Kahn. *Active Portfolio Management.* 1999.

New frontiers

Today, systematic investment strategies are poised to expand even further, from integrating sustainability as a component of alpha, to better identifying thematic baskets of unrelated securities, to applying a systematic approach to adjacent asset classes like private equity and private real estate. In private markets, sourcing attractive deals has long been relationship-based. The breadth and depth of personal networks have determined a manager's investment opportunity set. Today, data science techniques have helped democratize access, allowing pioneering managers to look beyond their network and proactively detect attractive company characteristics using predictive models. In the following section, we review these new frontiers for systematic investors.

Sustainable investing

Sustainability — and its related areas of transition to a lower carbon economy, ESG, or investments aligning with UN Sustainable Development Goals (UN SDGs) — is a large opportunity for systematic investing. Sustainable or ESG data is often a type of alternative data. Or, if ESG data is unstructured, it may require proprietary methods of analysis.

The fact that a data set or signal is related to sustainability does not mean that it is relevant for forecasting returns. In fact, academic research has found that sometimes the opposite of a desirable real-world ESG outcome is related to lower returns. A framework in sustainable reporting is "double materiality" — where a firm considers how risks linked to sustainability issues could be material to its business operations and how the firm's activities may affect society or the environment in a material way. Likewise, systematic investors at BlackRock have extended a framework that systematic ESG data or signals should forecast returns to a framework that the same ESG data or signals measure or help contribute to a real-world sustainable outcome. This is called the "Double Bottom Line" framework.

As an example of the Double Bottom Line, systematic researchers at BlackRock have found that a portfolio of companies with a high proportion of Leadership in Energy and Environment Design (LEED)-certified buildings has historically outperformed the market.[14] These companies tend to exhibit high efficiency metrics, like return-on-assets, and occupying or owning LEED-certified buildings can reduce company expenses. At the same time, LEED-certified buildings are, by definition of having been awarded the certification, more environmentally friendly.

An important consideration in sustainability is greenwashing, which refers to companies making unsubstantiated claims about their sustainable practices. BlackRock Systematic research has shown that companies with ESG-friendly policies, which tend to have had historically higher weights in ESG indexes, may also have higher regulatory and reputational controversies.[15] Careful, systematic analysis of data can help investors to forecast higher returns which may also be associated with positive social outcomes.

Private equity investing

At first glance, private equity seems quite a stretch for systematic investing. While systematic strategies have long been applied to small cap growth stocks, and such stocks share many characteristics with private growth equity (late-stage private companies),[16] the challenges are significant:

• Liquidity is very low. Establishing a position often involves investing during a round of fund-raising which requires several meetings and due diligence. This involves much more than pressing a button on a screen.

• Pricing is problematic, with the best reads only occurring at funding rounds. The standardized financial statements we rely on for public companies do not exist.

There are opportunities, however. Many alternative datasets, for example job postings, include private company information. It is a positive sign when companies increase hiring, whether they are public or private. We can hence apply some of our small cap growth stock insights toward private companies. Advanced forecasting techniques (machine learning) can harness those data to provide views on every private company.

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14 Kazdin, Schwaiger, Wendt, and Ang (2021). **15** Garvey, Kazdin, La Fond, Nash, and Safad (2017). **16** See Ang, Chen, Goetzmann, and Phalippou (2018).

Here is one concrete example applying the rigor of systematic investing to privates. First, focus on forecasting things we can observe, i.e., not returns. We can observe positive outcomes,[17] i.e., exits — IPOs and acquisitions — and so we can build systematic models to forecast the probability of such a positive outcome in the next several years. Systematic investors at BlackRock have deployed such models. A private company chosen at random has about a 41% chance of a positive outcome in seven years. The forecasting model can raise that to 79%. As currently implemented, systematic investors partner with fundamental private equity investors who target their research and due diligence on the companies most likely to have positive outcomes.

Data–driven information advantage

Terabytes of data processed every month				
10 million VC transaction data points created or updated	**25,000+** Active VC investors	**8 million** News articles	**140,000** Broker reports per month	**~3-5 million** Google search interest data points[18]

Breadth
Ability to **identify more growth equity opportunities** than a traditional sourcing process

Speed
Proactive identification of disruptive companies before they are recognized by the broader markets

Certainty
More than a quant screen — the systematic model assigns a **probability of success** to each potential opportunity

Probability of exit[19]

41% — Model universe

79% — Systematic model[20]
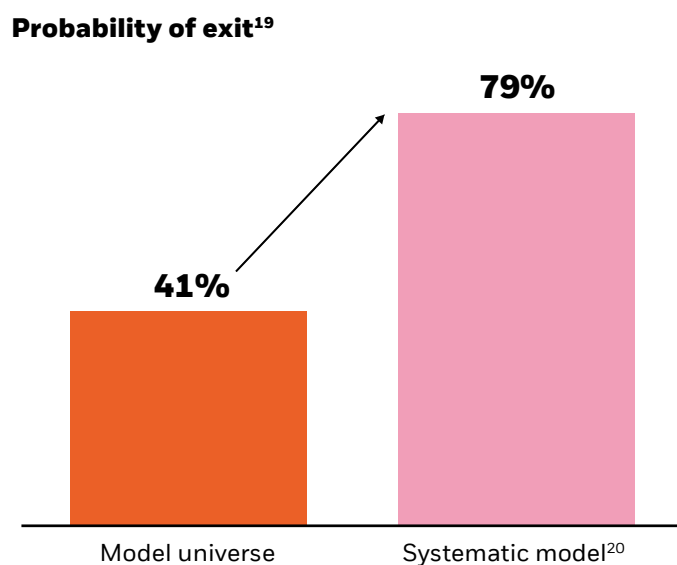
The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results and should not be the sole factor of consideration when selecting a product or strategy. Source: BlackRock, as of June 30, 2023.

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17 We often do not have enough information to judge how positive these outcomes are. For example, we seldom know the acquisition price. Here, we are equating exits of any sort with positive outcomes. **18** Refers to number of Google search interest values processed for the growth equity universe per month. **19** Representative of aggregate success rate across the investable universe. Success is defined as the probability of an exit (IPO or acquisition) within 6 years of investment. **20** The "systematic model" figure invests in the top scoring companies that are derived from the model. The model seeks to achieve a higher rate of success for predicting IPO or M&A as illustrated in the figure above. The model selection success rate is being provided for illustrative purposes only as a hypothetical example of what the model seeks to potentially achieve. The information is not a prediction of future performance of any investments selected by the model and does not represent any actual success rates of the model.

Extract themes and related companies
Examples of LLM big data insights

We leverage data science and advanced statistical techniques to parse massive troves of data daily

1,000,000+
financial news articles per year

5,000+
earnings call transcripts every quarter

1,000+
broker baskets and thematic funds

We turn unstructured textual information into meaningful relationships across stocks and themes

"**We are increasing R&D into our hardware focus on electric vehicles, with a specific goal of increasing battery charging capacity by 20%"**

– Quarterly Earnings Call for Company A[21]

"**Company B signs multi-year partnership to supply semiconductors to leading electric vehicle manufacturers"**

– Financial News Provider[21]

Source: BlackRock as of October 31, 2023.

Thematic investing

New quantitative methods can identify emerging themes that drive commonalities in stock returns. A hallmark of themes is that they are time varying, and often connect generally unrelated groups of stocks — like Covid in 2020 driving up the returns of growth-oriented technology stocks and simultaneously driving down the returns of retailers relying on consumer foot traffic.

By nature, themes are often generated from investors' attention that can be picked up in news, conference calls, social media, web searchers, and a variety of other unstructured and alternative data. Natural language processing techniques can identify common topics across these different types of data, and the flow of information can dictate a theme's development, relevance, and lifespan. Fund flows and baskets of stocks recommended by brokers also are useful to seed data-driven search for potential themes. After the themes are identified, the attractiveness of each theme can be assessed using valuations, sentiment, flows, and other insights.

With the arrival of LLMs, there are even more opportunities to use systematic techniques to identify emerging themes, as LLMs can summarize and synthesize very large amounts of information. These information

sets can include publicly available information, like multi-modal media, but also proprietary information. Different LLMs, often with a human in the loop, can distill large amounts of information into key investment themes, and those themes can then be used to generate appropriate baskets of stocks to take long or short positions. This process can be iteratively done to refine the thematic baskets, and to identify new themes.

Conclusion

With the publication of mean-variance investing in the 1950s, systematic investing is now over 80 years old. Throughout its long history, it has been characterized by employing the most recent forecasting techniques — statistical and economic analysis to now including machine learning and artificial intelligence, rigorous thinking and economic intuition, all applied on ever-expanding sources of data. Now a mainstay of public market investing through index, factors, and pure alpha strategies, there is a world of opportunities of systematic investing in the next generation of alternative markets applications. If history repeats from the way systematic investing changed traditional investing in public markets, these new areas will also be transformed as systematic investing is more widely adopted.

21 For illustrative purposes only and subject to change. Examples are hypothetical and reflect sample natural language processing which searches for keywords in financial news, earnings transcripts, broker research, broker baskets and other data points.

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