BlackRock®

Systematic investing

Designed for a new frontier in data availability

Raffaele Savi
Global Head of
BlackRock Systematic

Ronald Kahn, PhD
Global Head of Systematic
Active Equity Research

Tom Parker, CFA
Chief Investment Officer of
Systematic Fixed Income

Jeff Shen, PhD
Co-CIO and Co-Head of
Systematic Active Equity

Summary

- “Big 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 a timing and tilting strategy, 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
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	Minimal 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 Systematic, as of March 2026.

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 USD was invested in these strategies.

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.* 2014. **4** Wigglesworth. *Trillions.* 2021. Expansion measured by number of systematic funds. **5** Ron 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 tend to 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 Systematic, as of March 2026.

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]

6 See Cochrane (1996) and Zhang (2005). **7** See Baker, Bradley and Wurgler (2011) and Ang (2014). **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).

BSYS0526-5333032-EXP0527-4/11

Systematic alpha

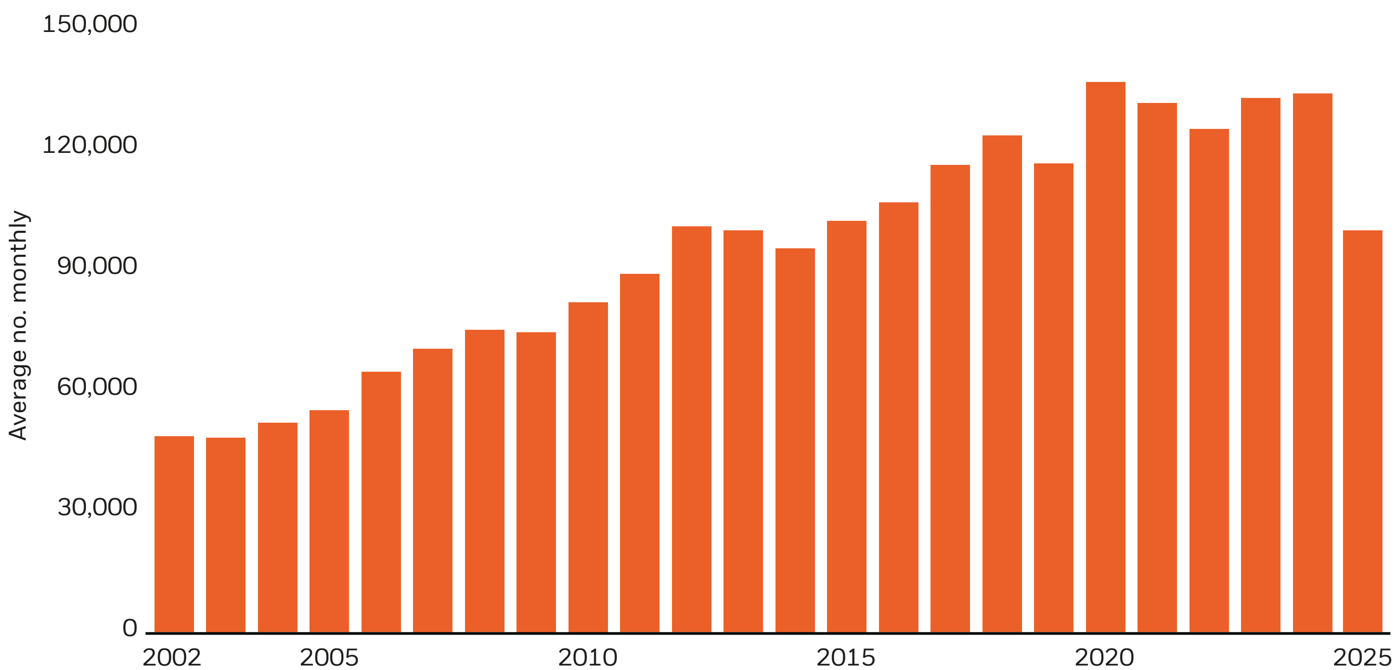
Pure alpha strategies rely on the explosion of new and unstructured data (sometimes called *alt data*), plus the latest advances in machine learning and AI to forecast returns. Systematic alpha strategies aim to generate performance in excess of market index and style factors.

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:[13] Seeking an information advantage requires investors to identify return-relevant insights or opportunities in inefficient markets that have not yet been arbitraged away.[14] There are two information advantages for systematic pure alpha strategies: Unique data or unique ways to analyze data.

Proprietary data is 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) captured the attention of the public, 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 March 1, 2026.

13 Di Mascio, Rick and Lines, Anton and Naik, Narayan Y., Alpha Decay and Institutional Trading (November 21, 2017). Available at SSRN: https://ssrn.com/abstract=2580551 or http://dx.doi.org/10.2139/ssrn.2580551. **14** Grinold and Kahn. *Active Portfolio Management*. 1999.

New frontiers

Systematic investment strategies are set to expand further. Today's strategies include using text analysis to extract macro signals, leveraging LLMs to identify thematic baskets of indirectly related securities, and applying AI and machine learning within illiquid asset classes like private equity and private real estate. In the past, sourcing attractive deals was largely dependent on the breadth and depth of a manager's personal networks. 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'll review these new frontiers for systematic investors.

Fixed income investing

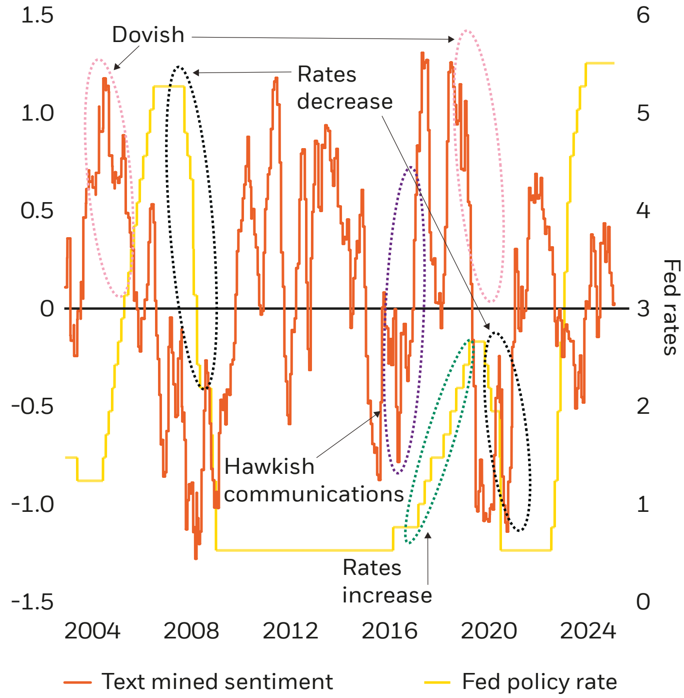
Traditional fundamental data and economist forecasts for growth and inflation can often be slow-moving, and central bank language can be highly specific. This presents a challenge for fixed income investors who need to quickly parse through data and uncover relevant investment insights. However, the new generation of large language models offers novel solutions to these age-old problems. Implementing these models systematically in the fixed income investment process can potentially alleviate time constraints and data limitations that may hinder forecasts.

Using text analysis techniques, systematic investors can extract macro text signals on growth, inflation and central bank sentiment. Investors can detect relevant changes through third-party analysis by examining sources such as news, broker reports, or direct communications from central banks. Information from these sources is then coalesced to measure sentiment and general risk appetite in the macro-economic environment.

Systematic investors have applied these techniques by using text analysis to train proprietary models. These models pick up on nuances in policy rate language and extract context-aware clues such as key topics and discussion points. Analytical frameworks can then detect these clues and generate sentiment forecasts accordingly. Combining these signal insights with other macro signals can further strengthen the depth and conviction of macro models.

Central bank policy forecasts based on text mined signals

Communication generally leads to policy moves



Source: BlackRock Systematic as of December 31, 2024. For illustrative purposes only.

Additionally, online prices have gained the attention of investors seeking new methods of data collection. Web scraping offers an opportunity to leverage alternative data available across the web to create more timely inflation forecasts. For instance, investors can use web-scraping techniques to assess prices that inform inflation signals. Food prices, a significant component of the CPI, can be used to measure inflation in day-to-day consumer living expenses. Data can be gathered from online retailers and used to build bottom-up forecasts. The higher frequency of data collection provides investors with a time advantage, as official CPI reports are typically published monthly. The granularity and near real-time assessment of this data enables investors to track underlying drivers and trends in price inflation, informing inflation forecasts.

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),[15] 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.

Investors can hence apply some small cap growth stock insights toward private companies. Advanced forecasting techniques (machine learning) can harness those data to provide views on every private company.

Here is one concrete example applying the rigor of systematic investing to private markets. First, the focus is on forecasting observable outcomes rather than returns. Positive outcomes — such as exits via IPOs or acquisitions — can be measured, therefore, systematic models can be leveraged to estimate the probability of such events over a multi-year horizon.

Research in this area has shown that a private company chosen at random may have roughly a 41% chance of a positive outcome over seven years, while systematic model-based approaches can significantly improve this probability by roughly 79%. In practice, these systematic insights can be combined with fundamental private equity analysis, helping investors prioritize research and due diligence on companies with a higher likelihood of positive outcomes.[16]

Baseline vs. model-conditioned outcomes

Data-driven information advantage

Terabytes of data processed every month

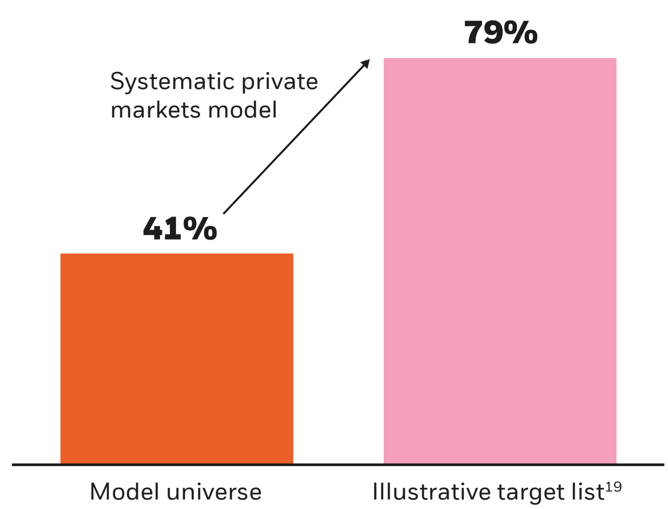
10 million	25,000+	8 million	140,000	~3-5 million
VC transaction data points created or updated	Active VC investors	News articles	Broker reports per month	Google search interest data points[17]

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[18]



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 December 31, 2025.

15 See Ang, Chen, Goetzmann, and Phalippou (2018). **16** Source: BlackRock Systematic, as of March 31, 2026. **17** Refers to number of Google search interest values processed for the growth equity universe per month. **18** 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. **19** The "Illustrative Target List" 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[20]

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

- Financial News Provider[20]

Source: BlackRock as of December 31, 2025.

Thematic investing

New quantitative methods can identify both direct and indirect relationships to relevant and emerging themes driving 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 create a persistent flow of news — they are topics that can be picked up in news, conference calls, social media, web searches, and a variety of other unstructured and alternative data. Leveraging this volume of textual sources, one can use natural language processing techniques to identify common topics and to quantify the flow of information dictating a theme's 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 over 75 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.

20 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.

BSYS0526-5333032-EXP0527-8/11

BlackRock: This document is marketing material: Before investing please read the Prospectus and the PRIIPs KID available on www.blackrock.com/it, which contain a summary of investors' rights.

Capital at risk. The value of investments and the income from them can fall as well as rise and are not guaranteed. Investors may not get back the amount originally invested.

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. Index returns are shown for illustrative purposes only. It is not possible to invest directly in an index. Forecasts are based on estimates and assumptions. There is no guarantee that they will be achieved.

Changes in the rates of exchange between currencies may cause the value of investments to diminish or increase. Fluctuation may be particularly marked in the case of a higher volatility fund and the value of an investment may fall suddenly and substantially. Levels and basis of taxation may change from time to time.

This material is provided for educational purposes only and is not intended to be relied upon as a forecast, research or investment advice, and is not a recommendation, offer or solicitation to buy or sell any securities or to adopt any investment strategy. The opinions expressed are subject to change. References to specific securities, asset classes and financial markets are for illustrative purposes only and are not intended to be and should not be interpreted as recommendations. Reliance upon information in this material is at the sole risk and discretion of the reader. The material was prepared without regard to specific objectives, financial situation or needs of any investor.

This material may contain "forward-looking" information that is not purely historical in nature. Such information may include, among other things, projections, forecasts, and estimates of yields or returns. No representation is made that any performance presented will be achieved by any BlackRock Funds, or that every assumption made in achieving, calculating or presenting either the forward-looking information or any historical performance information herein has been considered or stated in preparing this material. Any changes to assumptions that may have been made in preparing this material could have a material impact on the investment returns that are presented herein. 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.

The information and opinions contained in this material are derived from proprietary and nonproprietary sources deemed by BlackRock to be reliable, are not necessarily all-inclusive and are not guaranteed as to accuracy.

In the U.S., this material is for Institutional use only – not for public distribution.

In Canada, this material is intended for permitted clients only, is for educational purposes only, does not constitute investment advice and should not be construed as a solicitation or offering of units of any fund or other security in any jurisdiction.

This material is for distribution to Professional Clients (as defined by the Financial Conduct Authority or MiFID Rules) only and should not be relied upon by any other persons.

In the UK and Non-European Economic Area (EEA) countries: This is issued by BlackRock Investment Management (UK) Limited, authorised and regulated by the Financial Conduct Authority. Registered office: 12 Throgmorton Avenue, London, EC2N 2DL. Tel: + 44 (0)20 7743 3000. Registered in England and Wales No. 02020394. For your protection telephone calls are usually recorded. Please refer to the Financial Conduct Authority website for a list of authorised activities conducted by BlackRock.

In the European Economic Area (EEA): This is issued by BlackRock (Netherlands) B.V. is authorised and regulated by the Netherlands Authority for the Financial Markets. Registered office Amstelplein 1, 1096 HA, Amsterdam, Tel: 020–549 5200, Tel: 31-20-549-5200. Trade Register No. 17068311. For your protection telephone calls are usually recorded.

For qualified investors in Switzerland: This document is marketing material. This document shall be exclusively made available to, and directed at, qualified investors as defined in the Swiss Collective Investment Schemes Act of June 23, 2006, as amended.

For investors in Italy: This document is marketing material: Before investing please read the Prospectus and the PRIIPS available on www.blackrock.com/it, which contain a summary of investors' rights. For information on investor rights and how to raise complaints please go to https://www.blackrock.com/corporate/compliance/investor-right available in Italian.

For investors in Israel: BlackRock Investment Management (UK) Limited is not licensed under Israel's Regulation of Investment Advice, Investment Marketing and Portfolio Management Law, 5755-1995 (the "Advice Law"), nor does it carry insurance thereunder.

In South Africa, please be advised that BlackRock Investment Management (UK) Limited is an authorized financial services provider with the South African Financial Services Board, FSP No. 43288. In the Abu Dhabi Global Market (ADGM), the information contained in this document is intended strictly for Professional Clients. BlackRock Advisors (UK) Limited-ADGM Branch is a Branch of a Foreign Company registered with the Abu Dhabi Global Market Registration Authority (Registered number 21523), with its office at Floor 25, Al Sila Tower, Abu Dhabi Global Market Square, Al Maryah Island, Abu Dhabi, UAE, and is regulated by the ADGM Financial Services Regulatory Authority ("FSRA") to engage in the regulated activities of 'Arranging Deals in Investments'; 'Advising on Investments or Credit' 'Managing Assets'; and 'Managing in a Collective Investment Fund' (FRSA Reference 240099).

In the DIFC, this material can be distributed in and from the Dubai International Financial Centre (DIFC) by BlackRock Advisors (UK) Limited — Dubai Branch which is regulated by the Dubai Financial Services Authority (DFSA). This material is only directed at 'Professional Clients' and no other person should rely upon the information contained within it. Blackrock Advisors (UK) Limited-Dubai Branch is a DIFC Foreign Recognised Company registered with the DIFC Registrar of Companies (DIFC Registered Number 546), with its office at Unit L15-01A, ICD Brookfield Place, Dubai International Financial Centre, PO Box 506661, Dubai, UAE, and is regulated by the DFSA to engage in the regulated activities of 'Advising on Financial Products' and 'Arranging Deals in Investments' in or from the DIFC, both of which are limited to units in a collective investment fund (DFSA Reference Number F000738).

In the Kingdom of Saudi Arabia, issued by BlackRock Saudi Arabia, authorised and regulated by the Capital Market Authority (License Number 18-192-30). Registered office: 7976 Salim Ibn Abi Bakr Shaikan St, 2223 West Umm Al Hamam District Riyadh, 12329 Riyadh, Kingdom of Saudi Arabia, Tel: +966 11 838 3600. CR No, 1010479419. For your protection telephone calls are usually recorded. Please refer to the Capital Market Authority website for a list of authorised activities conducted by BlackRock Saudi Arabia. You may only reproduce, circulate and use this document (or any part of it) with the consent of BlackRock.

In the United Arab Emirates, this material is only intended for Professional Investors only. Neither the DFSA or any other authority or regulator located in the GCC or MENA region has approved this information.

In the Sultanate of Oman, to sophisticated institutions who have experience in investing in local and international securities, are financially solvent and have knowledge of the risks associated with investing in securities.

In Latin America, for institutional investors and financial intermediaries only (not for public distribution). This material is for educational purposes only and does not constitute investment advice or an offer or solicitation to sell or a solicitation of an offer to buy any shares of any fund or security and it is your responsibility to inform yourself of, and to observe, all applicable laws and regulations of your relevant jurisdiction. If any funds are mentioned or inferred in this material, such funds may not been registered with the securities regulators of Argentina, Brazil, Chile, Colombia, Mexico, Panama, Peru, Uruguay or any other securities regulator in any Latin American country and thus, may not be publicly offered in any such countries. The securities regulators of any country within Latin America have not confirmed the accuracy of any information contained herein. No information discussed herein can be provided to the general public in Latin America. The contents of this material are strictly confidential and must not be passed to any third part.

In Argentina, only for use with Qualified Investors under the definition as set by the Comisión Nacional de Valores (CNV).

In Chile, the securities if any described in this document are foreign securities, therefore: i) their rights and obligations will be subject to the legal framework of the issuer's country of origin, and therefore, investors must inform themselves regarding the form and means through which they may exercise their rights; and that ii) the supervision of the Commission for the Financial Market (Comisión para el Mercado Financiero or "CMF") will be concentrated exclusively on compliance with the information obligations established in General Standard No. 352 of the CMF and that, therefore, the supervision of the security and its issuer will be mainly made by the foreign regulator.

In the case of a fund not registered with the CMF is subject to General Rule No. 336 issued by the SVS (now the CMF). The subject matter of this sale may include securities not registered with the CMF; therefore, such securities are not subject to the supervision of the CMF. Since the securities are not registered in Chile, there is no obligation of the issuer to make publicly available information about the securities in Chile. The securities shall not be subject to public offering in Chile unless registered with the relevant registry of the CMF.

In Colombia, the promotion of each product discussed herein is carried out through the Representative Office of BlackRock Fund Advisors, authorized by the Colombian Financial Superintendence. The transmission of this information does not constitute a securities public offering in Colombia. The products discussed herein may not be promoted or marketed in Colombia or to Colombian residents unless such promotion and marketing is made in compliance with Decree 2555 of 2010 and other applicable rules and regulations related to the promotion of foreign financial and/or securities related products or services in Colombia. With the receipt of these materials, and unless the Client contacts BlackRock with additional requests for information, the Client agrees to have been provided the information for due advisory required by the marketing and promotion regulatory regime applicable in Colombia.

IN MEXICO, FOR INSTITUTIONAL AND QUALIFIED INVESTORS USE ONLY. INVESTING INVOLVES RISK, INCLUDING POSSIBLE LOSS OF PRINCIPAL. THIS MATERIAL IS PROVIDED FOR EDUCATIONAL AND INFORMATIONAL PURPOSES ONLY AND DOES NOT CONSTITUTE AN OFFER OR SOLICITATION TO SELL OR A SOLICITATION OF AN OFFER TO BUY ANY SHARES OF ANY FUND OR SECURITY. This information does not consider the investment objectives, risk tolerance or the financial circumstances of any specific investor. This information does not replace the obligation of financial advisor to apply his/her best judgment in making investment decisions or investment recommendations. It is your responsibility to inform yourself of, and to observe, all applicable laws and regulations of Mexico. If any funds, securities or investment strategies are mentioned or inferred in this material, such funds, securities or strategies have not been registered with the Mexican National Banking and Securities Commission (Comisión Nacional Bancaria y de Valores, the "CNBV") and thus, may not be publicly offered in Mexico. The CNBV has not confirmed the accuracy of any information contained herein. The provision of investment management and investment advisory services ("Investment Services") is a regulated activity in Mexico, subject to strict rules, and performed under the supervision of the CNBV. These materials are shared for information purposes only, do not constitute investment advice, and are being shared in the understanding that the addressee is an Institutional or Qualified investor as defined under Mexican Securities (Ley del Mercado de Valores). Each potential investor shall make its own investment decision based on their own analysis of the available information. Please note that by receiving these materials, it shall be construed as a representation by the receiver that it is an Institutional or Qualified investor as defined under Mexican law. BlackRock México Operadora, S.A. de C.V., Sociedad Operadora de Fondos de Inversión ("BlackRock México Operadora") is a Mexican subsidiary of BlackRock, Inc., authorized by the CNBV as a Mutual Fund Manager (Operadora de Fondos), and as such, authorized to manage Mexican mutual funds, ETFs and provide Investment Advisory Services. For more information on the Investment Services offered by BlackRock Mexico, please review our Investment Services Guide available in www.blackrock.com/mx. This material represents an assessment at a specific time and its information should not be relied upon by the you as research or investment advice regarding the funds, any security or investment strategy in particular. Reliance upon information in this material is at your sole discretion. BlackRock México is not authorized to receive deposits, carry out intermediation activities, or act as a broker dealer, or bank in Mexico. For more information on BlackRock México, please visit: www.blackrock.com/mx. BlackRock receives revenue in the form of advisory fees for our advisory services and management fees for our mutual funds, exchange traded funds and collective investment trusts. Any modification, change, distribution or inadequate use of information of this document is not responsibility of BlackRock or any of its affiliates. Pursuant to the Mexican Data Privacy Law (Ley Federal de Protección de Datos Personales en Posesión de Particulares), to register your personal data you must confirm that you have read and understood the Privacy Notice of BlackRock México Operadora. For the full disclosure, please visit www.blackrock.com/mx and accept that your personal information will be managed according with the terms and conditions set forth therein.

In Peru, this private offer does not constitute a public offer, and is not registered with the Securities Market Public Registry of the Peruvian Securities Market Commission, for use only with institutional investors as such term is defined by the Superintendencia de Banca, Seguros y AFP.

In Uruguay, the securities are not and will not be registered with the Central Bank of Uruguay. The Securities are not and will not be offered publicly in or from Uruguay and are not and will not be traded on any Uruguayan stock exchange. This offer has not been and will not be announced to the public and offering materials will not be made available to the general public except in circumstances which do not constitute a public offering of securities in Uruguay, in compliance with the requirements of the Uruguayan Securities Market Law (Law Nº 18.627 and Decree 322/011).

For investors in Central America, these securities have not been registered before the Securities Superintendence of the Republic of Panama, nor did the offer, sale or their trading procedures. The registration exemption has made according to numeral 3 of Article 129 of the Consolidated Text containing of the Decree-Law No. 1 of July 8, 1999 (institutional investors). Consequently, the tax treatment set forth in Articles 334 to 336 of the Unified Text containing Decree-Law No. 1 of July 8, 1999, does not apply to them. These securities are not under the supervision of the Securities Superintendence of the Republic of Panama. The information contained herein does not describe any product that is supervised or regulated by the National Banking and Insurance Commission (CNBS) in Honduras. Therefore any investment described herein is done at the investor's own risk. In Costa Rica, any securities or services mentioned herein constitute an individual and private offer made through reverse solicitation upon reliance on an exemption from registration before the General Superintendence of Securities ("SUGEVAL"), pursuant to articles 7 and 8 of the Regulations on the Public Offering of Securities ("Reglamento sobre Oferta Pública de Valores"). This information is confidential, and is not to be reproduced or distributed to third parties as this is NOT a public offering of securities in Costa Rica. The product being offered is not intended for the Costa Rican public or market and neither is registered or will be registered before the SUGEVAL, nor can be traded in the secondary market. If any recipient of this documentation receives this document in El Salvador, such recipient acknowledges that the same has been delivered upon their request and instructions, and on a private placement basis. In Guatemala, this communication and any accompanying information (the "Materials") are intended solely for informational purposes and do not constitute (and should not be interpreted to constitute) the offering, selling, or conducting of business with respect to such securities, products or services in the jurisdiction of the addressee (this "Jurisdiction"), or the conducting of any brokerage, banking or other similarly regulated activities ("Financial Activities") in the Jurisdiction. Neither BlackRock, nor the securities, products and services described herein, are registered (or intended to be registered) in the Jurisdiction. Furthermore, neither BlackRock, nor the securities, products, services or activities described herein, are regulated or supervised by any governmental or similar authority in the Jurisdiction.

The Materials are private, confidential and are sent by BlackRock only for the exclusive use of the addressee. The Materials must not be publicly distributed and any use of the Materials by anyone other than the addressee is not authorized. The addressee is required to comply with all applicable laws in the Jurisdiction, including, without limitation, tax laws and exchange control regulations, if any.

For investors in the Caribbean, any funds mentioned or inferred in this material have not been registered under the provisions of the Investment Funds Act of 2003 of the Bahamas, nor have they been registered with the securities regulators of Dominica, the Cayman Islands, the British Virgin Islands, Grenada, Trinidad & Tobago or any jurisdiction in the Organisation of Eastern Caribbean States, and thus, may not be publicly offered in any such jurisdiction. Engaging in marketing, offering or selling any fund from within the Cayman Islands to persons or entities in the Cayman Islands may be deemed carrying on business in the Cayman Islands. As a non-Cayman Islands person, BlackRock may not carry on or engage in any trade or business unless it properly registers and obtains a license for such activities in accordance with the applicable Cayman Islands law. In the Dominican Republic, any securities mentioned or inferred in this material may only be offered in a private character according to the laws of the Dominican Republic, falling beyond the scope of articles 1 numeral (31), 46 et al of Law 249-17 dated December 19, 2017, as amended and its Regulations. Since no governmental authorizations are required in such offering, any "securities" mentioned or inferred in this material have not been and will not be registered with the Stock Market Superintendency of the Dominican Republic (Superintendencia de Mercado de Valores de la República Dominicana), and these "securities" may only be circulated, offered and sold in the Dominican Republic in a private manner based on the criteria established under Dominican laws and regulations.

In Barbados, any funds mentioned or inferred in this material shall not be offered or sold into Barbados except in circumstances that do not constitute an offer to the public. This document is made available on the condition that it is for the use only by the recipient and may not be passed onto any other person or be reproduced in any part. The Financial Services Commission has not in any way evaluated the merits of any such funds and any representation to the contrary is an offence.

For Offshore Wealth Investors, for institutional investors and financial intermediaries only (not for public distribution). The information contained herein is for informational purposes only and is not intended to be relied upon as a forecast, research or investment advice, and is not a recommendation, offer or solicitation to buy or sell any securities or to adopt any investment strategy. An assessment should be made as to whether the information is appropriate for you having regard to your objectives, financial situation, and needs. This information does not consider the investment objectives, risk tolerance, or the financial circumstances of any specific investor. This information does not replace the obligation of financial advisor to apply his/her best judgment in making investment decisions or investment recommendations. This material is restricted to distribution to non-U.S. Persons outside the United States within the meaning of Regulation S under the U.S. Securities Act of 1933, as amended (the "Securities Act"). Any securities described herein may not be registered under the Securities Act or with any securities regulatory authority of any state or other jurisdiction and may not be offered, sold, pledged or otherwise transferred except to persons outside the U.S. in accordance with Regulation S under the Securities Act pursuant to the terms of such securities. In particular, any UCITS funds mentioned herein are not available to investors in the U.S. and this material cannot be construed as an offer of any UCITS fund to any investor in the U.S.

BSYS0526-5333032-EXP0527-10/11

In Singapore, this document is provided by BlackRock (Singapore) Limited (company registration number: 200010143N) for use only with institutional and accredited investors as defined in Section 4A of the Securities and Futures Act, Chapter 289 of Singapore. This advertisement or publication has not been reviewed by the Monetary Authority of Singapore.

In Hong Kong, this material is issued by BlackRock Asset Management North Asia Limited and has not been reviewed by the Securities and Futures Commission of Hong Kong. This material is for distribution to "Professional Investors" (as defined in the Securities and Futures Ordinance (Cap.571 of the laws of Hong Kong) and any rules made under that ordinance.) and should not be relied upon by any other persons or redistributed to retail clients in Hong Kong.

In South Korea, this information is issued by BlackRock Investment (Korea) Limited. This material is for distribution to the Qualified Professional Investors (as defined in the Financial Investment Services and Capital Market Act and its sub-regulations) and for information or educational purposes only, and does not constitute investment advice or an offer or solicitation to purchase or sells in any securities or any investment strategies.

In Taiwan, independently operated by BlackRock Investment Management (Taiwan) Limited. Address: 28F., No. 100, Songren Rd., Xinyi Dist., Taipei City 110, Taiwan. Tel: (02)23261600.

In Australia & New Zealand, issued by BlackRock Investment Management (Australia) Limited ABN 13 006 165 975, AFSL 230 523 (BIMAL) for the exclusive use of the recipient, who warrants by receipt of this material that they are a wholesale client as defined under the Australian Corporations Act 2001 (Cth) and the New Zealand Financial Advisers Act 2008 respectively.

BlackRock Investment Management (Australia) Limited ("BIMAL") is not licensed by a New Zealand regulator to provide 'Financial Advice Service' or 'Keeping, investing, administering, or managing money, securities, or investment portfolios on behalf of other persons'. BIMAL's registration on the New Zealand register of financial service providers does not mean that BIMAL is subject to active regulation or oversight by a New Zealand regulator. This material provides general advice only and does not take into account your individual objectives, financial situation, needs or circumstances. Before making any investment decision, you should therefore assess whether the material is appropriate for you and obtain financial advice tailored to you having regard to your individual objectives, financial situation, needs and circumstances. Refer to BIMAL's Financial Services Guide on its website for more information. This material is not a financial product recommendation or an offer or solicitation with respect to the purchase or sale of any financial product in any jurisdiction. Information provided is for illustrative and informational purposes and is subject to change. It has not been approved by any regulator. This material is not intended for distribution to, or use by, any person or entity in any jurisdiction or country where such distribution or use would be contrary to local law or regulation. BIMAL is a part of the global BlackRock Group which comprises of financial product issuers and investment managers around the world. BIMAL is the issuer of financial products and acts as an investment manager in Australia. BIMAL does not offer financial products to persons in New Zealand who are retail investors (as that term is defined in the Financial Markets Conduct Act 2013 (FMCA)). This material does not constitute or relate to such an offer. To the extent that this material does constitute or relate to such an offer of financial products, the offer is only made to, and capable of acceptance by, persons in New Zealand who are wholesale investors (as that term is defined in the FMCA). BIMAL, its officers, employees and agents believe that the information in this material and the sources on which it is based (which may be sourced from third parties) are correct as at the date of publication. While every care has been taken in the preparation of this material, no warranty of accuracy or reliability is given and no responsibility for the information is accepted by BIMAL, its officers, employees or agents. Except where contrary to law, BIMAL excludes all liability for this information. No part of this material may be reproduced or distributed in any manner without the prior written permission of BIMAL.

In China, this material may not be distributed to individuals resident in the People's Republic of China ("PRC," for such purposes, not applicable to Hong Kong, Macau and Taiwan) or entities registered in the PRC unless such parties have received all the required PRC government approvals to participate in any investment or receive any investment advisory or investment management services.

For Other Countries in APAC: This material is provided for your informational purposes only and must not be distributed to any other persons or redistributed. This material is issued for Institutional Investors only (or professional/sophisticated/qualified investors as such term may apply in local jurisdictions) and does not constitute investment advice or an offer or solicitation to purchase or sell in any securities, BlackRock funds or any investment strategy nor shall any securities be offered or sold to any person in any jurisdiction in which an offer, solicitation, purchase or sale would be unlawful under the securities laws of such jurisdiction.

In Japan, this is issued by BlackRock Japan. Co., Ltd. (Financial Instruments Business Operator: The Kanto Regional Financial Bureau. License No. 375, Association Memberships: Japan Investment Advisers Association, The Investment Trusts Association, Japan, Japan Securities Dealers Association, Type II Financial Instruments Firms Association) for Institutional Investors only. All strategies or products BLK Japan offer through the discretionary investment contracts or through investment trust funds do not guarantee the principal amount invested. The risks and costs of each strategy or product we offer cannot be indicated here because the financial instruments in which they are invested vary each strategy or product. Therefore, before deciding to receive our strategies or products, please refer to the document provided prior to the execution of agreement, prospectus, terms and conditions of investment trust and the explanatory document, etc. that will be delivered to you in accordance with each offering model and confirm the contents thereof.

This material is provided to the recipient on a strictly confidential basis and is intended for informational or educational purposes only. Nothing in this document, directly or indirectly, represents to you that BlackRock will provide, or is providing BlackRock products or services to the recipient, or is making available, inviting, or offering for subscription or purchase, or invitation to subscribe for or purchase, or sale, of any BlackRock fund, or interests therein. This material neither constitutes an offer to enter into an investment agreement with the recipient of this document, nor is it an invitation to respond to it by making an offer to enter into an investment agreement.

The distribution of the information contained herein may be restricted by law and any person who accesses it is required to comply with any such restrictions. By reading this information you confirm that you are aware of the laws in your own jurisdiction regarding the provision and sale of funds and related financial services or products, and you warrant and represent that you will not pass on or utilize the information contained herein in a manner that could constitute a breach of such laws by BlackRock, its affiliates or any other person.

The information provided here is neither tax nor legal advice and should not be relied on as such. Investment involves risk including possible loss of principal.

FOR PROFESSIONAL, INSTITUTIONAL, QUALIFIED, WHOLESALE INVESTORS AND PERMITTED, PROFESSIONAL AND QUALIFIED CLIENT USE ONLY. THIS MATERIAL IS NOT TO BE REPRODUCED OR DISTRIBUTED TO PERSONS OTHER THAN THE RECIPIENT.

260674T-0326

BlackRock.