BlackRock®

Alternative data for systematic investing

Finding diamonds in the rough

Summary

- **Finding the competitive edge:** In an era where data is abundant and accessible, in our view, it is discernment — not information — that defines the competitive edge. For systematic investors, the true challenge is no longer acquiring data but identifying what matters. Amid the noise of countless datasets, seeking durable alpha requires a clear focus: selecting high-quality sources, extracting *meaningful* signals, and scaling them efficiently across investment strategies with discipline and precision.

- **Data evaluation:** The rise of AI and machine learning has unlocked new frontiers in unstructured data, offering immense potential — but only for those with the capabilities to harness it. Model accuracy may improve with large quantities of high-quality datasets.[1] But quantity alone is not enough. A complementary insight is that every dataset selected must undergo rigorous evaluation to ensure it adds real, incremental value.

- **Assessing alpha additivity:** This piece outlines BlackRock Systematic's approach to onboarding alternative datasets, which we define as "non-traditional" datasets that deviate from traditional financial metrics or reports. In our process, disciplined selection, robust architecture, and domain expertise converge to transform information overload into a structured path toward alpha.[2]

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1 BlackRock. "Alpha Reimagined — Redefining Investing." BlackRock. **2** There is no guarantee that a positive investment outcome will be achieved.

1 Navigating the data deluge

Systematic investing has always been driven by data — but in today's landscape, not all data are created equal.

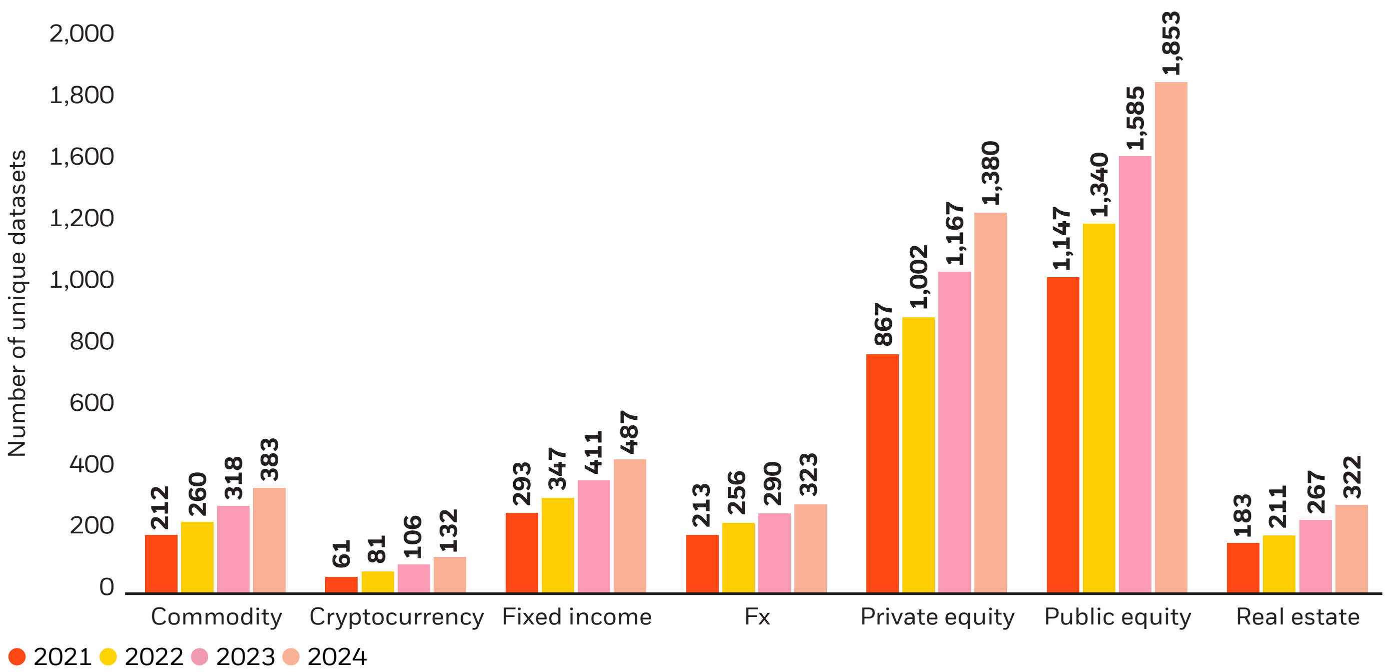
Over the last decade, the explosion of alternative data sets — from satellite imagery and job postings to shipping records and scraped web content — has radically expanded what's measurable. Yet with this abundance comes a new challenge: discernment. The challenge is no longer insufficient data, but mistaking noise for signal. Without a rigorous process, it's easy to succumb to confirmation bias, leaning on a single dataset that "proves" a hypothesis rather than genuinely additive insights.

At BlackRock Systematic, our approach to signal discovery is grounded in three principles:

- **Diverse inputs:** We diversify across data types and sources to analyze potential asset price drivers from multiple, often orthogonal, angles.
- **Integrated views:** We blend signals from different datasets using ensemble modeling, strengthening alpha forecasts by layering independent insights.
- **Scalable evaluation:** Our proprietary research platform streamlines data ingestion, evaluation and transformation — enabling efficient signal testing at scale.

As Figure 1 illustrates, the number of unique datasets available in the broader marketplace — spanning asset classes and geographies — continues to grow steadily. This reinforces the need for structured evaluation and curation, rather than indiscriminate acquisition.[3]

Figure 1: The total number of unique alternative datasets available in the broader marketplace has grown across numerous asset classes



Source: BlackRock Systematic estimates, as of 12/31/24. Figures from 10/31/2022-12/31/2024.

3 There is no guarantee that research capabilities will contribute to a positive investment outcome.

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Systematic investors are no longer limited by access to data — the constraint is now *discernment*.

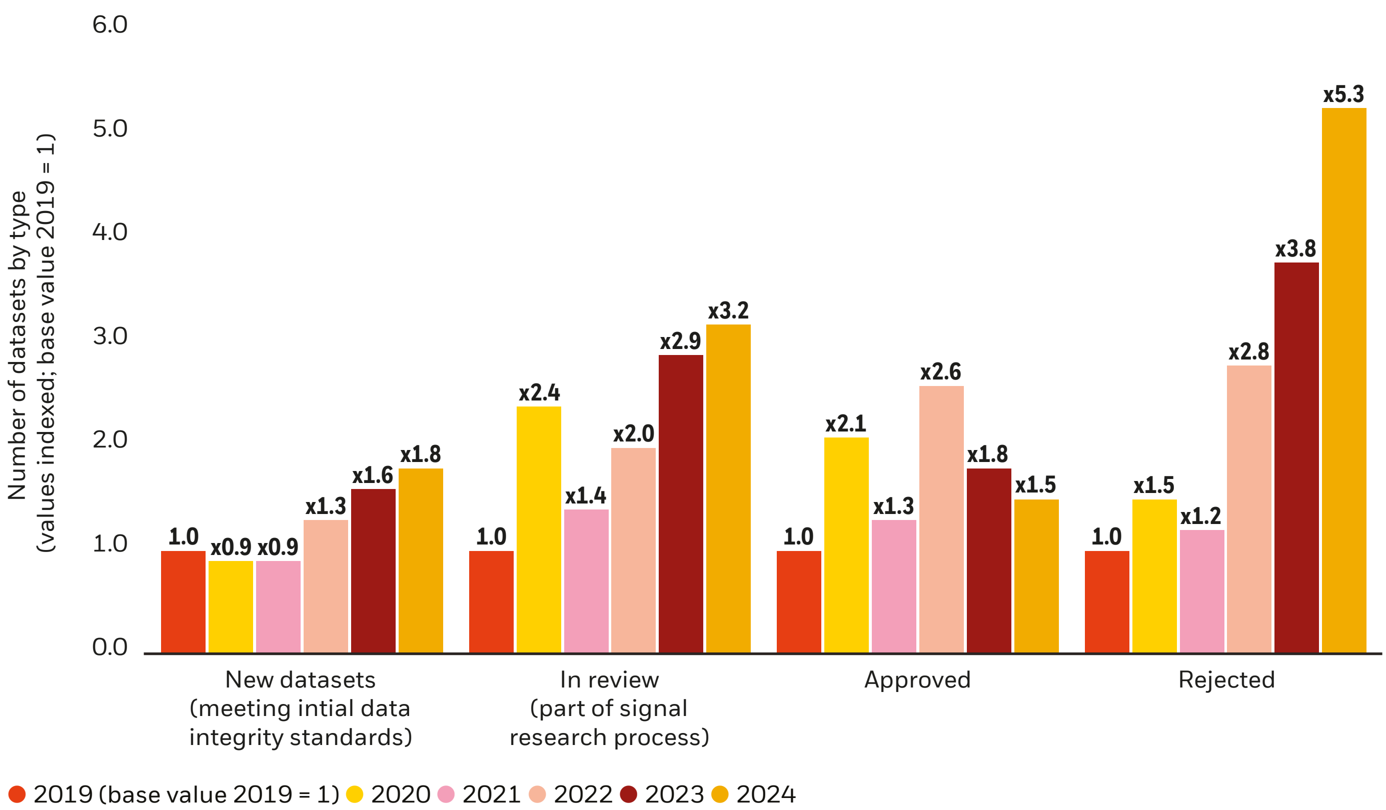
From 2019 to 2024, the number of datasets under review by our research team more than tripled, reflecting both the growing availability of alternative data and the increasing complexity of distinguishing true signals from noise.

But quantity does not equal quality. As shown in Figure 2, while the inflow of datasets has surged, our selectivity has tightened. Over that same period, the number of datasets rejected by our research team increased more than fivefold. By 2024, only ~30% of evaluated datasets met the threshold for inclusion. This disciplined approach seeks to ensure that resources are directed toward the most promising data assets, enabling us to extract signals while minimizing overfitting and redundancy.

To manage this scale, we've invested heavily in systems and workflows that accelerate high-value research while enforcing quality control. This includes tools for rapid ingestion, lineage tracking, automated anomaly detection, and robust data governance. It's how we turn data deluge into potential investment edge — not by chasing every dataset, but by selecting the few that we believe truly matter.

Figure 2: Finding quality datasets

The number of new datasets has almost doubled, while the number being rejected has increased more than fivefold, vs. five years ago



Source: BlackRock Systematic, as of 12/31/24. Figures from 2019-2024.

2 How we evaluate data quality

Alternative data is only as valuable as it is reliable. Just as discretionary investors scrutinize management teams on earnings calls, systematic investors must interrogate the structure, provenance, and usability of every dataset they consider. In our view, due diligence on data is no less important than diligence on securities.

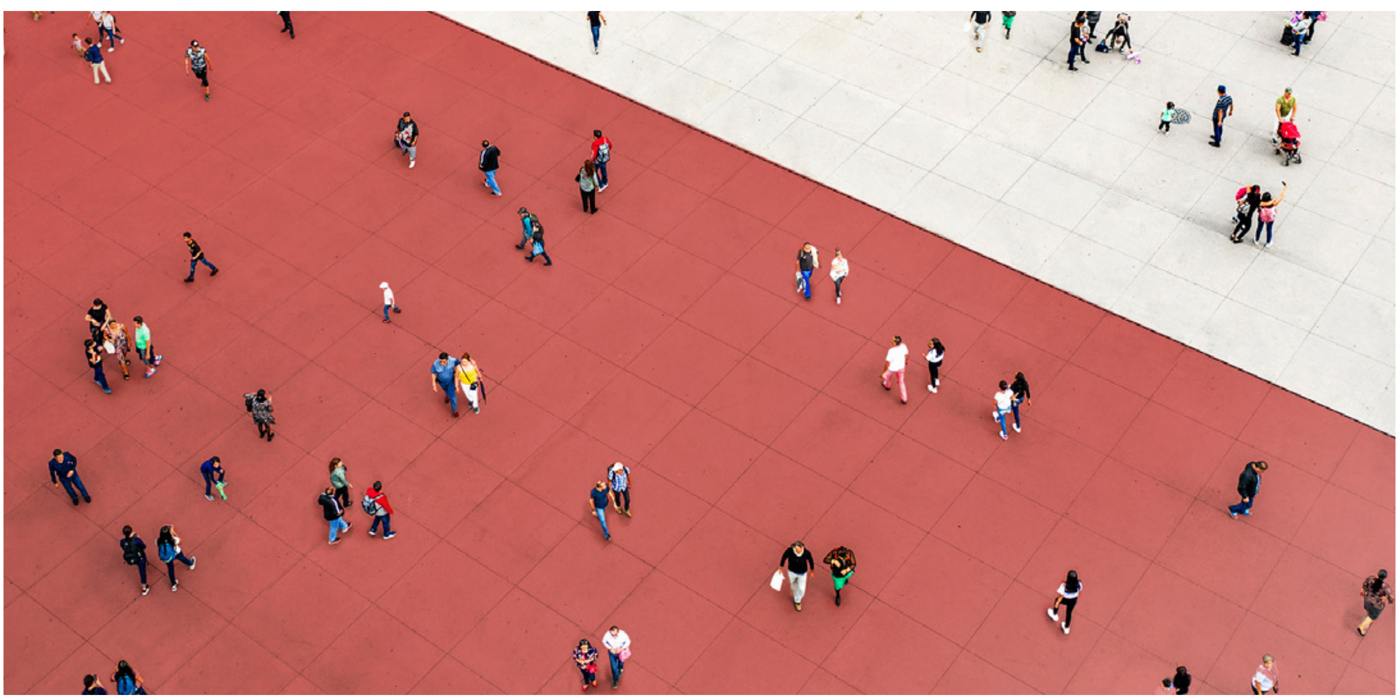
With thousands of datasets available in the market, only a small fraction meets our standards for signal quality, novelty, and operational fit. Like fundamental investors who probe business models, we engage data providers to understand what their datasets truly measure — and whether those insights can drive repeatable alpha.

Before testing begins, we ask a foundational question: “Does this dataset make economic sense as a predictor of returns?” If a dataset reflects information that is already quickly priced by the market (such as public macroeconomic releases) we often exclude it from further evaluation. Conversely, if we feel a dataset offers differentiated or hard-to-replicate perspectives — and it is potentially underpriced by markets — we often move forward into deeper assessment.

Each promising dataset is evaluated across four key dimensions:

1	**Originality —** does the dataset offer new, distinct insights not already captured by existing signals?
2	**Completeness and coverage —** is the data broad, deep and representative across time, sectors and geographies?
3	**Timeliness and latency —** how quickly is the data updated? Are timestamps reliable and consistent?
4	**Transparency and lineage —** can we trace the source, processing methods, and version history with confidence?

The first of these dimensions reflects idea generation and signal creativity. The latter three dimensions speak to data integrity — and are non-negotiable in our onboarding process.



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Evaluating integrity: High vs. low-quality data

The table below illustrates how integrity across key characteristics can materially impact model reliability and portfolio outcomes:

Examples of high- vs. low-integrity data and their impact on model outcomes

Characteristic	High integrity example	Low integrity example	Impact on models	Our requirement
Coverage	A dataset of corporate earnings transcripts that covers 15+ years, includes global firms, and provides consistent speaker tagging and timestamps.	An incomplete set of transcripts with gaps in coverage (e.g., missing years or sectors), non-standardized formats, or inconsistent metadata.	Incomplete data creates **biased training sets**. Leads to **overfitting** to underrepresented periods or industries. Model outputs may falsely generalize insights that were only present in partial data.	We require a large cross-section of asset coverage, regardless of current listing status e.g., delisted securities or corporate actions known only later.
Timeliness	Real-time shipping container movement data with accurate geolocation and time stamps, updated continuously.	Trade data updated weekly or monthly, with unclear timestamp precision or inconsistent update cadence.	Delayed signals lead to missed alpha opportunities. Models might **back test well** but underperform live due to unanticipated latency. **False confidence** in signal timing can lead to poor execution windows.	We look for datasets, which clearly timestamp **the observation date and the processing data**, and which consistently update on the same cadence, to optimize signal timing and reduce latency. Point-in-time datasets that reflect the **information available at each moment**, excluding delisted securities and corporate actions only known later, are preferred.
Transparency	Data sources with **clear documentation**, audit trails, and version control — including updates to methodology or corrections.	Black-box datasets with unclear provenance, retroactive changes, or non-replicable construction methods.	Poor data lineage and transparency makes **validation** difficult and creates a false sense of model robustness under historical conditions. If quality is poor, portfolio Information Ratios (IR) would drop significantly when the data are deployed in real-time.	Pre-processed analytics should be supported by clear documentation of the underlying calculations. Release notes should accompany each version of the dataset, explaining corrections and revisions.

Source: BlackRock, as of June 2025. Information is provided for illustrative purposes only to show how data can impact outcomes. It is not meant to depict actual data or signal analysis.

Even well-structured data can fail live deployment if it lacks integrity. As datasets scale, small flaws compound — amplifying noise, degrading model performance, and eroding investor trust. That's why transparency, timeliness, and completeness are just as important as novelty.

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Real-world rejections: When good ideas don't add up

To illustrate our evaluation process in action, here are **two anonymized examples of datasets which we rejected:**

Dataset	Status	Description	Reason for rejection
Online store purchase tracking	Trialed, rejected	Data collected via a Google Chrome extension, tracking users' online purchases across e-commerce platforms.	• The data coverage was skewed toward a small number of merchants, reducing representativeness. • Company coverage overlapped with our existing transaction data sources, therefore it lacked additivity. • High correlation with existing signals offered limited incremental value.
Headcount analytics	Prospect, rejected	Aggregated employee movement data, based on updates to professional profiles. The dataset was described as having a good historical archive of information available, spanning back to 2015.	• Data lacked true point-in-time accuracy. • Algorithm for detecting company exits was unstable and frequently revised. • Data ignored update latency — e.g. users typically input job changes retroactively, creating backward-looking bias.

Source: BlackRock, as of June 2025. Information is provided for illustrative purposes only to show datasets that would not meet our criteria. It is not meant to depict actual data or signal analysis.

As these examples show, additivity is a key requirement. We explore the concept of additivity further in the following section.

3 Distinguishing signal from noise

We believe a clean, well-structured dataset is a necessary foundation — but it is not enough. A dataset's true value, in our view, ultimately hinges on its ability to generate predictive, economically intuitive signals that consistently forecast asset returns. Without that, even the most elegant dataset becomes an expensive distraction.

Our process requires datasets to:

Take macroeconomic surprise indices, for example. These are clean and widely followed, yet for many years it has been understood that their signals are priced in by the market, often within minutes of release, making them largely unusable for medium- to low-frequency models.[4] For models with three-to-six-month forecast horizons, this kind of latency renders the data irrelevant.

Forecast potential future returns, not simply explain the past.

Deliver out-of-sample performance, not just in-sample fit.

Hold up under economic scrutiny, not just against statistical metrics.

4 Almeida, Alvaro, Charles Goodhart, and Richard Payne. "The effects of macroeconomic news on high frequency exchange rate behavior." Journal of Financial and Quantitative Analysis 33.3 (1998): 383-408.

Our signal evaluation framework

We evaluate prospective signals using a combination of quantitative testing, economic reasoning, and cross-signal validation. Our process includes:

- **Back-testing for statistical power:** Evaluation frameworks such as the Information Coefficient (IC), Predictive R-squared analysis, and the Horizon-Decayed IR can help quantify the effectiveness of a dataset in return forecasting.
- **Economic intuition testing:** Event studies, cross-sectional regression tests, or integrating the signal into a broader alpha model — can help determine whether the signal is consistent with rational investor behavior or arbitrage dynamics.
- **Additivity and redundancy checks:** Orthogonal testing against existing signals (e.g. fundamentals, sentiment, broker forecasts) seeks to ensure the signal adds differentiated, non-redundant insight to our alpha models.

Red flags arise when signals defy sound economic logic, exhibit instability across regimes, or generate spurious correlations. Ultimately, value arises not from data novelty alone, but from its ability to deliver a **repeatable, economically grounded, and statistically significant** edge within a robust investment process.

One particularly valuable — but underutilized — category is **cost-based alternative data**. These datasets track real inputs such as transportation rates, supply chain expenses, and execution costs. They offer direct, observable insights into corporate pressure points like margin compression or pricing power.

During the COVID-19 pandemic, real-time shipping and logistics data revealed soaring container freight rates months before they appeared in earnings commentary or traditional economic statistics. Systematic models incorporating global freight cost indices or satellite-tracked port congestion data were able to anticipate margin pressure in sectors like retail, manufacturing, and consumer goods ahead of quarterly disclosures.[5] More broadly, cost-based signals can alert investors to inflation pass-through risks, input bottlenecks, or changes in pricing power — especially when traditional price series or accounting data fail to capture these frictions in a timely manner. As the need for economically sensible and forward-looking signals grows, such datasets are increasingly viewed not as peripheral, but as foundational elements in systematic investment processes.

Moving from data to insight

Even a clean dataset must pass one final hurdle: Does it capture a potentially investable edge?

To determine this, we often conduct provider trials and perform a rigorous sequence of steps:

Historical in-sample evaluation, to assess alpha generation potential.

Human-in-the-loop evaluations to interpret what the data actually reflects.

Cross-signal validation to ensure incremental value relative to existing signals (e.g. broker reports, company disclosures).

Our bar is high. Fewer than 30% of datasets we evaluate are ultimately onboarded. This high bar ensures that each signal adds distinct value, avoids redundancy, and enhances portfolio diversification. With over 1,000 active signals in our library, any new signal must meet this high bar for incremental value.[6]

In many cases, it's the *counterintuitive insights* that prove most impactful. For example, a dataset that diverges from market sentiment, but aligns with fundamental deterioration, may indicate an underpriced risk. The discipline lies in distinguishing signals from mirage. Assessing the capture rate, noise filtering, and running ancillary testing with orthogonal views (e.g. broker reports, company disclosures) are crucial steps in the process.

5 Historical example only; not intended to be indicative of current data. Source: BlackRock Systematic, with data from Clarksons, February 2024. **6** BlackRock Systematic data as of 6/30/25.

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4 Case study: Dissecting an investment theme using alternative data

The following case study illustrates how multiple alternative datasets can be combined to assess a single investment theme. In this case, we focus on the theme of "AI adoption." While the theme itself is widely recognized, identifying which firms are more or less exposed and to what degree is far more complex.

A company's relationship to the "AI adoption" theme can be multi-dimensional. A company may invest heavily in talent, signal ambition in public disclosures, or simply benefit from market sentiment. These signals often diverge, making it difficult to form a clear picture through any single lens.

Using a systematic, data-driven process we can triangulate across hiring patterns, fundamental disclosures, and investor sentiment to help us to map this at scale and forecast what we believe the *net exposure* of each company to be.

Theme: AI adoption
Stock example: Company X, a global logistics and software provider

Data layer	Insight
Hiring trends	Alternative data flagged a surge in AI-related job postings at Company X. An alternative dataset was used to track employee job descriptions and hiring trends. This suggests that Company X is aggressively building AI-related roles, suggesting a rising exposure to the **AI adoption** theme.
Fundamentals	Company disclosures showed limited CAPEX or R&D dedicated to AI. In investor filings and earnings calls, AI receives little direct mention, suggesting the firm's actual investment in the **AI adoption** theme may be minimal or early-stage.
Broker sentiment	Analysts speculated on AI potential, driving stock outperformance despite flat earnings. Broker commentary reveals that investors are already treating Company X as an AI beneficiary, citing "early moves in automation and predictive logistics." The stock has rallied strongly over the past two months on this narrative regarding the **AI adoption** theme, even as earnings have remained flat.

Takeaway: By triangulating multiple data sources, our models built a nuanced view of exposure to the "AI adoption" theme. Even when fundamentals lag or sentiment overshoots, alternative datasets can help detect the true stage of thematic adoption and market recognition. The result is the ability to truly capture what is (or isn't) in the price, thus capturing precious alpha opportunities.

5 Infrastructure: The invisible edge

Signal development is no longer a solo pursuit — it's a platform capability. At BlackRock, we don't just invest in data, we invest in the infrastructure, talent, and processes required to extract lasting value from it.

Our systematic investment platform is built to scale signal discovery through:

Scalable infrastructure for ingesting and transforming massive data flows.

Specialist teams focused on data sourcing, vetting and curating high-quality datasets.

Rigorous onboarding including versioning, documentation, and lineage tracking.

Cross-asset collaboration, enabling signals to be reused and recontextualized across strategies and markets.

Alternative data is not yet commoditized. The most valuable datasets remain scarce, expensive and difficult to replicate. In this environment, **infrastructure scale becomes strategic advantage**. Alternative data has emerged as a key driver of alpha — but extracting value from it is not a function of creativity alone. It's a function of infrastructure: having the resources to afford high-quality datasets, the systems to integrate them seamlessly, and the expertise to iterate on signal design continuously.

While advances in AI and machine learning have lowered barriers to signal generation, frontier techniques still require significant resources. *High-quality data* is costly. Computing power is expensive. Expertise is essential. That's why scale isn't just helpful – it's decisive.

Our 40+ year investment platform, supported by more than 220 cross-asset investors and researchers, acts as a flywheel for innovation.[7]

This scale allows us to test, validate and iterate our signals faster — while maintaining rigorous quality standards. Without our robust data onboarding processes — including version control, lineage tracking, and evaluation discipline — model outputs risk becoming unstable, non-replicable, or misleading. With robust data in place, we improve our ability to convert our model forecasts into real-world portfolio alpha.

One example of this scale in action is our ability to transfer insights across asset classes. Consider commodity-linked equities. It's reasonably straightforward to identify firms whose revenues depend on commodity prices. But it's far more challenging (and therefore more alpha-relevant) to pinpoint firms whose cost structures are driven by commodity inputs. By combining expertise across commodities, macroeconomics, and equities we uncover subtle market dynamics that others may miss.

In short, signal innovation isn't just about creative ideas. It's about having the infrastructure, governance, and collaboration to deliver those ideas at scale.

Finding alpha potential in a sea of raw data

We believe that sourcing, selecting, and scaling high quality alternative data is no longer a niche capability — it's a strategic imperative. In a world where signal libraries number in the thousands, finding the next source of alpha isn't just about being faster — it's about being smarter.

The future belongs to those who combine human insight, operational precision, and organizational scale. Because when every marginal dataset matters, *how you source* data becomes just as important as *how you use it*.

7 BlackRock Systematic as of 6/30/25. History includes time at predecessor firms.

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