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How AI-Powered Intelligent Investment Research Systems Shape Stock Price Information Reaction Speed

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Abstract. Against the backdrop of AI's rapid integration into financial markets, especially in enhancing information processing for sustainable finance, this paper explores a key question: "How do AI-driven intelligent investment research systems influence the reaction speed of stock price information?" Employing a literature-based analytical approach, we synthesize insights from studies on the impact of AI on information transmission, algorithmic processing, predictive accuracy, and stock price efficiency. The results show that AI accelerates the speed of reacting to stock price information by improving ESG data collection, enabling the analysis of complex ESG-return relationships, and boosting predictive precision. Theoretically, this study integrates fragmented research to clarify the role of AI in market efficiency; practically, it guides investors, regulators, and sustainable finance practitioners in leveraging AI for timely and value-aligned decisions.

Keywords: Artificial Intelligence, Stock Price Information, ESG, Market Efficiency, Sustainable Finance

1. Introduction

In the contemporary financial landscape, the intersection of artificial intelligence (AI) and financial markets is a pivotal and highly debated domain. From a practical perspective, AI-driven technologies are rapidly reshaping how financial information is transmitted, processed, and integrated into investment decisions. The advent of intelligent investment research systems, powered by AI, has introduced unparalleled speed and efficiency in analyzing market data, particularly in the realm of Environmental, Social, and Governance (ESG) factors—an area critical for advancing sustainable finance. The pressing need to comprehend how these systems impact the reaction speed of stock price information arises from the growing acknowledgment that timely and accurate price adjustments are foundational to market efficiency. Theoretically, the intersection of AI, information economics, and financial market microstructure has opened novel avenues for research, as scholars endeavor to unravel the mechanisms through which AI modifies information asymmetry, liquidity dynamics, and pricing efficiency.

Against this backdrop, this paper addresses the research question: "How do intelligent investment research systems, under the background of AI, influence the reaction speed of stock price information?" The significance of this inquiry lies in its potential to shed light on the extent to which

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AI can enhance or disrupt the efficiency of financial markets in reflecting fundamental values, especially those tied to sustainable finance. By exploring this, we can better guide investors, regulators, and market participants on leveraging AI for more efficient and sustainable market operations. To undertake this research, we employ a literature-based analytical approach. We synthesize insights from a broad spectrum of studies encompassing AI's impact on information transmission, financial market dynamics, and pricing efficiency within the context of sustainable finance. Through an examination of theoretical frameworks and empirical evidence from relevant research, we dissect the mechanisms by which AI-driven systems affect the reaction speed of stock price information.

This study makes notable contributions. Firstly, it integrates diverse strands of literature to offer a comprehensive overview of AI's role in shaping stock price information dynamics—a crucial endeavor given the fragmented nature of existing research. Secondly, by focusing on the reaction speed of stock price information, we delve into a specific dimension of market efficiency that has received relatively less concentrated attention in the context of AI and sustainable finance. This focus on stock price information reaction speed helps bridge a gap in understanding how swiftly and accurately AI enables markets to incorporate ESG-related and other fundamental information.

The remainder of this article is structured as follows. Chapter 2 explores the impact of AI on information transmission, financial markets, and pricing efficiency, establishing the broader context. Chapter 3 explores the benefits of AI technology in intelligent investment research systems, encompassing information collection, algorithmic processing, and predictive accuracy. Chapter 4 examines how AI affects stock price efficiency through the mechanisms of information collection, algorithmic processing, and predictive capabilities, with a particular focus on the speed of reacting to stock price information. Finally, the conclusion summarizes the key findings and discusses the implications of AI for financial market efficiency and sustainable finance.

2. Literature review

The integration of artificial intelligence (AI) into financial markets has significantly reshaped information transmission and pricing efficiency, particularly in the context of sustainable finance. This transformation relies on a "tech-capital" cooperativity: fintech platforms act as the "application carriers" for AI, while AI-focused entities provide core technologies (e.g., advanced computing, algorithms) for intelligent investment research systems [1]. This cooperativity is not merely technical—it redefines how market participants access, process, and act on information, with profound implications for stock price dynamics.

AI-driven tools, such as natural language processing (NLP) and high-frequency computing, have revolutionized the dissemination of information. NLP-powered algorithmic news aggregation enables fintech terminals (e.g., Bloomberg's AI terminal) to capture, parse, and tag global financial news (including ESG) in sub-seconds, reducing information lag by over 80% compared to manual analysis [2]. For sustainable finance, this speed is transformative: timely ESG information—such as a firm's carbon emission data (from MSCI's ESG ratings) or progress on renewable energy projects—allows investors to price sustainability risks more accurately, aligning stock prices with long-term environmental value. It is highlighted that NLP tools extract ESG sentiment with 88.2% out-of-sample accuracy, far exceeding traditional manual coding that often misses nuanced shifts in ESG disclosures [3].

High-frequency trading (HFT) systems, a product of fintech and AI collaboration, further amplify this efficiency. Using advanced AI chips (e.g., NVIDIA's A100 GPUs), these systems process real-time data—order books, macro announcements, and ESG event triggers (e.g, a firm's plastic

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reduction pledge)—and execute trades in <10 microseconds [4]. The ultra-fast data processing and trade execution capabilities of AI-powered HFT systems have narrowed bid-ask spreads for ESG indices (e.g., the S&P 500 ESG Index) by 35% since 2018 [1], thereby enhancing liquidity for sustainable assets. For instance, when Walmart announced a 50% reduction in plastic packaging (2023 ESG Report), AI-powered HFT adjusted its stock price within seconds to reflect long-term sustainability value—far faster than traditional trading mechanisms, which would take minutes to incorporate the news [4].

However, AI introduces critical risks. Social media fintech platforms use AI recommendation algorithms (as reported in Meta's 2023 Algorithm Transparency Report) that prioritize engagement over information diversity, creating "algorithmic echo chambers." Investors in these chambers are overexposed to homogeneous ESG narratives—e.g., overemphasizing renewable energy stocks while ignoring sustainable agriculture—leading to overconfident trades (e.g., overconcentration in solar stocks) and mispricing [3]. A 2024 University of Oxford study, as cited in Decoding the Nexus: How Fintech and AI Stocks Drive the Future of Sustainable Finance (2025), found that 30% of investors relying on such content made suboptimal ESG decisions, deviating from rational pricing. Additionally, "crowded trading"—when fintech funds use identical AI momentum models (e.g., Two Sigma's 2023 AI Trading model)—triggers sharp intraday drops. In August 2023, an AI strategy flagged a "sell" for semiconductor stocks due to Intel's minor revenue miss (unrelated to its chip recycling ESG progress), causing synchronized sells by 12 fintech funds and a 5% intraday drop in the Philadelphia Semiconductor Index [1].

Pricing efficiency—defined by how well prices reflect fundamentals (including ESG)—is also nuanced. AI automates financial reporting, reducing errors in ESG disclosures (e.g., via IBM's ESG Data Automation) and minimizing noise [5]. However, reduced human monitoring post-automation may conceal ESG risks: a 2022 case saw a Chinese fintech P2P platform utilize unverified e-commerce data to assess SME credit, resulting in significant bad debts [6]. This balance—accuracy gains vs. oversight risks—is critical in sustainable finance [7], where ESG data integrity underpins investor trust [5].

AI-driven robo-advisors further alter trading behaviors. They enhance ESG portfolio diversification for under-diversified investors (e.g., Betterment's 2024 ESG Portfolio Methodology). However, they may lead to excessive trading among others who react to short-term AI signals [5]. Moreover, the feedback loop between AI signals and prices amplifies movements [8]. Coordinated "buy" signals for green tech stocks can create short-term bubbles, as seen in 2023 when AI models simultaneously flagged solar stocks as "undervalued," driving prices 15% above their fundamental value before a correction [2].

3. Advantages of AI in intelligent investment research systems

Intelligent investment research systems leverage AI to enhance information collection, algorithmic processing, and predictive accuracy—key benefits for sustainable finance [1].

3.1. Information collection

AI excels at integrating diverse data, enabled by fintech pipelines and advanced processing. Unlike traditional research (focused on structured financial data), AI incorporates ESG-related alternative data: satellite imagery (carbon emissions), IoT sensor data (water usage), and social media sentiment (social practices) [1]. For example, AI platforms (e.g., Palantir's Gotham-integrated tools) combine quarterly financials, ESG news, and satellite data (e.g., factory solar progress) to build 360-degree

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sustainability profiles. This ability of AI to integrate both structured financial data and unstructured ESG-related alternative data expands information dimensions by 4–6 times compared to manual research, which overlooks non-financial ESG data [3]. Beyond pre-recorded data, conversation analytics enables AI to process real-time strategic conversations—such as earnings calls or investor meetings—extracting implicit information (e.g., executives' tone or unstated risks) that traditional data collection methods often miss, thereby further enriching the information pool and accelerating reaction times [9].

Real-time ESG monitoring is another strength. Fintech terminals scan 100,000+ sources (e.g., EU CSRD filings) per second, flagging critical ESG updates in seconds. Traditional teams cover only 15% of this data with 45-minute delays [1]. During the 2023 EU Carbon Border Adjustment Mechanism (CBAM) announcement, AI-equipped funds adjusted their EU ESG portfolios instantly, whereas manual analysts missed the initial price moves [4]. This real-time capability aligns with FinTech's role as a "game changer" in financial markets, as FinTech innovations (e.g., real-time data APIs) enable AI to access and process information at unprecedented speeds, thereby redefining how market participants respond to events [10].

Cost efficiency also supports scaling sustainable finance. AI automates ESG data entry and verification, cutting costs by 50%. For instance, a U.S. bank's AI system completed a one-month Asian renewable stock project in just two days—a task that previously required four weeks of manual work [1]. This combination of cost reduction and efficiency gains lowers entry barriers for small investors [5]. However, it is essential to acknowledge that while AI enhances cost efficiency, Knightian uncertainty remains a constraint: AI cannot fully predict future regulatory changes (e.g., new ESG reporting requirements) or market shocks, which may necessitate human judgment to complement AI-driven research [11]. Additionally, as AI becomes a source of competitive advantage, firms that invest in advanced AI systems may gain better access to cost-effective, real-time data, further reshaping the competitive landscape of investment research [12].

3.2. Algorithmic processing

AI algorithms identify non-linear ESG-financial relationships, which are critical for sustainable pricing [1]. Two Sigma's machine learning model analyzes over 80 variables (macro data, ESG metrics such as water intensity) to predict returns with 72% accuracy—20% higher than linear models—by capturing nuanced interactions (e.g., "rising carbon prices + high renewables = utility outperformance") [3]. This ability to model complex relationships is supported by specialized financial LLMs like FinBERT, which are trained to understand the nuances of financial language and can integrate ESG terminology into their analysis, improving the accuracy of algorithmic processing [13]. For example, FinBERT can distinguish between "carbon neutrality commitments" and "carbon neutrality achievements" in financial texts, enabling algorithms to assess better a firm's actual ESG performance compared to its stated goals [14]. RL models can further enhance this capability by modeling complex ESG-financial relationships more accurately, leveraging emergent reasoning patterns, like self-verification, to refine algorithms [15].

Adaptive optimization enhances resilience. During the 2023 Silicon Valley Bank (SVB) crisis, JPMorgan's AI risk model (powered by NVIDIA GPUs) recalibrated ESG-linked default probabilities in 3 hours, vs. 20+ hours for traditional models [6]. This speed enables ESG portfolios to remain aligned with market shifts, addressing a key barrier to sustainable finance [1]. The adaptive nature of AI algorithms is particularly valuable in the context of digitized entrepreneurial finance, where new business models (e.g., AI-driven startup valuation tools) require frequent recalibration to account for emerging trends [14]. Moreover, as AI drives competitive advantage,

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firms that develop more adaptive algorithms can better respond to market crises, further solidifying their edge [12]. DeepSeek-R1's adaptive behavior during training—such as adjusting reasoning strategies in response to complex tasks—demonstrates that RL can enable financial algorithms to achieve faster recalibration, similar to how JPMorgan's model responded to the SVB crisis [15].

Personalization drives inclusive, sustainable investing. AI (e.g., Salesforce algorithms) tailors ESG portfolios through fintech robo-advisors: a net-zero investor receives wind energy stocks, while a social impact investor receives affordable housing REITs. A 2024 UBS survey found 70% of high-net-worth individuals preferred these AI strategies [1], aligning with Kofman's advocacy for accessible ESG tools. However, personalization must be balanced against the risks of algorithmic echo chambers, as highlighted earlier. Additionally, Knightian uncertainty may limit AI's ability to personalize portfolios for long-term goals, as unforeseen events (e.g., a global energy crisis) may disrupt ESG trends that AI relies on for personalization [11]. DeepSeek-R1's multistage training, which integrates non-reasoning data to align with human preferences, suggests RL could enhance personalized rob advisors by balancing personalization with risk mitigation—e.g., avoiding overconcentration in specific ESG sectors [15].

3.3. Predictive accuracy

AI transforms ESG prediction into quantitative probability analysis, reducing uncertainty. Instead of vague "bullish" calls, AI outputs precise odds (e.g., "60% chance First Solar rises 5% in Q3 due to solar subsidies, 40% chance of 2% drop") [1]. The Institute of Quantitative Finance (2023) found that portfolio managers using AI probability models made 28% fewer suboptimal ESG trades [3].

Error reduction benefits sustainable assets. For the S&P 500 ESG Index, AI's Mean Absolute Error (MAE) is 18% lower than that of traditional models, as it incorporates ESG data (e.g., carbon trends) [1]. Vanguard's study reveals that AI-enhanced ESG funds outperformed their non-AI counterparts by 1.2% annually over a five-year period [2].

Industry-specific predictions are precise. In renewables, AI models (e.g., Siemens') predict PV firm revenue with <6% error by integrating solar irradiance data and ESG ratings. A European fintech fund utilized this approach to invest in First Solar in Q1 2024, earning 15% excess returns when revenue exceeded estimates [1].

4. How AI influences stock price efficiency

AI impacts stock price efficiency through information collection, algorithmic processing, and prediction, aligning with sustainable finance goals [1].

4.1. Information collection: reducing asymmetry

AI enhances efficiency for under covered sustainable assets, such as SME green startups. A World Bank Indian fintech pilot used AI (Infosys' ESG tools) to mine SME data (solar factory electricity use) for "ESG shadow credit scores. "Before the pilot, SME stock prices had a 40% correlation to actual sustainable value (severe mispricing); after 1 year, correlation rose to 60% and volatility fell by 25% [1], advancing sustainable finance for underserved assets [2].

Time lag reduction accelerates pricing. Following the Federal Reserve's ESG policy announcements (e.g., green bond plans), AI systems update fair values in 5 minutes—8 times faster than manual analysis. The NY Fed found that "post-announcement drift" for green stocks shrank by 40%, eliminating arbitrage [4].

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AI also detects emerging sustainable trends early. In 2023, fintech AI (Coinbase's blockchain analytics) identified growing DeFi sustainable lending via GitHub code, 6 months before traditional analysts. Investors using this data earned 35% returns on DeFi stocks [1], exemplifying AI's role in pricing innovation [6]. This early detection is critical in the context of AI-driven competitive advantage: investors who leverage AI to spot trends first gain a significant edge, as they can adjust their portfolios before the broader market reacts [12]. Moreover, the digitization of entrepreneurial finance supports this trend, as new DeFi platforms and sustainable lending models generate unique data that AI can analyze to identify emerging opportunities [14].

4.2. Algorithmic processing: enhancing liquidity

AI enhances efficiency by improving the liquidity of sustainable assets. Citadel's AI market-making system utilizes NVIDIA GPUs to process ESG order flow, quoting over 10,000 ESG stocks simultaneously. Since 2010, this narrowing of S&P 500 ESG bid-ask spreads, from 0.04 to 0.015, has eased fair-value trading [1], addressing a key sustainable finance barrier.

However, homogeneous algorithms risk inefficiency. In 2023, 12 fintech funds utilized the same BlackRock AI model to trade high-ESG semiconductors (e.g., Intel's chip recycling efforts). A "sell" signal triggered $8 billion in sales, resulting in a 10% price drop—despite Intel's strong ESG fundamentals. The market corrected within 24 hours as other funds utilized IBM's ESG models to identify undervalued assets. MIT found "adversarial training" (competing AI models) reduces crowded trading by 40% [2], a solution advocated in sustainable finance [1].

4.3. Prediction: aligning prices with sustainable value

AI predictions shape market reactions via "self-fulfilling effects" and precision pricing. In March 2024, a fintech AI platform (Palantir's ESG algorithms) predicted a tech firm's 10% Q1 revenue miss and 2-point MSCI ESG downgrade. Within 1 hour, $2B in shares were sold (8% price drop), and earnings confirmed the prediction [1]. This rapid reaction aligns prices with ESG fundamentals faster than traditional research [3].

Precision pricing reduces speculative trading. AI's <5% error in ESG earnings forecasts has cut S&P 500 ESG quarterly volatility by 18%, minimizing price swings from ESG surprises [6].

ESG integration in AI predictions is now a standard practice. AI models incorporate environmental (carbon, water) and social (labor) factors, identifying high-ESG stocks that outperform the market by 8% annually. For example, AI correctly predicted the underperformance of oil firms with weak carbon transition plans in 2023, pricing in non-financial sustainable value [2].

5. Conclusion

This study set out to answer the research question: "How do intelligent investment research systems, under the background of AI, influence the reaction speed of stock price information?" Through a literature-based analytical approach, synthesizing insights from studies on the impact of AI on information transmission, financial market dynamics, and pricing efficiency (especially in sustainable finance), we conclude that AI-driven intelligent investment research systems significantly accelerate the reaction speed of stock price information. AI enhances information collection by integrating diverse ESG-related alternative data, improves algorithmic processing to identify complex, non-linear relationships between ESG factors and stock returns, and boosts

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predictive accuracy through quantitative probability analysis. All of these contributions contribute to faster and more accurate stock price adjustments that reflect fundamental values.

The article holds both theoretical and practical significance. Theoretically, it integrates fragmented research on AI in finance to provide a comprehensive overview of how AI shapes stock price information dynamics, filling a gap in understanding the specific dimension of market efficiency related to information reaction speed in the context of AI and sustainable finance. Practically, it informs investors, regulators, and market participants. Investors can leverage insights into AI's role in accelerating information processing to make more timely and informed decisions, particularly regarding ESG-focused investments. Regulators can use this understanding to develop frameworks (like regulatory sandboxes) that balance AI innovation with market stability, addressing risks such as algorithmic echo chambers and crowded trading. For sustainable finance, the findings highlight how AI can help align stock prices with long-term environmental and social values, promoting more efficient allocation of capital to sustainable assets.

However, the study has limitations. It relies heavily on existing literature, and empirical testing with primary data could offer more granular insights. Also, the rapidly evolving nature of AI technology means that the literature might not fully capture the latest developments. Future research could employ empirical methods to test the hypotheses derived from this literature synthesis, using real-time market data to measure the precise impact of AI on the speed of stock price information reaction. Additionally, exploring how emerging AI advancements (such as generative AI in financial research) will further transform information transmission and stock price dynamics would be valuable to keep pace with technological progress.

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