

Early Lessons from the AI Revolution for Financial Market Behavior

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Abstract

Will the Artificial Intelligence (AI) revolution be a game-changer for financial markets? You would think so, considering how the latest leap forward in AI—generative AI with large language models—is disrupting traditional practices across various industries. Interestingly, however, the impact of AI on the behavior of financial markets seems to be lagging, compared to other sectors in which the emergence of AI has been remarkably fast. In this research, we explore some early AI lessons from sectors unrelated to investing. Specifically, we have chosen health care, education, and chess to inform our understanding of how AI may impact investing, asset management, and financial market behavior. The insights from these case studies are hints to how AI will impact investment firms and more generally, financial market behavior. AI is easily applied to static problems. Financial markets are decidedly dynamic, presenting challenges to the successful application of AI that involve extension curating of the input data, collaboration between AI technicians and financial domain experts, with an emphasis on multiple perspectives and a multi-disciplinary approach to AI implementation in finance. All of this suggests that while processes may change, investment outcomes that influence financial market behavior may be significantly less impacted.

Keywords

Artificial intelligence, AI, financial markets, education, health care, chess

Early Lessons from the AI Revolution for Financial Market Behavior

Will the Artificial Intelligence (AI) revolution be a game-changer for financial markets? You would think so, considering how the latest leap forward in AI—generative AI with large language models—is disrupting traditional practices across various industriesⁱⁱⁱ. Interestingly, however, the impact of AI on the behavior of financial markets seems to be lagging, compared to other sectors in which the emergence of AI has been remarkably fast^{iv}. In this research, we explore some early AI lessons from sectors unrelated to investing. Specifically, we have chosen health care, education, and chess to inform our understanding of how AI may impact investing, asset management, and financial market behavior.

We define AI broadly, encompassing an array of computer-driven pattern recognition tools, from traditional statistics to machine learning (ML) and the new large language models (LLM). This wide-ranging definition helps us appreciate why AI could already be a powerful disrupter for many industries or sectors yet might have little impact on the efficiency and behavior of financial markets. We draw lessons from various fields to understand this phenomenon better. Initially, we examine AI's role in health care, followed by its effect on the education sector, which is already feeling tremendous impact, and finally we revisit how computers achieved the status of Grand Masters in chess.

The insights from these case studies are hints to how AI will impact investment firms and more generally, financial market behavior. Asset management companies are already investing heavily in AI^v, motivated by the promise to streamline operations, allow some tasks to be executed more efficiently and with fewer people, and potentially reduce labor costs and boost profits. And yet, despite these transformative effects on the labor market, which are relevant across many sectors, we believe that the core trading and investing activities—those that fundamentally drive financial market behavior—may remain largely unchanged by AI.

I. Health Care

In health care, the initial advances in AI are quite evident. The US Food and Drug Administration (FDA) keeps a list of approved AI/ML-enabled medical devices.^{vi} Currently, there are almost 700 devices on this list, with three-quarters pertaining to radiology, the fastest growing category. Why this concentration in radiology? Basically, because of its stationary nature; the challenge in health care, especially in radiology, is the early detection of disease, a stationary problem in which the data patterns do not

dynamically evolve over time. Since AI models require vast amounts of data to learn effectively, AI has been initially applied to static problems. Thus, disease detection is an ideal application for AI, particularly in fields like radiology where large historical databases of lung scans and other medical imaging techniques already exist^{vii}. Conversely, new medical procedures and treatments do not have sufficient data sets from which AI can learn effectively.

From the changes AI is bringing to radiology, we have learned that AI models can diagnose a disease much earlier than even seasoned and experienced specialists.^{viii} Early detection can save lives. Interestingly though, AI has not been nearly as effective at recommending treatments, struggling particularly where there are competing novel choices with scarce historical data. In such cases, AI cannot do the job alone and needs help from experts^{ix}.

To summarize the key lessons from health care: (1) AI is easiest to use—and most effective—on static problems where data patterns do not change dynamically; (2) large existing data sets are essential to begin using AI, and (3) more sophisticated applications of AI often need to be paired with domain experts to enhance the learning process.

II. Education

University students are already using ChatGPT and similar AI tools to obtain short summaries, identify key themes, and write the analyses of their reading assignments, which is exacerbating an already dramatic decline in college-level reading and writing skills.^x Many faculty have followed in their students' steps, finding that AI tools can make class preparation not only more time effective but also more innovative, facilitating the exploration of novel topics and teaching methods. Additionally, AI is widely employed for text revisions, improving academic texts, and detecting fraud. In scholarly research, AI is not only an inexpensive and highly efficient language and style editor—too bad for graduate students who made an income reviewing and editing academic articles—but also assists in quantitative and qualitative analyses.

This is a vast upgrade from traditional search engine queries, which typically yield long lists of URLs dominated by paid advertising. AI is set to transform even your favorite search engine, with education leading the way. Indeed, for a fee, Microsoft is introducing a new key on laptop keyboards for instant access to AI tools in the Microsoft Azure cloud,^{xi} and Apple plans to integrate AI tools directly into its iPhones.^{xii}

But the disrupting impact of AI on education extends beyond internet search^{xiii}. The traditional silo-ed approach to teaching statistics, as seen in disciplines like econometrics, biometrics, and psychometrics, is being challenged by the distinct advantages of AI-supported statistical methods that encourage multi-disciplinary collaboration and move beyond the narrow thinking of discipline-specific silos. Likewise,

STEM courses, essential for the AI revolution, should also adopt more interdisciplinary approaches. The interaction of STEM with liberal arts could not only enhance the curating of datasets before using them as learning tools but would also improve the evaluation of AI-produced output. Indeed, statistics, data analytics, and other data-driven topics should evolve so that data inputs are as much appreciated as the AI tools themselves. Without domain expertise applied to both the data inputs and the AI outputs, AI's effectiveness is limited, especially in dynamic, non-stationary problem-solving contexts.

To further explore how AI is reshaping education, we used ChatGPT ourselves and numerous ideas surfaced. For instance, AI is facilitating more personalized learning experiences within higher education, tailoring educational content and pacing learning experiences to meet individual students' needs, preferences, and learning styles. AI-powered adaptive learning systems can analyze student interactions with educational materials, pinpoint strengths and weaknesses, and adjust instruction accordingly. Moreover, AI-driven chatbots and virtual assistants target support and guidance where it is most needed, from answering questions to providing feedback on assignments and personalized study tips. These tools not only enhance the learning experience but also relieve educators of some burdens, allowing them to focus more on teaching, mentoring, and meaningful student interactions.^{xiv}

In summary, while AI's impact on higher education is already significant, several aspects still require exploration, including personalized learning, ethical considerations, and the democratization of education. By thoughtfully addressing these issues, educators and institutions can harness the full potential of AI to better prepare students for future challenges and opportunities. Like health care, in education (1) static problems are tackled first, (2) large datasets are essential, and (3) domain expertise is critical, emphasizing the benefits of collaborative processes between technology and experts. Additionally, (4) the growing use of AI underscores the need for interdisciplinary approaches in data-driven contexts.

III. Chess

Let us briefly turn to chess to put some of our lessons into perspective. In 1996, reigning Chess Grand Master Gary Kasparov took on IBM's Deep Blue and won the match. In the 1997 re-match, Deep Blue prevailed.^{xv} While a good amateur chess player foresees five or six moves ahead, and a Grand Master typically anticipates 15 to 20 moves, Deep Blue was capable of calculating thousands of moves ahead, backed by a massive database containing vast numbers of past chess games, which allowed it to instantly compare future moves and outcomes. Advances in computer processing, storage, and search speed were key to its victory, and from that point onwards AI has been virtually unbeatable by humans^{xvi}.

Note that, like radiology, chess has a static objective—capture the king—and unchanging rules. However, unlike radiology, chess is a complex game that involves behavioral feedback, meaning that what one competitor does influences the subsequent moves of their opponent. The computer achieved mastery in chess only when it could store, search, and instantly process massive datasets of previously played games. As in health care, the need for massive data sets on which AI can learn is essential in chess, given that the feedback challenges are handled with a large inventory of historical records rather than through a built-in, dynamic learning process.

Therefore, in chess, as in health care and education, AI tools (1) are better equipped to tackle a static objective, rather than complex dynamic situations, and (2) AI-driven mastery can be achieved when large datasets are readily available.

IV. Financial Markets

What have we learned about the opportunities and challenges of using AI that makes us skeptical that the AI revolution will have a significant impact on the behavior of financial markets? While using AI with large, well-structured datasets offers major advantages for asset management firms and other financial industry companies, integrating AI into certain business aspects to serve clients better or benefit from labor-saving applications poses substantial challenges when it comes to improving trading outcomes or developing successful investing strategies. Our lessons from health care, education, and chess suggest that we need to address the AI challenges that arise when the data sets, as large as they might be, are decidedly non-stationary and evolve dynamically, creating complex feedback effects.

There is nothing stationary about financial markets; they are dynamic and forever changing. From the same datasets, traders and investor may reach different conclusions about the potential for different patterns, influenced by their own experiences or backgrounds. For instance, opinions on cryptocurrencies can vary widely, with some viewing them as innovative and others as scams. Moreover, the frequently changing rules require all players to adapt quickly to remain successful. And, unlike the close monitoring of cheating in chess tournaments, financial regulators have their hands full overseeing ethical issues, possible fraud, insider trading, or just unscrupulous players disseminating false rumors or other misleading information that can affect prices.

Financial markets are a complex system where dynamic problems with interactive feedback effects are much more difficult to model than static systems. Though not insurmountable, the challenges of dynamic pattern recognition involving feedback among players require sophisticated AI tools. Statistical tools like Bayesian inference or expert collaboration in supervised learning can help identify when a major pattern-changing shift, such as the Great Recession of 2008 or the Pandemic of 2020, is

under way.^{xvii} The point is that applying AI to dynamic, complex systems is inherently more challenging than to static problems with extensive historical data. Remembering the lessons from health care, even when AI can diagnose a disease, it often struggles recommending a treatment or predicting impacts on the patient. Similarly, in financial markets, while AI might identify a problem, constructing a trading strategy that consistently and successfully manages the identified risk or opportunity is far more complicated.

Then there is the challenge that some AI systems have been prone to what has been dubbed hallucinations. That is, AI sometimes makes things up. There are a couple of classic examples already observed as well as possible solutions.^{xviii} The hallucination challenge may only be the tip of the iceberg when it comes to data challenges. GIGO or “garbage in, garbage out” is a familiar maxim in the computer world. AI is likely to be a garbage maximizer – “bad data in, a landfill of garbage out”. This observation suggests that users of AI are going to have to be especially careful of the quality of their inputs. Given that AI tool makers know little about finance and finance experts know little about how AI works, the need for multi-disciplinary teams, collaboration, and for domain expertise is likely to be essential to success in using AI for investment management or trading strategies.

Our conclusions about AI’s impact on financial markets’ behavior and efficiency are straightforward. First, to manage the complex market dynamics, AI systems must be paired with experts to facilitate effective collaboration and enhance decision-making. The common view of pitting human against machine totally misses the broader potential of successful, collaborative uses of AI for investing. AI should be considered more as Augmented Intelligence than something purely artificial. Secondly, akin to the difficulties AI faces in health care when attempting to device treatment plans, in financial markets, even with the collaboration of experts, AI will struggle to formulate consistently successful trading strategies.

This leads us to an important policy implication: regulators concerned about AI’s impact on financial markets should focus on trading outcomes rather than on the tools themselves. Markets are ruthlessly Darwinian, and naturally weed out ineffective AI tools, which will lose money and be discarded. It follows that AI will be extensively tested by traders and investors but seismic changes in the behavior of financial markets are unlikely to occur. Rather than a dramatic transformation, it will more likely be a slow grind in which success will depend on human-computer partnerships.

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