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M MResearch on the Mechanisms and Effects of Artificial Intelligence in Expanding the Production Possibility Frontier in Finance

Junru Tang

Central University of Finance and Economics, Beijing, China

Abstract

Building on the production possibility frontier (PPF) theory from economics, this paper develops a theoretical framework to analyze how artificial intelligence (AI) is transforming the financial sector. The study proposes that AI systematically shifts the financial PPF outward through four key mechanisms: activating data as a production factor, improving technological efficiency, restructuring service models, and optimizing risk management. In practice, this shift leads to revolutionary improvements in supply efficiency, broader and more inclusive financial services, more precise risk control, and varied innovation in financial products. At the same time, the paper also examines challenges such as algorithmic bias and black-box decision-making, emphasizing that technology, ethics, and regulation form new constraints on the expansion of the frontier. This research provides a new theoretical perspective for understanding the nature and development of financial technology.

Keywords

Artificial Intelligence; Financial Technology; Production Possibility Frontier; Expansion Mechanisms.

1. Introduction

The evolution of the financial industry is fundamentally governed by its internal "production possibility frontier" (PPF). This frontier represents the maximum combination of financial services-such as credit, payments, and wealth management-that the system can deliver given existing technological and resource constraints. Historically, expanding this frontier relied primarily on scaling human capital and physical branches, an approach that was not only costly but also quickly ran into limits of efficiency and scale. Consequently, a significant portion of the market, often referred to as "long-tail" customers, saw their financial needs go unmet.

The emergence and deep integration of artificial intelligence (AI) are now transforming this dynamic at a foundational level. This paper argues that AI acts not merely as a tool for incremental efficiency improvements, but as a revolutionary factor of production. It pushes the financial PPF outward in multiple, systematic ways by fundamentally reshaping core financial processes and operational models.

To support this argument, the paper first clarifies the core concept and measurement of the financial PPF in the context of AI. It then provides a detailed analysis of the four key mechanisms driving its expansion. This is followed by practical evidence demonstrating the real effects of this boundary shift. Finally, the paper concludes with a balanced discussion of the accompanying challenges and new constraints. A recent systematic review of 84 studies on generative AI in finance confirms that this technology is reshaping key areas like financial decision-making and risk management, while also sparking critical debates on bias, transparency, and regulation (Ali et al., 2025).[1] This body of work provides important theoretical context and helps frame the inquiry of this study.

ISSN: 2710-0723

2. Core Conception and Measurement of the AI-Empowered Financial Production Possibility Frontier

2.1. Core Connotation

The Financial Production Possibility Frontier (PPF) refers to the maximum combination of outputs-such as credit, payment, and insurance services-that the financial system can deliver under given technological and resource constraints. The essential role of AI lies in its ability to intelligently reconfigure production factors, thereby overcoming previous resource allocation bottlenecks without heavy reliance on traditional inputs of capital and labor. By elevating data to a key production factor and advancing algorithms into core production tools, AI significantly boosts total factor productivity.

It is important to note that at some research approaches AI as a priced production factor, indicating that its market power may have complex implications for welfare distribution (Athey & Scott Morton, 2025)[2]. This insight necessitates that we consider these distributional effects alongside the expansion of the frontier itself. In summary, AI enables the financial system to provide services with lower costs, wider coverage, better risk management, and more diverse products, which leads to a sustained outward shift of the financial PPF.

2.2. Measurement Dimensions

To effectively observe and measure how AI expands the financial PPF, we propose the following four key dimensions:

1) Supply Efficiency

This dimension focuses on the cost and speed of producing each unit of financial service. Key measures include the time needed to process a single transaction, the volume of business handled per employee, and the operating cost-to-income ratio. The impact of AI is clearly demonstrated through substantial improvements in these areas.

2) Service Coverage

This dimension assesses the accessibility and inclusiveness of financial services. It is measured by the share of traditionally underserved "long-tail" customers-such as small businesses, farmers, and low-income groups-within the total client base, as well as the reach of financial services in counties and rural areas. AI broadens the range of services by overcoming barriers posed by geography and physical branches.

3) Risk Management

This dimension evaluates the financial system's ability to identify, price, and manage risks. Core measures include the non-performing loan rate for credit business, the success rate and speed of identifying and blocking fraud, and the accuracy of early risk warnings. AI's key contribution here is transforming risk control from a reactive process to a more active and preventive one.

4) Product Innovation

This dimension reflects the capacity of financial services to meet diverse and personalized needs. It is measured by the scale and market acceptance of AI-driven innovative products, such as personalized wealth management plans, context-specific insurance, and credit with dynamic pricing. This dimension offers the most direct and visible evidence of the frontier's expansion.

3. Expansion Mechanisms of the AI-Empowered Financial Production Possibility Frontier

3.1. Data Activation Mechanism

Traditional financial risk control mainly uses strongly characterized, structured data such as central bank credit reports and financial statements. As a result, many creditworthy individuals

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and businesses who lack this kind of formal data are left out of the financial system. AI technologies, especially machine learning and natural language processing, can effectively process and analyze large amounts of unstructured and semi-structured data. This includes online transaction records, social media activity, corporate supply chain information, and even satellite imagery. By deeply exploring and extracting features from these diverse data sources, AI builds dynamic and multi-dimensional user credit profiles and business health assessments that go far beyond traditional methods. For example, MYbank has offered unsecured credit loans to millions of small and micro businesses by analyzing their operational data on e-commerce platforms. In essence, this mechanism turns inactive "information silos" into measurable and priceable "credit assets." This fundamentally reduces information asymmetry, extends financial services to previously unreachable customer groups, and directly expands the service coverage boundary of the financial PPF.

3.2. Technology-Driven Efficiency Mechanism

The financial industry involves numerous repetitive and rule-based tasks, including document processing, customer identity checks, and initial credit screening. Technologies powered by AI-such as Robotic Process Automation (RPA), Optical Character Recognition (OCR), and voice AI-can perform these tasks around the clock, often with higher accuracy than humans. In more advanced applications, AI algorithms are also taking over mid-level analytical work, such as automated investment advising and approving small-scale loans.

According to research by Accenture, AI can improve the efficiency of back-office operations in financial institutions by more than 30%. This shift toward automation and smarter processes greatly reduces labor costs and operational risks. It also allows employees to focus on more valuable and complex tasks.

With significantly lower operating costs, financial institutions can serve more customers using the same amount of resources. They may also pass on the cost savings to customers, making services more affordable. Through these improvements in input-output efficiency, AI strongly contributes to expanding the financial PPF.

3.3. Service Model Restructuring Mechanism

AI technology is breaking down the traditional time and space limitations of financial services, fundamentally changing how users access them. The old model, which required customers to visit a physical branch during set business hours, is quickly being replaced by a new approach that is online, context-aware, and available everywhere.

Through open APIs, mini-programs, and smart applications, financial services are now smoothly and naturally embedded into daily life and business activities-like online shopping, travel, dining, and supply chain management. Much like basic utilities, these services are always available when needed. For example, users can instantly access installment payment options while shopping online or be automatically offered flight delay insurance when booking a trip.

Furthermore, by using AI to build detailed user profiles, financial institutions can now offer highly personalized product recommendations. This shifts the nature of service from one-size-fits-all to personalized solutions that meet individual needs.

This transformation significantly broadens the availability and variety of financial services, making it a key driver in expanding the financial PPF.

3.4. Enhanced Risk Control Mechanism

Traditional risk management often depends on static rules from past data and manual checks that are slow to respond. This makes it hard to deal with new types of risks that are becoming more complex and hidden. AI algorithms, especially advanced deep learning models, can

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process large amounts of real-time transaction data continuously. By recognizing patterns and detecting unusual activities, they help spot potential fraud and signs of declining credit quality.

For example, Alipay's smart risk control system can identify whether a payment is fraudulent in just milliseconds and block it before it is completed. In the lending business, AI models keep track of changes in a company's operational data and provide early warnings about possible defaults. This changes the way overdue loans are managed-from waiting to collect payment to taking early action.

Research by Carrera and Benalcázar (2025) shows that by using machine learning methods like XGBoost, financial institutions can accurately predict the probability that a customer will eventually repay at different stages of late payment. This allows collection efforts to be directed more accurately to those who need them most, improving recovery rates and making the process more efficient.[3]

This major improvement in the ability to identify and control risks has significantly lowered overall losses for financial institutions. It also gives them the confidence and ability to serve riskier customer groups and develop more innovative products. As a result, the business boundaries that were once limited by risk concerns are now being expanded.

4. Practical Effects of AI-Driven Financial Production Possibility Frontier Expansion

4.1. Revolutionary Improvements in Supply Efficiency

The application of AI has led to fundamental changes in the speed and cost of financial operations. In the payments sector, technologies such as facial recognition payment and contactless payment have reduced the time required for a single transaction to just seconds. In credit services, as mentioned earlier, MYbank's AI credit model has cut the average approval time for small business loans from several weeks in traditional banking down to three minutes. The operational cost for each loan is kept under two Chinese yuan. This has achieved what is known as the "310 model": 3 minutes to apply, 1 second for approval and disbursement, and 0 human intervention.

In customer service, AI-powered support systems are now capable of handling over 85% of routine inquiries, greatly reducing the workload of human agents. These efficiency gains are not isolated cases but have become benchmarks for the industry, clearly indicating a major shift in the financial PPF from the perspective of supply efficiency.

4.2. Broadening Access to Financial Services

AI-powered risk assessment models address a key obstacle in serving underserved customer groups: the lack of traditional credit history. This has turned the concept of inclusive finance into a reality on a large scale. For example, according to WeBank’s annual report, nearly 80% of its individual customers at the end of 2023 were manual and service workers , and it served over 4 million small and micro-business clients.

In rural areas, AI-driven technologies that use satellite imagery allow financial institutions to evaluate a farmer’s credit by analyzing crop conditions in their fields. This has enabled loans to be issued to millions of farmers who do not have physical assets to offer as collateral. In addition, data from the China Banking and Insurance Regulatory Commission shows consistently strong growth in inclusive lending to small and micro-enterprises. This trend serves as clear evidence that AI is widening the scope of accessible financial services.

ISSN: 2710-0723

4.3. More Accurate Risk Management

The benefits of AI in risk control have proven effective in real-world use. For example, in fighting fraud, data from Tencent Security shows that its AI system stops more than a million suspicious transactions for its partners every day, keeping financial losses very low.

In managing credit risk, many consumer finance companies have started using AI models to more accurately identify high-risk customers. As a result, they have reduced their overall bad loan rates by 10 to 20 percent.

In capital markets, AI is also being used in automated trading and risk monitoring systems. These systems can spot unusual market movements as they happen, giving institutional investors valuable information for their decisions.

This progress in risk control is essential for the financial system to grow steadily while maintaining its stability.

4.4. Diversified Product and Service Innovation

AI has enabled the creation of many new types of financial services that were not feasible with earlier technologies. In the insurance sector, usage-based insurance (UBI) uses data collected from in-car devices to offer lower premiums to safe drivers. This allows for more accurate matching of price to risk.

In supply chain finance, platforms now use AI to verify transactions, making it possible for the strong credit of major companies to be passed down the supply chain. This provides much-needed financial support to the small businesses involved.

In wealth management, robo-advisors help average investors by creating personalized investment plans that are easy to access and affordable.

The lending industry is also changing. New AI-managed loan products can automatically adjust their strategies based on shifts in the broader economy and individual risk levels, aiming for a better balance between risk and return (Gramespacher & Posth, 2021).[4]

These diverse innovations continuously add to the range of available financial services, demonstrating a dynamic expansion of the financial PPF.

5. Challenges and Reflections: The Costs and New Boundaries of Expansion

While artificial intelligence pushes the financial production possibility frontier outward, it also brings new challenges and limitations.

First, bias in AI systems can create fairness problems. If the data used to train these systems contains existing societal biases-related to gender, location, or income, for example,the AI may learn and even strengthen these biases. As a result, certain groups could face unfair treatment, such as being offered lower credit scores or higher interest rates, which goes against the goal of inclusive finance.

Second, the "black box" nature of AI decisions makes it hard to assign responsibility. Complex models like deep learning do not clearly show how they make decisions. When a loan application is rejected or a transaction is wrongly blocked, financial institutions often cannot explain why. This hurts user experience and damages trust.

Additionally, data privacy and security risks are becoming more serious. Because AI collects and uses large amounts of data, the chances of information being leaked or misused increase. Finding the right balance between technological progress and protecting privacy has become an important issue.

Finally, although AI greatly improves the efficiency and reach of financial services, we still need to carefully evaluate how well it really works. Some studies point out that when machine

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learning models perform exceptionally well in certain financial forecasting tasks, it may not be because the technology itself is superior. Instead, it could be due to flaws in how the model was built, such as "look-ahead bias." For example, Zhang et al. (2025) showed that after correcting for this bias, a random forest model that had previously produced strong excess returns no longer performed better than a traditional linear model. This reminds us that machine learning is not a perfect solution. As we use it to expand financial possibilities, we must also thoroughly test how reliable and rigorous these models really are [5].

6. Conclusion and Outlook

This study shows how artificial intelligence expands the financial production possibility frontier in a structured way through four main mechanisms: activating data as a productive resource, improving technical efficiency, redesigning service models, and enhancing risk control. As a result, financial services see improved output in efficiency, broader coverage, better risk management, and greater innovation. By connecting economic theory with real-world technology applications, this framework helps explain how fintech overcomes existing limits and creates new value by raising overall productivity.

Looking ahead, the expansion of the financial PPF is likely to follow three major trends. First, generative AI and large language models will make financial data analysis and services more intelligent. Second, human-AI collaboration will become the standard way of working, allowing each to focus on what they do best. Third, regulatory technology (RegTech) will use AI to enable more detailed and real-time oversight, helping to balance innovation with fairness.

Fundamentally, AI-driven financial development is about finding a workable balance between technology, business needs, customer interests, and system stability. A clear understanding of how the financial PPF expands and what effects this has is essential to channel financial resources in ways that support economic and social goals more effectively and fairly.

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