

The Financial Embedding of Generative AI: A Comprehensive Review of DeepSeek's Innovation Dividends and Negative Externalities

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Abstract

Generative artificial intelligence is increasingly integrated into the financial sector. While offering substantial commercial benefits, it also introduces notable negative externalities, reflecting the dual nature of its application. Most prior studies focus solely on either the technological potential or the associated risks of generative AI in finance, lacking a comprehensive framework that simultaneously considers both innovation dividends and negative externalities. To address this gap, this study uses DeepSeek as a representative technological model, adopting a 'financial embedding' perspective to analyze how generative AI creates value and evolves risks within financial scenarios. By reviewing existing research, the paper reconciles fragmented findings from narrowly focused studies. Considering the technical features and practical deployment of domestic large language models, it clarifies the relationship between smart finance innovation and risk constraints, identifies value generated through technological support and business model upgrades, and examines operational challenges such as algorithmic errors, data security issues, and regulatory delays. Using a dual-in-one analytical approach, the study integrates prior research to propose a framework adapted to the local financial context, offering theoretical guidance and governance strategies for the sustainable and compliant integration of generative AI into financial systems.

Keywords

Generative Artificial Intelligence; Financial Embedding; Innovation Dividends; Negative Externalities; DeepSeek.

1. Introduction

With the mutual reinforcement between the digital economy and fintech, generative AI is advancing rapidly in the financial sector[1]. Financial institutions and technology firms, including domestic models such as DeepSeek, are actively deploying these technologies, enhancing operational efficiency and integrating large-scale model upgrades into long-term strategies[2]. Domestically developed large language models are making fast breakthroughs, with DeepSeek gaining significant influence internationally[3]. Generative AI has been widely implemented, improving operational processes while supporting digital economy initiatives[3]. It provides essential support for the high-quality development of finance and the construction of modern industrial systems.

Despite these advantages, embedding generative AI in finance reveals several negative externalities[4]. Risks such as widening capability gaps, algorithmic black-box limitations, data corruption, and information leaks are becoming prominent constraints on smart finance growth[5]. A review of academic literature and industry discussions shows a persistent fragmentation: some studies emphasize technological benefits, highlighting efficiency gains and

paradigm shifts, while others focus on negative externalities, including data security, regulatory gaps, and compliance loopholes[6]. These two perspectives often remain isolated.

Current research on generative AI in digital finance generally exhibits a dichotomy between innovation dividends and negative externalities, with few integrated frameworks[7]. To address this, this paper adopts a dual-in-unity approach to establish a framework that balances innovation and risk. DeepSeek is chosen as a representative case; leveraging its open-source nature, cost-effectiveness, and adaptability, this study explores its advantages in financial applications and its role in bridging research perspectives[8]. A systematic review analyzes DeepSeek's innovation benefits, limitations, and practical challenges, extending insights to the overall financial integration of generative AI. Based on this analysis, regulatory pathways and governance strategies suited to China's financial context are proposed, providing guidance for aligning intelligent financial innovation with risk prevention and standardizing generative AI integration into financial systems.

2. Research Significance

2.1. Theoretical Significance

This paper conducts a comprehensive and systematic review centred on key aspects such as the integration of generative AI into the financial sector, the benefits of large-scale model technology to finance, and the risk governance of smart finance, with the aim of further refining theoretical frameworks at the intersection of artificial intelligence and digital finance. Taking the DeepSeek technological paradigm as a starting point, this study conducts an in-depth analysis of the endogenous mechanisms driving the integration of generative large models with financial business models, thereby addressing the theoretical shortcoming in current research where innovation value and risk issues are treated as separate entities[9]. Building upon existing research findings, this study integrates theories of technological innovation, financial risk and modern regulation to establish a balanced, integrated analytical framework, thereby enriching the research dimensions of fintech digital transformation. By focusing on the practical application scenarios of domestic large language models, this study supplements theoretical research on how domestically developed AI contributes to financial development. It provides new research approaches and theoretical references for further exploration of similar topics, thereby promoting the development of intelligent finance theoretical models towards greater sophistication and broader scope.

2.2. Practical Significance

In terms of industrial practice, this paper provides a comprehensive and detailed review of DeepSeek's implementation scenarios across banking, consumer finance, inclusive finance, and securities services, summarising practical experience in technological application[10]. By mapping out feasible pathways for the intelligent transformation of financial institutions, this paper assists industry stakeholders in clearly understanding the application advantages and potential risks of generative AI, thereby providing practical guidance for financial enterprises to strategically deploy large-scale model technologies, optimise business processes, and enhance internal risk control[11]. In the realm of industry governance, by integrating existing risk research findings, this study identifies practical challenges in areas such as legal compliance, data security and algorithmic regulation. It provides a basis for decision-making to help regulatory authorities refine smart finance regulatory policies, optimise supervisory models and strike a balance between innovation and risk control[12]. Concurrently, it helps to define the boundaries of generative AI applications in the financial sector, promotes the positive development of fintech, facilitates the widespread adoption of inclusive finance and fosters high-quality development in regional finance.

3. Current State of Research at Home and Abroad

3.1. Domestic Research Trends

Domestic research on the integration of generative AI and DeepSeek into the financial sector has continued to deepen in tandem with the industrialisation of large language models. These studies are closely aligned with the practical realities of local financial development, advancing in four key areas: scenario applications, innovation dividends, risks of negative externalities, and governance strategies. This has established a multi-tiered research framework, ultimately accumulating a wealth of research findings for the development of intelligent finance.

3.1.1. Research on the Concept and Practice of the Financial Integration of Generative AI

At the present stage, official policy documents have yet to provide a unified definition of the financial integration of generative AI. The domestic academic community has offered diverse interpretations of its conceptual scope, operational logic and application boundaries, based on the characteristics of the technology and actual industrial practices. Research perspectives from the perspective of industrial development indicate that domestic generative large language models, such as DeepSeek, serve as key enablers for the upgrading of the digital industry. Given its characteristics of high data density and strong service demand, the financial sector has become a key sector for the commercial deployment of large language models. Financial integration essentially represents a comprehensive restructuring of traditional financial operations, service models and management frameworks through digital technology[13]. Research from the perspective of technological innovation indicates that DeepSeek has achieved a breakthrough in the AI technology paradigm; its integration with financial scenarios is a significant manifestation of technology empowering the real economy, encompassing multiple fields such as financial services, intelligent decision-making and risk management[14]. Some studies focus on the underlying technical logic, defining large-model fintech as a new business model that transforms financial operating modes by relying on technologies such as natural language processing, big data analysis and intelligent algorithms, thereby clarifying the underlying operational mechanisms of generative AI's integration into finance[9].

In specific practical scenarios, existing research covers diverse financial sub-sectors. Relevant practical studies in the banking sector demonstrate that generative large language models can effectively empower counter services, customer service and credit approval processes, thereby simplifying operational workflows and promoting the digital transformation of banks[15]. Research on small and medium-sized financial institutions suggests that lightweight large models align with the current development status of regional banks, effectively addressing shortcomings in the digital finance infrastructure of small and medium-sized banks and driving the upgrading of grassroots financial services[16]. Furthermore, some studies have expanded their research perspective to a deeper level, exploring the beneficial effects of large models in inclusive finance, rural finance and regional economic development, thereby further broadening the scope of research on the integration of generative AI into finance[17].

3.1.2. Research on the Disconnect between Innovation Dividends and Negative Externalities

Current domestic research exhibits a marked dichotomy, with the majority of studies focusing solely on either technological dividends or potential risks; integrated research that addresses both aspects is rare, and the fragmentation of perspectives has become a prominent issue in this field.

Firstly, there is research on the innovation dividends of generative AI's integration into finance. Most domestic studies agree that large-scale model technology has a positive impact on the financial sector. Literature on the development of smart finance indicates that the continuous

iteration of generative AI technology has broken through the limitations of traditional financial service models, effectively improving the industry's operational efficiency and expanding the coverage of financial services[18]. Research on banking sector transformation indicates that DeepSeek can reshape the business models of financial institutions, unlocking digital dividends in scenarios such as intelligent marketing, risk screening and operational management, whilst reducing corporate operating costs[11]. Studies conducted in the financial markets sector demonstrate that artificial intelligence technology can optimise decision-making logic in areas such as quantitative trading and asset allocation, thereby improving the efficiency of resource allocation in financial markets[19]. As things stand, most existing research on this topic suggests that generative AI can drive the transformation and upgrading of the financial sector, improve the competitive landscape of the industry, and continuously inject momentum into the high-quality development of the financial sector[20].

Secondly, there is research into the negative externalities associated with the integration of generative AI into the financial sector. As the scope of technological applications continues to expand, various associated risks are gradually attracting the attention of the academic community. Research in the field of consumer finance indicates that the application of large language models entails compliance risks such as unclear legal boundaries, ambiguous allocation of responsibility, and harm to consumer rights[21]. Research on data governance emphasises that the large-scale collection of users' financial information by generative AI can easily lead to security issues such as data breaches and misuse of information, posing a threat to personal financial privacy[22]. Studies focusing on technical limitations point out that issues such as algorithmic black boxes, insufficient model fault tolerance, and over-reliance on technology increase operational risks for financial institutions and the likelihood of decision-making errors[4]. Macro-financial research further warns that algorithmic homogenisation can intensify the contagion of financial risks, potentially triggering regional or even systemic financial volatility. Furthermore, hidden negative externalities such as regulatory lag, algorithmic bias and technological monopolies have been confirmed in numerous studies[7].

Thirdly, there is the issue of fragmented research perspectives and a lack of a coherent framework. A review of the existing literature reveals that current research generally exhibits a marked bias. Innovation-oriented studies often downplay long-term latent risks and one-sidedly exaggerate the value of technological assistance, whilst risk-oriented studies focus excessively on negative implications, overlooking the transformative value of generative AI for the financial sector[6]. In industry practice discussions, evaluations of large models such as DeepSeek have become polarised, lacking objective and dialectical comprehensive assessments; a unified integrated analytical framework has yet to be established[23]. The separation of perspectives and the fragmentation of research frameworks have limited the depth of research in this field and its practical guidance value.

3.1.3. Research on Risk Governance and Optimisation Pathways

In response to the series of issues arising from the application of generative AI in the financial sector, the domestic academic community has conducted research using real-world industry cases. From multiple perspectives-including legal refinement, regulatory optimisation, corporate practice and industry collaboration-it has explored and proposed diverse governance strategies. In the legal and regulatory sphere, some studies suggest that specialised legislation on smart finance should be further refined to clearly define the boundaries of responsibility for large model applications, and that robust algorithm review[12] and compliance management systems should be established to address existing gaps in legal and regulatory frameworks. Research drawing on global regulatory experience indicates the need to establish a comprehensive regulatory model suited to China's national conditions, innovate governance models, and strike a balance between innovation and risk prevention through a combination of flexible regulation and rigid constraints. In terms of institutional practice,

research generally holds that financial institutions should, based on their own business characteristics, promote the localisation and customised optimisation and upgrading of large models[11], enabling them to meet the risk control requirements of the financial sector. It is necessary to improve internal technical control models and establish end-to-end management mechanisms covering algorithm review, model iteration, risk early warning and other stages[24], thereby reducing the risks associated with technology application at source. In terms of industry collaboration, relevant research proposes establishing a governance model involving multi-stakeholder cooperation among governments, financial institutions, technology firms and industry associations to unify industry standards for technology application[8], intensify talent development and strengthen technological research and development. Through policy guidance and the improvement of computing infrastructure, a favourable industrial environment should be created to ensure the compliant and standardised implementation of generative AI[25].

3.2. International Research Trends

Research and development in generative AI began earlier abroad, and the research framework integrating large models with the financial sector is relatively mature. The research focus differs significantly from that in China, concentrating primarily on areas such as underlying technology R&D, cross-border financial risks, and global regulatory coordination.

In terms of research into technological value, the international academic community has long engaged in in-depth study of underlying technologies such as machine learning, algorithm optimisation and big data mining, with a particular focus on exploring the application value of generative AI in scenarios such as asset pricing, robo-advisory and cross-border financial services. Relevant research confirms that the reasoning capabilities of large models possess significant practical value in core areas such as financial decision-making and risk assessment, and can effectively enhance the efficiency of financial services and the scientific rigour of decision-making[19]. Concurrently, the academic community has conducted systematic analyses of the evolutionary trajectory of large-scale model technology, clarifying the future development direction and application boundaries of generative AI[9]. Comparative studies of mainstream large language models such as DeepSeek reveal differences in technical characteristics, performance and deployment scenarios, providing a reference for model selection in the financial sector[8]. Empirical research further indicates that technological breakthroughs in large language models directly impact the value of financial enterprises and the competitive landscape of the industry, highlighting the significant role of generative AI in the financial sector[20].

In the field of research on negative externalities, international studies cover a broader scope, focusing on issues such as algorithmic bias, model hallucinations, cross-border data flows, global risk contagion and monopolies by tech giants. Relevant research indicates that algorithmic opacity and bias exacerbate inequalities in financial services, whilst model hallucinations directly undermine the reliability of financial decision-making[5]. Cross-border data transmission is prone to security risks, whilst the interconnectedness of global financial markets amplifies the risk of homogenisation in AI algorithms, thereby triggering cross-regional financial volatility and necessitating the establishment of a comprehensive risk identification system.

In terms of governance measures, overseas jurisdictions, building upon mature financial regulatory frameworks, have implemented systems such as tiered and categorised supervision, algorithmic transparency reviews, and joint prevention and control of cross-border risks. The regulatory sandbox model is widely adopted, allowing for technological pilot schemes within controlled parameters; flexible regulation embraces technological innovation, whilst global

regulatory collaboration alleviates the challenges of transnational financial AI governance, providing a governance reference for the global development of smart finance.

3.3. Analytical Framework

To overcome the difficulty of research dispersion, our research suggests an integrated analytical model based on 'financial embedding.' Financial embedding means integrating large-scale generative language models into financial operations, services and management systems. As a result, it affects the creation of value and the distribution of risk in the financial system.

The framework consists of three main aspects. It interprets "financial embedding" as a step-by-step procedure. This procedure starts with simple task automation at the beginning and progresses to the complete incorporation into the main decision-making and compliance procedures. This distinction is important because it affects both the size of the benefits of innovation and the severity of the negative impacts from outside sources. From a mechanism point of view, the framework considers that the innovation rewards and the adverse external effects are jointly produced by the same process of financial embedding. The factors which result in higher efficiency and service growth are the same as those causing the lack of algorithmic understanding, the vulnerability of data and regulatory strain. Analytically, the framework has a multi-level perspective. It includes micro-level institutional changes, meso-level industry reorganization and macro-level system stability. This method enables an overall assessment of the financial influence of AI at various levels.

These three aspects form a dual unity analytical framework. This framework considers innovation and risk as factors which influence each other rather than conflicting issues. It provides the basis for the following examination and management analysis.

3.4. Comparative Assessment

A contrast between domestic and foreign investigations shows three main deficiencies. First, the opinions remain controversial. Research on the stimulation of innovation and adverse externalities is generally carried out independently. Second, the theoretical foundations are inconsistent. Current studies mostly deal with single cases rather than the entire financial aspect of artificial intelligence. Third, the extent of research is unequal. A thorough micro-meso-macro analysis and the long-term systematic impacts have not been adequately examined. These shortcomings indicate the necessity for a more comprehensive and logically reasonable assessment, which will be further discussed in the subsequent chapter.

4. Research Review

A comprehensive review of existing domestic and international literature reveals that the domestic academic community has conducted extensive and diverse research on the integration of DeepSeek and generative AI into the financial sector, accumulating a substantial body of research findings across multiple dimensions, including application scenarios, innovation dividends, risk identification and governance strategies. Existing research, grounded in sub-sectors such as banking, consumer finance and inclusive finance, has conducted in-depth analyses of the value and practical limitations of large-scale model technologies, providing robust theoretical support and practical guidance for the transformation of China's fintech sector and the implementation of domestic large-scale model industries. Domestic research generally acknowledges the transformative role of generative AI in the financial sector, viewing the orderly integration of AI technology with financial scenarios as an inevitable trend for industry development, whilst recognising that robust risk control models and improved regulatory frameworks are key to the sector's stable growth. Overseas research focuses on the development of underlying technologies, the quantification of risks, and cross-border regulatory coordination, with particular attention paid to algorithmic governance, data security

and global financial stability. By relying on empirical models and quantitative analysis, it has established a diverse range of research perspectives. Although there are differences in the focus of domestic and international research, both revolve around the two core issues of AI-driven financial innovation and risk, laying a certain foundation for the theoretical refinement and standardised development of the intelligent finance sector. Taking the literature as a whole, existing research still has shortcomings. On the one hand, the fragmentation of research perspectives is particularly pronounced; studies on innovation dividends and negative externalities are disconnected, lacking an integrated analytical approach that treats them as two sides of the same coin. On the other hand, research frameworks remain scattered, with few systematic studies specifically using DeepSeek as a core case study and tailored to the context of China's financial development. Furthermore, research dimensions are limited; there is insufficient integrated analysis across micro-level institutional operations, meso-level industry competition and macro-level financial stability, whilst exploration of long-term latent risks remains relatively weak. Overall, existing research has laid a relatively solid theoretical foundation for this review; however, aspects such as fragmented perspectives and inadequate frameworks require further refinement and improvement.

5. Conclusion

This research carries out a detailed investigation on the current applications of generative artificial intelligence in the financial sector. By using DeepSeek as an example, the benefits and drawbacks of large language models in the financial system are assessed. The results show that these two aspects are related rather than separate. To improve service efficiency and promote innovation may lead to problems such as algorithm uncertainty, data security risks and governmental regulations. Taking both these aspects into account at the same time instead of considering them separately, this study makes an important theoretical progress.

Concerning the practical effects, banking organizations should adopt a step-by-step method for integrating AI. This method evaluates the degree of AI incorporation according to their own risk-managing abilities. At the same time, supervisory authorities should concentrate on improving the governance of algorithm evaluation, data responsibility and cross-institutional risk monitoring.

Further study should be carried out from simple summaries to the verification of the co-production mechanism mentioned here through empirical research. Attention should be focused on the restructuring of industries at the meso-level and the long-term systemic effects caused by the extensive integration of artificial intelligence in financial markets.

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