

National Audit, Enterprise Digital Transformation, and Total Factor Productivity

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Abstract: Total factor productivity (TFP) is an important engine for promoting high-quality economic development. This article analyzes the impact mechanism of national audit on the TFP of enterprises, and examines the moderating effect of digital transformation on its process, as well as the path of inefficient investment. Research has shown that national auditing can significantly improve the TFP of enterprises by exerting deterrent, preventive, and defensive functions, while digital transformation can play a positive regulatory role. Furthermore, alleviating inefficient investment plays a mediating role in the process of promoting enterprise total factor productivity through national auditing, while digital transformation plays a positive moderating role in the path of national auditing affecting inefficient investment. The research results help to reveal the relationship and mechanism between national audit and high-quality development of enterprises in the process of digital transformation, and provide management insights for high-quality development of enterprises.

Keywords: National Audit; Total Factor Productivity; Digital Transformation; Influencing Mechanism; Regulating Effect

1. Introduction

High-quality development is the primary task of comprehensively building a modernized country, and improving total factor productivity (TFP) has become a reliable path to promote high-quality economic development in China. However, Chinese state-owned enterprises are currently facing problems such as high resource and energy consumption, high external dependence on core technologies, and sustained slowdown in productivity growth. National audit is the cornerstone and important guarantee of

national governance, and an important force in promoting the modernization of the national governance system and governance capacity. Its function continues to expand with the development of the theory of public entrusted economic responsibility and the transformation of national governance priorities. Recent literature suggests that in the new wave of technological revolution, digital transformation, as the core driving force for modernizing national governance capabilities, is conducive to promoting innovation in audit technology methods and improving the ability to identify and warn of risks and hidden dangers in high-quality economic development [1,2].

The varying degrees of digital transformation of enterprises have different impacts on the economic supervision role of national auditing. So, in the context of rapid digital transformation, how can national auditing promote the growth of total factor productivity in state-owned enterprises? What regulatory role has digital technology played in its process? What is the specific pathway of action? These issues still need further verification. This article delves into the impact mechanism and path of national audit on the TFP of state-owned enterprises, and examines the moderating role of digital transformation in the process of inefficient investment, in order to alleviate the continuous slowdown of TFP in state-owned enterprises. It has important theoretical significance and practical value for promoting state-owned enterprises to get rid of the problems of "large but not strong" and "comprehensive but not excellent".

The possible contributions of this article include: firstly, starting from the micro governance perspective of national audit, exploring the impact mechanism of national audit on the TFP of state-owned enterprises, analyzing the role path of inefficient investment, and further revealing the heterogeneity of the role path from the perspectives of underinvestment and

overinvestment by examining the different characteristics of inefficient investment, providing new basis for the improvement mechanism of national audit on TFP. Secondly, examine the heterogeneity of the impact of national audit on the TFP of state-owned enterprises in the process of different digital transformation roles. Existing literature mainly focuses on the macro impact of the digital economy on provincial or municipal levels, with few studies exploring the role of different levels of digital technology from a digital technology perspective. Thirdly, the boundary conditions of digital technology have been supplemented. This article further analyzes the moderating effect of digital transformation on the intermediary pathway of inefficient investment, in order to provide feasible solutions for enterprises to suppress inefficient investment and achieve TFP growth.

2. Literature Review

2.1 Literature Review on Total Factor Productivity

Total factor productivity (TFP) is the additional production efficiency achieved under the premise of a fixed level of input factors, which can be used to measure the quality and sustainability of economic growth. How to further improve TFP has become a key issue of concern for current scholars. Scholars mainly focus on the influencing factors of changes in total factor productivity of enterprises from both external and internal perspectives. At the external level of enterprises, scholars mainly examine how to enhance the TFP growth of enterprises in areas such as digital economy development, tax reduction and fee reduction policies, optimization of business environment, and efficiency of financial resource allocation [3,4]. At the internal level of enterprises, existing literature has mostly studied aspects such as operational leverage, technological integration innovation, and ESG information disclosure [5,6].

2.2 Literature Review on National Audit

National audit is an institutional external supervision that plays a positive role in promoting economic development based on its independent, mandatory, and professional characteristics. Existing literature mainly

examines the governance effects of national auditing from two perspectives: macro and micro. At the macro level, scholars have found that national auditing has a positive spatial spillover effect on government budget performance [7], and it can effectively enhance regional economic resilience [8] and promoting local economic growth plays an important role in maintaining national economic security and preventing and resolving major risks [9]. At the micro level, the intervention of national auditing can promote the fulfillment of social responsibility of central enterprises and make the "development potential" of the enterprise a key supervision content to curb the short-sighted behavior of the management and optimize internal corporate governance [10,11].

2.3 Literature Review on Digital Transformation and Productivity

With the continuous penetration of digital technology, new business opportunities, innovative products and services, and new business models emerge and prevail. Faced with the profound changes in technology and market environment in the digital age, most enterprises regard digital technology as a strategic priority to improve business performance and gain sustainable competitive advantages [12]. Early literature considered investment in information and communication technology as a production factor and discussed its impact on productivity [13]. Existing research suggests that enterprise TFP can be improved by enhancing technological progress and management efficiency [14]. Relying on new technologies such as blockchain, big data, cloud computing, artificial intelligence, and the Internet of Things, digital technology can improve the technical level and management efficiency of enterprises from multiple aspects such as technology, information, and platforms, thereby eliminating obstacles to the growth of total factor productivity of enterprises [15,16]. Therefore, TFP can enhance enterprise digital transformation driven by digital technology

In summary, there is relatively little research on the relationship between national audit and TFP, and there are few literature on the impact mechanism and pathway of national audit on TFP of state-owned enterprises. At the same time, research in the field of national auditing

and digital technology mostly focuses on exploring the overall development trends of industries or regions under the development of the digital economy at the theoretical level, while lacking research on how digital technology empowers national auditing to promote the modernization of the national governance system and governance capacity.

3. The Impact Mechanism of National Audit on Total Factor Productivity of Enterprises

Improving the total factor productivity of enterprises is of great significance for high-quality economic development. As a normalized economic supervision mechanism, the value function of national audit has a positive effect on the growth of total factor productivity of enterprises. The specific implementation mechanism is reflected in the following three aspects.

3.1 Deterrent Role

On the one hand, national auditors can use their professional skills and information processing abilities to identify the authenticity and fairness of information disclosed by the company's management, reveal opportunistic behaviors such as fraud, embezzlement, interest transfer, and inefficient investment decisions, form a "credible threat", effectively alleviate information asymmetry and agency problems within the company, improve the information environment, curb the deterioration of earnings management, and enhance resource utilization efficiency. On the other hand, national auditing takes the implementation of corporate policies as the entry point, revealing the risks and hidden dangers in the process of policy implementation, and generating a deterrent effect. Previous studies have confirmed that the main driving force behind TFP growth is technological innovation. In recent years, the government has issued a series of policies and regulations, such as the "Implementation Opinions on the Construction and Application of Manufacturing Technology Innovation System" and the "Interim Measures for Equity and Dividend Incentives of State owned Science and Technology Enterprises", aimed at mobilizing enterprise innovation and ensuring TFP growth. Due to the pressure of political achievements and considerations of enterprise economic assessment, leading cadres tend to

invest in projects with short investment cycles, quick results, and low risks, resulting in inadequate implementation of policy measures, insufficient innovation capabilities, distorted resource allocation, and other problems, exacerbating the adverse impact on enterprise TFP. The national audit monitors the implementation of enterprise policies, timely discovers problems in the implementation process, reduces the mismatch of responsibilities among leadership cadres, and directly punishes, transfers or holds enterprises accountable to make illegal and irregular personnel bear corresponding consequences, avoiding deviation from policy implementation goals, guiding the rational flow of resources between enterprises and manufacturing industries, and achieving the goal of improving innovation capabilities and production efficiency. In addition, audit institutions will release audit notices in the form of audit announcements to the public regarding issues discovered during the audit process, such as business management and policy implementation effectiveness, which will attract media and public attention, generate information spillover effects, and invisibly increase the additional costs and risks required for irrational decision-making by executives, amplify the deterrent effect of audits, and promote the improvement of TFP.

3.2 Responsive Role

On the basis of fully identifying and revealing relevant issues, national auditing conducts in-depth analysis of the causes of problems, proposes targeted improvement suggestions, supervises relevant departments and enterprises to deepen reforms, helps audited state-owned enterprises correct adverse behaviors that deviate from production and operation goals, prevents the occurrence of "repeated inspections and violations", achieves reasonable and efficient decision-making on enterprise technology research and development behavior, and promotes the improvement of enterprise TFP. In addition, the national audit will track the implementation and rectification of institutional recommendations by the audited units through multiple audits. According to statistics, from 2010 to 2018, the National Audit Office conducted "patrol inspections" on 34 state-owned listed manufacturing

enterprises. The implementation of multiple audits is highly targeted. By fully utilizing past audit results and conducting precise inspections, it effectively leverages the responsiveness of audits, helping to promote substantial progress in rectifying institutional loopholes in audited enterprises and providing a good foundation for achieving TFP growth.

3.3 Preventive Role

On the one hand, as an effective policy tool, national auditing provides constructive audit recommendations to help audited units improve internal controls, enhance management levels, form long-term mechanisms, regulate their irrational behavior from the root, compress the space for report embellishment, and prevent the recurrence of violations. On the other hand, national auditing helps to curb the short-sighted tendencies of management, thereby improving the total factor productivity of enterprises. As a preventive mechanism to prevent opportunistic behavior by management in the future, national auditing conducts audits on central enterprises and their holding companies. The audit results will be included in the assessment of the responsible persons of central enterprises, thereby affecting the compensation and future career promotion of management. Therefore, executives of state-owned enterprises will reduce their pursuit of short-term performance, encourage them to increase their motivation for technological research and development, make decisions from the perspective of legality and long-term, promote the improvement of enterprise management efficiency, improve resource utilization efficiency, and obtain more future development opportunities. Therefore, this article believes that national auditing can promote the growth of total factor productivity of enterprises.

4. Analysis of the Regulatory Role of Digital Technology

The development of digital technology has brought new challenges and opportunities to the effectiveness of national audit governance, which can meet the new needs of national audit in governance function construction. This article argues that empowering national auditing with digital technologies such as big data and blockchain is beneficial for improving the governance efficiency of national auditing,

expanding the scope of audit supervision, and increasing audit supervision efforts, thereby promoting the growth of total factor productivity of enterprises.

4.1 Improving Governance Efficiency

Firstly, digital technology can optimize the collection, access, perspective, and sharing of information. The application of digital technologies such as big data and blockchain can collect, process, store, and process data, improving the convenience and effectiveness of obtaining audit evidence. It can further alleviate the information asymmetry between audit institutions and audited units, effectively reducing information barriers. Identify and reveal improper behavior of enterprises, improve the efficiency of fund utilization and resource allocation of enterprises. Secondly, empowering national auditing with digital technology can improve the professionalism and objectivity of auditors, effectively avoiding cognitive limitations and inference errors of national auditors through data aggregation, modeling analysis, and other methods, avoiding interference from redundant information, focusing on behaviors of state-owned manufacturing enterprises that are not conducive to improving their total factor productivity, and proposing more targeted audit rectification opinions.

4.2 Expanding the Scope of Supervision

National auditing can rely on digital technology to efficiently connect with the terminal data of audited units, obtain dynamic information throughout the entire process of audited units, which is conducive to the proactive supervision of audit institutions, promote the transformation of state-owned enterprise governance from "remedial measures after the fact" to "preventive measures before the fact", achieve comprehensive and continuous supervision, and expand the scope of supervision. In addition, empowering national auditing with digital technology is conducive to achieving collaborative supervision between auditing agencies, disciplinary inspection and supervision, inspection and supervision, etc., providing technical support for multi subject joint supervision. Auditing agencies can focus on the handling of relevant matters and personnel of state-owned enterprises

transferred by judicial agencies, disciplinary inspection and supervision departments, etc., and improve the utilization of audit results.

4.3 Conducive to Increasing Supervision Efforts

For example, blockchain technology enables remote supervision of networked auditing through distributed sharing technology and timestamp characteristics, which can closely track and accurately collect data from state-owned enterprises, reduce the risk of data fraud and tampering, increase the probability of revealing rent-seeking behavior, further deter and regulate improper behavior of enterprises, reduce illegal and irregular behavior of leaders, and reduce policy implementation deviations. Natural language processing technology can quickly analyze a large amount of textual information of state-owned enterprises according to audit needs, extract key information, achieve systematic retrieval of risk points, and present multi-dimensional and three-dimensional analysis results of data to discover the deep-seated reasons for the slowdown of total factor productivity growth in enterprises, and achieve real-time risk warning. Therefore, digital technology plays a positive moderating role in the improvement effect of national audit on total factor productivity of enterprises.

5. Analysis of Action Path

Effective investment is an important foundation for the development and growth of enterprises. In the real economy, there are often a lot of frictions and interferences in the market that affect the investment efficiency of enterprises and have a negative impact on the improvement of total factor productivity. National auditing can improve corporate TFP by alleviating underinvestment and curbing overinvestment. In terms of insufficient investment, national audit institutions reveal the financial and operational status of enterprises, reduce the possibility of increased costs for managers to conceal and falsify information, improve the level of information disclosure for enterprise investment projects, promote more open and transparent information flow, and alleviate financial risks by easing financing constraints and ensuring a virtuous cycle of funds. In terms of overinvestment, national audit institutions can

discover inefficient or ineffective investments in investment projects through their review of fund utilization. They can handle illegal and irregular behaviors exposed by blind investment by enterprises in accordance with the law, transfer relevant audit clues to judicial and disciplinary inspection departments for processing, and propose corresponding improvement suggestions. This helps alleviate the principal-agent problem, strengthen internal management controls, standardize the investment decision-making and execution process of enterprises, and curb management's excessive investment activities driven by self-interest motives. Therefore, national auditing improves the total factor productivity of enterprises by suppressing inefficient investment.

Furthermore, digital technology plays a role in improving information transparency, reducing search costs for information products, enhancing investment efficiency, and improving misallocation of factor resources, thereby curbing inefficient investment by enterprises. Digital technology empowers the traceability, accuracy, and completeness of information. The use of digital technology can collect, synthesize, and analyze data on various market investments, reduce information asymmetry, improve information quality, diversify information, alleviate blind and lagging market investment problems, reduce unknown investment risks, and enhance the accuracy and objectivity of enterprise investment. In addition, digital development indirectly reduces the reliance of enterprises on management intuition and experience in decision-making, and reduces irrational decision-making behavior of management. Secondly, the development of digital technology has reduced the search cost, transaction cost, and matching cost of information products. By using information technology to obtain consumer behavior data in the market, enterprises can track consumer preferences, use digital technology to understand their value demands based on consumer behavior data, make effective investments or adjustments according to market demand, achieve precise matching of supply and demand, improve investment efficiency, and further promote the improvement of enterprise investment performance. Thirdly, the application of digital

technology helps to eliminate information barriers within and between enterprises, including communication barriers between upstream and downstream enterprises as well as between enterprises and the external environment, breaking through the boundaries of enterprise activities and avoiding the emergence of "information silos". Digital technology effectively alleviates investment decision-making errors caused by insufficient information collection and utilization, suppresses the occurrence of adverse selection and moral hazard caused by information asymmetry between business operators and investors, strengthens the integration of data and knowledge elements, improves the mismatch of factor resources, and promotes the improvement of enterprise TFP. Therefore, the higher the level of digital technology, the stronger the mediating role of inefficient investment between national auditing and total factor productivity of enterprises.

6. Conclusion and Policy Suggestions

Clarifying the internal logic and path of national audit to enhance the TFP of manufacturing enterprises is of great significance for promoting the steady operation of China's economy and achieving high-quality development. This article examines the impact mechanism and pathway of national audit on the TFP of state-owned enterprises, and analyzes the moderating role of digital transformation in the process of inefficient investment. The following conclusions are drawn: (1) National audit has a positive effect on the TFP of enterprises, and inefficient investment plays an intermediary role in it; (2) Digital technology plays a positive moderating role between national audit and enterprise TFP. The higher the level of digital technology, the more significant the promoting effect of national audit on enterprise TFP; (3) Digital technology can significantly regulate the mediating effect of inefficient investment. The higher the level of digital technology, the stronger the mediating effect of inefficient investment between national audit and enterprise TFP.

Based on the research findings, this article proposes the following policy recommendations: (1) Audit institutions should actively expand the scope of audit supervision, ensure comprehensive coverage, attach

importance to the important role of total factor productivity in high-quality economic development, strengthen the deterrent and responsive functions, propose targeted audit recommendations, ensure that relevant problems and institutional loopholes discovered during the audit process are repaired, and improve audit governance efficiency. (2) Audit institutions should accelerate their own informationization construction, proficiently apply technologies such as big data and blockchain in audit work, strengthen the construction of data sharing platforms with other supervisory agencies, form a full coverage network for auditing, expand and improve the efficiency, effectiveness, and effectiveness of auditing, deeply explore the violations and hidden risks of state-owned manufacturing enterprises in total factor productivity, investment efficiency, and other aspects, and suppress opportunistic behavior of management. (3) Audit institutions should pay attention to the allocation of audit resources during the audit process, and dynamically optimize and adjust work priorities based on specific circumstances, in order to achieve better results in promoting the improvement of total factor productivity of enterprises.

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