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DIGITAL ECONOMY EMPOWERS CHINA'S HIGH-QUALITY ECONOMIC DEVELOPMENT: MECHANISM, EFFECT AND PATH

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Abstract. China's economy has entered a stage of high-quality development, and the extensive factor input model is unsustainable, and improving total factor productivity (TFP) has become the core issue of cultivating new economic momentum.

Keywords: digital economy, Chinese economy, economic growth, factors of production, economy and technology, regional economy.

1. Research background.

At present, China's economy has shifted from a stage of rapid growth to a stage of high-quality development, and the extensive development model that relied on the input of factors such as land and labor in the past has been difficult to adapt to the new requirements of economic development in the new era. Improving total factor productivity (TFP), as the core starting point for cultivating new momentum for economic development, has become an important issue of common concern to the government and academia. At the same time, the new generation of information technologies such as big data, cloud computing, Internet of Things, and artificial intelligence has accelerated its iteration, and has been deeply integrated with various fields of economy and society.

1.1. Theoretical analysis and research hypothesis.

Theoretical mechanism.

As an important source of high-quality economic development, total factor productivity (TFP) has always been a hot issue in economic research. According to the existing research results, the key to improving TFP is to improve the technical level and optimize the efficiency of factor allocation. As a highly technology-intensive economic form, the digital economy plays an irreplaceable role in promoting technological change

and improving factor allocation efficiency, and its theoretical mechanism affecting TFP can be carried out from two dimensions: technological innovation effect and factor allocation effect.

Technological innovation effect: the path of the digital economy to promote technological innovation.

The development of the digital economy can promote technological innovation by easing financing constraints, improving innovation capabilities, and reducing innovation risks, thereby laying the foundation for TFP improvement.

Ease corporate financing constraints. Technological innovation activities require a lot of financial support, but under the condition of information asymmetry, traditional financial institutions generally have the phenomenon of "reluctance to lend", and a large number of enterprises face serious external financing constraints, resulting in insufficient R&D investment. With the widespread application of digital technology in the financial field, financial institutions can more easily obtain relevant information about enterprises, accurately identify the real operating conditions of enterprises, and provide financing services according to the actual situation, effectively alleviating corporate financing constraints. At the same time, the development of digital finance has intensified competition among financial institutions and broadened corporate financing channels, which helps to improve the utilization and matching efficiency of credit resources, alleviate the problem of misallocation of credit resources, and provide stronger support for enterprise innovation financing.

Improve technological innovation capabilities. Innovative enterprises rely on digital technologies such as the Internet and artificial intelligence to build a network collaborative innovation platform, which can reduce the cost of searching and matching R&D resources, realize the effective integration of fragmented R&D resources and knowledge information, and enhance collaborative innovation capabilities. In addition, with the help of the network collaborative innovation platform, R&D personnel can obtain diversified technical information and achieve benign interaction at almost zero cost, promote the collision and integration of innovative inspiration, and improve the efficiency of cutting-edge technologies.

Reduce innovation risk. In the traditional R&D model, it is often difficult for new products and services launched by enterprises to accurately match the real market demand, resulting in a high risk of innovation fail-

ure. The development of the digital economy has gradually shifted the innovation organization model from closed to open, and relevant departments and even the whole society can participate in the research and development and design of new products, effectively bridging the information gap between developers and demanders, improving the matching efficiency of innovation activities and actual needs, thereby reducing innovation risks and stimulating the enthusiasm of enterprises to innovate.

Factor allocation effect: the path to optimize the allocation of factors in the digital economy.

The development of the digital economy can improve the efficiency of factor allocation by improving the efficiency of factor matching, intensifying market competition, and promoting the upgrading of industrial structure, creating favorable conditions for TFP improvement.

Improve the efficiency of matching factor supply and demand. The development of the digital economy has greatly improved the efficiency of information search and broken the information asymmetry barrier between the supply and demand sides of factors. This not only helps to reduce the gap between factor supply and demand, but also corrects the mismatch of production factors, thereby effectively improving the efficiency of factor supply and demand matching.

Intensify market competition and promote optimal allocation of resources. On the one hand, the digital economy improves information availability, lowers the market entry threshold on the supply side, reduces consumer information retrieval and comparison costs on the demand side, and significantly enhances market competition. On the other hand, the rapid development of online digital trading platforms such as Taobao and JD.com has blurred the geographical restrictions of enterprise operation, intensified cross-regional competition between enterprises, and expanded the scope of production factor allocation. In the fierce market competition, enterprises with low production efficiency will be forced to withdraw from the market, and the production factors released by them will flow into departments with higher production efficiency to achieve optimal allocation of resources.

Promote the upgrading of industrial structure. Digital technology has the characteristics of versatility and high penetration, and has been widely used in various fields of economy and society, giving birth to a large number of emerging intelligent industries with high technical level and production efficiency, such as network office, sharing economy, and intelligent manufacturing. With their strong growth ability and profit creation

ability, these emerging industries have attracted a large influx of human capital, financial capital and other production factors, making the proportion of knowledge-intensive industries continue to rise, and achieving industrial structure optimization and upgrading and production efficiency improvement. At the same time, in the process of deepening the integration of digital technology and traditional industries, the leading technologies of traditional industries have been improved, the production organization model has been reshaped, and the business process has been greatly optimized through the digital and intelligent transformation of procurement, production, circulation and other links, and the efficiency of factor allocation and production efficiency have been effectively improved.

Research hypotheses.

Based on the above theoretical analysis, the following research hypotheses are proposed:

Hypothesis 1: The development of the digital economy has a significant role in promoting TFP.

Hypothesis 2: The effect of technological innovation and the effect of factor allocation are effective paths for the digital economy to influence TFP.

1.2. Study design.

Model setting.

Benchmark regression model: construct a panel fixed-effect model to test the direct impact of digital economy on TFP, and control variables such as investment in science and technology education, industrial structure, and financial development.

Mediation effect model: Technological innovation, capital allocation efficiency, and labor allocation efficiency are introduced as mediating variables to reveal the transmission mechanism of the impact of the digital economy on TFP.

Spatial econometric model: The fixed-effect spatial lag (SAR) model is used to investigate the spatial spillover effect of the digital economy.

Variable definition.

The explained variable: total factor productivity (TFP), which is calculated by using the super-efficient SBM model based on undesired output, taking into account undesired outputs such as industrial wastewater and sulfur dioxide.

Core explanatory variables: Digital Economy Development Index (Dige), which is constructed by principal component analysis method

through five indicators, including Internet penetration rate, proportion of related employees, and per capita telecommunications business volume.

Mediating variables: technological innovation (Innov) is measured by the number of patents granted; Factor allocation efficiency includes capital allocation efficiency (KA) and labor allocation efficiency (LA), which are converted based on the degree of factor market distortion.

Control variables: covering key factors such as investment in science and technology education, industrial structure, financial development, infrastructure, and foreign direct investment.

Data source.

The research sample is 284 prefecture-level and above cities in China from 2011 to 2018, with a total of 2 272 observations. The data are derived from the China Research Data Service Platform (CNRDS), the Digital Finance Research Center of Peking University, the CEIC database and the statistical bulletins of various cities, and the missing data are filled by linear interpolation method.

2. Analysis of empirical results.

Benchmark regression results.

The development of the digital economy has a significant positive impact on TFP, and the growth rate of TFP increases by 7.59 percentage points for every standard deviation (0.903) of the digital economy development index after adding the control variable. Quile regression showed that the promotion effect of the digital economy was more obvious in cities with higher TFP levels (75 % quantile), with an estimated coefficient of 0,066. Among the control variables, investment in science and technology education, industrial structure upgrading and infrastructure improvement all have a positive effect on TFP growth.

Robustness test.

Endogenous treatment: The number of urban fixed telephones and the number of post offices in 1 986 were used as instrumental variables, and the panel instrumental variables were constructed for 2SLS regression, and the results were still significant.

Dynamic effect control: Add the first-order lagging term of TFP and regression using the differential GMM method, and the promotion effect of the digital economy remains stable.

Replacement of measurement method: TFP was recalculated by stochastic frontier analysis (SFA), and the regression results were consistent with the baseline conclusions, which verified the reliability of the study.

Influence mechanism test.

Technological innovation channels: The digital economy significantly promotes technological innovation, and technological innovation further promotes the growth of TFP, and the mediating effect exists significantly.

Capital allocation efficiency channel: The digital economy effectively improves the efficiency of capital allocation, and the capital allocation efficiency completely mediates the impact of the digital economy on TFP.

Labor allocation efficiency channels: The impact of the digital economy on labor allocation efficiency is not significant, and it is restricted by non-market factors such as geographical distance and social culture, and the mediating effect has not been formed.

Further research.

Spatial spillover effect: The impact of the digital economy on TFP has a significant positive spatial spillover effect, with the direct effect accounting for 75.45 % of the total effect under the nested spatial weight matrix, and the indirect effect driving the TFP growth rate of neighboring cities to increase by 2.44 percentage points.

Time heterogeneity: The promotion effect of the digital economy has increased significantly after 2015, and the estimated coefficient has increased from 0.024 in 2011–2014 to 0,115 in 2015–2018, reflecting the stage characteristics of the development of the digital economy.

Regional heterogeneity: The digital economy dividends of eastern cities and central cities (municipalities directly under the Central Government, provincial capitals, etc.) are more obvious, and the TFP impact on central and western cities and peripheral cities is not significant, reflecting regional development differences.

3. Research conclusions and policy recommendations.

Research conclusions.

The digital economy is an important driving force for the high-quality development of China's economy, and the promotion of TFP is still established after controlling the endogenous and dynamic effects.

Technological innovation and capital allocation efficiency are the core intermediary channels affecting TFP in the digital economy, and the mediating role of labor allocation efficiency has not been revealed.

The digital economy has a significant positive spatial spillover effect, which is conducive to the formation of a coordinated development pattern between cities.

The role of the digital economy is heterogeneous, and the role has been strengthened after 2015, and the benefits of eastern cities and central cities are more obvious.

Policy recommendations.

Consolidate digital infrastructure and deepen industrial integration: Increase investment in infrastructure such as 5G, big data, and artificial intelligence, and promote the digital transformation of traditional industries through policies such as technical training and tax incentives.

Implement differentiated regional strategies: give more policy preference to the central and western and peripheral cities, accelerate the construction of digital infrastructure, and rely on the spatial spillover effect to give full play to the radiation and driving role of the eastern and central cities.

Strengthen innovation support and factor flow: increase investment in science and technology education, improve intellectual property protection, break down institutional barriers to factor flow, and promote efficient allocation of production factors across regions.

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