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Path analysis of digital economy development affecting economic growth

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Abstract

Abstract: The concept of digital economy has received widespread attention in recent years, and its role in promoting economic growth has also been recognized. This paper, by sorting out the path of the digital economy affecting economic growth, concludes that the digital economy can promote the increase of equilibrium output by increasing product supply and promoting demand; at the same time, in the market transaction, the digital economy can facilitate the transaction cooperation by safeguarding the interests and improving the efficiency. This paper also gives suggestions for problems due to the rapid development of the digital economy.

CCS Concepts

• Applied computing; • Law, social and behavioral sciences; • Economics;

Keywords

Digital Economy, Economic Growth, Supply and Demand

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1 Introduction

The sources of economic growth have been studied for many years by economics. According to Western economic theory, in the long term, the level of output is determined by the production capacity of enterprises, which is determined by factor and technology. In the short term, the demand for products is an important factor influencing the final equilibrium output. Demand consists of four parts: consumption, investment, government purchases and net exports, which together determine the level of demand. In general, the supply and demand for products determine the final equilibrium output and the market price of the product. In addition, the effective

operation of the market is also an important factor in promoting balanced economic output.

In recent years, the digital economy has been widely discussed. Many studies have already explored the role of the digital economy on economic growth through empirical analysis. According to CAICT, digital economy refers to digital industrialization and digitalization of industries, digital governance of society and resourcefulness of data elements (China Academy of Information and Communications Technology, 2024). In detail, the digital economy encompasses high-tech industries that build digital information infrastructure, produce digital information products and provide digital information services; it also includes the old industries undergoing digitalization to improve their production capacity; it also includes the use of digital information technology in the field of social operation to help the regulatory and service departments to carry out social governance and to improve the level of social governance; and finally, as a resource, data has value and can be put into production as a factor to create value, and data can also be utilized by both parties of transaction to cooperate.

2 Research Review

There are various studies on digital economy for economic growth. The details are as follows: some studies confirm that the development of digital economy can have a significant positive effect on economic growth through empirical analysis. For example, Ge Heping et al. (2021) confirm that the digital economy promotes the high-quality development of China's economy by improving economic efficiency and optimizing economic structure through empirical research (Ge, H. & Wu, F., 2021). Some studies, through theoretical analysis, at the micro level, confirm that the digital economy promotes economic growth by increasing enterprise productivity (Du Chuanzhong et al, 2021). Some studies also conduct theoretical analyses, but confirm at the macro level that the digital economy promotes economic growth by boosting foreign trade (Bao Zhenshan et al, 2023), consumption (Ren Baoping et al, 2022), and so on. In addition, there are literatures that examine the role of the digital economy in promoting economic growth through some of the components included in its connotations, such as Qian Haizhang et al. (2020) who confirm that the development of digital finance in China promotes economic growth.

Although a large number of researches have explored the impact of the digital economy on economic growth, there is still much to be added. This paper analyzes in detail how the digital economy contributes to economic growth by affecting the supply side and the demand side, as well as transaction assurance and transaction

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efficiency, at the macroeconomic level. In addition, previous studies have failed to define the specific definition of the digital economy, this paper adopts the precise definition of the digital economy by the China Academy of Information and Communication Technology (CAICT), which on the one hand clarifies the impact of the digital economy on economic growth from the scope of the definition of the digital economy itself, and on the other hand demonstrates in detail that the digital economy promotes the balanced economic growth from the three dimensions, namely, supply, demand, and transaction.

3 Theoretical analysis of the impact path

3.1 The supply side

3.1.1 Industrialization of digitalization. Industries such as the communications industry and other information technology industries are typical examples of digital industrialization. These industries produce communications infrastructure equipment, design and invent new digital collection and information dissemination technologies; at the same time, digital industries provide information technology services for other industries, enhance the basic technological capacity of digital dissemination, improve production efficiency, and promote the increase of various types of production capacity.

The path of industrialization of digitalization promoting economic development is that all types of communication services and communication equipment manufacturers, by continuously updating their digital collecting and processing capabilities, provide more information-based services to society; produce more information equipment, increase their production capacity, and at the same time contribute to the improvement of production efficiency in other industries. Specific examples include various types of wired and wireless communications equipment, such as telephone and cellular equipment for consumers. Another example is the Internet industry. The role of the Internet industry in promoting economic growth has been widely recognized.

3.1.2 Industrial digitization. With the continuous upgrading of digital information collection and application technologies, various industries are moving towards the adoption of digital transformation to enhance their production and service capabilities. In the primary industry, agriculture, forestry, animal husbandry, fishery and related auxiliary activities collect various kinds of data on agricultural production, such as crop production, and utilize a large amount of data to formulate targeted production activities. The secondary industry, which is mainly in the manufacturing industry, can fully adopt the digital transformation technology in the process of production. For example, the general and special equipment manufacturing industry can design and manufacture more advanced equipment according to the collected data, while different kinds of manufacturing industries can not only adopt new manufacturing machines and equipment, but also collect the data from the feedback from the production and sales of the products in the process of designing and producing products, which are more adaptable to the market demand. The Internet of things is the most typical example of industrial enterprises undergoing digital transformation. The application of digital transformation in the service industry

is even more extensive. In the circulation sector, the adoption of digital transformation can enhance the industry's service efficiency, reduce costs and create more value. For example, in the logistics industry, through digital transformation, logistics enterprises can adopt intelligent logistics systems to reduce costs and increase efficiency. In the location of logistics and distribution centers, big data can be used to find the most optimal solution; in the mode of cargo transportation, more and more enterprises are adopting intelligent distribution modes for delivery. In the financial industry, by adopting digital transformation, more efficient financial services can be provided to corporate and residential customers. For example, the current financial digitalization has penetrated in the supply chain field, where the industry collects financial data, provides convenient financial services for upstream and downstream industries when conducting transactions, and designs a variety of financial products to provide more targeted services for enterprises in need of financing, guarantees and other financial services.

3.1.3 Factors of production. The idea that data as a factor of production can generate value is widely recognized. Like services, data do not have a physical form, but they do produce output and create value. Data elements are collected by various industries and put into production and services to get output. For example, in the education industry, AI education platforms are constantly being developed, and more and more schools are adopting various AI education platforms as part of their teaching, assisting teachers in the classroom, and some schools are even directly adopting such platforms to make up for the shortage of teachers. In addition, various types of data are collected into database for enterprises in various industries to carry out digital transformation, such data has its own value, but also can be involved in the production to create more value.

3.1.4 Modelling from growth theory. Economic growth modelling is the process of putting various factors affecting economic growth into a model and studying the extent to which they affect economic growth, so as to explore ways to promote economic growth. In this paper, digital economy factors are defined and included in the economic growth model. Conventional economic growth models contain factors such as human capital, physical capital and technological innovation. With the introduction of the digital economy, we can see that the digital economy can promote growth by empowering conventional economic growth factors, while fueling growth as an independent factor of production. Specifically:

- Artificial intelligence, smart manufacturing, etc. can empower human capital and improve its productivity. And to some extent, smart robots can even replace part of the labor force in production (represented by S1 in the model).
- Digital industry and digital transformation of industry (represented by S2 in the model), as well as various types of data resources (represented by S3 in the model) can enhance physical capital, which is an important production factor for growth.
- The digital economy can achieve rapid economic growth by improving efficiency and productivity (represented by S4 in the model).

Thus, the economic growth model incorporating the digital economy is modelled as follows:

$$Y = A(S4) F[L(S1), K(S2), S3] \quad (1)$$

$L(S1)$ is the human capital, $K(S2)$ is the physical capital, $S3$ is the digital type of production factors, and $A(S4)$ is the technological innovation indicator containing the development of digital technology.

The above is an introduction to the digital economy affecting economic development from the product supply side, and the following will start from the product demand side to analyze how the digital economy affects the demand and promotes economic development by enhancing the demand.

3.2 The Demand side

In the short run, even if the supply capacity of firms is sufficient, the lack of demand can lead to a decline in equilibrium output, and thus raising demand spending is also an important part of promoting economic growth. The development of the digital economy has the following effects on demand spending.

3.2.1 Consumption. Consumption is an important driving force for economic growth, and enterprises can promote consumption and economic development by producing products that meet the needs of various types of consumers. At present, with the improvement of data storage, processing and analysis capabilities, enterprises can collect and analyze data reflecting consumers' consumption behavior, characteristics and hobbies, and develop and produce different kinds of products for different types of consumers to choose. For example, in the entertainment industry, customized recreational activities are launched for consumers, and consumers of different age groups and preferences will have different needs when selecting travel products. Through big data analysis, travel agencies can accurately grasp the needs of different types of consumers. Younger consumers will be interested in various types of current IP trips, office workers will be in demand for leisure trips, and so on. Through the collection and analysis of consumer-related information and data, the targeted development of products that meet consumer needs can effectively stimulate demand and promote product growth.

3.2.2 Investment. When the digital transformation of industries is in full swing, there is an increasing demand for various types of cutting-edge equipment, core components and other infrastructure equipment that support digital transformation; Data storage and computing are increasingly demanding support devices such as computing power. All of these give guidance to the direction of enterprise investment.

In the field of enterprise investment and financing, the financial industry utilizes big data to create a digital financial platform to provide services to enterprises with financial transactions and investment and financing needs. The application of big data provides financial institutions with convenient conditions for enterprise transactions and applications for investment and financing, improves the efficiency of financial institutions by reducing information asymmetry and lowering the cost of investigation, and

allows enterprises with financial business needs to obtain financial support at a faster speed and lower cost.

3.2.3 Government expenditure. Government expenditure is an important part of demand spending, and governments can regulate the size of demand spending by adjusting government purchasing expenditures. At present, all governments are making great efforts to develop the digital economy in order to achieve a better scale and speed of economic development. In order to achieve this goal, governments at all levels have issued plans for the development of the digital economy for many years to come, and at the same time, the government departments themselves have also participated in the planning as the main body of development to help the development of the digital economy. For example, in the field of social governance and public services, various governments have procured various types of digital equipment to provide various types of efficient public services. When citizens visit government public service halls, most of their business can be handled by self-service machines and equipment, which saves time and reduces the government's operating costs. In addition, in order to promote the rapid development of various digital industries and industrial digitization, government departments need to subsidize the construction and maintenance costs of infrastructure, which is also an important part of government expenditure.

3.2.4 Import and export. The development of the digital economy for international trade promotion effect is also obvious to all. Taking the import and export of products and services as an example, the artificial intelligence industry, which is currently at the forefront of technological development, is a representative product of the rapid development of the digital economy. Its products include robots with various purposes, cars equipped with intelligent driving, and software and hardware products that can provide various intelligent services. In international trade activities, these AI products have cost and performance advantages when competing with other products, and can quickly capture the market. In addition, in order to promote the smooth running of international trade activities, various types of digital economy technology tools have been adopted to provide better services. For example, digital currency is used by the financial services industry in various aspects of international trade to facilitate transactions; at the same time, the financial industry collects data from both sides of the transaction and provides investment and financing to both sides of the transaction to ensure that the transaction is carried out smoothly.

3.3 Transaction assurance and efficiency gains

The digital economy has advantages for economic development in terms of ensuring transactions and efficiency.

3.3.1 Governance and regulation. The development of the digital economy has generated a large amount of different types of data, and the government and relevant regulatory authorities can guarantee the smooth progress of transactions by using data to control and supervise transactions through information collection and processing technologies. For example, when the financial industry conducts investment and financing business, it will understand the creditworthiness of customers through the credit system to judge

whether the counterparty is reliable or not; when the relevant regulatory agencies monitor all kinds of data of transactions, they can observe the abnormal information, and find out the problems in a timely manner and rectify the situation; in addition, the invention of the digital currency is one of the effective tools to ensure the smooth progress of the transaction.

3.3.2 Collaboration with the informal system. In discussing the sources of economic growth, some theoretical scholars have argued that institutions are also one of the important factors contributing to economic growth. Among these, informal institutions, i.e. social capital, have been widely used to study how they affect economic growth. The digital economy and social capital complement and fulfil each other in improving transaction efficiency (Jiang, W., 2024). The collection and dissemination of data helps to deepen and widen the width and breadth of social networks; the development of high-tech industries, such as artificial intelligence, reshapes social norms that are conducive to social development; and trust is a catalyst for co-operation in social exchanges and transactions, and the development of digital applications, such as digital currencies, as well as the assistance of digital governance models, will support the achievement of co-operation through trust in the process of transactions.

4 Problems and recommendations

At present, countries around the world are developing the digital economy to obtain a faster rate of economic development, but in the process of development there are some problems that deserve attention.

4.1 Unemployment

Artificial intelligence, intelligent robots and other technological devices are being rapidly invented and manufactured, which on the one hand can improve the efficiency of production, but on the other hand may replace some of the labor force's work, thus creating a situation of unemployment. For example, when driverless cars, which have been introduced in the automobile market in recent years, are introduced into the taxi market, it can be expected that a large number of taxi drivers will face the loss of their jobs. Similarly, a large number of workers who sell low-end labor will lose their jobs as a result of the use of intelligent machines and equipment, which will increase the local unemployment rate and cause certain disturbances to the society.

In this regard, the development of the digital economy, represented by the development of artificial intelligence, must be engaged in production with the aim of enhancing productivity or facilitating the lives of the population rather than replacing the labor force when a large labor force exists in the current society. In the future, when the rate of population growth is gradually slowing down, it will be necessary to replace the lack of labor with smart devices.

4.2 Leakage of privacy

The development of the digital economy is accompanied by a large amount of data information being collected and applied. If data and information security is not done properly, the risk of privacy leakage will increase. With the use and development of data collection

and data processing and analysis tools, all kinds of private information, if not protected, can easily be used by unscrupulous people, resulting in losses. For example, through crawlers and other data collection modes, lawbreakers obtain a large amount of personal telephone and address information, and use virtual phones to make a large amount of contacts to the public, and cheat the victim's funds through various fraudulent means and methods. Or some organizations that legally possess private information are exploited by lawless elements, resulting in data leakage.

Data elements are an important part of the digital economy, and failure to secure them can have an impact on the development of the digital economy. Therefore, various methods need to be adopted to safeguard data security. Legislation can be adopted to establish the responsibilities and obligations of data security for the main body that owns data resources, and severe penalties can be imposed on the relevant main body that maliciously leaks data and causes losses. At the same time, accelerating the development of data security technology to build a protection network for all kinds of data is necessary.

4.3 Talent training

Artificial intelligence is an important application of the digital economy to promote economic development, and various kinds of big models have been developed and put into daily life to work and study. All kinds of models can meet the needs of most users by virtue of their excellent information collection and data analysis capabilities, so they can meet the needs of most users. However, it is worth noting that in the process of talent cultivation, the improper use of various application models can have a negative effect on education. For example, in the process of learning, if students rely on the use of models to search for answers to assignments and questions, they will skip the thinking part of answering questions, which is not conducive to the development of their independent thinking ability. At the same time, the uniformity of the answers searched through the models is questionable for the development of the user's creativity.

Therefore, it is recommended that, at the talent development stage, school educators and family caregivers need to take seriously the use of AI devices, including but not limited to mobile phones, computers, and various hardware and software tools, by students who are still receiving education. With talent development as the main purpose, we should make full use of the advantages of AI in terms of efficiency in finding data and be alert to its adverse effects on users.

5 Conclusion

In conjunction with the foreword, all components of the digital economy can play a role in promoting economic growth. On the one hand, the supply side of output can create a great deal of value through the digital economy; on the other hand, the digital economy can stimulate economic growth by stimulating demand for products and services through stimulating demand for various types of expenditures, such as consumption, investment, exports, etc.; and, finally, the digital economy can play a full role in ensuring that transactions are carried out in a more efficient manner, fostering cooperation and boosting output. Despite the role of the digital

economy in promoting economic growth, the negative impacts of its rapid development, such as increased unemployment, compromised privacy and unfavorable talent development, deserve attention.

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