

# ***How the Development of the Digital Economy Affects Gross Domestic Product — From the Perspective of the Expenditure Accounting Method***

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**Abstract:** In the current era of the digital economy, digitalization has emerged as the core driver of China's economic development. This paper explores the transformative impact of the digital economy on Gross Domestic Product (GDP) during the Fourth Industrial Revolution. The study employs the GDP expenditure accounting method to analyze the influence of the digital economy on consumption expenditure, investment, government purchases, and net exports. Through qualitative analysis, it reveals how digital advancements stimulate consumption expenditure directly and indirectly by enhancing product diversity, increasing income, and improving market integration. It also discusses how digital finance facilitates investment, how digital governance reforms influence government spending, and how digital trade increases net exports. The research concludes that the digital economy is crucial for economic transformation and high-quality development, providing policymakers with a theoretical basis for leveraging digital innovation to promote GDP growth.

**Keywords:** Digital Economy, GDP, Expenditure Method, Digital Innovation.

## **1. Introduction**

Currently, the world is undergoing the Fourth Industrial Revolution, in this process, the digital economy stands out as the most prominent economic sector. Compared with the traditional economy, the digital economy demonstrates significant advantages in terms of growth dynamics, efficiency, and quality. In terms of growth dynamics, the digital economy represents a new economic model with prominent zero marginal cost effects. Its market activities are conducted on digital platforms, relying on digital networks. According to Metcalfe's Law, the value generated by a digital network grows in proportion to the square of the number of nodes, or users, within the network. Once the number of users surpasses a critical threshold, costs approach zero while output value grows exponentially [1]. In terms of efficiency, the digital economy is characterized by economies of scope. Through platformization and online integration, large numbers of buyers and sellers converge, an increasing number of niche, differentiated demands are being met, and the value creation of non-mainstream markets is stacking up, which can even rival the market share of a few popular products, forming a "long tail effect" [2]. In terms of quality, the digital economy is a low-energy, low-emission, and low-pollution green economy. It leverages digital technologies to transform traditional production methods, shifting many activities previously conducted offline to online, optimizing energy

consumption, reducing carbon emissions, minimizing resource waste, and decreasing inefficient consumption. This contributes to achieving “carbon peak” and “carbon neutrality” goals. The speed of development, scope of influence, and degree of impact of the digital economy are unprecedented, driving profound changes in production methods, lifestyles, and governance models. With the rapid development of new-generation information technologies such as big data, 5G, blockchain, cloud computing, the Internet of Things, and artificial intelligence, the deep integration of digital technology with traditional industries is unleashing immense energy. The digital economy has become a critical engine for leading socioeconomic change and driving high-quality economic development.

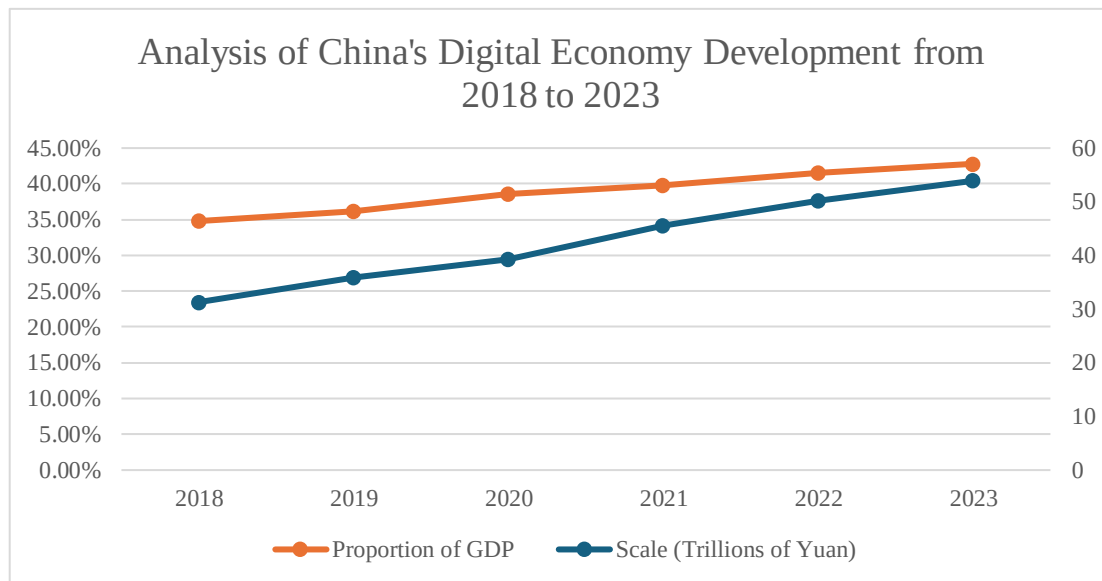


Figure 1: China’s Digital Economy Scale and Its Share of GDP, 2018-2023.

The rapid advancement of digital technologies is steadily increasing their contribution to GDP. The digital economy is driving the transformation of traditional industries, enhancing production efficiency and product quality while fostering new industrial forms and business models. Emerging sectors like e-commerce, mobile payments, online education, and telemedicine are significantly improving economic efficiency, fostering innovation, and meeting consumer demand.

Since the 18th National Congress of the Communist Party of China, the country has placed great emphasis on the development of the digital economy. On December 12, 2021, the State Council issued the 14th Five-Year Plan for the Development of the Digital Economy, which outlined the guiding principles, basic tenets, development goals, key tasks, and safeguarding measures for promoting the healthy development of the digital economy during the 14th Five-Year Plan period. The plan proposed “developing the digital economy, promoting the digitalization of industries, advancing the deep integration of digital technologies with the real economy, and building internationally competitive digital industry clusters.” According to the 14th Five-Year Plan for the Development of the Digital Economy, during the 13th Five-Year Plan period, the value added of China’s core digital economy industries accounted for 7.8% of GDP. By 2025, China aims to become a major digital economy nation with significant international competitiveness and influence, with the value added of core digital economy industries expected to reach 10% of GDP. A preliminary data factor market system will be established, with various indicators expected to maintain high growth rates: the number of gigabit fiber users will increase from 6.4 million to 60 million, the application penetration rate of industrial internet platforms will rise from 14.7% to 45%, total online retail sales will grow from 11.76 trillion yuan to 17 trillion yuan, and the number of registered users of online

government services will expand from 400 million to 800 million. Therefore, exploring the impact of digital economy development on GDP holds profound significance. This paper uses the GDP expenditure accounting method as a point of entry to qualitatively study the effects of the digital economy on four aspects: consumption expenditure, investment, government purchases, and imports and exports. In comparison with existing literature, this study provides a more comprehensive examination of the impact of digital economy development on GDP and expenditure, enriching the body of research on the digital economy.

## **2. Literature Review**

### **2.1. Definitions of the Digital Economy and GDP**

Before delving into the research, this paper clarifies the definitions of the digital economy and China's Gross Domestic Product (GDP). The term "digital economy" originated in 1996 in an article titled *The Digital Economy: Promise and Peril in the Age of Networked Intelligence* by Don Tapscott, known as the "father of the digital economy," where he outlined its key characteristics. Since then, numerous definitions and studies have emerged on the topic. Although existing literature tends to emphasize different aspects of the digital economy, this paper follows the definition provided by the National Bureau of Statistics. According to this definition, the digital economy is the primary economic form after agricultural and industrial economies, characterized by data resources as key elements, modern information networks as the main carrier, and the integration of information and communication technologies with the full digital transformation of production as major driving forces, promoting a unified balance between equity and efficiency in this new economic model.

China's GDP refers to the total market value of all final goods and services produced within a country's (or region's) borders during a specific period. In any economy, total income, total expenditure, and total output are equivalent. Therefore, GDP can be measured using the income approach, the expenditure approach, and the production approach.

### **2.2. Detailed Explanation of GDP Accounting Methods**

The income approach measures GDP from the perspective of income by summing up the costs of production factors used in the production of goods and services. This includes wages, interest, and rent as returns on production factors; pre-tax profits; the income of non-corporate business owners, such as doctors, lawyers, farmers, and small shop owners; corporate transfer payments, indirect taxes, and capital depreciation.  $\text{National income} = \text{wages} + \text{profits} + \text{rents} + \text{corporate profits} + \text{proprietors' income} + \text{indirect taxes and corporate transfer payments} + \text{depreciation} + \text{statistical discrepancies}$ .

The expenditure approach calculates GDP by summing the expenditures on final products during a specific period (usually a year). It includes household consumption expenditures (C); investment expenditures (I), which encompass corporate spending on factories, equipment, and inventories, as well as household expenditures on residences; government purchases (G), which are expenditures by all levels of government on goods and services, excluding transfer payments and interest on public debt; and net exports (NX), which is the value of exports (the total value of goods and services provided by the domestic economy to foreign entities) minus imports (the total value of goods and services imported into the domestic economy). Therefore,  $\text{GDP} = C + I + G + (X - M)$ .

Finally, the production approach measures GDP from the perspective of production, viewing the production of goods and services as a process of combining intermediate goods with capital and labor. The value of production includes the input of intermediate goods and the value created by labor, the latter referred to as added value. The value-added is obtained by subtracting intermediate consumption from gross output, and the sum of the value-added across all sectors equals the gross

domestic product. Given the complexity of the production and income approaches, this paper primarily adopts the expenditure approach to explore the impact of the digital economy on GDP.

### 2.3. Overview of Relevant Research Findings

Currently, a substantial body of literature investigates the macroeconomic effects of the digital economy on GDP. Most studies categorize variables into the impact of the digital economy on consumption expenditures (C), investments (I), government expenditures (G), and net exports. In terms of the impact on consumption expenditures, existing literature primarily concentrates on the mechanisms and spatial effects of the digital economy on household consumption [3-5]. For instance, Yang Fang et al.[3] posit that the digital economy not only directly boosts consumption but also indirectly stimulates it by enhancing product diversity, increasing household incomes, and integrating markets. The spatial analysis conducted by Zhong Ruoyu et al. [4] indicates that the digital economy significantly fosters the upgrading of rural household consumption and augments educational expenditures, aiding in the reduction of regional disparities.

As for the impact of the digital economy on investments, numerous studies analyze aspects such as reducing information asymmetry, constructing big data models for investment credit assessment, and investing in digital transformation [6-8]. Jiang Hongli et al. [6] and Xiong Guangqin et al. [7] found that the digital economy plays a role in promoting corporate investment and alleviating financing constraints. Moreover, big data facilitates the construction of credit evaluation models by analyzing large amounts of behavioral data from small-scale corporate borrowers, speeding up the approval process for loans and business financing [9-11]. In the digital economy era, most enterprises undergo digital transformation, and investments in this area help optimize regional capital allocation and labor distribution, accelerating marketization processes [8].

The development of the digital economy has a positive effect on the sustainability of local government finances. It can also optimize the structure of government expenditures by promoting reforms in fiscal and tax management systems, strengthening the application of digital technologies in fiscal management, and implementing a comprehensive performance management system for digital budgeting [12]. This leads to increased government spending on digital transformation. On the other hand, as the digital economy advances, data becomes a critical production factor, and issues related to data security and privacy protection become more pronounced. It is necessary to establish a sound data security governance system, with a classification and grading protection system for data, to prevent and stop the abuse of market dominance and protect fair competition in the market [13].

Although existing literature has explored the digital economy's effects on consumption expenditures, investments, government expenditures, and net exports from various perspectives, comprehensive studies examining its overall impact on China's GDP are relatively scarce. This paper employs the expenditure approach to GDP measurement, contributing valuable insights to the literature on digital innovation, and providing theoretical references for China's ongoing digital economy development efforts.

### 3. Theoretical Analysis of How the Development of the Digital Economy Affects GDP

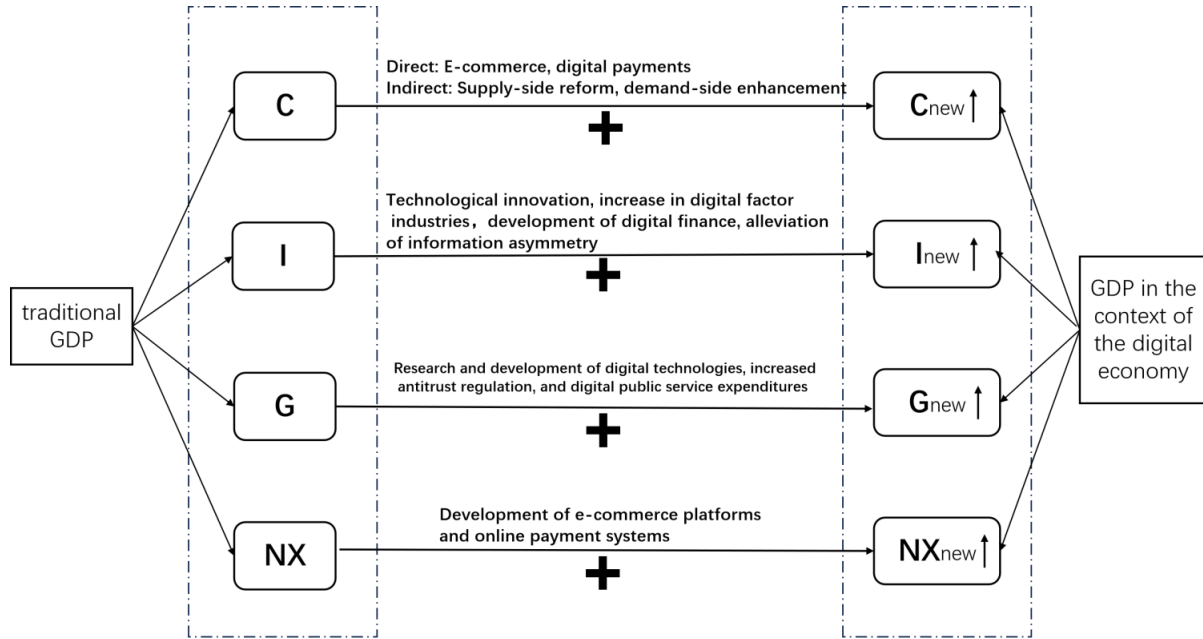


Figure 2: How the Digital Economy Affects GDP.

#### 3.1. Impact on Household Consumption Expenditure (C)

##### 3.1.1. Direct Impact of the Digital Economy on Household Consumption

The application of emerging digital technologies has enhanced consumer experiences, helping to unlock consumption potential. The direct impact of the digital economy on household consumption is primarily reflected in the expansion of consumption channels through e-commerce and the improvement of user experience via innovative digital payment methods.

E-commerce broadens consumption channels, breaking the historical asymmetry of information between buyers and sellers. Firstly, e-commerce transcends the limitations of time and space in transactions. The development of the sharing economy, live-streaming economy, and platform economy provides consumers with a wider range of choices, enhancing consumption convenience and expanding consumption channels [14, 15]. Secondly, e-commerce has given rise to new online shopping models, increasing price transparency and reducing consumers' search costs, thus accelerating the matching process between supply and demand [16].

Innovative digital payment methods have improved user experience and helped stimulate consumer potential. First, electronic payments reduce consumers' price sensitivity during shopping, boosting consumption while increasing the convenience of transactions and lowering cash management costs. Second, big data analyzes consumers' characteristics and preferences to offer precise product recommendations, better meeting personalized needs [17]. Thus, this paper argues that the development of the digital economy directly promotes the increase in household consumption levels.

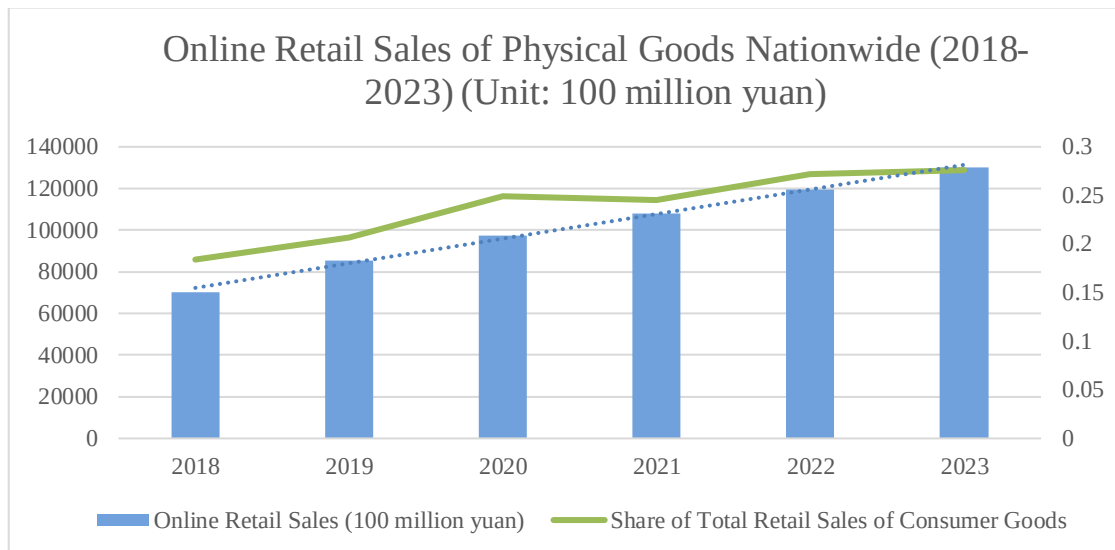


Figure 3: National Online Retail Sales of Physical Goods from 2018 to 2023.

### 3.1.2. Indirect Impact of the Digital Economy on Household Consumption

#### Supply Side – Enriching the Diversity of Products and Services

The digital economy drives supply-side reforms [18], enabling the supply side to efficiently access demand information, thereby prompting structural changes in production. Manufacturers, through digital transformation, can significantly shorten product development and research cycles, saving time, financial, and human resources, while also achieving breakthroughs in product development through intelligent digital production. Digital technology, when integrated with traditional industries such as education, agriculture, healthcare, and culture, spurs innovation across various sectors. New forms of consumption, such as cloud-based classrooms, remote surgeries, cloud consultations, and VR interactive entertainment, have emerged. The diversification of products and services has driven consumption upgrades, allowing consumers to compare products, giving them more control over their choices and unlocking consumption potential, which in turn expands market demand.

#### Demand Side – Enhancing Residents' Capabilities and Income

Household consumption expenditure is primarily influenced by household income, and the development of the digital economy can increase residents' income, thereby boosting consumption. First, the digital economy promotes employment, ensuring higher employment rates. The digitalization of industries helps create numerous job opportunities, enhancing residents' income and job security. Second, the digital economy provides a digital platform for the economic development of rural agricultural products, allowing farmers to market their products and receive financial compensation, alleviating the budget constraints of low-income residents. Additionally, by improving residents' digital skills, the digital economy enhances the value and employability of workers, reducing job instability. Finally, the digital economy removes the "geographic segmentation" of products, allowing residents in different regions to purchase products of the same quality and price, easing the consumption budget nationwide. This improves residents' purchasing power and market demand, driving rapid and high-quality economic growth.

Therefore, this paper argues that the development of the digital economy has increased household consumption expenditure in multiple ways.

## **3.2. Impact on Investment (I)**

### **3.2.1. Innovative Digitalization Attracts Investment**

The widespread application and penetration of digital technologies can foster new business models and innovations, thereby attracting more investment. The core of the digital economy is technological innovation, including artificial intelligence, big data, cloud computing, and the Internet of Things. The development of these technologies increases production efficiency and reduces costs for enterprises, thus attracting more corporate investments [19]. For example, on July 17, 2019, Wuhan Union Hospital and Xiangfeng County People's Hospital in Hubei Province successfully performed a remote surgery on a 76-year-old patient with a thoracic vertebral fracture via a 5G mixed-reality cloud platform. This was the world's first remote surgery using a mixed-reality (MR) cloud platform in a 5G environment. Wuhan Union Hospital's 5G remote medical practice provided a solution for surgery on patients in remote mountainous areas with limited mobility. The collaboration between Wuhan Union Hospital and Xiangfeng County People's Hospital on the first national 5G+MR+cloud platform (mixed-reality) orthopedic surgery marked the beginning of a significant digital transformation in the medical equipment industry and offered unprecedented opportunities for digital investments in related companies.

### **3.2.2. Alleviation of Information Asymmetry Promotes Investment**

In the digital context, market potential and consumer demand can be more easily tracked. The development of the digital economy often makes it clearer to identify new market demands and changes in consumer behavior, thus alleviating issues of information asymmetry [20]. This improves the efficiency of corporate investments, clarifies investment directions, reduces inefficient investments, and increases investment in related products and services. For instance, on e-commerce platforms like Taobao, Pinduoduo, and Xiaohongshu, many university students engage in entrepreneurship by investing based on the sales data and consumer preferences they observe online, keeping the market in a state of constant innovation and driving economic growth.

### **3.2.3. Development of Digital Finance Accelerates Investment Processes**

Relying on big data, digital finance can assess the risks of small and micro-enterprises at a relatively low cost, addressing the "financing difficulty" issue faced by such enterprises. Traditional financial institutions are often unwilling to lend to small and micro-enterprises due to their lack of authoritative financing and operational records, which increases information asymmetry [9] and makes it difficult for financial institutions to assess the credibility of enterprises seeking investment. This lack of trust limits their access to financial support. Moreover, in the past, bank approval processes were slow, but now, with digital finance, big data analysis can leverage vast amounts of behavioral data and other soft information accumulated online by loan applicants to build credit evaluation models for small and micro-enterprises. This allows for faster identification of applicants' creditworthiness, streamlines the approval process, and helps those in need of investment save both time and financing costs. By overcoming financial constraints, digital finance helps small and micro-enterprises cross the threshold for startup funding, thereby promoting venture capital investment.

### **3.2.4. The Expansion of Digital Industries Increases Investment**

The explosion of digital industries has introduced new investment opportunities across entire supply chains. In the past, without the internet and big data, digital industries did not exist. Now, these industries represent a new investment chain. For instance, Baidu's creation of the "Yongle Canon

High-Definition Image Database” employs 3D restoration technology to immerse users in 40 volumes and 75 scrolls of the Yongle Canon, promoting the shared cultural resources for all. The immersive opera The Burial of Flowers, integrates virtual reality (VR) technology to combine virtual Yue Opera performances with real stage installations, overlaying them to innovate viewing experiences. These are examples of emerging digital industries. Moreover, the government strongly supports digital industries through policies and legal frameworks: government policies supporting the digital economy, such as tax incentives, financial subsidies, and the formulation of regulations, reduce investment risks for enterprises and stimulate more investment activities.

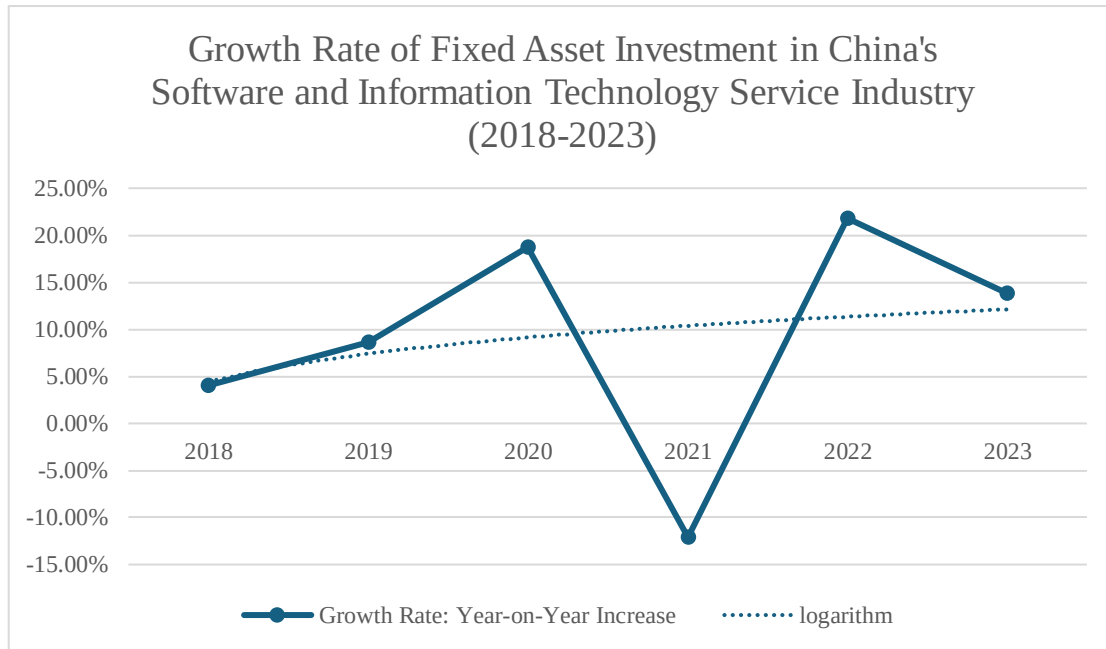


Figure 4: Growth Rate of Fixed Investments in China’s Software and Information Technology Services Industry, 2018-2023.

Therefore, this paper argues that by improving investment efficiency and optimizing the allocation of corporate resources, the digital economy plays a role in promoting investment growth.

### 3.3. Impact on Government Expenditure (G)

First, government expenditure has increased in promoting the digitalization of industries and the development of the digital industry, leading to an optimized structure of fiscal expenditure. This, in turn, has prompted the government to invest more in digital technology research and development. For example, governments may increase investment in areas such as digital infrastructure construction, technological innovation, education, and training to foster the growth of the digital economy. Additionally, the advancement of the digital economy enhances the efficiency of public service provision, improves government procurement processes, and strengthens external supervision. Therefore, the government is likely to digitize sectors such as education, healthcare, and transportation [21], to improve service efficiency and quality, thereby promoting consumption upgrades. Lastly, as the digital economy evolves, data becomes a key factor of production. The network effects and economies of scale within the platform economy in the digital economy may lead to market power concentration, raising concerns about monopolies [13]. The government needs to strengthen antitrust regulations to prevent and curb abuses of market dominance, protecting fair competition in the market. Consequently, the government must increase regulatory spending on issues

such as data security, privacy protection, and antitrust measures, aiming to establish and improve relevant legal frameworks and regulatory systems. Therefore, the digital economy has promoted government expenditure.

### 3.4. Impact on Imports and Exports (NX)

The digital economy positively impacts imports and exports. In 2022, China's trade in digitally deliverable services reached \$372.71 billion, up 3.4% from the previous year, while cross-border e-commerce volumes hit 2.11 trillion RMB, a 9.8% increase, reflecting strong growth in digital trade. According to WTO statistics, global exports of digitally deliverable services totaled \$4.1 trillion in 2022, comprising 57.1% of total service exports. This rapid growth in digital service exports, particularly in developing economies, underscores the rising significance of digital trade worldwide.

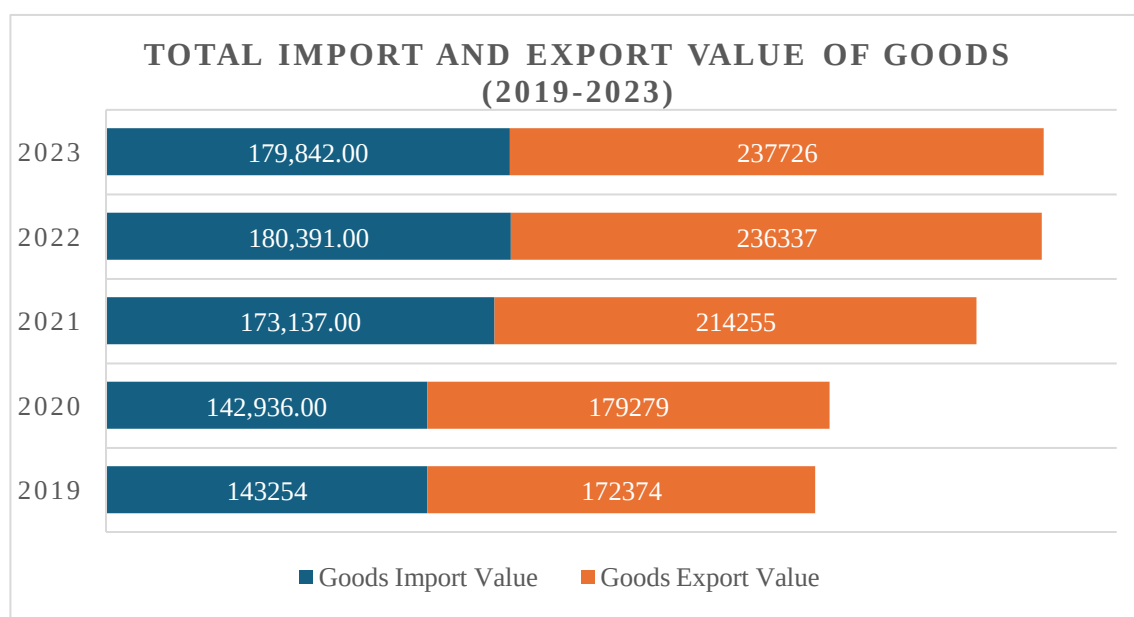


Figure 5: Total Volume of Goods Imports and Exports, 2019-2023.

The digital economy has fueled the growth of e-commerce platforms and online payment systems, breaking geographical barriers and expanding market scale, which increases product export shares [22]. Enterprises can now directly reach overseas consumers without relying on traditional channels. Additionally, big data and AI enable exporters to analyze competitors, assess market positions, and identify new opportunities, fostering the development of innovative digital trade models. Consequently, the digital economy has positively impacted import and export shares.

## 4. Conclusion

The Fourth Industrial Revolution, driven by digital technologies, has promoted sustained socio-economic development and long-term GDP growth, though this effect may be gradual. This paper identifies positive impacts of the digital economy on four key areas: consumption, investment, government spending, and trade.

In consumption, e-commerce and digital payments directly boost household spending, while supply-side reforms indirectly enhance consumption levels. For investment, digital innovation increases efficiency and optimizes corporate resources by reducing information asymmetry. In terms of government spending, digital growth drives higher public spending on service digitization and antitrust regulation. For trade, digital platforms expand market reach and increase export shares.

Together, these effects demonstrate the digital economy's role in promoting GDP growth across these dimensions.

The rapid advancement of digital technologies has led to significant transformations across various economic dimensions, providing new avenues for growth. Digital technologies have sparked the Fourth Industrial Revolution, supporting long-term GDP growth through impacts on consumption, investment, government spending, and trade. While initial R&D requires significant investment, the digital economy boosts consumer spending via e-commerce, improves investment efficiency through innovation, increases government spending on digital services and regulation, and expands trade through online platforms. Thus, the digital economy enhances GDP growth across these dimensions.

In addition to boosting overall GDP, digital inclusive finance plays a crucial role in enhancing financial service quality and accessibility. To support this, the government should improve credit-sharing systems to reduce information asymmetry, especially for small businesses, and encourage financial institutions to develop services catering to evolving consumer needs. Strengthening intellectual property protections within the digital economy is also essential, requiring updated laws and institutions to safeguard digital IP rights effectively.

Finally, to fully capitalize on the digital economy's potential, government governance must also undergo digital transformation to increase efficiency and alleviate fiscal pressures. By enhancing high-frequency services for businesses, implementing expansionary fiscal policies to boost domestic demand, and leveraging tax incentives to improve social welfare, the government can further stimulate growth. Additionally, support for regional development through strategic economic zones and increased aid to underdeveloped areas will stimulate growth and reduce fiscal burdens. These concerted efforts will help unlock the digital economy's potential, promote sustainable development, and continually improve living standards.

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