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Article

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China Political Economy (CPE)

Provided in Cooperation with:
School of Economics, Nanjing University

Suggested Citation: Qi, Yudong; Chu, Xi (2022) : Development of the digital economy, transformation of the economic structure and leaping of the middle-income trap, China Political Economy (CPE), ISSN 2516-1652, Emerald, Leeds, Vol. 5, Iss. 1, pp. 14-39, https://doi.org/10.1108/CPE-09-2022-0012

This Version is available at:
https://hdl.handle.net/10419/319448

Received 15 September 2022
Revised 16 September 2022
Accepted 16 September 2022

Development of the digital economy, transformation of the economic structure and leaping of the middle-income trap

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Abstract

Purpose – Currently, China's economy is in the critical phase of transforming economic development patterns and replacing old growth drivers with new ones. Whether it can successfully overcome the "middle-income trap" has become a significant issue attracting wide attention.

Design/methodology/approach – Driven by underlying digital technologies such as artificial intelligence, blockchain, cloud computing and big data, the fourth industrial revolution featuring the booming digital economy has provided significant opportunities for China's economy to "overtake" and overcome the "middle-income trap". The transformation of economic development pattern, the optimization of industrial structure, and the change of growth drivers, brought by the deep integration of digital and real economies are the keys to leaping over the "middle-income trap".

Findings – From the supply side, the digital economy can improve the quality and efficiency of the supply side and promote the supply-side structural reform and economic growth from the following three aspects: First, promote the quality, efficiency and diversification of the supply system; second, promote networking, opening-up and synergy in the innovation system and third, promote the socialization, modularization and flexibility of production pattern. From the demand side, the digital economy can boost the new drivers of the "troika" of economic growth consisting of consumption, exports and investment by changing the market investment direction, promoting consumption upgrade and fostering export strengths. However, once these two attributes interact with each other, especially when data is combined with capital, the most adhesive factor in the market economy, a series of new social relations will then be produced based on the technical attribute, resulting in significant adjustments in social relations, involving both positive and negative externalities.

Originality/value – To overcome the "middle-income trap", it is necessary to adapt to the laws of economic evolution and promote a fundamental change in economic growth drivers; boost the high-quality development of the digital economy by strengthening the support role of data in the digital economy; and accelerate digital industrialization and industrial digitalization to realize the integration of digital and real economies.

Keywords Digital economy, Economic structural transformation, The middle-income trap

Paper type Research paper

1. Situation and challenges facing China in overcoming the middle-income trap

From 1979 to 2019, China's economy grew at an average annual rate of 9.4%, with total economic volume climbing. In 2019, China was on the verge of leaping over the middle-income

JEL Classification — E0, O30

This article received support from National Social Science Fund Project "Research on Mechanism and Path of Collaborative Promotion of Digital Industry Innovation through Technical Standards and Intellectual Property" (Grant No. 19ZDA077). Chu Xi is the corresponding author of this article.

China Political Economy
Vol. 5 No. 1, 2022
pp. 14-39
Emerald Publishing Limited
2516-1652
DOI 10.1108/CPE-09-2022-0012

trap – China's GDP reached 99.1 trillion yuan and its gross national income (GNI) per capita exceeded USD 10,000 for the first time, reaching USD 10,410. The next five years will be crucial for China to overcome the middle-income trap. As the world's second-largest economy and largest developing country for a long time, whether China can overcome the middle-income trap attracts worldwide attention. The Chinese government is actively grasping the strategic opportunity to overcome the middle-income trap. The party and state leaders have repeatedly stressed the urgency and positive significance of overcoming the middle-income trap. As General Secretary Xi Jinping pointed out in 2014, "For China, the middle-income trap is bound to pass. The key is when to cross it and how to move forward after crossing it." The outline of the 13th Five-Year Plan for National Economic and Social Development of the People's Republic of China has set forth the goal of "striving to overcome the middle-income trap and constantly exploring a new realm of development". The fifth plenary session of the 19th Central Committee of the Communist Party of China (CPC) has listed "China's GDP per capita to reach the level of moderately developed countries with significantly expanding middle-income group" as a long-term goal for 2035. Undoubtedly, early overcoming the middle-income trap is of strategic significance for achieving socialist modernization and the great rejuvenation of the Chinese nation and further realizing the "Two Centenary Goals".

From the perspective of development practice worldwide, overcoming the middle-income trap is one of the great challenges for middle-income countries. Most countries and regions have encountered development bottlenecks in their progress toward high-income countries after reaching the middle-income stage. According to the World Bank (The World Bank ; the People's Republic of China Development Research Center of the State Council, 2013), among the 101 economies that entered the middle-income stage in 1960, only 13 countries and regions, including Equatorial Guinea, Greece and Ireland, have succeeded in overcoming the middle-income trap as of 2008. Using the Peen World Table (PWT) database, we collected GDP per capita data of 180 countries and regions from 1990 to 2015 and constructed a transition probability matrix by means of the relative standard deviation method for classifying national per capita income. We took the US's GDP per capita as the reference group and set the GDP per capita thresholds for low income, middle income and high income at 10% and 60% of that of the US, respectively; namely, the GDP per capita of middle-income countries is 10%–60% of that of the US. As shown in Table 1, 67 countries or regions were categorized as low-income countries in 1990, and as of 2015, 47 (70.1%) of them remained low-income countries and only 20 (19.9%) became middle-income countries. Moreover, in 1990, 83 countries or regions were categorized as middle-income countries, in which 4 (4.8%) became low-income countries again, 12 (14.4%) overcame the middle-income trap and became the high-income countries and 67 (80.7%) were still middle-income countries. It is thus clear that the middle-income trap is a stylized fact.

During the 13th Five-Year Plan period (2016–2020), economic development achievements have laid a solid foundation for China to overcome the middle-income trap. As for the 14th

2015 1990	Low income	Middle income	High income	Total for 1990
Low income	47 (70.1%)	4 (4.8%)	0 (0%)	51 (28.3%)
Middle income	20 (19.9%)	67 (80.7%)	3 (10%)	90 (50%)
High income	0 (0%)	12 (14.4%)	27 (90%)	39 (21.7%)
Total for 2015	67 (100%)	83 (100%)	30 (100%)	180 (100%)

Note(s): Percentages in brackets are transition probabilities
Source(s): Calculated from Penn World Table 9.0

Table 1.
Transition probability matrix for the relative standard deviation of per capita income

Five-Year Plan period (2021–2025), the world is facing a great change in the century – instability and uncertainty have increased significantly, the COVID-19 pandemic has far-reaching implications and economic globalization is facing headwinds. The new industrial revolution is ongoing, competition and strategic games among big powers are inflamed, the global governance system is changing rapidly and competition regarding markets, technology, and talents is becoming more fierce. Challenges and opportunities coexist for economic growth (see Figure 1). With the global competition pattern change, the interference, suppression and containment of China's economic development by the United States and other developed countries will become the norm. Furthermore, as developing countries implement stricter protection of domestic rights and interests, China's economic development will face a more complex and severe international situation with increasing competition and challenges from developing countries. In 2010, China's GNI per capita reached USD 4,240, entering the upper-middle-income stage. Nowadays, China's economic development is faced with constraints in fields such as population, capital and technology, and the potential energy and drive of the demographic dividend, capital dividend and technological dividend that support China's rapid economic growth are weakening (Zhang, 2013). Population, capital and technology jointly determine the economic growth rate on the supply side. Strategies based on factor accumulation may have diminishing marginal utility on economic growth as the economy grows (Barro *et al.*, 1995).

From the perspective of the population, demographic problems such as low fertility rate and the aging population have become increasingly prominent in China, and with the rapid process of industrialization and urbanization in recent decades, the underemployed rural labor force has been decreasing in China. That is to say, after passing the "Lewis turning point", the surplus labor population in China has been fully absorbed, and the situation that the labor supply curve remains unchanged at a fixed wage rate became history. The rise of labor costs resulting from the supply and demand imbalance is inevitable. The aging of the population and the rise of the dependency ratio, as well as labor, cost not only weaken China's international competitiveness in labor-intensive industries but also inhibit the improvement

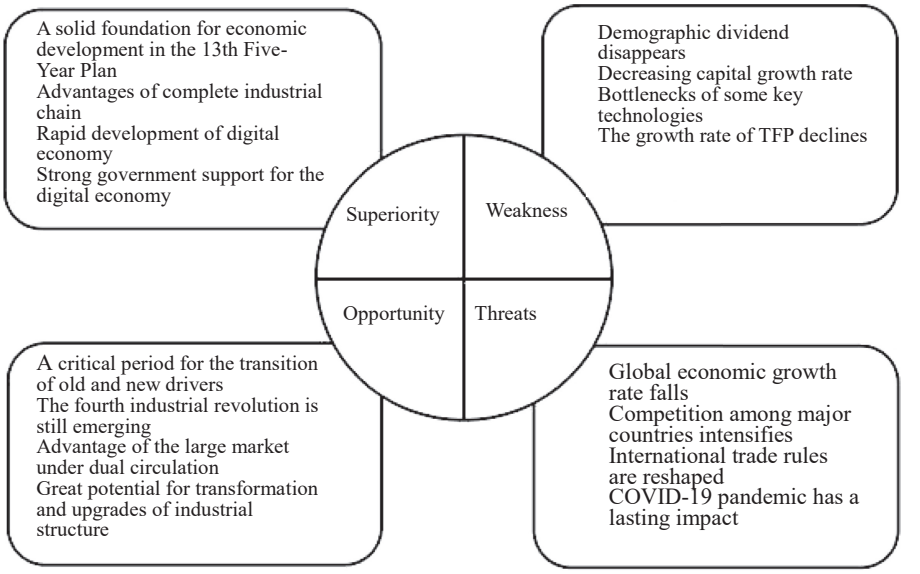


Figure 1.
SWOT analysis of China's economic growth

of productivity through the cross-sectoral allocation of production factors by reducing the total factor productivity (TFP) and the return on capital (Glawe and Wagner, 2016).

From the perspective of capital, in recent years, although the growth rate of China's capital stock has been faster than that of China's GDP, China is facing the pressure of a declining growth rate of the capital stock. According to the economic equation, savings equal investment, and investment indicates the momentum for future economic development. After peaking at 51.5% in 2010, China's savings rate quickly fell to 46.4% at the end of 2017. From 2010 to 2017, the ratio of growth of household savings deposits to disposable income fell by half, from 25.4% to 12.7%. The savings advantage disappeared, and consumption and investment growth lagged. At the same time, the decline in the savings rate was accompanied by a rapid increase in the household leverage ratio. From 2013 to 2017, the share of household debt in GDP rose from 33% to 49%. With the decline in China's household savings rate, investment and consumption as economic drivers became unsustainable, weakening the economic growth drivers. In addition, Bai and Zhang (2014) calculated that the return on capital fell by 45% between 2008 and 2013, which also inhibited investment growth.

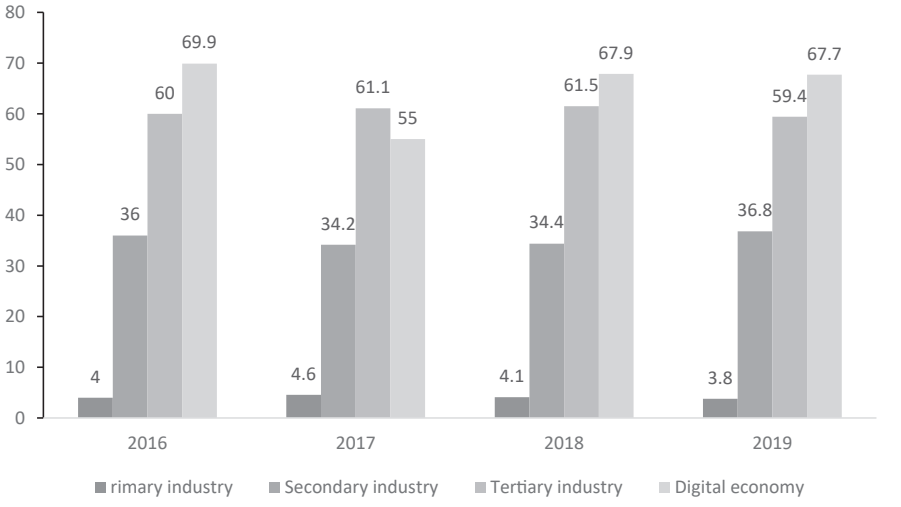
From the perspective of technology, productivity growth comes from embodied and non-embodied technological progress, and China's technological progress may be more of the embodied or materialized technological progress embedded in equipment capital (Zhang *et al.*, 2010). In the initial stage, China may utilize imported technologies to produce labor-intensive, low-cost products and reallocate labor from low-productivity agriculture to higher-productivity manufacturing, thus achieving a significant increase in productivity (Agénor, 2017). In the second stage, after China became a middle-income country, the return on imported foreign technologies has shown a diminishing trend (Eichengreen *et al.*, 2012). There is also a risk of a significant decline in TFP growth. For example, declines in TFP have been a major factor in the economic slowdown in Latin America, and TFP slowdowns tend to be more frequent in middle-income countries than in low- and high-income countries.

Moreover, the growth "slowdown" is not temporary and may prolong a country's transition to high-income status (Aiyar *et al.*, 2013). The process of "creative destruction" is a major source of economic growth. Without core technological competitiveness built by solid technological innovation capability, China cannot complete the transition from technology-following to technology-leading. TFP has played an essential role in China's economic growth in the past few decades. From 1991 to 2010, TFP growth contributed 44.85% to China's economic growth on average (Wu, 2018). For China, TFP played a good role in its transition from a low-income country to a middle-income country but may become an obstacle to moving toward a high-income country.

Currently, the principal contradiction facing Chinese society has been transformed into the contradiction between the people's growing need for a better life and the unbalanced and inadequate development. As the Communique of the Fifth Plenary Session of the 19th CPC Central Committee pointed out, "The whole Party should coordinate the overall situation of the strategy for the great rejuvenation of the Chinese nation and the world's unprecedented changes, deeply understand the new features and new requirements caused by changes in the principal contradictions in Chinese society as well as the new contradictions and new challenges brought about by the complex international environment, and enhance the awareness of opportunities and risks." China's economic development has been in a critical stage of pattern transformation and the transition between old and new economic drivers. Against the background of the weakening role of traditional growth drivers in economic development, there is an urgent need to establish a drive system with economic structural transformation and technological progress as the base. Whether China can transform its development mode, optimize its economic structure, transform its growth drivers and nurture new drivers for economic growth is the key to maintaining economic growth and overcoming the middle-income trap.

So far, humans have gone through four waves of industrial revolutions, and each industrial revolution has produced a new economic form. The adjustment of economic forms, accompanied by technological innovation and industrial revolutions, has brought about the rapid progress of productivity in the economic society. Regarding the fourth industrial revolution characterized by the ongoing digital economy, the digital economy has a comprehensive and profound impact on human production, living and ecology and is also restructuring the landscape of the world economy. According to the data released by the China Academy of Information and Communications Technology from 2002 to 2019, the added value of China's digital economy increased from 1.2 trillion yuan to 35.8 trillion yuan, with an average annual growth rate of 22%, far higher than the average annual growth rate of GDP over the same period. The proportion of the digital economy in China's GDP increased from 10.3% in 2002 to 36.2% in 2019; however, it is still lower than those of Germany, the United Kingdom and the United States, which occupy over 60% of GDP, showing that there is considerable space in China for digital development. From 2016 to 2019, China's digital economy contributed more than 50% to GDP growth, significantly higher than the contribution of the three industries to China's economic growth (see Figure 2). According to estimates by Accenture, for every 10% increase in a country's digitalization level, GDP per capita will increase by 0.5%–0.62%. The potential of the digital economy to drive China's economic growth remains to be further explored in the future.

The primary feature of China's economic development in the new era is to shift from high-speed growth to high-quality development. The rapid evolution of the new technological revolution enlightens us that the digital revolution is a future-oriented systematic revolution where new drivers of economic growth are bound to be involved. Developing the digital economy is an inevitable choice to ensure the replacement of old growth drivers with new ones and push the economy out of the middle-income trap. China should actively grasp the opportunities of overtaking created by the new round of industrial revolution and technological revolution, focus on improving the quality and efficiency of economic development, and boost the development of new economic drivers to overcome the middle-income trap.



Source(s): China Academy of Information and Communication Technology "2020 China Digital Economy Development Report"

Figure 2.
Contribution of three major industries and the digital economy to economic growth in China in 2016–2019

2. The development of digital economy and the transformation and upgrade of economic structure

The economic structure is those proportions and relations that characterize an economy as a whole in time and space (Piaget, 1984). The rapid growth of one or several new production sectors is a powerful and central engine of the structural transformation of an economy because these production sectors with new production functions will cause diffusion effects, which can lead to a leap in economic growth. In this process, new production sectors are born when the old ones decay (Rostow, 1988). Economic structure and growth cause and affect each other and are closely related. Different economic structures reflect different patterns of economic growth, and the transformation of economic growth patterns is, to a large extent, determined by economic structural adjustment (Zhou, 1991). The economic structural transformation and upgrade are objective requirements to promote economic development and realize the structural optimization and upgrade of the economic growth pattern. Economic growth is both the result of the transformation and upgrade of economic structure and the cause of further transformation of economic structure. Only by combining the process of economic growth with the overall transformation of economic structure can the transformation of the economic growth pattern be forwarded, the economic structure optimized and the high-quality economic growth achieved, further promoting healthy and sustainable economic development (Chenery *et al.*, 1989).

The significance of the structural transformation of an economy to economic growth is undoubted. If countries fail to transition from resource-driven growth with low-cost labor and capital to productivity-driven growth in good time, they will fall into the middle-income trap (Kharas and Kohli, 2011). However, economic structural transformation is often painful. During the world economic development, many states have fallen into the middle-income trap because they failed to seize the opportunities for structural transformation. For example, Latin American countries' stagnant structural transformation is one of the fundamental causes of falling into the middle-income trap. For countries transforming and upgrading their economic structure, the risk of falling into the "transformation trap" should not be ignored either. In the case of China, the resources and environment enabling China's rapid economic growth in the short term have been largely exhausted, and the potential triggers of the "transformation trap" faced by China may include the uncoordinated regional economic development, the widening income disparity and increasing constraints on resources and environment. As shown in Figure 3, China is currently in a critical period of socioeconomic

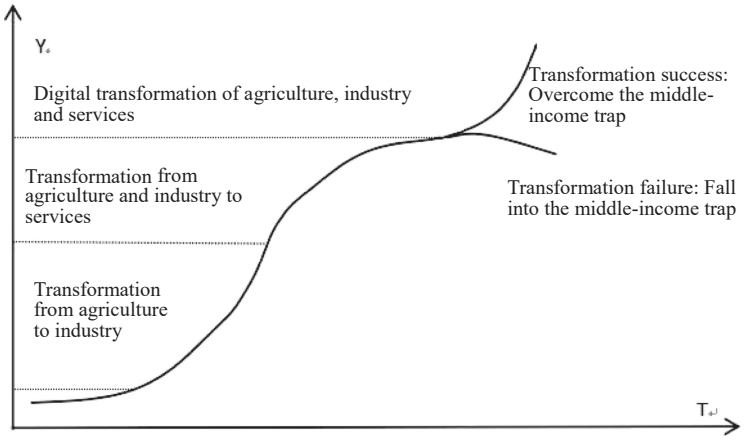


Figure 3.
China's economic structural transformation and economic growth

digitalization transformation. To break out of the "transformation trap", China urgently needs to break down the institutional barriers that hinder the transformation of economic structure, grasp the historical opportunity of the development of the digital economy and take digitalization transformation as a breakthrough for China to overcome the middle-income trap. Furthermore, China should nurture new drivers of economic growth through the transformation and upgrade of the economic structure and adjustment of economic growth patterns.

The slowdown in economic growth related to the middle-income trap is essentially a productivity slowdown and not just the result of declining returns to physical capital accumulation. For the economy as a whole, growth in factor productivity often contains the factor of structural transformation, which occurs when resources are reallocated from low- to high-productivity activities (Chenery *et al.*, 1989). Since 1949, two significant structural upgrades have occurred in China's economy, the first being the structural transformation and upgrade from an agricultural to an industrial economy and the second from the industrial economy to a service economy.

A feature of the first transformation and upgrade of economic structure is the declining share of agriculture and the increasing shares of industrial and services sectors, with industry gradually becoming the dominant sector in the economy. In a traditional agricultural economy, the drivers of industrialization can be push or pull factors or both at the same time – that is, industrialization is driven by a combination of productivity level and consumer demand. A specific force that arises within the agricultural sector can be regarded as the "push" factor, as there is a surplus of labor in the agricultural economy under the guise of underemployment and disguised employment. Therefore, expanding employment outside of agriculture will raise the productivity level of the surplus labor, such as in manufacturing, to drive economic growth (Lewis, 1954). The technological structure is also constantly adjusted along with rapid economic growth (Swiecki, 2017). Since the low productivity of agriculture is a technological feature of this sector, technological improvements within agriculture are assumed to be necessary to trigger economic development. When physical capital, technology and innovation trigger various prerequisites for growth, industrialization starts, and the profits caused by the rising productivity level in the industrial sector are reaped. The vast potential for sustained productivity improvements in the industrial sector can, in turn, lead to sustained economic growth and continued structural transformation, guiding the economy on a rapid development path.

Moreover, in the process of industrialization transition, comparative advantages in the global economic competition are obtained through specialized and large-scale production as well as globalized and open trade, which are transformed into a higher market share in global demand. The main feature of this stage is the mutual influence and promotion of economic growth and rapid structural changes. Therefore, the economy in the process of industrial transition is in a stage of rapid growth, expressed not only as the growth effect of input of factors of production such as labor and capital but also as the growth effect of changes in demand and supply structures. Once an economy enters the postindustrial era, technological progress becomes the primary method for improving labor productivity and TFP. This is because of the significant reduction of the technological gap between industrialized countries and other countries and the diminishing marginal effect of "technological dividends" caused by the introduction and absorption of technologies. The speed of economic growth is highly correlated with that of technological progress. Countries that cannot rely on technical progress and technological innovation to transform and upgrade their economic structure find it challenging to maintain sustainable economic growth, and their risk of falling into the middle-income trap increases significantly.

Generally speaking, after an economy basically completes a structural transformation, there is generally a significant decline in economic growth. After more than 40 years of large-

scale industrial expansion, China has formed a modern industrial system with reasonable structure and complete sectors. China has entered the late stage of industrialization, with the Industrialization Composite Index of 84 in 2015, which is expected to reach 100 in 2020 (Huang and Li, 2017). This indicates that China has basically completed industrialization, and the development means that relying on industrial transformation releasing "industrialization dividends" to promote economic growth is hard to maintain.

The second transformation and upgrade of the economic structure are characterized by the declining shares of agricultural and industrial sectors and a continuous increase in the share of the service sector, which will become the leading industry of the economy. The process of structural transformation of the economy into services often occurs in the postindustrialization stage, which is prone to "deindustrialization" and "disengagement from the real economy". Once the industrialization process is nearing its end, the negative impact on economic growth will become increasingly evident as the services-oriented structure tendency of the economy gradually increases. First of all, the accelerated transfer of labor from industry to the service sector lowers the labor productivity of the whole society. When the middle-income level is reached, the economic development changes from "structural acceleration" to "structural deceleration", and labor productivity and TFP continue to decline. This side effect affects the economic growth rate and the sustainability of economic growth (Yuan, 2012). Besides, when the stage of industrialization evolves into the service economy stage, it faces the triple shock of structural deceleration, namely, the inverted U-shaped trend of capital growth, the inverted trend of labor growth and the gradual weakening of the learning-by-doing effect (Zhang *et al.*, 2014). Last but not least, whether the economy is in a boom or a bust, the unemployment rate in the structural transformation toward the service economy rises compared with the previous period (Grubel and Walker, 1993). Premature deindustrialization or the lack of practical support from producer services may lead to the "Reverse Kuznets Curve" problem with declining productivity, inhibiting economic growth, and thus falling into the middle-income trap. For example, Argentina, Brazil, Mexico and other Latin American countries have been deindustrialized prematurely, and the proportion of services in the economy has been increasing in these countries, most of which have suffered from Baumol's cost disease caused by the inefficient economic structural transformation toward the service economy, where the technology-intensive producer services are relatively underdeveloped, the economic structure has been transformed but not upgraded, and the economy loses its long-term growth momentum and falls into the middle-income trap.

The essence of China's new economic normal is the essential demands of China's dynamic adjustment of economic structure and high-quality economic development. The improvement of labor productivity and TFP will still be the core driver of China's economic growth in the future and also the dominant way to resolve the "structural economic slowdown" problem. Under the adverse impact of diminishing marginal returns from factors, the transformation and upgrade of economic structure is the long-term driver of economic growth. China's future economic growth should not only find new sources of TFP but also tap the potential of traditional TFP (Cai, 2013). If China succeeds in initiating the next stage of its economic structural transformation, it will make up for the productivity decrease caused by the economic structural transformation toward services in the postindustrial era (Felipe and Mehta, 2016). Particular attention should be paid to the improvement of TFP through economic structural transformation, especially with the structural upgrade toward digitalization. As the third economic form after the agricultural and industrial economies, the digital economy includes two aspects, i.e. digital industrialization and industrial digitalization, which can be regarded as the all-around, all-angle and all-chain digital transformation of traditional industries, including agriculture, industry and services, with data as the critical factor and digital technology as the critical support. Currently, China's economic structure has started a new digital transformation journey. From the perspective of

economic structural transformation, China has entered a new stage of economic development, which is undergoing the third transformation and the pattern reconstruction of economic efficiency, that is, the stage of economic structure digitalization. The economic structural digitalization can solve the problems that an economy may fall into low-value production activities, lack functional upgrades or fail to participate in the high-end fields of global value chains, which realizes the breakthrough of economic growth from "quantitative change" to "qualitative change".

Unlike the previous two economic structural transformations, digital transformation can catalyze the generation of new industries and empower traditional industries; the former kind of digitalization is called digital industrialization, and the latter is industrial digitalization. In addition to promoting the optimization and upgrade of industrial structure, digital industrialization is the variable with the most market vitality and technological innovation potential. Digital industrialization is the catalyst for the birth of new industries, new business forms, new technologies and new services, with a series of strategic emerging industries, such as platform economy, sharing economy, mobile payment and digital currency. With typical features of technology-intensive and data-intensive, the digital industry is characterized by the explosive growth of data in the process of digital industrialization transformation, high-speed iteration of technology-driven development paradigm, development of digital industry toward networking, digitalization and intelligence, breaking of industrial margins, and rapid expansion of industrial ecology. Industrial digitalization is the upgrade and transformation of traditional industries by data and digital technology, covering agriculture, industry and services. With the in-depth integration of traditional and digital economies and the enhanced technology expansion and "softening" factors of economic development, industrial digitalization transformation will penetrate into all links of the industrial chain, supply chain and value chain, and traditional industrial clusters are becoming the vital force to lead the transformation and upgrade of economic structure and promote economic growth. According to the China Industrial Digitalization Report 2020, the added value of China's industrial digitalization in 2019 was about 28.8 trillion yuan, accounting for 29.0% of GDP, in which the penetration rates of the digital economy in services, industry and agriculture were 37.8%, 19.5% and 8.2%, respectively. Industrial digitalization drives the transformation and upgrading of the whole industrial chain, and digital technologies and data elements represented by artificial intelligence, blockchain, cloud computing and big data are the "glue" and "lubricant" among industries, greatly enhancing the synergy of industrial chain and improving the matching supply–demand level of supply chains. In addition, industrial digitalization reshapes the industrial value chain, and the use of data deepens the division of labor in the industrial value chain, enhances the value increment capacity of the industrial chain and leads China's traditional industries to the high-end global value chain.

The improvement of TFP is essential to promote sustainable economic growth, and the advantage of digital transformation of the economic structure lies in TFP improvement. Countries that have escaped the middle-income trap generally have experienced higher TFP growth, lower inflation and a relatively rapid process of structural transformation leading to a smooth transition to high-income status (Bulman *et al.*, 2017). Nowadays, with the rapid development of digital economy and digital technology, if China formulates economic development strategies by simply taking the traditional exogenous factors of production such as population and resources as comparative advantages and neglects the digital and intelligent transformations of economic structure, it will bring about the problem of follow-up weak economic growth, and the path of China's economic development will hardly converge with that of developed countries eventually. Digital transformation enables China to tap its comparative advantages. Digital industrialization and industrial digitalization together bring about a new round of "marginal revolution" and "boundary revolution" in economic society, with increasing marginal productivity and a blurred industry boundary. Digital

transformation accelerates the spread of advanced technologies and breakthrough innovations in digital technologies and promotes the deep integration of cutting-edge technologies with industrial and value chains. During the accumulation and release of latecomer advantages, China realizes the transformation from the technology gap to late-developing advantages and from absorptive capacity to social capacity and national capacity. The level of TFP in China is only about 43% of that in the United States, with vast potential for improvement (Wang, 2020). The digital transformation of economic structure provides a shortcut for China to achieve technological catch-up, which is to promote TFP improvement, release future economic growth potential and expand economic development space by injecting new vitality into traditional industries and new drivers into economic growth.

With the PWT database and based on the model and contribution coefficient of factor growth formulated by Jia (2020), this paper takes the impact of digital transformation of economic structure on TFP into account and resets the dynamic growth rate of TFP during the 14th Five-Year Plan period, estimates the trend of China's potential economic growth rate in the next five years and predicts the time point for leaping over the middle-income trap in the next five years. Similar to the trend of TFP growth in the early industrialization stage, the TFP growth rate in China, which is at the early economic structural digital transformation stage during the 14th Five-Year Plan period, will show an increasing trend. Thanks to the amplification, superposition and multiplication of digitalization, the transformation and upgrade of the economic structure have a boosting effect on TFP (Liu and Chen, 2020). We set China's TFP growth rate in 2020 as the benchmark at 1% and forecast China's TFP growth rate in the next five years in three scenarios: the benchmark, optimistic and prudent scenarios, where the annual TFP growth rate increases by 0.4%, 0.6% and 0.2%, respectively. The corresponding economic growth rates and GNI per capita for 2021–2025 estimated using different sample groups of total factor growth rates are given in Table 2. According to the estimated parameters of the benchmark regression, the average annual economic growth rate of China during the 14th Five-Year Plan period may reach about 5.7%, the economic growth rate may reach 6.222% in 2025, and the GNI per capita will be USD 13,180 in 2024 and over USD 14,000 in 2025. According to the World Bank's classification standard for national income in 2020, it is expected that China will get rid of the middle-income trap in 2024.

3. Digital economy enhances supply-side efficiency and production–sales integration

The economic growth indicators shall be limited to not only the growth speed but also the quality of economic growth. While promoting economic growth, the digital economy enables dynamic adjustment of supply-side structure. Throughout the history of the world economy, the key to cultivating potential productivity is to start with the supply side and vigorously promote supply-side reform. The supply-side structural reform shall focus on, through the optimization of factor allocation and realignment of the production structure, improving the quality and efficiency of the supply system, enhancing the adaptability and flexibility of the supply structure to changes in demand, promoting the effective resolution of overcapacity, accelerating industrial optimization and restructuring, reducing enterprise costs, promoting the optimization and upgrade of traditional industries, fostering emerging industries and modern services, and increasing the supply of public goods and services. The results of the combined effect of various factors in the industrial system determine the development direction of the industrial structure and the speed of supply-side structural adjustment. The digital economy, as the core driver of economic development, is of great significance to the structural reform on the supply side. The digital economy, empowered by

Economic indicators	Contribution coefficient of factor growth	Factor growth targets 2021	2022	2023	2024	2025
Physical capital	0.47	7.5	7.5	7.5	7.5	7.5
Labor	0.50	−0.3	−0.3	−0.3	−0.3	−0.3
Human capital per labor	0.20	1	1	1	1	1
Total factor productivity (benchmark forecast)	0.67	1.4	1.8	2.2	2.6	3
Total factor productivity (optimistic forecast)		1.6	2.2	2.8	3.4	4
Total factor productivity (prudent forecast)		1.2	1.4	1.6	1.8	2
Intercept item	–	0.64	0.64	0.64	0.64	0.64
Economic growth target (benchmark forecast)	–	5.15	5.418	5.686	5.954	6.222
Economic growth target (optimistic forecast)	–	5.284	5.686	6.088	6.49	6.892
Economic growth target (prudent forecast)	–	5.016	5.15	5.284	5.418	5.552
GNI per capita (benchmark forecast)	–	11,165	11,770	12,439	13,180	14,000
GNI per capita (optimistic forecast)	–	11,179	11,815	12,534	13,348	14,268
GNI per capita (prudent forecast)	–	11,151	11,725	12,345	13,013	13,736

Note(s): We assume that the growth rate of GNI per capita in 2020 is calculated at 2% and that the growth rate of GNI per capita is the same as that of GDP during the 14th Five-Year Plan period. The unit of factor growth and economic growth targets is %, and the unit of GNI per capita is USD

Table 2. Forecast results of China's economic growth rate and GNI per capita for 2021–2025

digital technologies and with data as the critical element, accelerates the interaction of various factors within the economic system, promotes the adjustment and change within the industrial system and optimizes the way of factor configuration and combination in all aspects to maximize the drivers of industrial structure adjustment and economic growth.

3.1 Enable quality, efficient and diversified supply system

The digital economy cultivates new technologies, industries, business forms and patterns, enormously enriching product categories and market suppliers. On the one hand, the digital transformation of the whole industry chain in the real economy has created plentiful market opportunities, attracting numerous production factors to flow to emerging industries. The digital economy lowers the entry threshold of the industry and results in the emergence of a large number of small- and medium-sized enterprises ("SMEs"). These enterprises expand the traditional market boundary, increase market suppliers and promote market competition in products and services by creating various flexible business models and means of operation. In addition, the level of technology is an endogenously determined variable of the market suppliers, and technological progress is reflected by the increase of categories of intermediate products or consumer goods (Zhu and Wu, 1999). Digital technology and data elements profoundly transform those traditional industries, and the real economy shows the characteristics of high-quality, efficient and diversified supply. On the other hand, the digital economy effectively promotes the specialized division of labor in production and continuously extends to form new industrial chains based on the original industrial chains. Producers in the digital economy will abandon rigid thinking such as one-way design and large-scale production and instead focus on the interactive design and customized production and operation of multiple products by various market players. The division of labor in the

industrial chain is increasingly refined, and personalized and diversified differentiated products will become the market mainstream.

The digital economy promotes the evolution and innovation of traditional industries toward networking, digitalization and intelligence, which continuously expedites the reform of internal production organization and external industrial organization of the manufacturing industry to realize the improvement of productivity and the optimization of product quality in the manufacturing industry. Product quality disparity is manifested as technology disparity, as continuous product innovation and technical capability improvement are the keys to improving supply quality. When a new technological pattern or a new generation of technology enters an emerging industry that has not yet been established, a country can create its own technological path that is different from that of other countries or regions, take a technological path different from that of the technology leader and achieve leapfrog growth with this path. Some latecomers can save massive investments and adopt new technologies through technological advances and disruptive innovations, thereby expanding their market share in competition with current companies or countries in the same industry. The discontinuity of new technologies may lead to the rise of new entrants, and the best time to implement this strategy is when all countries or companies find themselves challenged by an emerging techno-economic pattern. Digital technology is the product of the new generation of technological revolution, and this emerging technological pattern will have a disruptive impact on the traditional industries, promoting the industry chain *t* from the middle and low-end to the high-end and continuously meeting the people's growing demand for upgrading consumption.

In the digital economy, the supply and demand of products are more balanced, which significantly solves the great contradiction of structural mismatch between supply and demand. The value of the data factor in the digital economy is constantly amplified, supply and demand are highly connected in terms of quantity and structure, and the supply side can effectively adapt to new demand changes. The use of data breaks down the information barriers in all links, greatly unblocking the circulation system of domestic and foreign production factors and improving the efficiency of resource allocation and the market-oriented level and accuracy of supply–demand matching, which helps to resolve the structural contradiction of uncoordinated and unbalanced production factors among regions. Furthermore, in the digital economy, producers and consumers are highly interconnected, where consumers may give feedback on their personalized demands and preferences to the producers and may even participate in enterprise production, operation and management, while producers may perceive the ever-changing consumer demands through big data analysis, artificial intelligence and other digital technologies to achieve on-demand production and precision marketing and further realizing a high-level dynamic balance between supply and demand. For example, Red Collar Group realized the assembly line production of a series of personalized clothing products through big data and the Internet of Things, which changed traditional production patterns and business concepts and met the consumer demand for personalized customization in the niche market.

3.2 Strengthen networking, opening-up and synergy in the innovation system

Overall, China's industries are at the low end of the global value chain, and the critical cause is the lack of innovation capacity. Due to the constraints of technology and innovation capacity, the technological level of products under the current international division of labor is relatively low, which weakens the competitive advantage of product supply. If a country's strategies do not shift from investment-based to innovation-based, the country may fall into the "non-convergence trap" and fail to reach the world's technological frontier (Acemoglu *et al.*, 2006). In addition, a critical flaw in China's innovation policies is its failure to strengthen

collaborative innovation among enterprises and between enterprises and research institutions. As Schumpeter (1990) pointed out, innovation in the true sense only emerges when scientific knowledge and technological inventions are transformed into commercial activities by entrepreneurs. Building innovation capacity is a crucial step in restructuring China's economy, improving its economic growth, enhancing its overall competitive advantage and building China into an innovative country. The digital economy provides an opportunity for the development of industrial innovation. Theoretically, innovation is to establish a newer production function, that is, to introduce a new combination of production factors into the production system. As a new factor in the digital economy, data facilitates the recombination of production factors and promotes innovation in the production pattern and business models of enterprises, making sustainable and stable economic growth possible.

The change in the structure of the modern innovation system is essentially the result of the interaction between productivity and production relations. The productivity matching with the production relations will promote the vigorous development of emerging industries. In turn, production relations adapting to productivity will continuously promote the capability upgrade of the innovation system. First of all, the digital economy promotes the synergistic development of the innovation system in enterprises. In the industrial era, no matter it is the linear system, the functional system, the linear-functional system, the business unit system or the matrix system, the organizational structure of enterprises is like a pyramid, characterized by verticality, bureaucracy and hierarchy, which lacks sufficient flexibility in responding to the external environment changes and resource allocation. In the digital economy era, functional departments of enterprises strengthen mutual coordination and win–win cooperation to make immediate responses to the market demand, and the organizational structure tends to be networked and flat. The design department can work with the manufacturing department to help the enterprise realize the sharing of innovation resources and the division of labor and cooperation in the industrial chain at a lower cost, promoting the large-scale innovation synergy and achievement transformation.

In addition, the digital economy builds an innovation network and market environment conducive to the open development of the innovation system. Digital technology and big data promote the clustering of innovation and strategic integration of the innovation system, and the industrial capabilities of original innovation, integrated innovation and re-innovation by introduction, digestion and absorption are greatly improved. By virtue of digital information platforms, innovation resources such as talents, technology, capital, information and service can be allocated globally, promoting the free flow, interaction and sharing of innovation factors. Single linear individual innovation is gradually transformed into networked collective innovation, and new innovation methods such as crowdsourcing, crowd innovation, crowdfunding and online to offline are widely used. Multiple innovators, including government, enterprises, schools, research institutions, associations and consumers, participate actively. The government-industry-academia-research-application innovation system with a clear division of labor and benefit-sharing plays an important role in forming a multi-entity, multi-field, multi-department and multidimensional deep integration innovation and improving the cross-sector coordination of innovation factors and releasing the innovation potential to the greatest extent.

Moreover, digital technology has the attributes of collaborative innovation, collective innovation and disruptive innovation, and new technologies emerge endlessly, which greatly shortens the innovation cycle of product iteration in the digital economy. Take Haier's HOPE platform as an example. It is currently the largest open innovation platform in China and the largest resource allocation platform in Asia, which establishes a parallel research and development (R&D) pattern in which users and resources participate in product development and innovation, creating a market-oriented path for product innovation.

3.3 Make the production pattern socialized, modularized and flexible

The digital economy can be regarded as an "economic revolution" that reveals three significant changes in three dimensions of the economic system, which are changes in the potential of social productivity; the nature of the knowledge base and the nature of the organization for realizing the productive potential (Dorn *et al.*, 2020). The rapid evolution of the new technological revolution has revealed that the digital transformation of production patterns is no longer an issue of ability but a systematic change for future development. The diversified and personalized market demand requires enterprises to have the ability to adjust their production lines quickly. To be more specific, they are required to transform enterprise workshops and technological processes into modules and combine and reshape these modules according to certain rules, thus constituting a more complex thinking system or production process. The modularization of products consists of two parts, the common part to all products and the other reflecting the customized features of products. Enterprises establish a new production system combining this modular semiautonomous subsystem with other production factors according to customer demand to produce different products and services, which not only improves production speed and efficiency but also meets the demand of different people for products and services with different functions and performance.

In the traditional economic paradigm, large-scale, assembly-line centralized production is the mainstream of production organization. However, as the digital economy reduces enterprises' costs of search, reproduction, transportation, tracing and certification, greatly improving the flexibility of production, the synergy of the supply chain and the production risk control (Goldfarb and Tucker, 2017), the accelerated application of new manufacturing modes, including networked collaboration and cloud manufacturing in flexible production, enables the links in the industrial organization to be subdivided infinitely. The miniaturized and networked production pattern has become a new trend. Enterprise production activities can be combined online and offline, breaking through the time and space constraints and realizing resource sharing and business collaboration between enterprises in different locations. Furthermore, enterprises can adjust production plans according to market information, optimize the factor allocation, flexibly release capacity, speed up inventory turnover and reduce the complexity and uncertainty of the production system. These new production patterns are becoming an important means for enterprises to increase the added value of products and enhance market competitiveness. SANY Heavy Industries has realized the flexible integration of various factors, including labor, equipment, materials and technology, in all links of the production process, which has played an important role in the innovation development as well as quality and efficiency improvement of the enterprise.

According to Engels (2012, p. 799), ". . . The bourgeoisie cannot turn the limited means of production into powerful productivity unless it transforms them from individual means of production into socialized means of production that can be used by a group of people." The openness and inclusiveness of the production pattern in the digital economy are one of the main differences between the digital economy and the traditional economy. Thanks to the openness of digital technology and data in the digital economy, the connections between means of production, production tools and laborers become closer, making it possible to socialize the production pattern. The value gained is higher if customers have a better understanding of their preferences, express them better and are more involved in the product (Franke *et al.*, 2009). In the digital economy, the network of the socialized division of labor in the mode of production is constantly improved, and the connections between enterprises and users as well as society are increasingly closer. Collaborative and modular production gradually becomes the new normal of production management. In other words, the decentralized production process based on custom is constantly transformed into a socialized, scientific process (Marx, 2004). With the rapid evolution of the digital revolution, the allocation efficiency of production factors and the level of collaboration in the division of

labor in the industry continually increase, leading to the multiplier effect and multiplication effect of production.

4. Digital economy revitalizes the "troika" on the demand-side led by internal circulation

Promoting economic growth to overcome the middle-income trap requires leveraging the driving role of supply-side structural reforms and the pulling role of the demand side. Countries falling into the middle-income trap usually suffer from insufficient effective demand, and their governments' fiscal and monetary policies have little effect. Particularly, when a country is in the transition from middle-income to high-income, the demand side is extremely important for short-term economic growth. The drivers of the demand-side "troika" of economic growth in the digital economy have changed profoundly, shifting to new infrastructure construction, consumption upgrades and digital trade. Among them, the digital economy, as the main component of new infrastructure construction, has positive externalities and spillover effects, changing consumers' consumption patterns and enhancing the comparative advantages of products and services in the international market.

4.1 Digital economy changes the market investment direction

In recent years, the digital economy has boomed, and the digital transformation requirements of the economic society and the government's targeted policy support have driven the growth of investment in the digital economy. Investment in the digital economy has high social benefits and significantly boosts economic growth in the short term, playing a critical role in TFP improvement, industrial structure transformation and upgrades, and technological progress. Investment in fields related to the digital economy has mobilized the enthusiasm and confidence of market investors and is becoming a key direction that attracts private and government investment. In 2018, fixed-asset investment in the computer, communications and other electronic equipment manufacturing industries grew by 16.6% year on year (YOY), and the YOY growth of fixed-asset investment in the Internet and related services was 37.6%. The investment growth in fields related to the digital economy was significantly higher than that in other industries. Investment in the digital economy can be roughly divided into the following two categories: investment in digital industrialization and investment in industrial digitalization. As for digital industrialization, there is still a widening gap between China and developed countries in the information technology and communications industries, especially high-end chips, operating systems and core components. These digital industries are crucial to China's high-quality economic development and state economic security, and there is a growing demand for replacement by domestically produced products. From a long-term perspective, investment in digital industrialization has a relatively large investment space and development potential. In terms of industrial digitalization investment, with the in-depth integration of digital technologies into traditional industries, there has been a steady growth in digital transformation investment in traditional enterprises, including digital transformation investment in production, operation and management.

Given the complexity of the current domestic and international situation of economic development and the negative impact of COVID-19, investment in digital economy facilities has been promoted to a new height. Since the requirements of "new infrastructure construction" were put forward at the 2018 Central Economic Work Conference, the central and local governments have issued multiple relevant policies and guidelines to support the development of new infrastructure construction, and the progress of new infrastructure construction has been significantly accelerated. The digital economy has changed the market investment direction and is changing the direction of global value chains. Investment in digital economic infrastructure such as the Internet in developing countries can quickly

improve the domestic investment environment (Xu, 2017). In addition to driving the investment demand directly, new infrastructure construction can play a key role in the replacement of old growth drivers with new ones and the upgrading of the industrial structure by driving a new round of industrial investment and technology investment, indirectly promoting social capital investment in emerging industries and technologies and other fields related to the digital economy.

Since "stable investment" is a critical part of the "Six Guarantees" and "Six Stabilities", the construction of digital infrastructure is urgent and significant, not only as a key direction of countercyclical investment but also as a key point for stable economic growth in the future. Similar to traditional infrastructures such as roads, railways, shipping and airports, digital economy infrastructure plays a support role in the high-quality development of the digital economy and is becoming the key for countries worldwide to seize the high ground in global competition. Unlike traditional infrastructure, the value expansion of new infrastructure construction can eliminate the constraints of physical space and realize the infinite expansion of value, which has become a hot area of investment in this round. The proportion of new infrastructure investment in total investment is expected to rise further during the 14th Five-Year Plan period, driving total investment to maintain an annual growth rate of about 10%. In terms of economic practice, about 40% of the investment demand in traditional investment is converted into consumption demand in the form of wages (Qi, 1993; Luo, 2004). Since new infrastructure is typically technology-intensive infrastructure, and the products and services provided for new infrastructure investment involve a wider range of economic sectors, the proportion of investment demand converted into consumption demand is expected to rise further. With the policy support of 34 trillion yuan, the new infrastructure investment is expected to activate the next round of "new consumption".

4.2 Digital economy promotes consumption upgrading

In traditional economic theories, consumption upgrades are closely related to residents' current income, expected income and social security system. Relevant theories include the "absolute income hypothesis" proposed by Keynes in *The General Theory of Employment, Interest and Money*, the "relative income hypothesis" put forward by Duesenberry and the "life-cycle hypothesis" by Modigliani. With the continuous development of economic theory, it is difficult to fully explain the whole picture of current resident consumption upgrading by using income theory as the basic theory of resident consumption research. Exogenous variables such as digital technology progress and data are gradually derived as the driving factors for consumption expansion. Factors such as the improvement of industry and service quality, the convenience of consumption methods, the reduction of transaction cost and the cross-regional matching of supply and demand are becoming the incentives for consumption upgrading.

Consumption upgrading is essential for developing productivity and promoting economic development. Marx (1979, p. 391) has pointed out the specific path of consumption upgrading, "First, it requires expanding existing consumption; second, expanding the existing consumption to a larger range to create new needs; and third, producing new needs and discovering and creating new use-values." The main ways of upgrading consumption can be derived from it, including three levels (see Figure 4).

The first level is consumption structure upgrading. Consumption demand in the digital economy is developing to diversification, individuation and high level, which is the "law of rising needs" summarized by Lenin. According to Maslow's theory of "the hierarchy of needs", the hierarchy of needs can be divided into spiritual value needs and material value needs. Humans show different degrees of urgency for these needs, and the most urgent need of humans becomes the motivation to stimulate human behavior (Maslow, 1943). The

material need for material products is mainly rigid, while the spiritual need for digital products is mainly a kind of psychological need, and these two kinds of needs overlap and depend on each other. After human basic material needs are satisfied, human needs focus more on spiritual satisfaction and self-worth realization (Pittman and Zeigler, 2007).

The second level is consumption pattern upgrading. With the gradual improvement of logistics, mobile payment, platforms and other supporting industries in the digital economy, consumption patterns are becoming network- and platform-based, and the traditional consumption patterns are being reshaped. In the digital economy, the offline and online markets complement each other and expand the traditional market boundary. Online consumption has become one of the major consumption patterns, which can be regarded as a cross-regional and all-weather, 24-h consumption pattern that bridges the regional market segmentation and pushes the regional market forward to the global market, greatly promoting the circulation of goods, expanding the market capacity and bringing the distance between producers and consumers closer. The emergence of online markets also weakens the market information asymmetry, reduces the structural friction and transaction costs in the market operation and improves the market transaction efficiency. Although the consumer groups in remote areas of central and western China and consumers in rural areas also have high consumption potential, they have difficulty accessing consumer goods markets due to information asymmetry and high transaction costs, which inhibits consumption demand. The digital economy opens up new channels for disadvantaged consumer groups to enter the consumer goods market, and the consumption potential of neglected disadvantaged consumer groups will be stimulated.

The third level is consumption form expansion. The digital economy has lowered the barriers to market entry for businesses, and the economic digitalization exposes businesses to new sources of competition as well as new markets and opportunities. It is easier than ever for enterprises to enter new markets, and with an increasing number of market players in the world being linked together, a larger market becomes within reach. Coupled with the deep integration of digital technology and various traditional consumption forms, plenty of new products, new business forms and new services are emerging, giving rise to the endogenous momentum of consumer upgrading. At the same time, digital companies use a massive amount of consumer transaction data to depict consumer preferences and cater specifically to consumers' individualized and diversified purchase needs, which can tap into the potential consumer market and develop a broader user base. Given the huge market potential of China's domestic demand, it is expected that China's annual consumption growth rate will remain above 10% during the 14th Five-Year Plan period.

4.3 Digital economy fosters new export advantages

As a large traditional trading country, China has a huge scale of international market demand. Improving the level of China's opening-up and increasing the quantity and quality of China's exported products and services is not only an important grasp to ensure stable growth but also a strategic choice to build a new development pattern for mutual support of

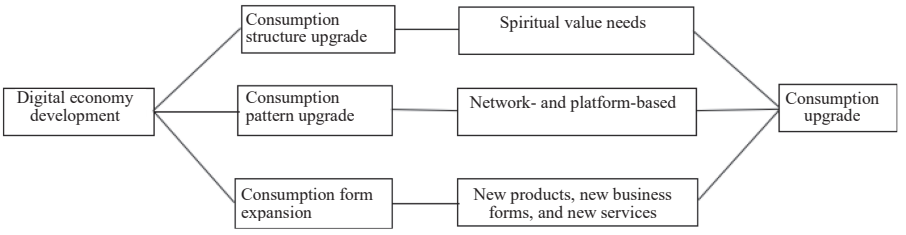


Figure 4.
Consumption upgrading in the digital economy

international and domestic circulation. The digital economy is changing the situation of international trade, deepening economic and trade cooperation between China and other countries and regions, and strengthening ties among economic entities. According to Engels (1958, pp. 361–362), ". . . In this way, big industry has brought all the people of the Earth into contact with each other, has merged all local markets into one world market", digital economy not only unites small markets into a big market but also improves the efficiency of resource circulation in the market. Digital trade is the result of trade mode digitalization in the digital economy and the product of the empowerment and penetration of digital technology and data factors. It is also the key direction of trade development in the future. The spread of COVID-19 has made international trade face uncertainty and many challenges, and the advantages of digital trade are further highlighted.

Digital trade has given a new connotation to international trade and brought new opportunities for the development of China's foreign trade. Digital trade is very different from traditional trade in terms of trade participants, trade objects, trade timing and regulatory policies, and its trend of intensive, unbounded and platform-based development can realize the efficient global allocation of production factors (Liu, 2020). From the perspective of trade cost and efficiency, the development of digital trade can reduce the transaction cost and improve the speed and quality of international trade. To be more specific, the development and application of digital technology can reduce the cost of obtaining market information, finding trade partners, establishing trade relationships and fulfilling delivery obligations in China, thus reducing the "artificial resistance" caused by information barriers and market institutional constraints in importing countries (Fan, 2020). Furthermore, digital trade helps to overcome the fixed cost of production and location cost of trade and to expand the trade boundary (Ju *et al.*, 2020). Since the negotiation, contract signing, payment of funds and other procedures for digital trade are completed in a digital way. The transaction means are paperless and virtualized, and digital trade procedures are much simpler than traditional trade procedures in aspects including trade negotiation, product and service delivery, and payment, greatly improving the efficiency of trade (Li *et al.*, 2014). From the perspective of the market entities of trade, digital trade will attract more micro-, small- and medium-sized enterprises (MSMEs) and even consumers to participate in trade globalization. In the traditional economy, only large enterprises with strong economic strength and advanced technology are capable of engaging in foreign export trade. Digital trade provides MSMEs with a new organizational form of foreign trade, and diversified trade modes such as C2C and O2O facilitate the integration of MSMEs into the global value chain system. From the perspective of export trade structure, digital trade can optimize the trade structure. First, digital trade will build a highly integrated global production network and promote China's trade structure to the high-end global value chain. Second, the digital economy expands the tradability of products and services. The digitalization of trade objects enables commodities in the form of data to be transmitted quickly through digital technology, and intangible products and services become important commodities and achieve cross-border transactions, including online education, copyright trading and financial services. Third, the development of the digital economy will increase the proportion of services trade in foreign trade. Digital technology has not only induced service industries and products but also deeply integrated with traditional service industries, such as finance, medical treatment and education, which makes digital technology a focus of China's new round of foreign trade expansion. In 2019, the total export value of China's trade in goods was 17.23 trillion yuan, an increase of 5.0%, while the total export value of China's digital trade was 786.95 billion yuan, marking 21.7% YOY growth. The proportion of digital trade in China's export trade is increasing. Given the slowdown of the world economic growth, trade friction and the uncertainty of the COVID-19 epidemic, the annual growth rate of China's foreign trade exports is expected to remain at about 5% during the 14th Five-Year Plan period.

5. China's solution to the middle-income trap in the trend of economic digital transformation

From the perspective of China's current development environment, "digitalization" is China's new task for adapting to the new round of industrial revolution and technological revolution and transforming the domestic factors as well as the development stage, serving the new requirements of socioeconomic digitalization and supporting the realization of the "Two Centenary Goals". Digital transformation of the economy is a key method for solving the middle-income trap problem and even the overall strategic issues of the whole socioeconomic situation in China. It embodies new concepts, adopts new factors, boosts new structures, drivers and patterns, and is supported by new systems. Behind the deceleration of economic growth under the influence of COVID-19, there is a hidden demand for digital transformation and upgrade of the economic structure, accompanied by the transformation from quantitative economic growth to qualitative economic growth. It is foreseeable that during the 14th Five-Year Plan period and in the future, the digital economic transformation will become the main line leading China's economic growth, while data elements and digital technology will become the strategic focus of value creation and quality improvement of the economy and digital industrialization and industrial digitalization will become the main path of China to optimize and upgrade its industrial structure. This means that facing the new situation and new challenges, China needs to focus on promoting the digital transformation of economic growth, accelerating its transformation in the quality, efficiency and drivers of the economic development to drive economic growth and overcome the middle-income trap.

5.1 Adapting to the laws of economic evolution, promote a fundamental change in the economic growth drivers

Currently, China's economic development is in the critical stage of transforming development patterns and replacing old growth drivers with new ones, featuring unreasonable industrial structure on the supply side, insufficient innovation capacity, relatively outdated production pattern sluggish consumer demand, insufficient investment motivation and difficult foreign trade situation. Accelerating the transformation of economic development pattern is the main route for China to overcome the middle-income trap and the only way to promote sustainable economic development. Transforming the economic development pattern is obviously China's adaptation to the laws of economic evolution, seizing the historical opportunity for strategic adjustment of economic structure to promote the long-term mechanism of sustainable development of economic growth. From a theoretical point of view, the development of the digital economy relies on intangible assets such as data capital and digital technology to recombine factors and is creating new growth factors, which not only solves the constraints of diminishing marginal returns and scarcity of factors but also provides the possibility of sustainable economic growth. Historically speaking, economic structural transformation and upgrading to release new vitality and creativity is the foundation for getting out of the global economic dilemmas and recovering after major crises. As a new economic form, the digital economy is a critical engine of China's replacement of old growth drivers with new ones and an inevitable choice for China to transform the drivers of economic growth. According to Schumpeter (1990), innovation is the fundamental force that drives sustainable economic development. Given the changes in the digitalization phases, in the middle-early phase of digital transformation, the economic growth of a country or region mainly depends on digital industrialization, when the digital economy develops relatively fast, and the driving effect of digital transformation on the economy has not yet been played entirely, while in the middle-late phase of digitalization, economic growth depends on the coordinated promotion by digital industrialization and industrial digitalization, and the transformation of economic development patterns and optimization of the industrial

structure become the critical support for high-quality economic development. To be more specific, the economic growth in the middle and late stages of digitalization mainly relies on the progress of digital technology, the innovation of products and services, and the large-scale application of data elements, which shows characteristics of a high-quality development trend toward high-end, integration, specialization and services.

To seize the historical opportunity for transforming the growth pattern and overcoming the middle-income trap is to give full play to the role of the digital transformation of economic structure as a core engine to propel innovations in science and technology, systems, industries, enterprises, markets, products, business forms and management, injecting new momentum into the development of traditional industries and constantly bringing about new technologies, new industries, new businesses and new models to accelerate the formation of the system of economic growth drivers with digital transformation as the main leader and support. From an institutional perspective, clear property rights and organizational systems are the guarantees of individual wealth growth and the keys to digital economy growth. With changes in the stage of socioeconomic development, if the old system fails to be renovated with the economic growth, it will seriously hinder technological progress and productivity improvement and further intensify unfair competition, leading to market disorder and economic recession, which requires that the institutional environment needs to be based on the new features of the digital economy development and meet the needs of economic development in the new era. Therefore, the government needs to solve the deep-seated economic and social development problems and guarantee a good market environment and institution, providing good conditions of incentives and support for the healthy development of the digital economy. Besides, it needs to remove obstacles to the proper flow and effective allocation of production factors through the constant system and mechanism reforms in technology, finance, talents and other fields, constantly improve market competition, financial, taxation, innovation, and other policies and create a good market and institutional environment for providing a fundamental guarantee for the high-quality development of the digital economy.

5.2 Strengthening the support role of data in the digital economy, boost the high-quality development of the digital economy

With the booming development of the digital economy, the growth rate of global data conforms to Moore's law for big data, approximately doubling every two years. Data is increasingly becoming an essential strategic asset for countries. The cover of *The Economist*, "The world's most valuable resource is no longer oil, but data", points out that in the future development of the digital economy, data will replace oil as the most important bulk commodity in the postindustrial era. Although the technological changes triggered by data will represent new productivity and new development direction in the coming period, they are also faced with many problems such as data circulation, protection, pricing and security, which greatly restrict the formation of the transaction system of the data market and hinder the perfection of data elements. "Data silos" are widespread among enterprises, industries and upstream and downstream enterprises, which makes the massive data of manufacturing enterprises in operation and production processes in a "dormant" state. The economic society has not been able to fully release the vast potential value in data circulation and interaction, which also causes many applications of digital technologies to be in an awkward situation, like water without sources and a tree without roots.

To solve these problems, firstly, the government should start promoting economic development transformation from traditional productive factors dominated by capital, land and labor to new productive factors like data. Efforts should be made to establish a market-oriented allocation mechanism for data and improve the national data resource management system by perfecting the system for registering, pricing and trading data assets and

intellectual property protection of data assets, and strengthening the management of data resources catalog, data integration, quality and security, cultivating the market for data trading. Besides, it should improve the efficiency of data circulation and the matching efficiency of digital supply and demand by actively implementing pilot market programs for trading data and their derivatives, encouraging various market players in the industry chain to use the data trading platform for trading data factors, and providing appropriate incentives and subsidies for owners of big data. Also, it should actively cultivate digital property agencies and market operators and perfect the agency system of data to enhance the value of knowledge and data and the transformation efficiency of research results.

Secondly, the government should promote the openness, circulation and sharing of data to fully release the positive externalities and digital dividends of data factors. To be specific, it should strengthen the sharing of public data resources, improve and implement administrative measures on data sharing, and establish big data service platforms integrating data collection, storage, processing, analysis, sharing and application to realize the integration of acquisition, transmission, storage, management and sharing of data. It should establish a legal and policy system for open sharing of public data resources and build a unified national platform for sharing, exchanging and disclosing government data to promote cross-departmental and cross-level data interconnection and collaborative sharing. Moreover, it should establish a management mechanism for the openly shared data aggregation, storage and security, defining the data-sharing mechanism and circulation means among government departments, enterprises and between the government and enterprises.

Lastly, the government should improve the top-level design by formulating laws and policies related to data. At present, China lacks not only laws and regulations on the development, right confirmation, circulation and protection of data but also a data governance pattern and regulatory system. It is urgent to define the property right ownership, transaction rules and regulatory measures related to data through laws and regulations. Therefore, the government should continuously strengthen the protection of data property rights by speeding up the formulation of laws and regulations on data, defining the division of data property ownership and establishing a sound system of punitive damages for data property violations. In addition, the government should also focus on improving the level of security guarantee and risk prevention of data and continuously improve the governance of data security.

5.3 Promoting the integration of digital and real economies, accelerate digital industrialization and industrial digitalization

Since the beginning of the 21st century, digital technology has set off a wave of high growth again. The in-depth integration of digital and traditional economies has dramatically changed the pattern of industrial development. Emerging fields such as sharing economy, platform economy and intelligent manufacturing are on the rise, with the continued evolution of cross-field integration, promoting the transformation of the modern economic development system and structure toward a more advanced form. To accelerate the integration of digital and traditional economies, bringing new infrastructure construction, as critical support, into play is required. Thus, governments should accelerate investment in new infrastructure construction. Specifically speaking, they should promote the construction of infrastructure, including 5G, industrial Internet, cloud computing, Internet of Things and data centers; increase investment in construction in areas of weakness, such as rural areas and central and western China; accelerate the development of 5G standard, technical test and commercial application and vigorously expand the applications of various innovative technologies to ensure that various new critical infrastructure can be brought into full play in economic growth. For a deeper integration of digital and traditional economies, it is imperative to bring

into play the "empowerment" and "osmosis" role of digital technology. Under such situations as the rising cost of productive factors and tight constraints on resources, the traditional economy urgently needs transformation and upgrading through digital technology so that the problems of unreasonable industrial structure, insufficient innovation capacity and bottlenecks in high-end manufacturing industries can be solved fundamentally. In this regard, one solution is strengthening digital technology supply capacity. Major digital technology innovation projects should be organized and implemented with a focus on key strategic emerging industries; more efforts should be put into promoting R&D, tackling critical problems, and the reserve of core digital technologies through independent innovation, introducing innovations, and integrated innovation, aiming at common digital technologies at the forefront of the world urgently needed by the industry development and transformation to continuously supply new technologies and accelerate the transformation of digital technology achievements. Moreover, to strengthen the position of enterprises as leading players in digital technology, R&D should be regarded as a critical task. Entrepreneurs should be provided with a better digital technology innovation environment; the intellectual property protection system should be improved to safeguard the profits of entrepreneurs from technology R&D, and digital technology R&D in SMEs should be stimulated. The government may guide and encourage enterprises to increase funds for basic research on digital technology by leveraging government funds and should strengthen the construction of public service platforms aimed at SMEs to create a favorable technology innovation environment for SMEs.

Industrial digitalization and digital industrialization are the products of the integration of digital and real economies, which are the inevitable choices for realizing high-quality, socioeconomic development. To deepen the transformation of digital industrialization, it is a must to establish a market institution system conducive to digital industrialization, accelerate the reform of factor marketization, establish a robust intellectual property system, improve the intellectual property law enforcement system, ensure a sound intellectual property protection system, facilitate the standardization of digital technologies, and promote digital industrial innovation based on the coordination of intellectual property and technical standards to accelerate the construction of digital industrial clusters that have international competitiveness. Meanwhile, the government should strengthen the construction of national common technology public research platforms, science and technology public service platforms, and technology transfer centers to supplement the insufficiency in the market mechanism and establish a multi-level digital talent training system. As for accelerating industrial digitalization, ecological chains for industrial digitalization transformation must be established to integrate domestic and foreign upstream and downstream industries and further promote the transformation and upgrade of the whole industry chain to a higher level. In addition, the competition in digital economy development has expanded from the economic competition among countries and regions to the competition among digital enterprises. There is a large gap between China and the United States in the scale and quantity of digital enterprises. The government shall actively guide and motivate enterprises to accelerate digital transformation and give full play to the initiatives of enterprises, the major players in digital transformation. A networked, digital and intelligent enterprise collaborative innovation platform should be established to strengthen the linkage system of industrial digital transformation among enterprises in different sectors and further realize industrial digitalization on a larger scale and in a broader field. Only in this way can the dual-driving role of digital industrialization and industrial digitalization be brought into full play to promote economic growth and let the country leap over the middle-income trap.

The digital regulatory capability of governments needs to be improved. The digital economy is an emerging economy, and the traditional regulation is severely

compartmentalized and fragmented by territories, making it difficult to meet the needs of digital economy development. In 2017, the State Council issued the 13th Five-year Plan for Market Regulation, proposing that the traditional administration concepts should be changed, and motivating the vitality and creativity of the market should be taken as an important direction of the market regulation. Especially, the market regulation should be adapted to the trend of thriving development of new technologies, new industries, new business forms and new business models. During the 14th Five-Year Plan period (2021–2025), in the reform of "streamlining administration, delegating powers and improving regulation and services", the government should continue to adhere to the basic principles of deregulation and carry out simplified, inclusive, prudent and smart regulation and other regulatory approaches to give full play to the decisive role of the market in the allocation of resources. Meanwhile, governments should accelerate the transformation of their functions, strive to optimize their services, improve their digital regulatory capabilities and give better play to the active role of "the visible hand".

6. Conclusion

After China has built a well-off society in an all-round way and achieved the first centenary goal, it stands at the starting point of building a modern socialist country in an all-round way and marching to the goal of the second centenary in the 14th Five-Year Plan period. China is in the strategic opportunity period of overcoming the middle-income trap. Under the unprecedented change of the century, it is an important issue in the 14th Five-Year Plan period to take advantage of the situation, nurture the first opportunity in the crisis, open a new situation in the change and successfully cross the middle-income trap. The First Industrial Revolution made the United Kingdom lead the world; the Second Industrial Revolution made the United States rise rapidly, and Calvin Coolidge's government created a "golden growth period" for the US economy driven by the rapid development of industries such as automobiles and electricity, known as the Coolidge Prosperity; the Third Industrial Revolution, since the 1950s, gave Japan an opportunity to catch up and the Fourth Industrial Revolution gave China a golden opportunity to overtake. As the product of the Fourth Industrial Revolution, the digital economy has given the traditional economic society a "new track" and "new drivers" for development and is becoming the force leading economic growth. To this end, during the 14th Five-Year Plan period, China needs to seize the historical opportunity of digital economy development, follow the trend of the digital economy, accelerate the digital transformation of economic structure and promote digital industrialization and industrial digitalization. With the rapid development of the digital economy to promote the transformation and upgrading of economic structure and economic growth, China's economy is expected to successfully achieve "overtaking" and move into the ranks of high-income countries in the next five years or so.

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