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The New Opportunities and Challenges in Economic Growth under the Fourth Industrial Revolution

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Abstract: *This paper shed light on how the Fourth Industrial Revolution promotes economic growth from nation, market and individual aspects. The research results suggest that the new revolution will usher economic growth through innovative productive factors, changes in the international trade, better institutions and social welfare. In addition, the high industrial expansion and agglomeration, the new production and business models will energize market players and promote economic growth. However, some factors generated by the new revolution might also cause economic setbacks.*

Keywords: *The Fourth Industrial Revolution, Economic growth, International trade, Opportunities and challenges*

1. Introduction

The Fourth Industrial Revolution took digital technology as the core and spawned a technological innovation group composed of big data, Internet of Things (IoT), and Artificial Intelligence (AI). With the advent of the Fourth Industrial Revolution, New technological progress will have a significant impact on economic growth and greatly change the mode of production and life of human beings.

Different scholars have different opinions on whether the fourth industrial revolution will promote economic growth. At present, there are mainly three views in the theoretical circle. Firstly, it will greatly increase productivity and directly promote economic growth. The second one is that substitution of new technology for workers leads to fewer jobs and lower wages, which in turn leads to lower personal consumption, lower investment and, ultimately, economic stagnation. Last one is that there will be a singularity in economic development, which means that the economy will go backward and then grow in a u-shaped curve.

This paper believes that the fourth industrial revolution will bring about a great deal of economic growth, and focuses on how to promote economic growth and social welfare, while emphasizing the risks involved.

2. Positive Results and Opportunities of the Fourth Industrial Revolution

2.1 National Economic Growth

2.1.1 Emerging dominant factors of production

The new revolution will enter the age of data. Data and information will enter field of production, transportation and consumption, becoming the new key factors of economic growth. For another, these new production factors integrate with capital, labor and other traditional factors to improve the efficiency of traditional factors of production.

We introduce Cobb-Douglas production function, take the logarithm of both sides and take the derivative with respect to time. The relational expression can be obtained:

$$GY = GA + \mathrm{m}GK + nGL \tag{1}$$

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Y stands for gross output. A is technological progress. K means the capital input, and L is labor input. G means the growth rate.

But In the new round of Industrial Revolution, data will become entirely new elements of economic growth. Then the equation will change into:

$$GY = GA + mGK + nGL + G(D\text{ata}) \tag{2}$$

Artificial intelligence (AI) based on big data further expands the value of data. According to McKinsey's report, by 2030, an additional economic output around $13 trillion could potentially be generated by AI, boosting global GDP by 1.2% a year[1]. Figure 1 shows that there would be a significant upward trend on the impact of AI on the economic growth.

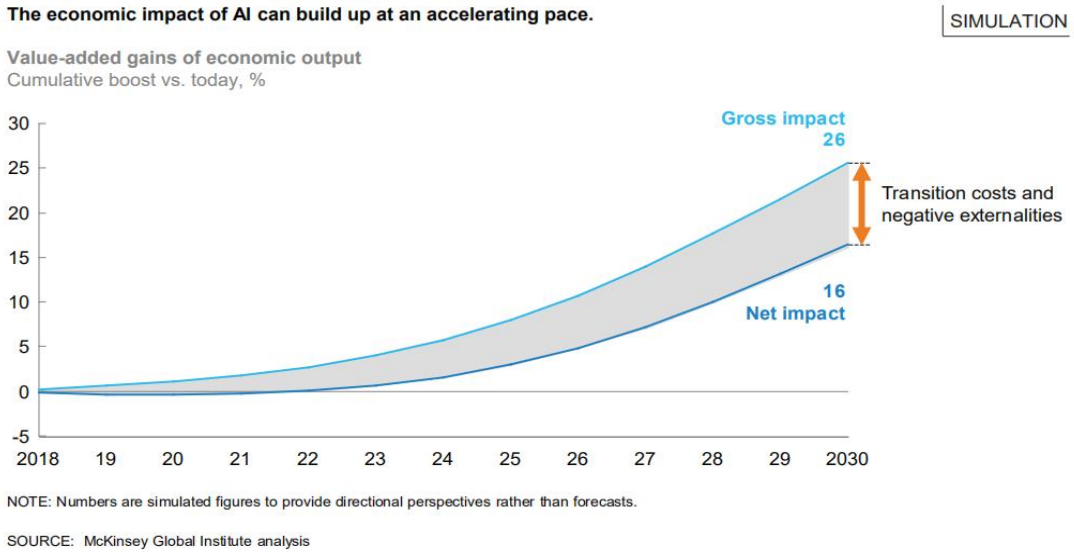

Figure 1: The economic impact of AI

2.1.2 Changes in International Trade

International trade can contribute to economic growth through import and export. It also can promote upgrading and transformation of industrial structure by accelerating the division and specialization of labor.

The new technologies would change the volume of international trade, the center sectors of trade, the way we trade and what are traded. World Trade Report 2019 illustrates that the international trade is estimated to increase by 2%, and the proportion of services trade will grow from 21% to 25%[2]. Furthermore, Global value chains (GVC) are being reshaped by rising demand and new industry capabilities. The GVC linkages and the complex GVC networks are rising gradually owing to increasingly high-tech sectors[3].

Trade cost determines how much a country participates in international trade. New technologies will continue to reduce cross-border transaction costs. Big Data and online platforms can achieve information sharing, helping overcome obstacles about the lack of information and trust. It can be seen that international trade costs declined by 15% between 1996 and 2014(Figure 2). Trade could grow yearly by 1.8% to 2% until 2030 as a result of the falling trade costs[4].

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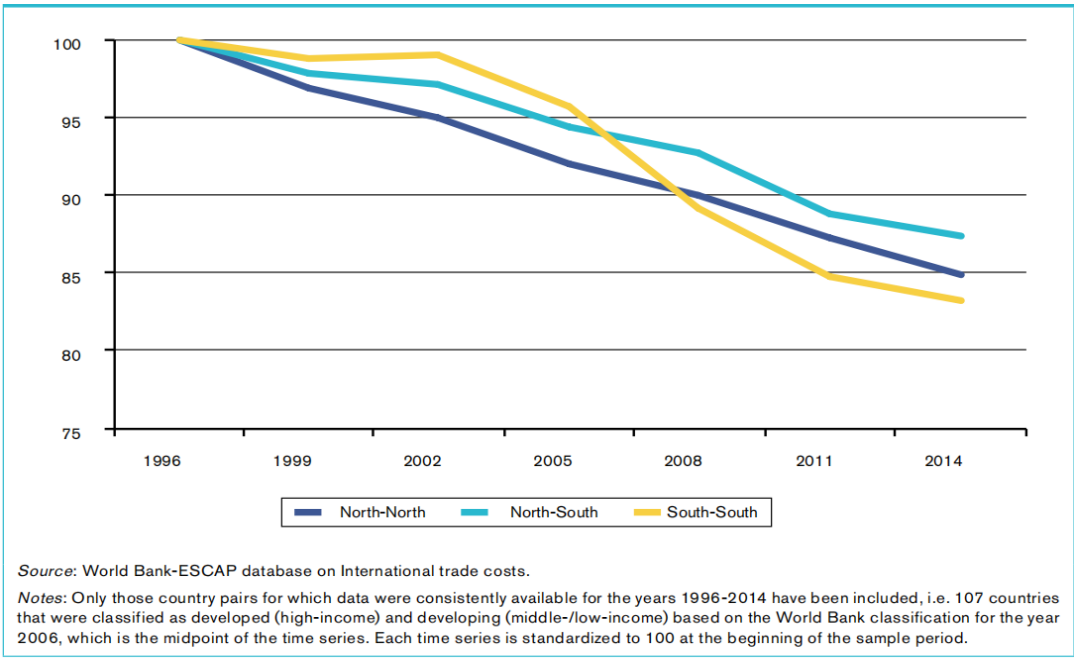

Source: World Bank-ESCAP database on International trade costs.

Notes: Only those country pairs for which data were consistently available for the years 1996-2014 have been included, i.e. 107 countries that were classified as developed (high-income) and developing (middle-/low-income) based on the World Bank classification for the year 2006, which is the midpoint of the time series. Each time series is standardized to 100 at the beginning of the sample period.

Figure 2: Overall trade costs, 1996-2014

2.1.3 Optimization of Policy and Institution

The new revolution will generate some new institutional arrangements to reduce the differences between individual benefits and social benefits, stimulating individuals to engage in productive activities and usher to economic growth.

The protection of property rights is the premise of effective investment and economic growth. However, the difficulties in property rights definition make piracy and infringement rampant. Blockchain for registered and unregistered rights could arguably be used to provide proof of creation and ownership, making it easier to define and protecting property rights[5]. The improvement of the property rights system can internalize the external effects and motivate enterprises to conduct basic research.

Positive and targeted industrial policies also promote the rapid development of industries. Chinese government published special policy-"Three Year Action Plan of Internet Plus Artificial Intelligence" to facilitate investment in the AI industries, which aims to build an AI application market valued at over 100 billion RMB[5]. Additionally, reduction in the average interest on loans to SMEs, by1% per year in 2018 and 2019[6].

To foster entrepreneurship and lighten their burden, governments around the world are lowering corporate tax rates and the overall corporate income tax fell by 7.5% between 2000 and 2018 (Figure 3)[6]. Especially, China deepened the value-added tax (VAT)reform in 2019, effectively reducing the operating costs of enterprises and leading to increase private economy's ROI by 4.54%. It is expected to increase cumulative GDP and employment by 0.362% and 0.028% respectively in three years[7].

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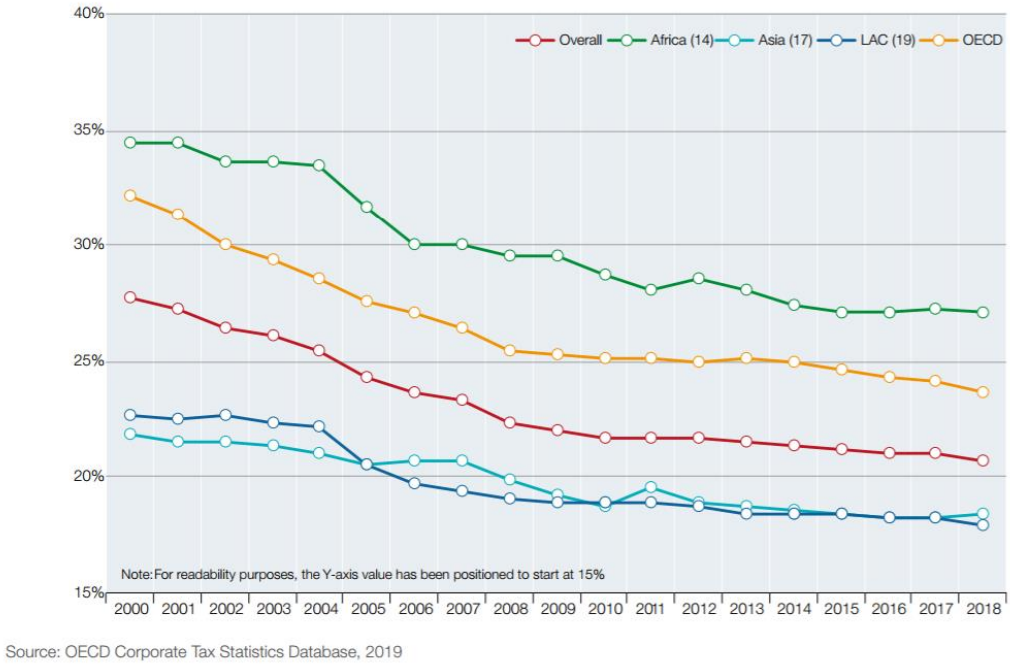

Figure 3: Declining average statutory corporate income tax rates by region (2000-2018)

2.1.4 Improvement of Social Welfare

New technologies have the potential not only to boost GDP growth but also to improve social welfare more broadly. For example, the new technology will create new products and services, which not only better meet the needs of customers but create more demand. In addition, digital platforms can help people find opportunities to match their skills more quickly and precisely, reducing the impact of frictional unemployment.

McKinsey broke down the welfare impact into different components and modeled scenarios of the social welfare with the application of new technology. This study concluded that in the "Tech for better lives" scenario, the increase in total welfare to 2030 is significant, approximately 1.5% to 2% per year, and the non-GDP welfare growth is about 0.3% to 0.5% per year[8]. Non-GDP welfare refers to the additionally benefits above GDP such as the value of health and longevity, the use of leisure, inequality.

2.2 Industrial Expansion and Industrial agglomeration

The new revolution will further deepen the trend of industrial integration, while the new technology will be widely used in traditional industries, penetrating into the whole industry chain. Meanwhile, with the penetration and integration of new technologies, some traditional industries will be transformed into new industries that meet the needs of new markets.

2.2.1 IoT Promoting Economic Growth

The Internet of things is the expansion of the Internet, and its user side extends to any object to exchange information and communicate with each other.

Due to the characteristics of IoT, the industry has high efficiency and coverage, creating rapid development and new room for economic growth. Since 2010, many major cities in China have successfully established the IoT industry alliances. As the center of the domestic IoT industry, Wuxi's total output value of the IoT and related industries was 105 billion yuan and the sales revenue of the microelectronics industry reached 51.62 billion yuan, a year-on-year increase of 29% in 2012[9].

Moreover, some scholars use the gray correlation model to calculate the correlation between the IoT sub-sectors and tertiary industry (Figure 4). According to their analysis, the correlation between the IoT industry and economic growth has high consistency, reached 0.849. It means that the higher the degree of development of the IoT industry, the more effective it will stimulate economic growth (Zhu, 2017)[10].

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Table 1: The Grey Correlation between the development of the Internet of Things industry and GDP per capita[10]

	Sub-industry	Single-level correlation	Multi-level correlation
Perception level development	Sensor output value	0.8636	
	RFID output value	0.7041	0.7702
	Measuring instrument output value	0.7427	
Network layer development level	Internet penetration	0.8583	
	Mobile phone switch capacity	0.9412	0.9299
	Mobile phone penetration	0.9901	
Application level Development level	Application software development revenue	0.7765	
	Information system integration services revenue	0.6588	0.6894
	Data processing and storage revenue	0.6329	
Aggregate level	IoT output value	0.8491	0.8491

2.2.2 5G Promoting Industrial agglomeration

5G networks have a higher data transmission rate and faster response than the previous cellular network. The importance of 5G in the economy largely comes from the demand for high-quality network by online services, especially online entertainment services. It is worth noting that the online video industry, which has higher requirements for network communication transmission speed, is gradually expanding the market. Statistically, the scale of China's online video industry exceeded 100 billion in 2018 and the number of online video (including short video) users reached 725 million and the use time of short video users accounted for 11.4% of the total online time[11]. The experience of the online video industry is subject to producers of videos and also affected by the network quality of the consumer's receiving port. Therefore, the communication network services provided by 5G can fit consumers' compatibility in video quality and fluency select.

2.3 Changes in business model and production mode

2.3.1 Production Mode

The change of production model is mainly reflected in the flexibility of the production process, which is specifically made to enable the machines on the same production line to achieve multiple functions by accepting electronic production instructions.

The production line can adjust the production and processing template by using a fixed production line machines, which solve the problems of high equipment-replacement-cost and production-unity in the JIT production mode. Some technological trend is integrating with the application of automated machinery. In this production process, developers can reduce the failure of physical products caused by automation and control. They can also use big data to create smart products and adopt new business models. This service can create new business opportunities for manufacturing[12].

2.3.2 Business Model

The impact of the new revolution on business is shifting them from the simple digitization to a

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much more complicated form based on the combination of multiple advanced technologies[13]. We take sharing economy and platform economy as examples to illustrate.

Jimmy G points out that platform-based businesses are digitally enabled marketplaces for directly matching buyers and sellers[14]. For example, Airbnb is a platform that matches users who want to rent any livable space with homeowners willing to share a room or a house. For another, the sharing economy is developing rapidly and becoming an important way to allocate resources. It can integrate the idle resources of the whole society with lower cost, and realize the efficient matching between supply and demand, thus greatly improving the efficiency of social resources and the effective capital stock in the economy.

3. Challenges of the Fourth Industrial Revolution

While we are talking about the new opportunities, we also need to know the significant challenges. These obstacles need to be harnessed to enable a sustainable technological revolution and further growth of the standard of living.

3.1 Domestic and International Inequalities

Due to the substitution of machinery in the labor market, the net displacement of workers by automation might aggravate the gap between returns to capital and returns to labor[15]. Additionally, it increases the income inequality as it closely relates to level of skills and educational credentials, and also exacerbates wealth inequality while the current enactment of tax policies are favoring the rich[16]. The polarization of the labor market with further enhance the job and income insecurity in the society. Lower-skilled workers are facing technological unemployment, while higher-skilled workers have more opportunities to apply the needed skills.

As developed countries have advanced economies, advanced technologies, higher-level of investment in Research and Development, etc., it is easier to see the direct contributions of industrial revolution. Yet, historically, the government in sub-Sahara Africa has failed to introduce the policies to chart innovation and technology trajectories[17], which indicates the new revolution might further increase the inequality gap between developed countries and developing countries.

3.2 High Investment -- R&D

According to the Solow model, productivity is an essential factor when influencing GDP, and research and development (R&D) is critical for productivity. In recent years, with the continued high growth of China's economy, China has also paid more attention to investment in R&D departments, and the total R&D investment has grown exponentially. Although China's investment in R&D has continued to grow, it has not had a great impact on overall economic development, resulting in China's overall economic development in a state of stagnation. There may be two reasons for this situation. First, the technological progress brought by the increase in R&D input is significant in the long term, but the technical progress is slow in the short term, and the effect is not obvious. Second, the output efficiency of R&D input is low. Therefore, while increasing R&D input in various regions, we should focus on improving R&D input-output performance[18].

4. Conclusion

With entering the new revolution, we are facing numerous new opportunities and challenges. Innovative factors of production, changes in international trade patterns, and institutional innovation will become the driving forces for economic growth. The new technologies will also significantly enhance social welfare. Moreover, the new revolution has spawned many industry trends with strong derivative capabilities. It is expected to build a set of intelligent supply chains that realize decision-production-sales with the help of big data and automated processing. Finally, the arrival of the new revolution has dramatically increased the flexibility and agility of the market, with new production and business model developed. However, the revolution may bring about a further expansion of the gap between the rich and the poor, and aggravate the contradictions in the domestic society and the turbulence between the international pattern. At the same time, the high R & D capital may increase the financial burden of the government or enterprises sharply, and if it fails, it would cause an overall economic recession.

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