

The Impact of Economic Development and Technological Advancement on National Inequalities

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Abstract: The impact of inequality has had a significant negative effect in most countries. In many countries, inequality is on an inexorable upward trend and, if allowed to continue, it will further undermine the development in societies and economies. This paper explains the effect of inequality from two perspectives, the economic development and technological advancement. Taking China as an example, the paper analyses the increase of China's Gross Domestic Product and its investment in scientific and technological development and innovation in recent years, and analyses the corresponding impact on inequality. This paper focuses on the factors that contribute to regional inequality in China. The findings show that Western China is lagging behind in terms of development while Eastern China has a much higher level of development in spite of the fact that it is already affluent. Further, this paper suggests that, in the future, artificial intelligence can be used to enhance equality in education and to increase skilled labour in poor areas for developmental purposes.

Keywords: technological advancement, regional inequality, economic development.

1. Introduction

It is commonly observed that inequality rose in nearly every region globally during the 1980s and 1990s, undoing the movement towards increased equality that characterized the early post-war years. Inequality is emerging as an economic concern that significantly affects numerous countries [1]. Inequality has increased even more in the last few years, seriously affecting the economic development of some countries. There are different reasons which can influence the inequality. In this time of rapid technological advancement, there are many new technologies such as artificial intelligence (AI), chip technology, meta-universes and cryptocurrencies. Advances in technology can cause changes in inequality. This paper provides a full explanation of how technological development affects income inequality and how it further affects inequality in economic development in a country.

Most of the research regarding the link between economic development disparities and income inequality indicates a positive relationship in affluent nations and a negative one in less affluent countries. Numerous studies have explored how technological advancements influence income inequality. The theoretical discussions reveal several pathways through which income inequality interacts with economic growth, including economic development stages, technological progresses, instabilities in socio-political status, flaws in credit markets, savings behavior, institutional frameworks, and fertility rates [2]. According to these models, the results indicate that the connection between income inequality and economic growth can be positive, negative, or uncertain. For instance,

inequality may be positively correlated with economic growth at the beginning, and the relationship turns negative given the fast progress in technology [2]. By and large, countries also receive different impacts depending on their level of development. The developed countries may receive a greater increase in inequality because of scientific and technological development, while some poor developing countries may mitigate the effects of inequality. Therefore, for the time being, scientific and technological development enlarges inequality in developed countries, while the opposite was true for less developed countries.

This paper conducts an in-depth study of technology, income inequality and development inequality, analysing the interactions among these factors. It also analyses how technology contributes to inequality, and how it can reduce inequality and contribute to economic growth. Taking China as an example, this paper compares and contrasts the economic impact of scientific and technological development.

2. Theoretical Background

This paper argues that advances in technology can have an impact that leads to increased income inequality for workers in early stage of the economic development. If there is no significant skill bias in technology, a considerable rise in the number of skilled workers will lower the skill premium as the economy shifts along a declining relative demand curve; in other words, skilled labor will replace unskilled labor in production, and consumers will shift from labor-intensive products to those that are produced with a greater reliance on skilled labor [3]. As an example, the gradual development of AI has replaced some jobs such as painters, and in the future, AI is more likely to develop driverless technology leading to unemployment in related industries. In addition, new technologies require highly skilled labour and training, and for jobs with higher technological barriers, employees often receive higher wages. Therefore, sectors with technological barriers will have higher wages compared to sectors using old technology. Overall, per capita income is higher in the new sectors, while it remains lower in sectors using old machinery. Thus, in the early stages of technological improvement, income inequality increases [4]. As then US Senator John F. Kennedy said in 1960, just as the computer revolution was beginning, following the new industrial revolution, the automation revolution was just about to arrive. This revolution would bring new prosperity for the labour force and the promise of new wealth for the United States, but it also carried with it the perverse threat of industrial chaos, rising unemployment and increasing poverty. Now, the twenty-first century also faces a new revolution that brings different opportunities and challenges.

Kuznets observed that the connection between income inequality and economic development varies according to a nation's level of economic progress. In the initial phases, it shows a positive correlation, whereas in the later, more developed stages, it demonstrates a negative correlation [5]. For instance, skills applied in industries other than the agricultural sector are higher, so that when individuals move out of the agricultural sector, income per capita rises. As a result, individuals see an increase in their per capita income due to the demand for their skills in these sectors. Conversely, at the meantime, those who stay in the agricultural sector face a potential widening income inequality. As the economy expands and workers transition away from the agricultural sector, those who stay in the sector would experience increasing earnings due to a shortage of labour supply. Consequently, during this time, the gap in income inequality narrows [5].

3. Economic Development, Technology and Inequality in China

3.1. Economic Development in China

China boasts one of the fastest-growing economies globally, but it also faces significant regional income inequality. Following the start of economic reforms in the late 1970s, the country has

undergone rapid growth for over three decades. China is not only the second largest economy in the world, but also the largest exporter of goods. Figure 1 depicts the Gross Domestic Product (GDP) of China from 2006 to 2020, showing that the economy has experienced a rapid growth over the years.

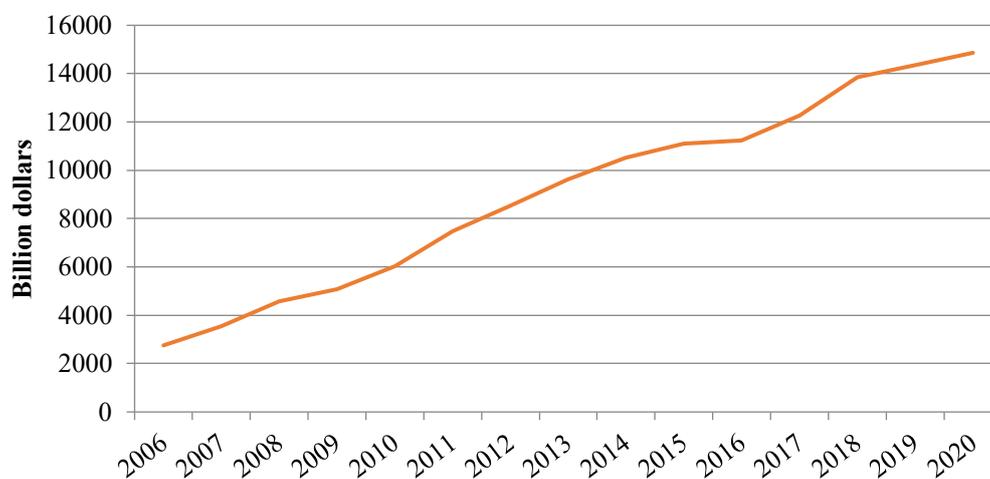


Figure 1: GDP from 2006 to 2020 in China (Data from: International Monetary Fund).

There exists a significant body of research examining the connection between economic development and economic inequality. Kuznets suggests an inverted U-shaped correlation, indicating that as average income increases, inequality in per capita income initially rises, reaches a peak, and then declines [6]. The primary theoretical justifications for the anticipated initial increase are the growing significance of the contemporary or urban economic sector, characterized by higher incomes and greater disparities, along with the rise of inequality stemming from the ownership of financial, physical, and human capital. The anticipated decline can primarily be attributed to the fact that low-income rural sector becoming a minority, the increase in returns for relatively unskilled labour driven by market shortages, and the rise of socio-political groups that have acquired political influence to advocate for redistribution and the establishment of a welfare state as the economy progressed [5]. In the case of a country with a vast geographical region like China, regional inequalities are more clearly expressed.

As China's economy develops and income rises, the transformation of its social structure is entering a new historical period. The wealth generated over the last thirty years has established the groundwork for wealth accumulation. The social structural differentiation experienced by the first generation during the Reform and Opening-up era has led to income inequality evolving into a form of wealth stratification that influences the future of the second generation and subsequent generations. Currently, the catalyst for further structural differentiation and restructuring of China's social framework is increasingly shifting income disparity into a wealth disparity and variations in household spending. This social differentiation is bound to result in enduring and continual social inequalities that can be inherited across generations.

3.2. Technological Advancement

It is widely recognized that the engine and foundation for promoting sustainable economic growth in a nation is its ability to innovate technologically, which holds an indispensable position in economic advancement [6]. These days, due to the globalization trend and competition across the globe, governments recognize the significance of technological advancement and the encouragement of innovation management to enhance the growth rate of total factor productivity. Nevertheless, only a

limited number of governments, especially in developing nations, have made significant efforts to promote various forms of technological advancement and innovation management [7]. After accessing the World Trade Organization (WTO) in 2001, China's manufacturing industry underwent a period of swift expansion and notable advancement. Benefited from huge and cheap labour, China became recognized as the largest manufacturing hub in the world, and millions of employment opportunities are generated for local residents. It is broadly acknowledged that manufacturing has been a crucial factor in China's swift economic expansion in recent years. Nevertheless, as a significant emerging market, China encounters substantial challenges due to global competition. Companies across all sectors are progressively depending on advancement in technologies, development in new products, and innovation to adapt to the ever-changing market and address the continuous shifts in consumer demand [8].

Since 2000, the intensity of China's investment in research and experimental development has continued to increase, rising rapidly from 1% in 2000 to 2.08% in 2013 and to 2.54% in 2022. According to the National Bureau of Statistics of China, China's research and development (R&D) investment intensity level in 2022 ranked 13th in the world, between the average level of the European Union (2.2%) and Organisation for Economic Cooperation and Development (OECD) countries (2.7%). This shows that the amount of money China spends on R&D in science and technology is considerable, which has made achievements in various fields, such as the development of 5G, AI (ranked second place in the AI innovation index), and aerospace and aviation (Mars exploration and moon exploration project, etc.). China has independently created a significant array of advanced technological equipment and systems that are now in practical application, serving as "sharp tools" for accelerating the rapid upgrading of industries. Technologies such as supercomputing, high-speed railways, smart grids, fourth-generation nuclear power, and extra-high-voltage power transmission have all achieved a position among the world's leading advancements. In particular, R&D in 5G and application scenarios are expanding in depth, and an ecosystem with Chinese characteristics for the development of AI has been initially established, which is accelerating the development of science and technology.

3.3. Regional Inequality in China

In the last three decades, inequality has risen in several nations while it has fallen in others. Nevertheless, the majority of the global population—over two-thirds—now faces an increase in income and wealth disparity, significantly hindering the chances for sustainable development. Inequality in China is also at a relatively high level. The Gini coefficient, which measures socio-economic inequality, was estimated at 0.33 in 1980 and has risen in recent years to between 0.45 and 0.47. According to the World Bank, this rate of increase is the fastest in the world. Spatial inequalities are also increasing between different regions and between urban and rural area [9]. Moreover, the widening gap between the rich and poor has led to a massive migration of people from the interior to the coast, which will further lead to a brain drain from the interior, slowing down inland development and increasing regional inequality [10].

In the 1990s, Eastern China has experienced rapid growth as a whole led to an upsurge in interregional inequality, and with it, interprovincial inequality. Between 1990s and early 2000s, growth rate in GDP per capita showed some convergence, both among provinces and among eastern, central, and western regions. As a result, absolute interprovincial and interregional disparities remain large [10]. From the data of China's National Bureau of Statistics, Eastern China has the largest R&D funding, with faster growth and outstanding innovation leadership; Central China has the fastest growth and the second largest scale, with a significant acceleration of the layout of innovation, while the western and northeastern regions have a smaller scale of R&D funding, with a lower growth rate. As discussed early that China's spending on research is increasing very rapidly, Figure 2 shows that

the rate of spending varies greatly between regions. This has done nothing but create a deeper impact on regional inequality in China.

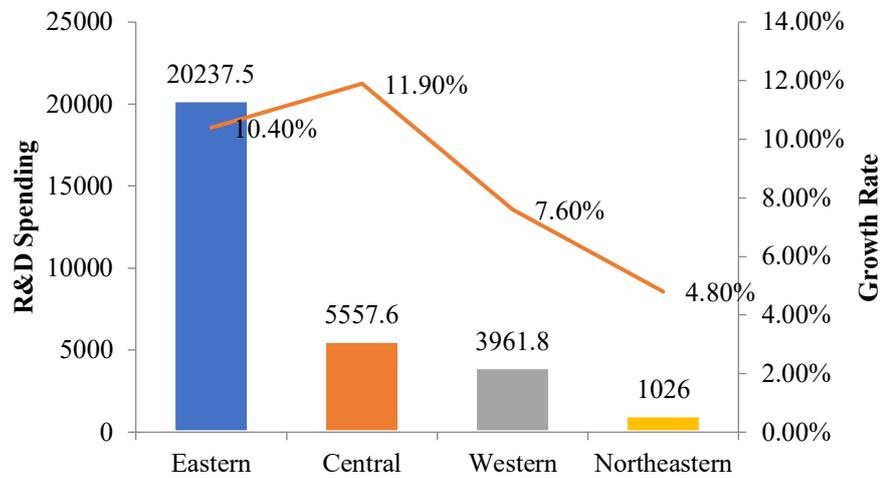


Figure 2: Four major regions' R&D investment (in billion RMB) and growth rate (%) in China in 2022 (Data from: China Development Institute).

3.4. Technology as a Solution to Inequality

While technological development runs the risk of allowing inequality to increase, the power of technology, if exercised in moderation, might also reduce inequality. It is like China's Western Development Policy, where China is building infrastructure such as railways, roads and base stations and industrialising the western part of the country. China's Qinghai-Tibet Railway and the "West-East Power Transmission" policy are challenging for the technological foundations. Moreover, the development of information technology has further promoted the development of remote areas, which will have more information and better education, and will be able to develop economically. Due to the development of 5G technology and the fast dissemination of information, technological barriers will become smaller for people in remote areas, making it easier for them to find jobs and develop the regional economy.

AI technology has also been developing rapidly in recent years, and AI is now undeniably being used in every aspect of life, with ChatGPT as a great example. When designed and implemented effectively, AI tools have the potential to provide widespread, competent access to education over the long term, overcoming barriers related to politics, culture, language, geography, and learning ability, thereby contributing to the creation of equitable, inclusive, and fulfilling lifelong learning environments in the schools of tomorrow. This can be achieved through the adoption of innovative teaching strategies. It may be possible to make education more equal for everyone and to obtain equal access to knowledge [11]. Moreover, AI education can be delivered through portable devices, as well as the internet, greatly reducing the barriers to accessing knowledge in remote areas. It makes information more widely available and allows for a relatively equal level of education. In less developed areas, where education is relatively difficult to access, technology provides the opportunity to acquire the skills and abilities to develop and build their local economies in the future. Then, the regional inequality could have narrowed by the higher labour quality.

4. Conclusion

This paper examines the impact of both scientific and technological advancements and economic progress on economic inequality. The article begins by illustrating some of the theoretical

implications of economic growth and technological development on inequality. The paper then analyses some data to illustrate the results using China as an example. Firstly, the paper examines data on China's GDP growth and the proportion of China's capital invested in scientific research. It is found that China's GDP has been on an upward trend and the amount of money invested in research has been increasing every year. As a result, China has maintained a high level of scientific and technological excellence. In spite of this growth, regional inequality in China has worsened, with the eastern part of the country growing faster and the rest of the country growing slower, leading to increased inequality. Overall, although China's technological and economic levels are rising steadily, regional inequalities are becoming more severe. However, there is an opportunity for China's technological development to mitigate this unequal development. In previous years, China has used technology to reduce the rise in inequality through various policies, and these methods have had some effect. In the future, AI could have the potential to help the development of education in remote areas, which would have a better effect on reducing inequality.

Although this paper analyses the impact of science and technology and economic development on inequality through data such as GDP and research funding, there are other factors that could contribute to the increase in inequality, which is a limitation in this regard. In the future, research may be further improved through social surveys and comparisons of data between regions.

References

- [1] Cornia, G. A., Addison, T. and Kiiski, S. (2004) *Income distribution changes and their impact in the post-Second World War period*. In Cornia, G. A., *Inequality, Growth, and Poverty in an Era of Liberalization and Globalization*. Oxford: Oxford University Press.
- [2] Mdingi, K. and Ho, S. Y. (2021) *Literature review on income inequality and economic growth*. *MethodsX*, 8, 101402.
- [3] Acemoglu, D. (2002) *Technology and inequality*. *NBER Reporter Online*, (Winter 2002/03), 12-16.
- [4] Galor, O. and Tsiddon, D. (1997) *Technological progress, mobility, and economic growth*. *The American Economic Review*, 87(3), 363-382
- [5] Kuznets, S. (2019) *Economic growth and income inequality*. In *The gap between rich and poor* (pp. 25-37). New York: Routledge.
- [6] Zeng, S. and Zhou, Y. (2021) *Foreign direct investment's impact on China's economic growth, technological innovation and pollution*. *International Journal of Environmental Research and Public Health*, 18(6), 2839.
- [7] Lee, J. W. (2019) *Effects of technology and innovation management and total factor productivity on the economic growth of China*. *Journal of Asian Finance Economics and Business*, 6(2), 63-73.
- [8] Ernst, H. (2002) *Success factors of new product development: a review of the empirical literature*. *International journal of management reviews*, 4(1), 1-40.
- [9] Fan, C. and Sun, M. (2008) *Regional inequality in China, 1978-2006*. *Eurasian geography and Economics*, 49(1), 1-18.
- [10] Fan, C. C. (2007) *China on the Move: Migration, the State, and the Household*. London: Routledge.
- [11] Bulathwela, S., Pérez-Ortiz, M., Holloway, C., Cukurova, M. and Shawe-Taylor, J. (2024) *Artificial intelligence alone will not democratise education: On educational inequality, techno-solutionism and inclusive tools*. *Sustainability*, 16(2), 781.