The Influence of Higher Education on China's Macro-Economy

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Education contributes to economic growth. China's economy has shifted from high growth to higher-quality development, creating a new demand to reform and develop higher education. This paper first measures the composite index of higher education in China from 2009 to 2019 by combining the Cobb-Douglas production function and Denison's economic growth factors analysis method. Results showed that higher education in China has an increasing contribution rate to economic growth from 2009 to 2019 but is still lagging behind developed countries. Second, it analyzes the new trends of higher education development in developed countries, compares the development models of higher education in different countries, and reveals the problems in China's higher education. Finally, it examines the impact of higher education on China's macro-economy from the human capital theory and the economies of scale theory. Furthermore, it proposes strategies for the higher-quality development of higher education and provides a reference for adjusting and optimizing the development model of higher education.

Keywords: higher education, economic growth, contribution rate, high-quality development

INTRODUCTION

In July 2020, China prepared the 14th Five-Year Plan for National Economic and Social Development. The plan is an integral part of China's national economic plan, setting out the priorities and directions for China's efforts in all sectors over five years. The plan is scheduled for implementation from 2021 to 2025, known as the 14th Five-Year Plan period. China's economic growth shifted from accelerated to high-quality development during this period. Moreover, China's national development has ushered in a new time of strategic opportunities, and higher education has become increasingly accessible. However, the unbalanced and insufficient development in various economic and social sectors is still prominent due to the COVID-19 pandemic and the IT revolution. In this context, China's higher education should be given a new connotation of the times, and a system for high-quality development of higher education should be constructed.

Moreover, China must take full advantage as a populous country to unleash the talent dividend, enabling education to better serve economic and social development. In the post-epidemic era, the global environment has undergone dramatic changes. The global industrial chain has been restructured and reorganized, trade protection has intensified, and economic globalization has suffered a backlash. In higher education, China is not motivated to foster innovative talents in high-tech development, and trade in higher education services is blocked and restricted. The challenging global economic situation has compelled China to optimize its strategy and push higher education reform and development. As a micro-unit of economic and social development, higher education is closely related to economic and social development. Given this, a new research proposition in education is how China's higher education focuses on the mainstream of macro-economy development, follows the development trend of higher education in developed countries, and achieves the synergistic development of higher education and economic growth.

Higher education is an essential component of education. Theoretical models of the contribution rate of education to economic growth have been used to derive and measure the contribution rate of higher education to economic growth. Previously, scholars built representative models to analyze the effects of education on economic development regarding the contribution of education to economic growth. Schultz (1961) and Denison (1962) proposed Schultz's method of remainder analysis and Denison's method of economic growth factors analysis on the measurement of education's contribution rate to national economic growth in the United States.

Based on previous studies on the economic performance of education, the relationship between higher education and economic development has been increasingly investigated. The contribution of education to the economy can be estimated by the Feder-Ram two-sector model and the simplified working coefficient method proposed by the Soviet economist Strumilin (1966). Mamoon and Murshed (2009) indicated that the accumulation of human capital promotes trade liberalization in the short run and effectively drives the development of universities in the long run. Gemmell (2010) analyzed the effect of human capital stock on economic growth by constructing an index system to measure the value of education-related human capital.

Subsequently, Johansen and Arano (2016) estimated the contribution rate of human capital to test the long-term impact of higher education on economic development. Li (2020) used the impulse response function of the vector autoregression model to examine the economic function of higher education. Wang and Yang (2022) examined the relationship between the scale of higher education and economic growth by constructing a spatial Durbin model. They concluded that economic growth in China is significantly spatially correlated across regions and that the scale of higher education significantly contributes to economic growth with spatial spillover.

The early Western market economy model widely used Schultz's remainder analysis method. It also provides a theoretical basis for measuring education's impact on China's national economy. However, Schultz's remainder analysis method and the simplified working coefficient method ignore other factors besides education, such as technology and personal development, which affect workers' productivity improvement. Most papers are limited to estimating the higher education contribution rate and do not analyze the relationship between higher education and economic development. The Feder-Ram two-sector model assumes that social production is based on the education and non-education sectors, ignoring the lag of education. It is not in line with the actual situation of current social development.

We proposed a new development model for higher education in China. Based on the Cobb-Douglas production function, this paper employed relevant labor and education statistics from the National Bureau of Statistics of China. Combined with the composite higher education index method, we used Denison's economic growth factors analysis method to measure higher education's contribution to economic growth in China from 2009 to 2019. Meanwhile, using Arc GIS, we mapped the distribution of per capita gross regional domestic product, education investment, per capita higher education public finance budget expenditure on education, and the number of universities in cities and provinces in China in 2019. We examined the differences between economic development and education investment in different regions of China and compared the teaching models of higher education among countries. Based on the measurement results, we examined and considered the problems in China's higher education with the strategic positioning

of China's overall development. Furthermore, by drawing on the human capital theory and the economies of scale theory, we analyzed the effects of higher education on economic growth.

Analysis of Effects of Higher Education on Economic Development

The COVID-19 epidemic in 2020 severely impacted countries' economic and social functioning, with more than 300 million confirmed COVID-19 cases worldwide by January 2022. The epidemic has significantly affected the world economic landscape and the reorganization of the global economic order. The implementation of social distancing measures generated significant fluctuations in economic activities. Moreover, the global economy fell into a deep recession due to the epidemic. Countries are expanding the scope of trade protection, highlighting the anti-globalization trend. China suffers from technological blockades of cutting-edge technologies, increased financial frictions and geopolitical suppression.

Moreover, all these essentially inhibit the transformation of innovative technologies and cultivating creative talents in universities. Against the complicated international economic and social environment, China's higher education should develop in line with the trend and expand new territories of international cooperation in higher education in countries along the Belt and Road. Also, it should overcome the blockage of trade in higher education services.

Higher Education Must Adapt to the New Pattern of Economic Development

In 2021, China's economy recovered steadily and improved moderately, and China achieved remarkable success in fighting the epidemic. However, the dramatic changes in the external environment in the post-epidemic period pose a more severe test for China's higher-quality economic development. On the one hand, China's economic growth has been transformed from external demand-driven to domestic demand-driven and from factor-driven to innovation-driven. Currently, China's economic development relies less and less on foreign markets, and China-US trade frictions and the reorganization of global industrial chains weaken China's export competitiveness. China's foreign trade dependence dropped from 70% in 2004 to 30% by 2020. Thus, we need to stimulate the potential of domestic demand to boost economic growth. At the same time, economic sustainability in the future depends on institutional innovation, scientific and technological innovation, and human resource innovation to improve the total factor productivity of the community. Given China's economic transformation and upgrading, higher education should be actively involved in cultivating a complete domestic demand system, increasing the supply for domestic demand, and promoting supply-side structural reform. Moreover, universities should take advantage of their innovation and develop innovative talents.

At the same time, there is a growing internal demand for higher education in the new development pattern. The Proposals for Formulating the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035 were adopted in 2020. The Proposals suggest supporting the development of high-level research universities and strengthening the cultivation of fundamental researchers, revealing China's strategic intention for developing higher education. China's higher education was first accessible to elites, then to the majority of the population, and then to the general public. The gross enrolment rate in higher education increased from 1.55% in 1978 to 57.8% in 2021. At present, higher education has become universal in China. As the number of universities and colleges in China continues to increase, society's demand is rising sharply for higher education for both undergraduate and graduate students.

There were 2,358 regular colleges and universities in China in 2010 and 3,012 in 2021. The total enrolment of higher education in all colleges and universities reached 44.3 million, with an increasing number of regular colleges and universities. In 2021, the admission rate of college entrance exams reached 95.14%, the number of applicants for graduate school increased to 3.77 million, and the number of full-time higher education teachers increased to 1.8852 million. These figures reflect the growing social demand for higher education and China's accelerated industrial development.

Developing higher education with Chinese characteristics is essential in building socialism with Chinese characteristics. Since 1995, the CPC Central Committee has attached great importance to education development. It has proposed strategies for reinvigorating China through science and education and

strengthening the nation through human resource development. In the 14th Five-Year Plan period, China proposed the higher-quality development of higher education and the plan to modernize education and build an educational power by 2035. Higher education has become increasingly important in economic and social development. Higher education is not limited to today's economic and social development, but universities should also be forward-looking and insightful, considering the current situation. Universities can provide human resources and technical support only when they adapt to the new development pattern and lead innovation. Moreover, universities should give full play to their subject consciousness and serve the country's and society's sustainable development. In this way, the strategic position of higher education can be highlighted.

Measurement of the Impact of Higher Education on Macro-Economy

Higher education influences the macro-economy by its contribution rate to economic growth and supports economic and social development. The key to building China into an educational powerhouse is to raise the contribution rate of higher education to economic growth and adapt higher education to the new pattern of economic development. The contribution rate of higher education to economic growth was measured based on the Cobb-Douglas production function. We measured the composite education index and the contribution rate of higher education to economic growth in China from 2009 to 2019 using Denison's economic growth factors analysis method. The human capital theory suggests that workers' education level affects economic development. Therefore, we added education investment $E_t$to labor input in the Cobb-Douglas production function, so the function is expressed as:

$$Y_t = A_t K_t^{\alpha} (L_{\text{ot}} E_t)^{\beta} \tag{1}$$

where, $Y_t$denotes the output, $A_t$denotes the technology level in period t, and $K_t$denotes the capital stock. $L_{ot}E_t$denotes the labor input, α denotes the capital-output elasticity coefficient and β denotes the labor output elasticity coefficient. In this measurement β was valued as 0.482 based on the labor output elasticity coefficient calculated by Li et al. (2017) from 2002 to 2014 in China. Compared with the international empirical value of 0.73, 0.482 is more consistent with China's actual development.

We derive the logarithm of both sides of Equation (1) and the total derivative of time to obtain the following equation:

$$y = \alpha + \alpha k + \beta l_0 + \beta e' \tag{2}$$

where, $y$denotes the economic growth rate, $k$denotes the growth rate of capital input, $l_0$denotes the growth rate of labor input, and e'denotes the growth rate of education investment. Based on this, the contribution rate $C_e$of education to economic growth is expressed as follows:

$$C_e = \frac{\beta e'}{y} \tag{3}$$

Meanwhile, the contribution rate $C_h$of higher education to economic growth is expressed as follows:

$$C_h = E_h C_e \tag{4}$$

$E_h$denotes the share of higher education in the average annual growth rate of the composite education index. The average years of education per capita and the labor simplification rate of the working population with different levels of education are two essential parameters for calculating the composite education index. We reviewed the China Labor Statistics Yearbook and compiled the composition of employed persons at each level of education from 2009 to 2019. From this, we separately calculated the years of education per employed person from 2009 to 2019 (Table 1). The labor simplification rate (S_i) was used in this study. The labor simplification coefficients for primary, middle, high school and higher education were

1, 1.38, 1.72 and 2.34, respectively (Yang & Liu, 2014), denoting the number of years of education per person at each level. The composite education index (e) is expressed as follows:

$$e = \sum X_i S_i \tag{5}$$

TABLE 1
YEARS OF EDUCATION PER EMPLOYED PERSON IN CHINA, 2009-2019

Year	Primary school	Junior high school	Senior high school	Junior college and above
2009	5.71	2.07	0.61	0.30
2010	5.80	2.18	0.72	0.40
2011	5.88	2.35	0.89	0.52
2012	5.88	2.37	0.92	0.54
2013	5.89	2.39	0.95	0.58
2014	5.89	2.40	1.00	0.65
2015	5.83	2.38	1.08	0.75
2016	5.84	2.40	1.10	0.78
2017	5.86	2.42	1.12	0.78
2018	5.86	2.44	1.15	0.81
2019	5.87	2.46	1.25	0.91

The composite education and higher education indexes of China from 2009 to 2019 were calculated as shown in Table 2. It can be seen that China's composite higher education index has grown year by year from 2009 to 2019. It suggests that the scale of higher education in China is expanding, educational resources are becoming more abundant, and academic standards are improving. After the composite education index was calculated, the actual annual growth rate of GDP from 2009 to 2019 was calculated based on the GDP index. Meanwhile, the average yearly growth rate of the composite education index (R_e) and the share of higher education in the average annual growth rate of the composite education index (E_h) were derived:

$$R_e = [(\frac{e_{n+1}}{e_1})^{\frac{1}{n}} - 1] \times 100\% \tag{6}$$

$$R'_e = [(\frac{h'_{n+1}}{h'_n})^{\frac{1}{n}} - 1] \times 100\% \tag{7}$$

$$E_h = 1 - \frac{R'_e}{R_e} \tag{8}$$

TABLE 2
COMPOSITE EDUCATION INDEX AND COMPOSITE HIGHER EDUCATION INDEX FROM 2009 TO 2019

Year	Composite education index	Composite higher education index
2009	10.30	0.69
2010	10.98	0.94
2011	11.88	1.22
2012	12.01	1.27
2013	12.18	1.37
2014	12.45	1.52
2015	12.74	1.76
2016	12.86	1.82
2017	12.95	1.82
2018	13.09	1.89
2019	13.54	2.13

Finally, the contribution rates of education and higher education to economic growth were calculated by combining equations (3) and (4), respectively. The results showed that the actual average annual growth rate of China's GDP from 2009 to 2019 was 8.56%, and the contribution rate of education to the actual average annual growth rate of GDP was 17.38%, including 6.53% from higher education. China is placing increasing emphasis on developing higher education. China has increased its financial investment in higher education, expanded the scale of higher education, and successfully popularized higher education. However, according to the calculation results of Hu (2017), the contribution rates of higher education to economic growth in the United States, the United Kingdom, and Germany were 14.61%, 8.64%, and 4.20%, respectively, from 1996 to 2014. The contribution rate of China's higher education to economic growth from 2009 to 2019 is only higher than that of Germany in the early 21st century. Therefore, China should develop higher education at a faster pace, optimize the allocation of higher education resources, and enhance the contribution of higher education to economic growth.

The Connotation of Higher Education in the New Development Pattern

China is facing new development opportunities and challenges in the further development stage, and it is a new strategic choice to build a new development pattern. Higher education should be developed with higher quality and modernized under the new development pattern in the new era. High-quality development of higher education meets the objective requirements of economic and social development under the unique situation and practice. China has taken the initiative to build a high-quality education system. Since 2012, China has made remarkable achievements in higher education reform, with a significantly increased scale of higher education, improved quality, and a constantly improved higher education system. It provides substantial human resources and intellectual support for China's economic and social development (Chen, 2022). To promote the high-quality development of higher education, the National Development and Reform Commission, the Ministry of Education and other departments jointly prepared the Project's Implementation Plan to Build China as an Education Power in the 14th Five-Year Plan Period. The gross enrolment rate of higher education in China reached 57.8% in 2021. China's higher education has become more universally accessible, and the quality of higher education has been further improved.

The high-quality development of higher education essentially means meeting the people's growing demand for quality education and eliminating the unstable and insufficient conditions in higher education

development. Government departments should address the unbalanced development of higher education in the east, middle and west and support the development of higher education in the west. Universities should bring in qualified teachers based on the reality of western China, expand the scale of education, and provide economic support to achieve a balanced structure of higher education. To promote the diversification of higher education, universities should change from a single teaching structure, define their position, and offer unique programs. In this way, research universities, vocational universities and applied universities can progress in parallel to achieve balanced status and promote the development of higher education with high quality. Chinese universities should increasingly emphasize the quality of talent cultivation and make innovations in disciplinary mechanisms to highlight their characteristics. Moreover, they should improve the professionalism of the faculty, explore, and innovate the content and development paths of school education, and put into practice the connotative development of higher education with high quality. High-quality development of higher education must be sustained to build a high-quality education system (Lu, 2022).

Economic growth is the cornerstone of education development. Under the new economic development pattern, China's economy is developing steadily, laying the foundation for the leapfrog development of education. In addition, modernized higher education is based on the new development stage, and it has become a new demand to modernize higher education. China's Education Modernization 2035 Plan sets out the development direction of China's education modernization in the new era. By 2020, China has progressed in education modernization, increasing its overall educational strength and international influence. By 2035, China will significantly improve the competitiveness of higher education, popularize higher education to a level similar to that of developed countries, and some universities and disciplines will be among the world's top ones (Chen, 2019). The development goal of China's education modernization has shifted from the enhancement of education strength by 2020 to the universalization of higher education in China, rising to the level of developed countries by 2035. It reflects the steady improvement of China's education modernization and the satisfaction of the demand for higher education.

In April 2021, Chinese President Xi Jinping emphasized during his visit to Tsinghua University that the new journey to fully build a modern socialist China had begun. The CPC and China would be in unprecedented need of higher education, scientific knowledge, and outstanding talents. Therefore, China's universities should abandon the educational concepts that deviate from the development of the times and integrate sustainable and international development concepts into higher education modernization. They should establish education concepts compatible with modern society's development and adapt to higher education's higher-quality development. They should cultivate talents who hold international perspectives ahead of the times, stand at the forefront of their disciplines, and adapt to global growth.

Meanwhile, they should clarify the appropriate orientation for development and provide special training programs for applied, multi-disciplinary and vocational-technical talents. While valuing social education, colleges and universities should stress the guidance of personal responsibility and harmonize internal and external values. It requires college teachers to utilize modern teaching methods to stimulate students' initiative, and creativity with student-oriented and teacher-assisted teaching approaches. Higher education has been given a new connotation in different development patterns. Thus, universities should adhere to the position of socialism with Chinese characteristics, and all parties should work together to reinforce the CPC's overall leadership over higher education. Governments should be urged to allocate resources rationally, and universities should be empowered to solve problems on their own to achieve balanced benefits, power sharing, and promote the modernization of the education governance system.

Problems and Challenges of Higher Education in China

Under economic globalization, international higher education is developing in a new trend. Higher education in some developed countries has become internationalized, and governments and universities have increased their exchanges and collaborations. Higher education is internationalized by organically integrating global concepts into domestic higher education's teaching and research practices through cross-national, cross-ethnic, and cross-cultural interactions and partnerships. Moreover, it aims to improve the educational vision and system in domestic universities and give full play to the educational function of

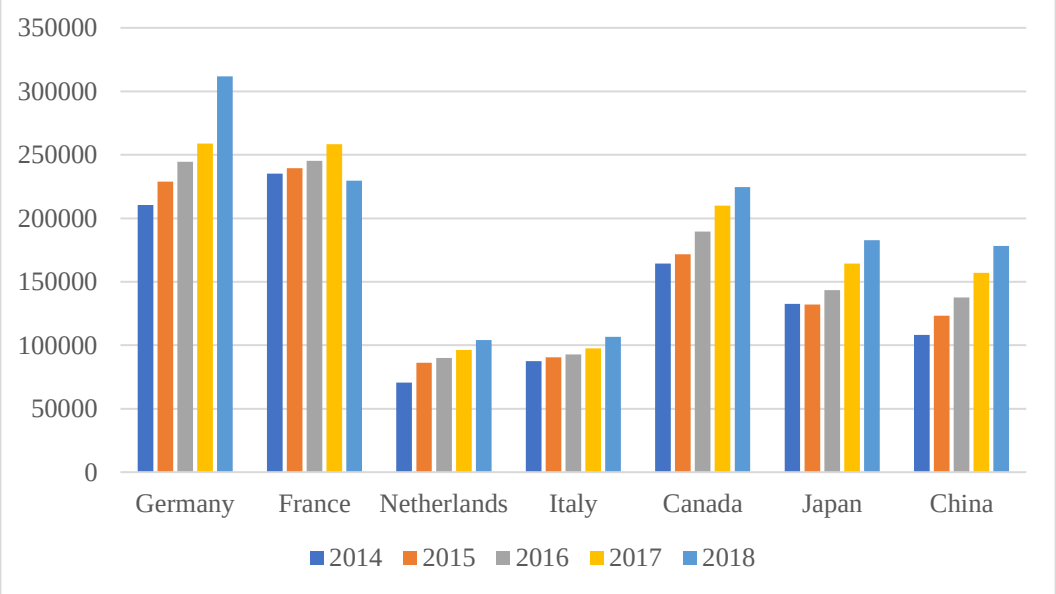
universities (Xia & Qu, 2018). Driven by economic globalization, the internationalization of higher education has gradually become a new trend, especially in developed countries.

New Trends in Higher Education in Developed Countries

First, with economic and social globalization, countries have increasingly frequent international exchanges in higher education. As shown in Figure 1, the number of inbound international students increased from 2014 to 2018 without being affected by the COVID-19 epidemic. Germany, France and Canada are economically advanced and boast relatively superior educational facilities, making them the top three among the six countries in the number of international students. Germany has been notably internationalizing its higher education and steadily improving the quality of higher education. As an inflow country, Germany saw a steady increase in the number of inbound international students from 2014 to 2018, with an annual growth rate of 5%-8%.

By 2019, more than 300,000 international students were studying in Germany. Germany is actively developing international programs, emphasizing educational cooperation with Asian universities, and offering many dual-degree programs. German universities also actively cooperate with universities worldwide in offering joint programs to promote the international exchanges of college students. In addition, based on their educational development models, most developed countries have firmly established the path to internationalize higher education and set the construction of global universities as the new development direction of higher education (Xu, 2022).

FIGURE 1
NUMBER OF INBOUND INTERNATIONAL STUDENTS FROM SOME DEVELOPED COUNTRIES AND CHINA, 2014-2018



Data source: International Statistical Yearbook, National Bureau of Statistics of China

Second, digital transformation has become a priority for the global sustainable and healthy development of higher education institutions. With the joint development of 5G, big data and artificial intelligence, the higher education model has undergone profound changes. Developed countries have established mainly learning centers, introduced global quality learning resources, and built smart classrooms. The Top 10 IT Issues, 2020: The Drive to Digital Transformation Begins, published by EDUCAUSE, examines the challenges and trends of digital transformation in higher education (Zhang, Tan & Peng, 2021).

In 2021, the German federal government launched the Digital Education Initiative to enable the masses to learn quickly and efficiently through digital education technologies. During the epidemic, many German universities expanded the scope of digital education and tried to cooperate internationally with other universities. As a result, the German digital higher education model has evolved further (Deng, 2021). It represents the prediction by developed countries, including Germany, on the future development of higher education.

Third, the construction of world-class universities is deeply influenced by the internal and external factors of universities. The United States values the relationship between universities, the market and the government because the government and the market directly influence universities' development potential. Since the 1990s, the developed countries, represented by the United States, have launched a market-oriented reform of higher education. As independent legal entities, universities do not rely on the government or other institutions but operate directly in the highly competitive market environment. They have facilitated the flexible and rational development of university teaching with an intricate market while producing many excellent administrators and front-line teachers (Gu & Kong, 2014). The national headhunting policy of the United States has brought global high-tech talents to its higher education. Nobel laureates at US universities reveal that their faculties have remained high quality. Furthermore, American universities mainly concentrate on building superior disciplines and improving overall strength. The above shows that the US's emphasis on constructing world-class universities is also highly effective.

Fourth, the open innovation consciousness and advanced education philosophy contribute to the development of developed countries into higher education powerhouses. In the early stage of higher education, colleges and universities overly emphasized the specialization of higher education, offering special programs and cultivating specialized talents. Because of this, the higher education system lacked a holistic approach, and a monolithic talent cultivation model emerged. Since then, international higher education practitioners have paid more attention to human resources free and all-around development. The American scholar Brubacher (1987) explicitly suggested that universities should reject research activities and focus on liberal and professional education. It is the path to innovation and reform in higher education.

Fifth, universities in developed countries are increasingly capable of serving economic and social development. Some developed countries have integrated universities into urban planning so that universities can create together with communities and education can be compatible with production. Thus, universities' development can be harmonized with social development. The US has made remarkable achievements in building communities around university clusters, integrating education with the community, and leveraging the benefits of community scale. The United States has established community colleges where people with learning abilities can study and live. Hence, it can improve the overall quality, promote the structural reform of higher education, and make the university more closely connected with society. Integrating higher education with the regional economy facilitates universities to fully exploit the advantages of high-technology talents and superior disciplines in combination with regional strategies and spatial patterns. Thus, following the example of the United States, Russia has attached great importance to integrating education, science, and production and establishing close ties between universities and enterprises. As a result, a synergy between universities, research institutes, specialized research centers and enterprises has been created (Geng, 2013).

Problems in China's Higher Education

Higher education in China has become one of the factors influencing the healthy development of the national economy and has increasingly contributed to enhancing China's soft power. In the meantime, the concept of higher education is less internationally oriented, and students lack international training and exchange opportunities. To a certain extent, it restricts the further development of higher education. China's higher education is faced with great challenges. Specifically, the structure of higher education is uncoordinated, there are deviations in the concept of higher education, and universities have insufficient development capacity. Universities are expanding in scale, but the allocation of other resources in some regions cannot be synchronized, resulting in the increasingly uneven regional development of higher education.

During the 14th Five-Year Plan period (2021-2025), higher education in China enters the primary stage of universalization. The development and reform of higher education will meet the opportunities and challenges brought by the transformation of the social situation in China and abroad, the optimization of the overall national strategic layout, and the information technology revolution (Zhong, 2021). Figure 2 shows the regional education expenditure, per capita GDP, number of colleges and universities, and per-student higher education budget in China in the form of a heat map. China's higher education system is not yet perfect. Specifically, in terms of the regional structure, as of 2021, there were 3,012 colleges and universities in China, but the distribution of colleges and universities and education expenditure is significantly unbalanced. Ningxia, Gansu, and Qinghai are geographically remote and have harsh natural conditions. Thus, these regions have low regional GDP per capita, and the financial sector has limited investment in education.

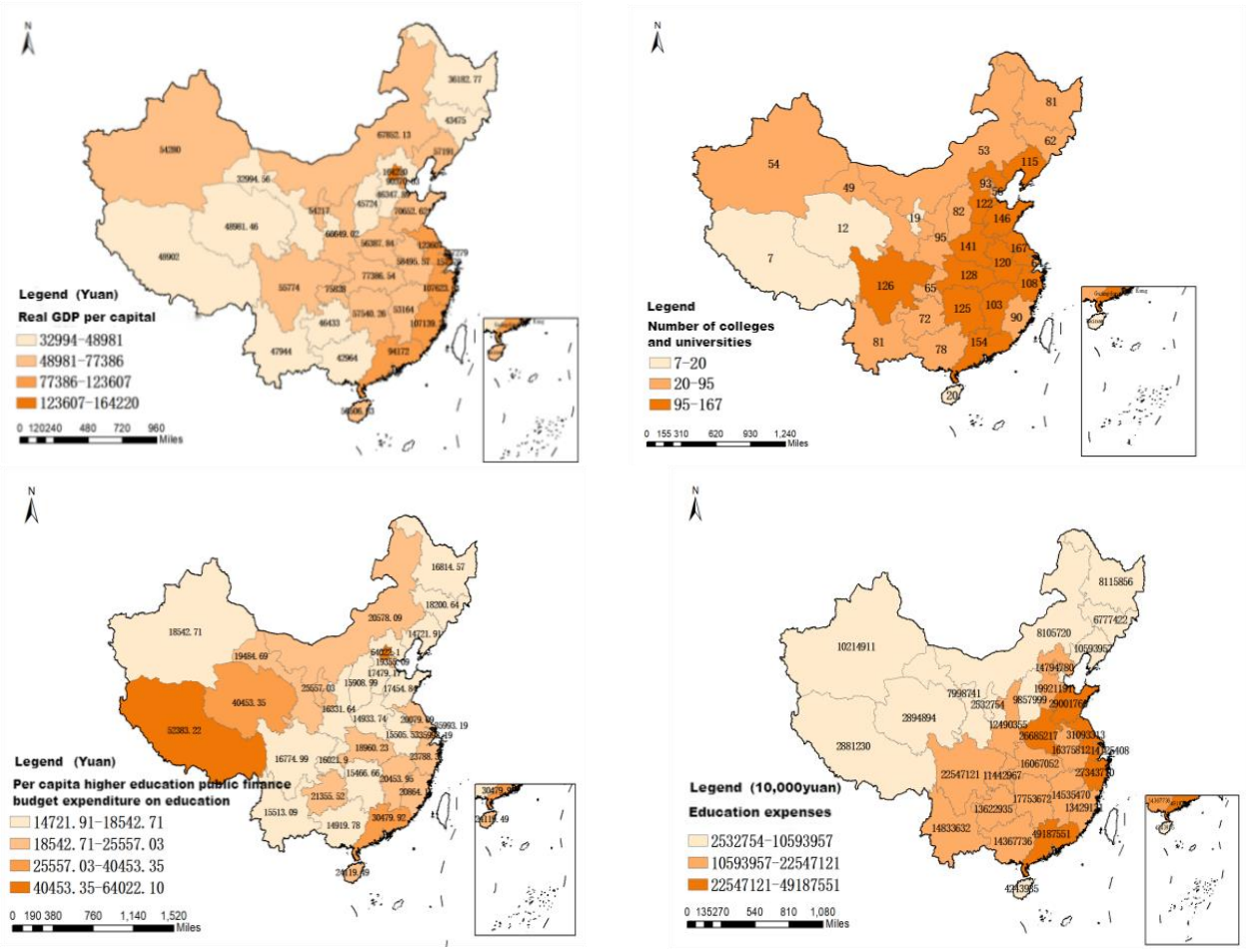
Moreover, higher education resources are scarce, and only a few colleges and universities are not attractive to students. The top universities are mainly located in the economically developed eastern coastal regions and central cities. Because of this, these regions are backward in education level. Meanwhile, Shandong, Jiangsu, Shanghai, Guangdong and other eastern coastal provinces and cities have the highest GDP per capita in China, with large investments in education. It further inhibits the increase of colleges and universities in western regions and remote cities.

Western China has scarce resources and is economically underdeveloped. If the government does not support the education resources in the western regions, it is prone to the imbalance of regional development and the massive loss of talent. Therefore, China is increasingly concerned about investment in higher education in remote areas in western China. In 2019, China increased the per capita higher education public finance budget expenditure on education in Qinghai and Tibet. Compared to 2018, the per capita higher education public finance budget expenditure on education in Tibet in 2019 increased by 40.51%. China is addressing the uneven distribution of higher education resources by financial means. In terms of hierarchical structure, undergraduates, junior college and graduate students are improperly distributed. Junior colleges are not well positioned and are not differentiated from universities, and there is a shortage of high-skilled talents.

The scale of undergraduate education is expanding too fast, and the teacher-student ratio is increasing sharply, resulting in reduced education resources per student. Because of this, the quality of undergraduate students has been reduced, and the number of students has increased. It has caused tremendous pressure on employment. Although the enrollment of graduate students has been expanded, China still has a gap with the United States, France, and Germany, which needs further improvement and development (Du, 2016).

In terms of types, regular colleges and universities are separated from adult colleges and universities. The scale of public colleges and universities is much larger than that of private colleges and universities, causing financial difficulties for the government and the non-utilization of scattered funds. Higher vocational education cannot be integrated with secondary vocational education, which is not conducive to talent cultivation. The International Association of Universities (IAU) of UNESCO defines the internationalization of higher education more comprehensively. The IAU requests that higher educational internationalization integrate cross-border, intercultural perspectives into it. This integration must be connected with the university's primary teaching, research, and social service functions. It is an all-encompassing change process, both within and outside the university. Accordingly, there are bottom-up and top-down international exchanges and collaborations (Xie, 2007).

FIGURE 2
CHINA'S EDUCATION EXPENSES, GDP PER CAPITA, NUMBER OF COLLEGES AND UNIVERSITIES AND PER CAPITA HIGHER EDUCATION PUBLIC FINANCE BUDGET EXPENDITURE ON EDUCATION IN 2019



Source: National Bureau of Statistics of China

Although the rapid development of globalization has facilitated the circulation of the world economy, China remains less open to higher education internationalization. The number of students studying abroad is increasing, but 90% are self-funded, making the high tuition fees one of the biggest problems for international students. The lack of international programs in China limits students' development, resulting in insufficient international training and exchange opportunities. China's universities have less inter-university cooperation with top universities abroad, and the joint education model between China and foreign countries is imperfect. Moreover, the absence of relevant management systems and cooperation processes restricts collaboration and exchange. Universities are unevenly internationalized. First-class universities are significantly more internationalized than regular universities. Regarding curriculum, traditional universities remain at the original levels, and their international programs are less popular. China should be more internationally open (Sun & Song, 2017).

China is a populous country, but the demographic and educational dividends are insignificant. The supply exceeds the demand in the labor market, but companies are in short supply of talented people. It is because higher education is less competent, and the talents cultivated in colleges and universities are detached from the market demand. Regular colleges and universities cannot supply sufficient skills. The majors of colleges and universities cannot meet the market demand for talent, and the majors offered by

colleges and universities are vastly different from the traditional ones. Some colleges and universities reform their professional programs in response to the needs of the times. However, these universities cannot offer new programs to cultivate innovative talents because of the government's strict control and their inability.

China's current higher education system suffers from the dilemma of low-quality talent cultivation in colleges and universities. Considering international economics and trade, colleges and universities emphasize the duration of learning but neglect the cultivation of students' ability to think out of the box. Because of this, international economics and trade students have no sense of independent innovation. Since the reform and opening, the market demand for global trade talents has increased significantly. However, the talents trained in colleges and universities cannot adapt to the market requirements, and many graduates find it difficult to get employed (Xu, 2014).

The Impact of Higher Education on Macro-Economy in China

Education is an essential driver of national economic development and social progress. For more than a decade, China has achieved remarkable results in higher education. As China enhances its comprehensive national power, it places greater emphasis on higher education, reflecting the advent of the era of the knowledge-based economy. The primary task of higher education is to cultivate various high-quality talents that meet the needs of social and economic development and serve the great cause of socialism with Chinese characteristics. The forecast of the macro-economy form meets the objective condition of promoting the peaceful development of a market economy, and it drives economic globalization. However, China's macro-economy has problems with an unreasonable industrial structure and needs to be upgraded.

The human capital theory, which originated from the study of economics, defines human capital as the sum of various productive knowledge, labor and management skills, and health qualities accumulated in human beings. From the history of international education, education is a meaningful way and channel to foster the formation of human capital. The progress of higher education is closely related to human capital development. China should keep popularizing higher education, improve people's educational level and comprehensive quality, and boost the accumulation and improvement of human capital in quality and quantity. This way, China can better meet people's growing cultural and spiritual needs for a better life.

China's economic development primarily aims to promote supply-side structural reform, implement the new development concept, facilitate high-quality products, and build a modern economic system. It highlights improving China's comprehensive national power and the core of the national development strategy to enhance the capability of independent innovation and adhere to the separate innovation path with Chinese characteristics. Thus, it can stimulate people's enthusiasm to work for China's macro-economy development, prepare more talents for China's economic growth, and accelerate the development of China's macro-economy.

China should develop higher education, stimulate the innovation intelligence of the entire society, and cultivate innovative talents in all fields. In this way, it will help to make breakthroughs in critical technologies that restrict economic and social development and allow China to nurture world-class scientists and leading talents in science and technology. Therefore, it can lay the human resource foundation for building China into an innovative country, thus promoting the optimization and upgrading of industrial structure, fulfilling the task of supply-side structural reform, and providing core strength for macro-economic development.

Under the economies of scale theory, China's development of higher education contributes enormously to the macroeconomy. The economies of scale theory mean that in a specific period, the unit cost of an enterprise's product decreases when its absolute volume increases. In other words, expanding the operation scale can lower the operation cost and thus raise the profit level. China has been developing higher education and raising the status of higher education in society, which has produced considerable effects. Higher education has trained high-quality talents, and various industries' scale and operation styles have been improved. It guarantees product quality and safety and effectively adjusts the industrial structure. As a result, enterprises can improve the absolute quantity of products and obtain higher profits. Doing so will facilitate them to develop into internationally competitive large enterprise groups. Enterprises have

improved their profitability, adjusted their industrial structure, and accelerated the transformation of economic development methods, creating absolute advantages for macroeconomic development.

Universities should be promoted to cooperate with local enterprises, to close the connections with regional economic and social development. Enterprises are more competitive in the market and can better survive and compete in domestic and international markets. Most enterprises in the market have expanded their production scale and increased their profits under the management of highly qualified executives. Because of this, more Chinese enterprises can rank among the world's top 500 and first-class enterprises. Enterprises have improved their comprehensive capability and upgraded their industrial structure. Also, they have acquired more advanced production technology and a complete production chain, significantly improving their independent R&D capability. Thus, it can accelerate China's autonomous innovation capability to a higher level and lay the material and technological foundation for macroeconomic development.

Under the human capital theory and the economies of scale theory, China should develop higher education, cultivate various talents to serve economic construction, and create an atmosphere of learning and innovation for everyone. Moreover, it should create a favorable business environment and advanced technical support for business and market economy development. At the same time, enterprises should enhance their independent innovation capabilities, adjust and optimize the industrial structure, improve and upgrade the whole industrial chain, and stimulate macroeconomic development.

A New Model for China's Higher Education

High-quality economic development requires high-quality development of higher education. In the past, the epidemic was one of the significant factors affecting the global macro economy. The global economy is recovering in the post-epidemic era, and the complex macroeconomic landscape has created new demands for higher education. As China's economy has shifted from high-speed growth to high-quality development, new requirements and trends in higher education have emerged. The CPC and the Chinese government have increased their financial and policy support for higher education, prompting China's higher education to become more modern and science-oriented.

New Demands for Higher Education from Macro-Economic Development

In recent years, China's higher education has made significant progress. Primarily it has made remarkable progress in constructing public service systems and infrastructures, such as library and literature security systems, modern instruments and equipment, and education and research networks. Meanwhile, a series of national key engineering laboratories, research centers and technology transfer centers have pushed universities' campus environment construction and base construction to a new level. It provides a favorable essential environment for students learning and higher education development. Chinese government departments should optimize the allocation of higher education resources and profoundly change the management system of higher education.

Moreover, they should strive to expand the autonomy of colleges and universities, mobilize the enthusiasm of the whole society to develop higher education and facilitate higher education to diversify and evolve from a single structure to multiple structures. Also, universities should follow the significant trend of reforming higher education worldwide and establish a reasonable talent structure to meet modern economic development needs. It should change the traditional system of higher education like an ivory tower. This way, various colleges and universities can co-exist with different training objectives and flexible teaching methods. Colleges and universities should implement supporting policies and measures such as student loans, educational savings, work-study, scholarships, and subsidies for needy students. Moreover, they should improve the cost-sharing mechanism of education and the national student support system to meet the needs of high-quality economic development and enlarge the talent pool for high-quality economic development. China should support the high-quality development of higher education in all aspects and cultivate various talents in line with high-quality economic development.

The Chinese government emphasizes that economic development should consider domestic circulation given the ever-changing international political and economic landscape. The regenerative development of

the domestic circulation requires that higher education be efficient and equitable. Based on the complex domestic and global environment, China's leaders have stated that China must accelerate efforts to foster a new pattern of development. The new practice is focused on the domestic economy and features a positive interplay between domestic and international economic flows (Zou, 2020). China's higher education needs to follow the new "dual-circulation" development pattern, and a new development model for China's higher education is emerging. The "focus on the domestic economy" requires that China fully unleash its domestic potential and achieve high-level economic development. Thus, China's higher education development should be efficient and equitable. Financial input, social capital input, and individual and family input together constitute the factors of production of higher education. Efficient production in higher education means that the government should choose the optimal allocation of resources in the production process, invest the least amount of production factors, and gain the most benefit from education.

On the one hand, China should continue to expand the scale of higher education, reform the mode of training high-level talents in fundamental disciplines and increase the supply to meet the new social demand for higher education. On the other hand, China should integrate innovative ideas and link circulation throughout the input of higher education resources to the output of achievements. Universities should innovate and incorporate new engineering, new medicine, new agriculture, and new liberal arts disciplines, strengthen the restructuring of disciplines and programs, and cultivate innovative talents to meet future economic development needs.

In addition, China needs to promote international exchange and cooperation in higher education under the economic dual-circulation pattern. Domestic and international dual-circulation facilitates the internationalization of China's higher education. In economic and trade globalization, all countries are open systems. China's economic growth rate depends on the world's consumer demand capacity, and external circulation is crucial to China's economic development. In the new stage of China's economic development, the development pattern of economic dual-circulation has become a feature of the contemporary scene. China has accelerated the high-quality development of higher education. Higher education involves the attributes of social and economic resources and is consistent with the circular economy theory. The COVID-19 epidemic has brought significant challenges to global education exchanges and collaborations, and in the post-epidemic era, universities have significantly reduced their work on international student exchanges. The primary way to enhance the internal quality of higher education is to strengthen foreign exchanges and learning and to realize the 4Rs principle of the circular economy of higher education. Therefore, as an essential organization for cultural transmission and international exchange, universities should adopt an open and cooperative attitude under the new development pattern of dual-circulation. They should cultivate talents, develop their disciplines, and transform their innovations.

On the one hand, they can export China's excellent higher education culture and products to the countries along the Belt and Road. On the other hand, they should recognize the gap between the quality of Chinese university education and Western developed countries and activate China's higher education resources. Moreover, they should solve the inherent contradictions, deepen the reform of the education system, and accelerate the internationalization of Chinese education.

Developing Higher Education to Enhance the Momentum of Economic Growth

To internationalize higher education, the government should increase the number of government-sponsored international students and attract international students to China for exchange. From the increased number of returnees and incoming students to China, Mao and Wu (2021) suggested that economic growth was boosted via consumption, human capital and technological innovation. Cui (2018) suggested that international students in Britain generate economic benefits through tuition fees, living expenses and spending on visits from family members and friends. Yu et al. (2020) argued that exports of higher education services could contribute to regional economic growth by promoting consumption, trade and investment, and innovation. It can boost the economic development of the region and the neighboring regions, with significant spatial spillover effects. Wang (2018) argued that students' international exchange could directly contribute to economic development, the development of trade in education services, and attract international students' consumption for capital operation. It can also increase foreign investment,

optimize the industrial structure, and enhance human resources. A review of existing studies reveals that promoting open exchanges in higher education can effectively contribute to China's economic operation. To this end, China should attract international students to study in China and gain economic benefits from their tuition fees, living expenses, and visits from friends and relatives to facilitate China's financial operation.

On the other hand, China should increase the number of students going abroad to study advanced technology and research methods in developed countries. In this way, China can improve the quality of domestic education, cultivate high-quality talents, and increase domestic labor productivity, thus boosting economic growth. Chinese students studying abroad can learn foreign advanced technology and combine it with their technology to promote China's technological progress, innovative development and economic trade. Universities should gradually introduce international programs to cultivate students' global awareness and lay the foundation for a prosperous global economy and business development.

University development should be integrated into the planning of surrounding urban areas to facilitate the joint development of universities and regional economies. Due to the strategies of socialist modernization and innovation-driven development, higher education has gradually become a new driver of regional economic development (Xie, 2018). The calculation of the Cobb-Douglas production function revealed that higher education contributed significantly to economic growth. Higher education contributes more to GDP growth in high-income regions than in low- and middle-income regions. Universities can efficiently boost consumption in the surrounding areas and promote social development and progress. With convenient logistics and consumer payment, students can access commodities and services they need in the vicinity of the university. In addition to meeting their own needs, universities also drive the circulation of funds and economic development in the surrounding areas.

To promote the development of higher education, universities should develop their competitive disciplines, enhance their strengths, and cultivate high-quality talents. They should attract Chinese students and become more attractive to overseas students. Students should acquire advanced knowledge on campus and respond to society through knowledge production. We should combine university education, scientific research and social services to meet the real needs of social and economic development. Therefore, to enhance the function of higher education for economic growth, China should first develop higher education, improve its soft power, and combine university development with social progress.

In the new era, China's higher education suffers from uneven regional development in its layout, hierarchy, type and significant structures. The Chinese government should optimize the higher education system to cultivate talents of all levels and styles to correspond to the economic structure as an essential link to develop higher education and enhance economic growth momentum. Chen and Hu (2021) conducted regression and gray correlation analyses on panel data of the national economy and HIGHER education in China from 2000 to 2019. They found that higher education hierarchy was significantly correlated with economic development.

Junior college, undergraduate, and graduate students contribute to economic growth, with graduate enrollment contributing the most. Therefore, to unleash the efficacy of higher education in promoting economic development, colleges and universities may cultivate high-quality professionals in different levels and categories, deal with the contradiction between economic structure and talent structure and build a diversified hierarchy of higher education. First, they should optimize the education hierarchy, control the ratio between undergraduates and graduate students, and develop a pyramidal education hierarchy. They should stress the special education at each level and precisely position their majors. Therefore, talents at different levels can meet other social demands. Secondly, it is necessary to develop higher vocational education vigorously, correct public misconceptions about vocational education, and properly guide the development of higher vocational education.

Building a High-Quality Higher Education System

China should leapfrog economic development, achieve great national rejuvenation, and build a high-quality higher education system in the new era. Xi Jinping pointed out that China needs higher education more urgently than ever and has a more robust demand for scientific knowledge and outstanding talents.

Based on the problems in Chinese higher education, this paper proposes strategies to facilitate the construction of a high-quality higher education system.

First, China should promptly optimize and adjust the structure of higher education to cultivate high-quality talents. In the regional system, China should vigorously develop higher education in backward and central and western regions, expand the scale of schooling, improve disciplines, and attract an influx of talent. Moreover, efforts should be made to upgrade the faculty, cultivate teachers for pairing assistance, and enhance the quality of local teachers. Regional education should be developed to nurture regional talents. Relevant departments should develop higher education strategies to adapt to local conditions and foster practice-oriented talents according to local characteristics. The government should vigorously support the development of the western region, give policy preferences, and provide economic assistance. Higher education in developed and eastern areas should be diversified and developed with multiple features to foster research-oriented talents. In terms of hierarchy, higher education should be developed in a pyramidal way. Vocational education should be specialized to cultivate vocational and technical talents.

Moreover, the number of students in undergraduate programs should be controlled, and undergraduate education should be popularized. Elite education should be provided for graduate students. The three modes should develop simultaneously, interacting with and promoting each other. In terms of types, regular colleges and universities, adult colleges and universities and private colleges and universities are separated, which hinders the development of higher education and lifelong education. It should clarify the entities of adult and private colleges and universities and establish a standard management system. Also, the government should integrate education resources, eliminate unnecessary education sites, strengthen the connections between these colleges and universities, and narrow the gap.

Second, colleges and universities should deepen international cooperation and establish the concept of international education. In 2021, the Ministry of Education and the other seven Departments issued The Opinion on Accelerating and Expanding the Opening Up of Education in the New Era. The document suggests that China should persist in opening education to the outside world and proactively strengthen mutual learning, accommodation, and interoperability with other countries. Thus, the beginning of education can be more inclusive, extensive, multi-layered, and proactive. Ridder-Symoens (2018) argued that universities' growth and development are fundamentally driven by the interest in scientific research, the demand for the world, and the desire to explore universal knowledge.

The internationalization of higher education is an integral part of its reform and is an inevitable product of China's globalization. Universities should strengthen international cooperation, improve internationalization, and offer international programs. In this way, students can experience global ideas and culture early and become international talents. The government should strengthen international education collaborations, provide exchange opportunities for university students, and increase the number of government-sponsored students studying abroad. High-quality Chinese-foreign universities should be launched. In the development of higher education, China should make up for the shortcomings of its educational model and learn from the advanced academic concepts and educational and teaching models of internationally recognized educational powerhouses.

Chinese universities should cultivate the concept of internationalization and deepen international cooperation. Thus, it will facilitate China to build a high-quality higher education system, improve the competitiveness of higher education, and build China into a higher education power. Moreover, China should exploit its unique educational advantages, run universities with socialist policies, and follow the road of socialist education with Chinese characteristics.

Third, China should activate the educational resources of colleges and universities, optimize the allocation of resources, and accelerate the sustainable development of higher education. On the one hand, social sustainability requires promoting higher education to enhance citizens' humanistic literacy. Moreover, the government and the public should abandon the stereotypes of dominating and overspending on nature, establish the concept of natural resources as invaluable assets, and establish a mechanism for the harmonious development of man and nature. On the other hand, higher education is a subsystem of the social system. Universities should accelerate the transformation of research achievements, upgrade their

ability to serve society, optimize the allocation of educational resources, and reduce resource waste, thus facilitating the sustainable development of society.

Higher education can accelerate sustainable economic and social development, while economic and social development creates a favorable macro environment for the high-quality development of higher education. Higher education is underdeveloped in the central and western regions. Quality higher education resources are unevenly distributed and are mainly concentrated in the eastern area. Therefore, to achieve high-quality development of higher education, China should complete a rational and effective allocation of educational resources and expand the coverage of quality educational resources. It should embody the concept of equality in education. Moreover, the government's leadership in education should be weakened, and different groups of people should be attracted to run schools in various forms. Chinese people should be better educated, and more entities should be involved in higher education, thereby contributing to its higher-quality development.

CONCLUSION

In the new era, economic and social transformation and development require human resources and technological support from higher education. Several changes will be made in the development concept and model of higher education and its evaluation and governance systems. Therefore, higher education restructuring has significant theoretical and practical implications for higher-quality macroeconomic development. Based on the Cobb-Douglas production function, we derived and measured China's composite higher education index by combining Denison's economic growth factors analysis method. Furthermore, we measured the contribution rate of higher education to China's economic growth. Second, from an international comparative perspective, we examined new trends in the development of higher education in developed countries. Using the Arc GIS platform, we visualized the regional distribution of China's higher education resources on a map and analyzed the problems in China's higher education. The specific conclusions are as follows:

Firstly, higher education can effectively contribute to the development of the national economy by promoting human capital accumulation. Moreover, higher education delivers talent dividends for economic and social development. Measured results show that China's composite higher education index increased yearly from 2009 to 2019, with a contribution rate of 6.53% for China's higher education to the average annual GDP growth rate. It indicated that China is expanding the scale of higher education, enriching education resources, and improving education levels. However, the contribution rate of higher education to economic growth in China from 2009 to 2019 was below that of developed countries. It is because higher education in China is not developed equally in the east and west regions, and the professional structure is incompatible with the social and economic industrial structure. At this stage, China's economy is being transformed and upgraded, and the economic system supported by new technologies and industries has further stimulated the potential social demand for education. Therefore, to adapt to the latest development pattern and contribute to China's higher-quality macro-economic development, Chinese universities should optimize the overall supply structure of higher education and build a modern higher education system that is innovative, coordinated, and open.

Secondly, the scale and quality of higher education boost the region's economic development, and the increased number of colleges and universities drives economic growth. It is the key to high-quality economic development by improving the quality of higher education. China has built the world's most extensive higher education system based on the increasing number of colleges and universities. On this basis, colleges and universities should be reformed to cultivate new skilled talents and develop their programs with industrial features. Colleges and universities should fill the gap of highly educated and technically proficient talents who have mastered cutting-edge scientific knowledge and technology. They should build a system of disciplines and majors adapted to the local economic structure and deeply bind and integrate disciplines and talent training with industries. Moreover, they should improve the quality of higher education, build a high-quality higher education system, and enhance the dynamics of economic growth.

Finally, China's higher education has unbalanced and uncoordinated development in terms of layout, hierarchy, type and program structures. The number of colleges and universities and GDP per capita are distributed progressively from west to east. While the eastern coastal and central regions are clusters of colleges and universities, there are fewer colleges and universities in the western areas. It indicates that the layout of colleges and universities is significantly influenced by economic development. In this regard, China's national finance department should invest heavily in higher education in the western region. Given the characteristics of regional development, the trend of industrial transfer and national development needs, it should optimize and reorganize university resources, establish universities with regional strengths and features, and ease the siphoning of education and talents.

This paper examined the contribution of higher education to economic growth in China using the C-D function and analyzed the problems of higher education in China. Based on the human capital theory and the economies of scale theory, we considered the new need for higher education for China's macroeconomic development. It provides some instructions for optimizing and adjusting the development model of higher education. However, the international economic environment is complicated, and countries' primary national conditions differ. Based on this alone, there are certain limitations if we conclude the impact of higher education on the macroeconomy. At the same time, this paper has not examined the relationship between higher education and economic growth from the perspective of inputs from various levels of higher education institutions. Therefore, we need to investigate and compare the development patterns of higher education in different countries from an international perspective. Moreover, the effects of international higher education on economic development should be adequately and empirically analyzed.

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