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Ten-Year Development Trajectory of Higher Education in China: Development Trend and Quality Path (2014–2024)

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Abstract: Based on 2014–2024 data from China's Ministry of Education National Education Development Statistical Bulletin, this study explores the ten-year development trends and quality improvement paths of China's higher education. It finds that the gross higher education enrollment rate rose from 37.5% to 60.8% over the decade, achieving a leap from popularization to accessibility, with significant growth in enrollment scale, institutional count, and resource investment. However, scale expansion has triggered quality challenges: fluctuating student-faculty ratios, imbalanced type structure, and lagging per capita resource growth. Enrollment growth has no significant linear correlation with full-time faculty growth, but a highly significant positive correlation with student-faculty ratio growth. The study proposes optimizing quality paths via a scale-quality linkage mechanism, faculty structure optimization, increased resource investment, and improved type structure, to provide empirical support and policy reference for China's higher education transformation from scale-driven to connotation-based high-quality development.

Keywords: Higher education; Development trend; Quality path; China

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1. Introduction

China has built the world's largest higher education system and cultivated a large number of high-quality talents. Higher education plays an important role in national construction [1,2]. In 2023, the gross enrollment rate (GER) of higher education in China is 60.2% [3], which has entered the stage of popularization defined by Martin Trow [4]. This achievement not only reshapes the development pattern of higher education in China, but also provides an important reference for the global process of education popularization.

However, the rapid growth of enrollment scale has also intensified the inherent tension of the higher education system, such as the decrease in per capita funding [5], the shortage of per capita infrastructure and professional teaching equipment funds [6], and the fact that the student-faculty ratio in undergraduate colleges

has reached less than 30% of the basic operating conditions [1]. In addition, some studies have pointed out that high-quality higher education resources are highly concentrated in the eastern coastal areas of China, and universities in the central and western regions of China are in a relatively disadvantaged position in terms of per capita funding, faculty strength, academic resources, etc. The issue of regional higher education equity and balanced development has not yet been resolved [2].

In summary, this study focuses on the development practice of higher education in China from 2014 to 2024. By analyzing the dynamic relationship between scale expansion, structural adjustment, resource allocation, and quality improvement, it explores the core path of high-quality development of higher education in the popularization stage. Focusing on the following three core questions, it provides empirical support and policy inspiration for the construction of an education powerhouse. By means of quantitative research on the following three core issues, the study provides empirical support and policy inspiration for the construction of an education powerhouse.

Q1: What are the core development trends of China's higher education in terms of scale, structure, and resource allocation in the past decade?

Q2: What are the changes in quality-related indicators, such as student-faculty ratio and educational resources, brought about by the expansion of enrollment scale?

Q3: What are the suggestions for achieving balanced development of scale and quality in higher education in the next stage?

2. Literature review

2.1. Transformation of higher education popularization

The transformation of higher education from popularization to universalization is a global trend. Before entering the stage of popularization, American higher education attempted to break free from the constraints of elite education in terms of system structure [7]. In 1900, only 4% of the eligible population for higher education in the United States entered universities, but the main characteristics of the modern American higher education system have almost all emerged [4]. The emergence of different types of universities such as research universities, junior colleges, state universities, and private for-profit universities has changed the dominance of traditional private non-profit universities in the United States. The functions of universities have shifted from singularity to diversification, and higher education has shown characteristics of diversity, multi-level, and multi-type [8].

In terms of popularization evaluation standards, different countries have formed differentiated perceptions based on their national conditions. For example, the United States uses a gross enrollment rate of 50% as the core indicator, while China has formed a multidimensional judgment system that includes scale, structure, quality, and other dimensions based on its development reality [7]. International academic research has shown that rapid expansion of enrollment often accompanies issues such as increased teacher workload, diluted per capita funding, and a mismatch between graduate skills and labor market demand. This inherent trade-off has been confirmed by research [9,10].

2.2. Optimization of higher education structures

The imbalance of higher education structures is a key factor restricting the improvement of quality. In terms of type structure, the coordinated development of vocational education and higher education has become a

policy focus [11].

The establishment of vocational undergraduate education is a key measure for structural optimization. In 2017, in order to provide students with broader opportunities for career development and high-level academic pursuits, the Japanese government decided to establish specialized vocational universities to meet the industry's demand for advanced specialized skilled talents [12], and enhance the academic status and social recognition of education. However, vocational education still faces systemic challenges such as low social recognition, insufficient resource investment, and poor vertical enrollment channels [13].

In terms of international experience, after abolishing apartheid, South Africa established a single and coordinated higher education system, set up a national higher education commission, and promoted the coordinated development of different types of institutions, providing useful reference for solving the structural inequality problem left over from history [14]. Over the past forty years, the management system of higher education in China has undergone profound changes from centralized and unified to hierarchical management, and from administrative leadership to diverse governance [15]. Research has pointed out that management system reform has always revolved around the relationship between the government, universities, and society. The core logic is to strengthen government macroeconomic regulation while expanding the autonomy of universities in running schools.

2.3. Internationalization and quality of higher education

Internationalization of higher education has become an important path to improve quality. From a global perspective, research on internationalization of education in the past decade has focused on core issues such as student mobility, cross-border education, and international scientific research cooperation [16–19]. However, China's internationalization practice faces controversy over Westernization [20]. Research has shown that unequal distribution of internationalization opportunities leads to a tendency towards elitism, with students with superior economic conditions or outstanding academic achievements being more likely to access internationalization resources [20].

Education quality assurance is the core support for the high-quality development of higher education. In studying the employment ability of graduates in Indonesia, it was found that there is a significant positive correlation between facility conditions, practical activities, research activities, knowledge and skill development, and the employment ability of graduates [21]. Through factor analysis in Saudi Arabia, six major factors affecting the quality of higher education were identified, including teaching and learning, institutional resources, admission standards, course content, outcome evaluation, and teaching methods [22], providing references for the construction of a quality assurance indicator system.

In terms of evaluation methods, the higher education teaching quality evaluation decision algorithm based on the intuitionistic fuzzy geometric Yager Heronian mean operator provides a new path for dealing with the problems of fuzziness and uncertainty in evaluation [23]. As the core carrier of human capital accumulation, the improvement of the quality of higher education is directly related to the sustainable development of the economy and society. Its positive promotion effect on the common prosperity of provinces, cities, and townships has been empirically verified [24]. Based on the background of building a strong education country, Li and Qin [25] proposed a fourfold logic for constructing the theoretical system of higher education quality assurance, namely high-quality development, quality culture, all-round education, and comprehensive human development.

In summary, existing research has extensively explored the high-quality development of higher education from multiple dimensions such as scale expansion, structural optimization, quality assurance, and international development. However, there is a lack of quantitative research and long-term comparative analysis on China's higher education in the past decade. This study fills this gap.

3. Methods

3.1. Data sources

The data for this study is entirely sourced from the National Education Development Statistical Bulletin (NEDSB) from 2014 to 2024 released by the Chinese Ministry of Education. This series of reports provides systematic, comparable, and authoritative data on the number of higher education admissions, types of admissions, number of institutions, number of institutions at all levels, number of full-time faculty, and infrastructure. Detailed raw data can be found on the official website of the Chinese Ministry of Education. The abbreviations and units of relevant education indicators have been explained in **Table 1**.

Table 1. The abbreviations and units of relevant education indicators

Educational indicators	Abbreviation	Unit
Total Scale of Students	TSS	10,000 persons
Gross Enrollment Ratio	GER	%
Total Number of Colleges	TNC	no.
Ordinary Higher Education Institutions	OHEI	no.
Undergraduate Institution	UI	no.
Higher Vocational (Junior College) Institutions	HVJI	no.
Adult Higher Education Institutions	AHEI	no.
Graduate Student	GS	10,000 persons
Undergraduate and Junior College Students	UJS	10,000 persons
Adult Undergraduate and Junior College Students	AUJS	10,000 persons
Enrollment Quantity	EQ	10,000 persons
Full-Time Faculty	FTF	10,000 persons
Student-Faculty Ratio	SFR	-
Per Capita School Building Area	PCA	square meters
Per Capita Value of Teaching and Research Instruments and Equipment	PCV	RMB, Yuan
Compound Annual Growth Rate	CAGR	%

3.2. Research design

By adopting a longitudinal quantitative research design and tracking changes over the past decade, a quantitative analysis of the development dynamics of higher education in China over the past decade was conducted using descriptive statistics, growth rate calculations, and comparative ratios. The analysis indicators are divided into scale indicators, structural indicators, quality indicators, and resource indicators.

Among them, the key indicators in the scale index include TSS, GER, and TNC. The key indicators in

the structural indicators include the ratio of UI to HVJI; Compound growth rate between different types of universities. The key indicators in quality indicators include SFR, growth rate of FTF, and CAGR. The key indicators in resource indicators include PCA and PCV.

3.3. Analysis approach

By analyzing the trends and annual growth rates of various aspects of higher education in China over the past decade, the development dynamics of higher education are presented. Emphasis was placed on analyzing the total scale of students, total number of colleges, the enrollment scale of graduate students, full-time faculty, per capita school building area, and per capita value of teaching and research instruments and equipment. In addition, the annual growth rates of different types of universities were compared.

Objectively analyze the development dynamics of education by calculating the compound growth rates of key educational indicators for the first five years, second five years, and ten years. Meanwhile, the correlation between the annual growth rate of enrollment scale and the annual growth rate of student-faculty ratio was analyzed.

The relevant data calculation formula is as follows:

PCA (square meters) = Total construction area of school buildings / TSS (1)

PCV (RMB, Yuan) = Total value of teaching and research instruments and equipment / TSS (2)

Annual Growth Rate (%) = (Value of this year - Value of the previous year) / Value of the previous year × 100 (3)

CAGR (%) = [(Final value / Initial value of period)^(1/Number of periods)-1]×100 (4)

Initial value of period: Number of starting years

Final value: Number of end years

Number of periods: The number of years elapsed from the starting year to the ending year

3.4. Data analysis

Excel software was used to perform statistical analysis on ten-year data, and Sigma Plot software was used for graphical analysis and correlation testing. Significance is represented by P-value < 0.01.

4. Results

4.1. TSS and GER

The TSS in higher education increased from 35.59 million in 2014 to 48.46 million in 2024, and has been climbing year by year (**Figure 1A**). The annual growth rate showed a curve change, with the highest growth rate of 5.9% in the TSS of 2021, and then the annual growth rate decreased year by year (**Figure 1B**). The GER increased by 23 percentage points from 37.5% in 2014 to 60.8% in 2024 (**Figure 1C**). The annual increase of GER in 2019 was the highest, followed by a downward trend (**Figure 1D**). This indicates that the scale of higher education in China has been continuously increasing in the past 10 years, with a significant increase in the gross enrollment rate, which has shown a slow growth trend in the future.

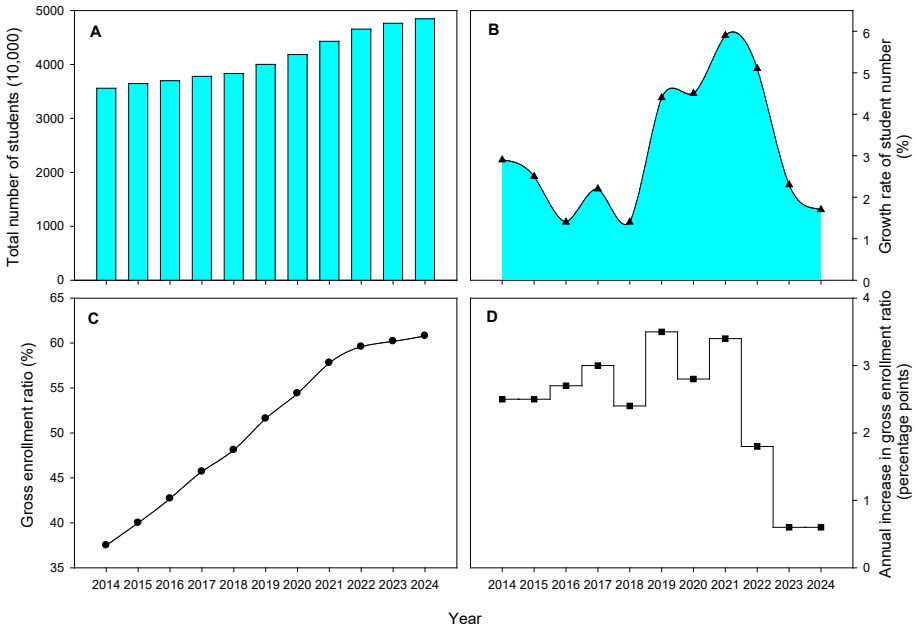

Figure 1. Changes in the total number of students (A), annual growth rate of student number (B), gross enrollment ratio (C), and annual increase in gross enrollment ratio (D) from 2014 to 2024

Note: The total number of students in higher education includes students in various forms such as graduate students, regular undergraduate students, vocational undergraduate students, and higher vocational (college) students, adult undergraduate and college students, online undergraduate and college students, and those enrolled in higher education self-study examinations for undergraduate and college levels.

4.2. Changes in the scale and structure of higher education institutions

The TNC is showing an upward trend year by year (**Table 2**). The number of UI and HVJI increases year by year, but the number of UI is lower than that of HVJI. In 2024, the number of HVJI will be 254 more than the number of UI; However, the number of AHEI is showing a downward trend. From the ratio of HVJI to UI, it shows an increasing trend.

Table 2. Scale of higher education institutions in China from 2014 to 2024

Institutions scale	Year										
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Number of OHEI	2529	2560	2596	2631	2663	2688	2738	2756	2760	2822	2870
Number of UI	1202	1219	1237	1243	1245	1265	1270	1270	1271	1275	1308
Number of HVJI	1327	1341	1359	1388	1418	1423	1468	1486	1489	1547	1562
Ratio of HVJI to UI	1.1	1.1	1.1	1.12	1.14	1.12	1.16	1.17	1.17	1.21	1.19
Number of AHEI	295	292	284	282	277	268	265	256	253	252	249
TNC	2824	2852	2880	2913	2940	2956	3003	3012	3013	3074	3119

The annual growth rate of the scale of OHEI from 2014 to 2022 shows a downward trend, with some increases in 2020 and 2023, reaching the highest level of 2.25% in 2023. The scale of AHEI has been experiencing negative growth (**Figure 2A**). The annual growth rate of UI is showing a downward trend, with

a rebound in 2019 and the highest growth rate of 2.59% in 2024. The overall annual growth rate of HVJI is on the rise, with lower growth rates in 2019, 2021, 2022, and 2024, and a peak of 3.9% in 2023 (**Figure 2B**). The total growth rate of HVJI is significantly higher than that of others. The CAGR of HVJI is the highest, with 1.64%. The CAGR of AHEI is the lowest, with -1.68% (**Figure 3**). In the process of adjusting the scale of Chinese higher education institutions, the good development trend of vocational colleges has become increasingly prominent year by year. The reduction in the scale of adult higher education institutions indicates a decrease in the number of people participating in the adult college entrance examination.

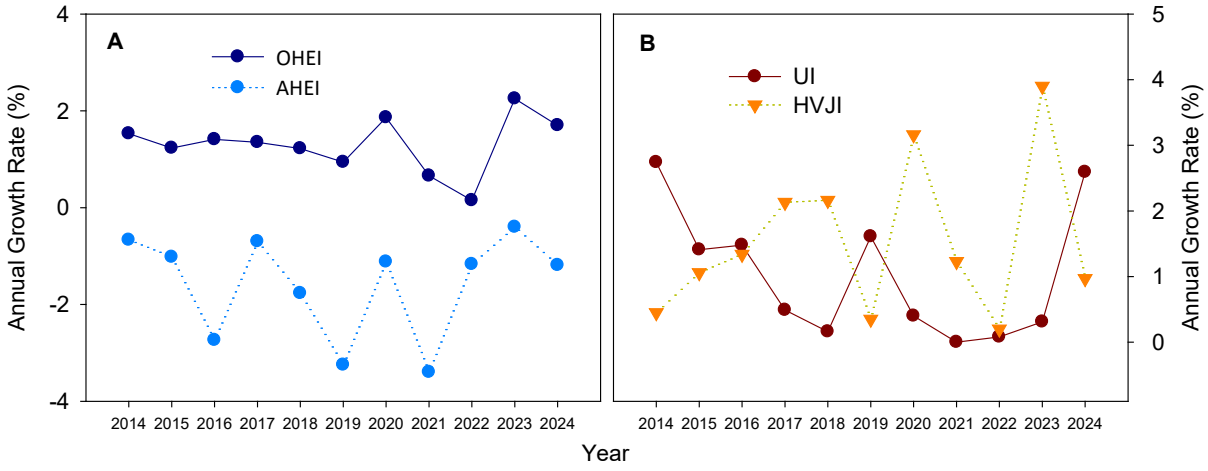

Figure 2. Annual growth rate of different types of institution from 2014 to 2024

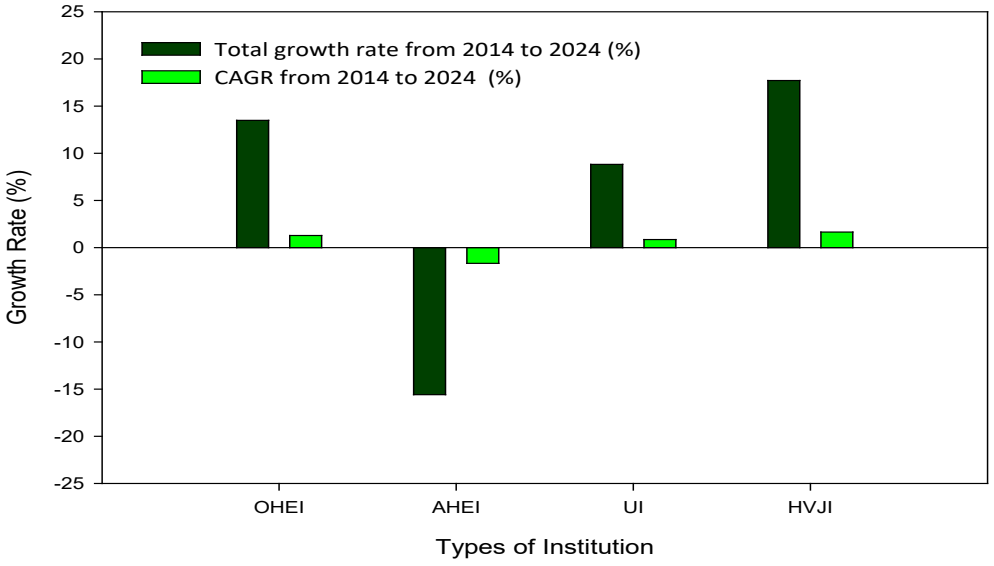

Figure 3. Total growth rate and CAGR from 2014 to 2024 in different types of institution

4.3. Enrollment scale

According to the size of enrollment in different levels of students, emphasis was placed on analyzing the situation of GS, UJS, and AUJS (**Figure 4**). The scale of enrolled GS had been increasing year by year (**Figure 4A**), with rapid growth in 2017 and 2020. The highest growth rate was in 2017, reaching 20.84%, followed by a slow growth rate (**Figure 4B**). The number of admitted UJS grew slowly from 2014 to 2018 (**Figure 4C**), with the highest growth rate reaching 15.67% in 2019, followed by a decrease in growth rate (**Figure 4D**). The number of admitted AUJS first increased and then decreased, with a maximum enrollment of 4.4549 million in 2023 (**Figure 4E**). The growth rate of the number of admitted AUJS showed an initial increase and then a decrease, with a growth rate of -18.76% in 2024 (**Figure 4F**). The era of rapid growth in the enrollment scale of higher education is coming to an end, and the future enrollment growth rate will be slow. A decrease in the scale of undergraduate and junior college students in adult higher education institutions.

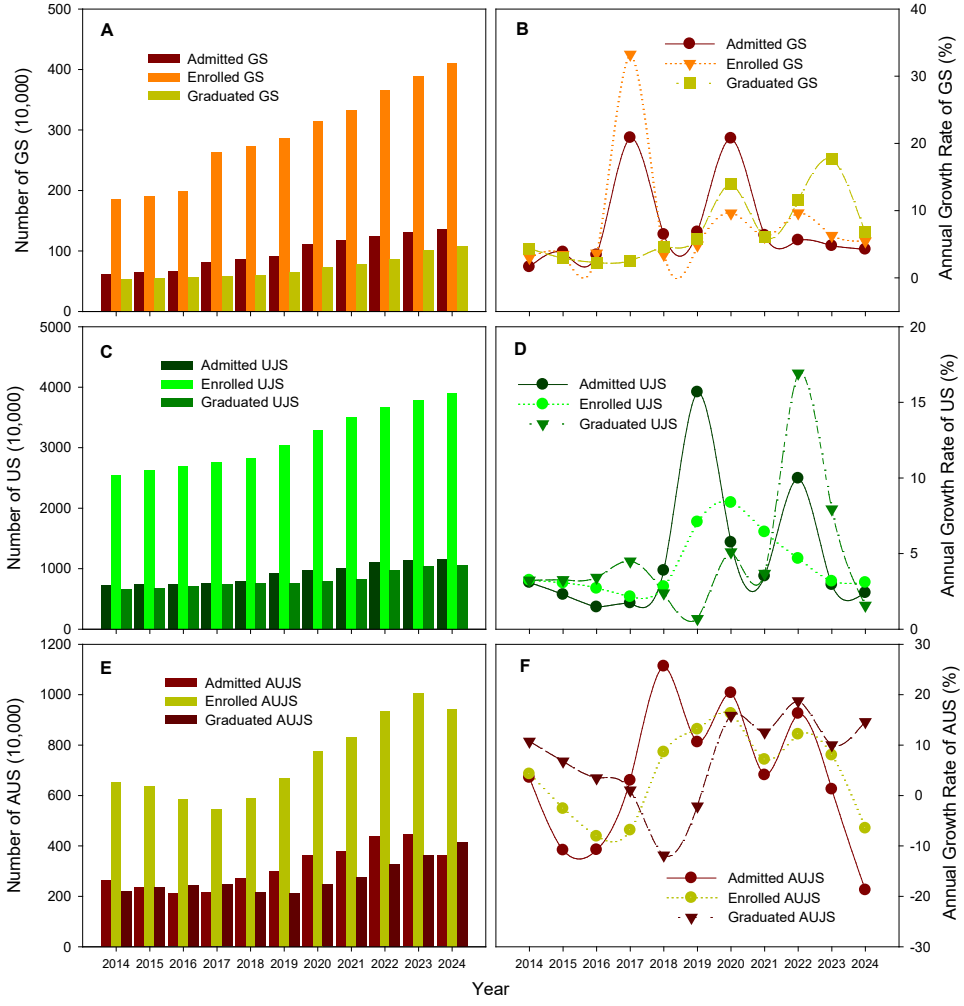

Figure 4. The admitted, enrolled, and graduated numbers and annual growth rate of GS, UJS, and AUJS from 2014 to 2024

4.4. Changes in the FTF and SFR

The number of FTF had increased from 1.5345 million in 2014 to 2.1635 million in 2024, with a fluctuating annual growth rate (**Table 3**). The highest growth rate with 5.34% was in 2020, and the growth rate had remained stable in the past three years. The SFR showed a curve fluctuation, with a minimum of 17.07:1 in 2016 and a maximum of 19.04:1 in 2021. From 2022 to 2024, the average annual growth was negative, showing a shrinking trend. From 2016 to 2021, the SFR had increased and the pressure on teaching staff had increased. From 2022 to 2024, the growth rate of FTF had increased, the SFR had decreased, which showed that the advantages of teaching staff had continued to expand.

Table 3. Change of the number of FTF and SFR from 2014 to 2024

Year	Number of FTF (10,000)	Annual growth rate of the number of FTF (%)	SFR	Annual growth rate of SFR (%)
2014	153.45	2.51	17.68:1	0.86
2015	157.26	2.48	17.73:1	0.28
2016	160.20	1.87	17.07:1	-3.72
2017	163.32	1.95	17.52:1	2.64
2018	167.28	2.42	17.56:1	0.23
2019	174.01	4.02	17.95:1	2.22
2020	183.30	5.34	18.37:1	2.34
2021	188.52	2.85	19.04:1 [a]	3.65
2022	197.78	4.91	18.55:1 [a]	-2.57
2023	207.49	4.91	18.00:1 [a]	-2.96
2024	216.35	4.27	17.52:1 [a]	-2.67

[a] The SFR from 2021 to 2024 is not directly provided in the Ministry of Education's Education Bulletin. It is calculated based on the average of three ratios: the SFR of ordinary undergraduate schools, the SFR of undergraduate vocational schools, and the SFR of vocational colleges (junior colleges).

4.5. Change in the PCA and PCV

Although the total amount of educational resources has increased significantly, the per capita indicator presents a more complex situation. From 2014 to 2019, the PCA grew slowly, then showed a trend of increase, decrease, and increase, and finally increased to 28.9 square meters by 2024 (**Figure 5A**). In terms of the annual growth rate of PCA, the highest was 13.72% in 2020 and the lowest was -9.64% in 2022 (**Figure 5B**). The PCV increased from 10,279.54 yuan in 2014 to 19,872.14 yuan in 2024, with a total growth rate of 93.32% (**Figure 5C**). The annual growth rate of PCV first increased and then decreased, showing an overall downward trend, with a minimum of 2.55% in 2022 (**Figure 5D**). The growth rate of resource investment has not kept up with the enrollment scale, resulting in a contradiction between resource investment and enrollment growth rate.

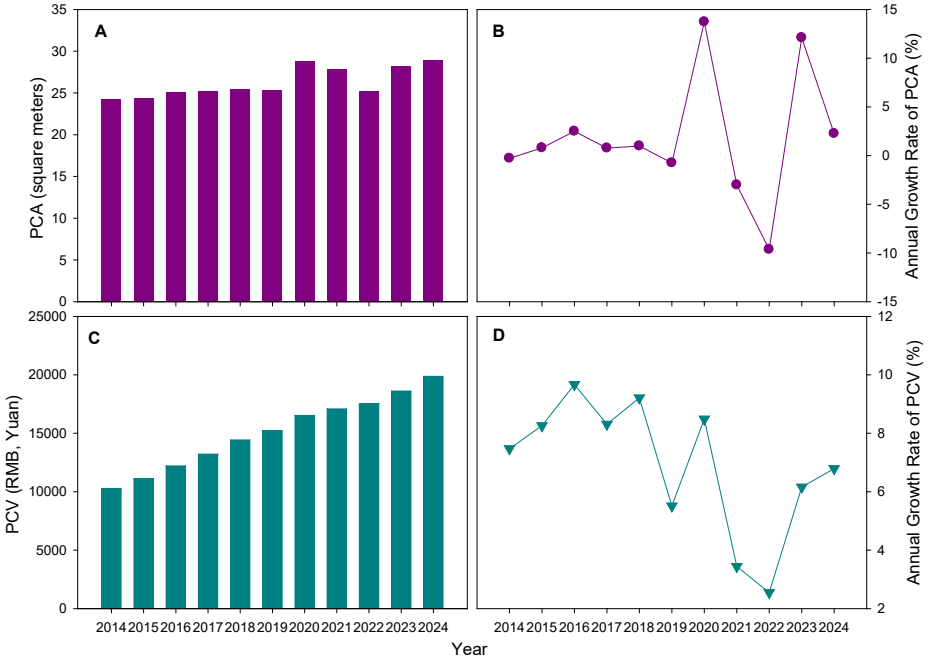

Figure 5. Change of the PCA and PCV from 2014 to 2024

Note: The PCA is calculated by dividing the total building area of the school by the total number of students enrolled. The PCV from 2014 to 2020 is calculated by dividing the total value of teaching and research instruments and equipment by the total number of students in school, because the dates are not provided in the Education Development Statistical Bulletin of the Ministry of Education.

4.6. Comparative analysis of CAGR

The highest total growth rate from 2014 to 2024 has been in the value of PCV, indicating an increase in resource investment (**Table 4**). The total growth rate of SFR has decreased, indicating the optimization of the teaching staff. Compared with the CAGR from 2014 to 2019, the CAGR of GER from 2019 to 2024 decreased, while the growth rate of EQ and FTF increased from 2019 to 2024. The CAGR of PCV over the past decade was the highest at 6.81%, and the CAGR of SFR was the lowest at -0.09%. This indicates that higher education in China has achieved long-term development in the past decade.

Table 4. Total growth rate and CAGR from 2014 to 2024

Educational indicators	Total growth rate from 2014 to 2024 (%)	CAGR from 2014 to 2019 (%)	CAGR from 2019 to 2024 (%)	CAGR from 2014 to 2024 (%)
TSS	36.16	2.37	3.9	3.13
GER	62.13	6.59	3.34	4.95
TNC	10.45	0.92	1.08	1
EQ	72.36	5.02	6.17	5.6
FTF	40.99	2.55	4.45	3.49
SFR	-0.9	0.3	-0.48	-0.09
PCA	19.17	0.85	2.7	1.77
PCV	93.32	8.18	5.47	6.81

A linear correlation analysis was conducted between the ten-year enrollment growth rate and the growth rate of FTF, with an R of 0.0545 and an R^2 of 0.003, $P > 0.05$. There is no linear correlation between the two (**Figure 6A**). A linear correlation analysis was conducted between the ten-year enrollment growth rate and the growth rate of the SFR. There is a highly significant moderate positive linear correlation between the two, with an R of 0.7644, an R^2 of 0.5843, and a P of 0.0061 < 0.01 (**Figure 6B**), indicating that an increase in the annual growth rate of enrollment scale will significantly drive an increase in the annual growth rate of the SFR.

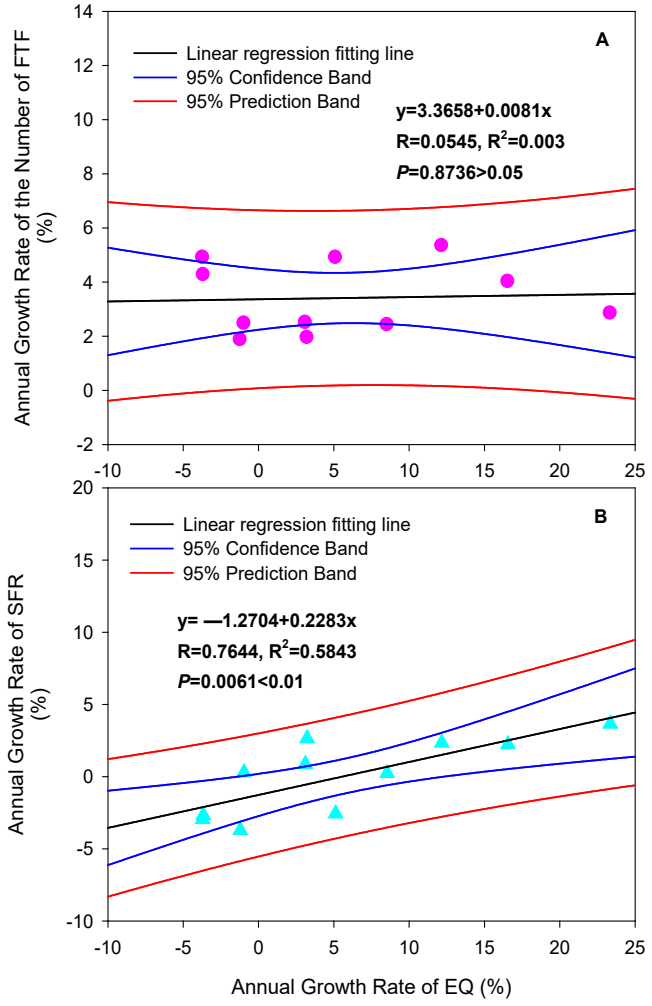

Figure 6. Correlation analysis of annual growth rate of enrollment scale to annual growth rate of the number of FTF and annual growth rate of SFR. $P < 0.01$ indicates extremely significant ($n = 10$).

5. Discussion

In the past decade, Chinese higher education has achieved a dual development of steady expansion in scale and continuous optimization in structure. The gross enrollment rate has increased from 37.5% to 60.8%, and the number of enrolled students has exceeded 48 million, marking a significant improvement in the level of popularization of higher education and in line with the phased goal of building an education powerhouse.

However, the slowdown in scale growth indicates that the focus of higher education development is shifting from quantity expansion to quality improvement.

The structural adjustment of educational institutions has achieved significant results, and the development momentum of vocational colleges is outstanding, with an average annual compound growth rate of 1.64%, far exceeding the number of ordinary undergraduate colleges. This reflects the continued prominent position of vocational education in the higher education system, which meets the demand for technical and skilled talents in industrial upgrading. The shrinking scale of adult colleges reflects the shift in demand from part-time supplementary education to full-time high-quality education among higher education audiences.

The enrollment structure presents differentiated characteristics, with graduate enrollment continuing to expand, undergraduate enrollment growth slowing down, and adult undergraduate and junior college enrollment first increasing and then decreasing, indicating that the hierarchical training system of higher education is constantly improving and gradually adapting to the educational needs of different groups. The construction of the teaching staff is steadily advancing, with the number of faculty increasing to 2.1635 million. The student-faculty ratio has been shrinking in recent years, and the supply capacity of teaching resources continues to be optimized. However, there is no significant linear correlation between enrollment growth rate and faculty growth, and further efforts are needed to improve the matching between faculty allocation and scale growth.

The contradiction between resource investment and scale growth still needs to be resolved. Although the per capita value of teaching administrative buildings and fixed assets continues to increase, the growth rate of resource investment has not fully kept up with the pace of enrollment growth, resulting in fluctuations in per capita resource indicators. The student-faculty ratio is significantly positively correlated with enrollment growth rate, indicating the need to simultaneously strengthen the supply of teaching staff and hardware resources to solve the resource shortage problem caused by scale growth.

In short, in the past decade, China's higher education has achieved high-quality development, but it is necessary to focus on structural optimization, balanced allocation of resources, continuously strengthen the connotation construction of vocational colleges, improve the mechanism of teacher and resource supply, and promote the steady progress of higher education from popularization to high-quality development. Therefore, this study proposes four coordination paths for the future development of higher education in China on how to coordinate the scale and quality of higher education development.

First, we should establish a linkage mechanism between scale regulation and quality assurance. The development of higher education should shift from scale-driven to quality-led. We should establish a four-dimensional comprehensive evaluation system of scale structure quality efficiency, incorporating key considerations such as SFR and average student resources into the allocation of higher education resources.

We should explore the establishment of a flexible enrollment system, dynamically adjust the enrollment scale according to the needs of economic and social development, changes in the job market, and the conditions of higher education institutions. For universities with consistently high student-faculty ratios and inadequate educational conditions, their enrollment growth rate should be limited.

Second, we should strengthen the construction of the teaching staff and optimize the structure of students and teachers. The construction of teaching staff is the fundamental guarantee for improving the quality of education. We should continue to expand the scale of university teachers and strive to reduce the

student-faculty ratio to below 16.5:1 by 2030. Special efforts should be made to strengthen the allocation of teaching staff in vocational colleges and narrow the gap with undergraduate institutions. We should innovate teacher development mechanisms and construct a classification evaluation system. For the teachers in research-oriented universities, we should strengthen evaluations of research and innovation capabilities. For teachers in applied universities, we should emphasize the integration of industry, academia, and research, as well as the contribution of social services. For vocational college teachers, we should focus on practical skills and industry experience.

Third, we should increase resource investment and improve educational conditions. In order to ensure the steady growth of per capita education resources, especially the value of teaching and research equipment should synchronize with GDP growth, it is suggested that the government further increase investment in higher education resources and innovate mechanisms to introduce strong social resources into the development of higher education. At the same time, we should establish a dynamic adjustment mechanism for per capita funding, adjust funding standards in a timely manner according to changes in educational costs, and scientifically plan to achieve sustainable and high-quality development of higher education.

Fourth, we should optimize the type structure of higher education. We should continuously promote the development of vocational undergraduate education, expand enrollment scale, and strive to significantly increase the proportion of vocational undergraduate students to undergraduate students by 2030. Moreover, we should improve the standard system of vocational undergraduate education and highlight the characteristics of different types, and promote the integrated development of vocational education and general education by establishing mechanisms for credit recognition, course sharing, and student status transfer. The applied undergraduate universities were encouraged to transform into vocational undergraduate institutions and form a diversified higher education pattern.

6. Conclusion

In the past decade, higher education in China has achieved a historic leap in scale and entered the stage of popularization development. This achievement has provided important talent support for the country's economic and social development, and made significant contributions to improving the quality of the nation.

However, the expansion of scale also brings quality challenges. The fluctuation of the student-faculty ratio and the slow growth of per capita resources are constraining the high-quality development of higher education. In the next decade, higher education should shift from "whether it exists" to "whether it is good or not," from "big or not" to "strong or not," and take the path of connotative development. This study suggests that the coordinated development of scale and quality is an inevitable choice. By establishing a linkage mechanism, strengthening faculty construction, increasing resource investment, and optimizing the type structure, higher education is fully capable of achieving sustained quality improvement while maintaining a moderate scale, laying a solid foundation for building an education powerhouse.

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Disclosure statement

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