

# The Scale and Structure of Funding Expenditures for China's First-class Universities

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## ABSTRACT

Adequate funding is identified as a crucial factor in ensuring the success of these universities, impacting talent cultivation, scientific research, and social services. Since the 1990s, China has launched several key projects to enhance the development of its first universities and aimed at elevating these institutions to world-class status. Using data from 34 first-class universities in China from 2014 to 2022, this study analyzes the characteristics and differences in expenditure. It employs an independent sample t-test model to compare the C9 League universities with other first-class universities. The findings reveal significant gaps in total expenditure and varying priorities in expenditure categories, with education being the dominant expenditure item. The study concludes with suggestions for optimizing the efficiency of fund utilization to support the development of world-class universities in China.

## 1. Background

In the era of the knowledge economy, economic growth is increasingly inseparable from the creation, processing, and dissemination of knowledge. The construction level of comprehensive and research-oriented universities that integrate teaching, scientific research, and social services is also receiving increasing attention from the country. Since the 1990s, the Chinese government has successively launched key construction projects such as "Project 211", "Project 985" and "985 Project Innovation Platform", aiming to empower a number of key universities and key discipline construction projects to reach world-class levels. In 2015, The State Council of the People's Republic of China issued documents which requires accelerating the construction of a number of world-class universities

and disciplines. In 2017, the ministry of education, the ministry of finance, and the national development and reform commission jointly released a selected list of universities and colleges. It emphasizes increasing supports for leading talents, boldly attempting in fundraising and utilization, highlighting performance orientation, dynamically adjusting support, and aiming to promote a new stage of improvement in higher education level.

Adequate funding is a key factor in ensuring the construction of universities, which has a significant impact on talent cultivation, scientific research, and social services.<sup>[1]</sup> Education funding is the material foundation of higher education, and its use has also received increasing attention from the government and the public. The top research universities in the United States have been increasing their

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funding year by year, accounting for the vast majority of research funding in domestic universities while providing the main output of scientific research.<sup>[2]</sup> To strive for world-class status, Chinese first-class universities should follow leaders as benchmarks. There is still a gap between the level of China's first-class universities and world-class universities. Besides, it is urgent to maintain high-intensity and long-term funding investment, optimize funding allocation methods, grasp our own educational positioning, and explore advantages and characteristics.

## 2. Literature review

Higher education expenditure is an important guarantee for achieving modernization of higher education. The scale of university expenditure often reflects the degree of importance that a country or region attaches to higher education investment, as well as the current development status of higher education scale. The expenditure on higher education in China has doubled from 881.5 billion yuan in 2014 to 1639.7 billion yuan in 2022, with an average annual growth rate of 11%, which is the driving force behind its vigorous development. As early as 2007, top universities in countries such as the United States and the United Kingdom had spent billions of dollars solely on research funding.<sup>[3]</sup> The total funding for contract research and donations at the University of California, Berkeley increased from \$462 million in 2003 to \$714 million in 2012, with a growth rate of 54.55%.<sup>[4]</sup> Compared to the world's top level, the current scale of university funding expenditure in China is still relatively small.

University expenditure details are often divided according to the purpose of use. From a functional perspective, the National Center for Education Statistics (NCES) divides the core expenditure structure of education funds for top universities in the United States into other expenditure categories such as teaching, research, public services, academic support, institutional support, student services, and independent operations. According to Dearden (2012), the funding expenditure of research universities in the UK mainly consists of four parts: personnel expenses, other operating expenses, depreciation of fixed assets, and interest expenses. Among them, personnel expenses include salaries paid to faculty and staff, social security contributions, and retirement funds, accounting for half of the total expenditure.<sup>[5]</sup> Christiana (2011) has outlined the expenditure structure of Nigerian universities, which is roughly divided into teaching, research and management costs, enrollment and training costs, faculty benefits and salaries, and facility maintenance.<sup>[6]</sup>

World-class universities all attach great importance to the rational allocation of resources in their operations to

promote comprehensive development. Just (2009) analyzed the structure of university funding expenditures in the United States and found that teaching, public affairs, and personal support for faculty and staff are the three main components of expenditures.<sup>[7]</sup> Pittman (2012) summarized the commonalities of various funding expenditures of world-class public universities in the United States. Setting aside teaching and research expenditures, the expenditure on providing resources and services for the daily work and learning of teachers, students, and faculty is increasingly valued.<sup>[8]</sup> Ota (2014) analyzed the use of funds at the University of Tokyo and found that the salaries and welfare expenses of full-time and part-time faculty and management personnel have been increasing year by year, with a growth level close to research expenses, but accounting for about three times the total expenditure of research expenses. This provides a superior development environment for top talents.<sup>[9]</sup>

In today's rapidly changing society, the competition for high-end knowledge is becoming increasingly fierce. As a social organization, although universities have the influence to safeguard their own interests, their dependence on external funding is also constantly increasing, thus possessing the dual characteristics of strong independent development and high resource dependence. Funding is the most basic material condition for building a first-class university, and the adequacy of funding is closely related to the development and construction strategy of the university.<sup>[10]</sup> For China's first-class universities, the imperfect expenditure structure and rough data still exist, and there are significant differences between different types of schools. To build a world-class university, it is not only necessary to obtain huge financial support, but also to continuously optimize the efficiency of fund utilization. Therefore, based on the expenditure data of first-class universities in China from 2014 to 2022, this study analyzes the characteristics and differences of expenditure, hoping to provide effective suggestions for the scientific and rational allocation of university funds.

## 3. Methods

### 3.1 Research object

In 2017, the Chinese government announced the list of world-class universities and first-class discipline construction universities and disciplines. The "Double First-Class Initiative" proposes that a number of universities and disciplines are developed into world-class ones, making China an international higher education power. The list of "Double First-Class Initiative" includes 42 universities and colleges which will be developed into first-class ed-

educational institutions. Among them, there are 36 A-level universities. Taking into account their construction backgrounds and major settings, this study selected 34 A-level universities, as shown in Table 1.

At the same time, C9, the first university alliance between top universities in China, represented the highest level of higher education in China, was compared and analyzed with other first-class universities, as shown in Table 1.

At the same time, the C9 League, also known as the China's top university alliance, is a consortium of nine prestigious Chinese universities established in 2009. The members of the C9 League are the highest-ranking univer-

sities in China, representing the country's best academic and research institutions. In this article, the C9 League is compared and analyzed with other first-class universities, representing China's best universities. We integrated the departmental budget data of 34 top universities in China from 2014 to 2022, and comprehensively considered the expenditure structure. It was found that each university had a total of 15 expenditure subjects. In addition, Beijing University of Aeronautics and Astronautics, Beijing Institute of Technology, Harbin Institute of Technology, and Northwestern Polytechnical University only disclose departmental final account information for 2020, 2021, and 2022 to the public as of now.

**Table1.** List of universities

No.	School Name	Type	No.	School Name	Type
1	Peking University	C9	18	Southeast University	/
2	Renmin University of China	/	19	Zhejiang University	C9
3	Tsinghua University	C9	20	University of Science and Technology of China	C9
4	Beijing University of Aeronautics and Astronautics	/	21	Xiamen University	/
5	Beijing Institute of Technology	/	22	Shandong University	/
6	China Agricultural University	/	23	Ocean University of China	/
7	Beijing Normal University	/	24	Wuhan University	/
8	Nankai University	/	25	Huazhong University of Science and Technology	/
9	Tianjin University	/	26	Central South University	/
10	Dalian University of Technology	/	27	Sun Yat-sen University	/
11	Jilin University	/	28	South China University of Technology	/
12	Harbin Institute of Technology	C9	29	Sichuan University	/
13	Fudan University	C9	30	University of Electronic Science and Technology of China	/
14	Tongji University	/	31	Chongqing University	/
15	Shanghai Jiao Tong University	C9	32	Xi'an Jiaotong University	C9
16	East China Normal University	/	33	Northwestern Polytechnical University	/
17	Nanjing University	C9	34	Lanzhou University	/

### 3.2 Research design

For different types of universities, there are significant differences between their environment, size, and other basic characteristics, so they will present development strategies that are more suitable for their own characteristics in terms of expenditure scale and structure. This study introduces an independent sample t-test model to test whether the difference between the mean of two unrelated samples and their respective populations is significant, so as to more accurately determine the group characteristics between different categories of schools and obtain more reliable conclusions. The best universities in China, represented by the C9 League, and other first-class universities are independent samples, denoted as  $x_{ai}$  and  $x_{bj}$ . Mean-

while, sample sizes are respectively denoted as  $n_a$  and  $n_b$ . The difference between the samples is expressed as  $t$ . The calculation is demonstrated in equations as follows:

$$\bar{x}_a = \frac{\sum_{i=1}^{n_a} x_{ai}}{n_a}$$

$$\bar{x}_b = \frac{\sum_{j=1}^{n_b} x_{bj}}{n_b}$$

$$S_p^2 = \frac{\sum_{i=1}^{n_a} (x_{ai} - \bar{x}_a)^2 + \sum_{j=1}^{n_b} (x_{bj} - \bar{x}_b)^2}{n_a + n_b - 2}$$

$$t = \frac{\bar{x}_a - \bar{x}_b}{\sqrt{S_p^2 \left( \frac{1}{n_a} + \frac{1}{n_b} \right)}}$$

where  $i = 1, \dots, n_a, j = 1, \dots, n_b$ .

## 4. Results

### 4.1 Descriptive analysis

This study conducted descriptive statistics on 282 observations from 34 first-class universities in China from 2014 to 2022, as shown in Table 2.

As shown in the table, there is a significant gap in the total expenditure scale of China's first-class universities, with an average of 6,294,027.0 thousand yuan, a maximum of 17,324,005.0 thousand yuan, and a minimum of 3,658,897.0 thousand yuan. From the perspective of expenditure function, except for education, science and technology, and housing security, there are some universities that do not have this expenditure for other projects. For categories that have consistently incurred expenditures over the past nine years, the average education expenditure is 5,689,900.7 thousand yuan, with a maximum of 23,267,300.0 thousand yuan and a minimum of 1,291,597.0 thousand yuan; the average expenditure on science and technology is 568,990.7 thousand yuan, with a maximum of 23,267,300.0 thousand yuan and a minimum

of 1,291,597.0 thousand yuan; the average expenditure on housing security is 568,990.7 thousand yuan, with a maximum of 23,267,300.0 thousand yuan and a minimum of 1,291,597.0 thousand yuan.

The expenditure structure of China's first-class universities shows a more obvious characteristic that exists one core and multiple elements. For each school, education occupies an absolute dominant position, with an average of 90.99%. But the gap between schools still exists, with a maximum value of 98.08% and a minimum value of 42.60%. The proportion of science and technology and housing security is relatively small compared to education expenditure, but they are still important components. The average proportion of science and technology is 5.01%, with a maximum of 54.43% and a minimum of 0.10%; The average proportion of housing security is 2.90%, with a maximum of 7.23% and a minimum of 0.64%. In addition, expenditure items with an average proportion of over 0.01% include general public services, culture, sports and media, social security and employment, health and hygiene, energy conservation and environmental protection, and resource exploration information.

**Table 2.** Descriptive statistics

Items of expenditure	Amount (thousand yuan)				Proportion (%)			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
General public service	1535.9	1896.8	0	11019.2	0.0292	0.0315	0	0.1559
Diplomacy	133.5	562.4	0	5547.2	0.0023	0.0094	0	0.0932
Education	5689907.0	3333776.0	1291597.0	23267300.0	90.9913	11.7891	42.6003	98.0763
Science and technology	322001.7	766529.9	5747.4	3990666.0	5.0101	11.9046	0.1029	54.4275
Culture, Sports and media	2349.7	7047.9	0	77625.5	0.0477	0.1525	0	1.4349
Social security and employment	57233.3	144939.4	0	1130013.0	0.7025	1.6713	0	12.2496
Hygiene and health	47138.5	259443.9	0	1773917.0	0.2741	1.4805	0	9.6248
Energy saving and environmental protection	401.8	1308.7	0	10477.5	0.0110	0.0453	0	0.6048
Agriculture, forestry and water conservancy	265.2	1534.4	0	14723.8	0.0068	0.0405	0	0.3852
Transportation	89.8	602.2	0	5621.7	0.0012	0.0076	0	0.0659
Resource exploration information	1493.9	7008.7	0	88583.7	0.0155	0.0538	0	0.3508
Territorial and Marine meteorology	432.3	3116.6	0	35870.5	0.0094	0.0675	0	0.7649
Housing security	170918.5	98104.9	23176.0	549741.7	2.8970	1.3166	0.6374	7.2251
Disaster prevention and emergency management	82.9	1375.0	0	23088.8	0.0014	0.0228	0	0.3832
Others	42.8	245.8	0	2505.9	0.0006	0.0039	0	0.0398
Total	6294027.0	3658897.0	1732405.0	26775140.0	/	/	/	/
N	282				282			

## 4.2 T-test analysis

This study divided 34 first-class universities in China into the best universities and other first-class universities. The T-test analysis was conducted on the observed values from 2014 to 2022, and the results of the entire dataset in this thesis are shown in Table 3.

The test suggests that from the perspective of education investment level, the best universities in China have demonstrated significant advantages. In terms of the total expenditure scale, the best universities in China have a much higher expenditure level than other first-class universities, with a confidence level of 99%. At the same time, in terms of general public services, education, science and technology, social security and employment, health, and resource exploration information, the expenditure level of the best universities is significantly higher than other first-class universities, with a confidence level of 99%. In addition, in terms of housing security, the ex-

penditure level of the best universities in China is slightly better, with a confidence level of 95%. However, in terms of transportation, the expenditure level of other first-class universities is relatively high, with a confidence level of 90%.

From the perspective of expenditure structure, the best universities in China and other top universities have their own emphasis on the use of funds. In terms of science and technology, health, and resource exploration information, the best universities in China have a significantly higher proportion of expenditure, with a confidence level of 99%. In terms of education and housing security, other first-class universities have a higher proportion of expenditure, with a confidence level of 99%. In addition, in terms of energy conservation, environmental protection, and transportation, other first universities also have a higher proportion of expenditure than the best universities, with a confidence level of 90%.

**Table 3.** T-test by groups divided by university category

Items of expenditure	Amount			Proportion		
	$\bar{x}_a$	$\bar{x}_b$	<i>t</i>	$\bar{x}_a$	$\bar{x}_b$	<i>t</i>
General public service	2201.9	1294.6	3.62***	0.0281	0.0296	-0.36
Diplomacy	150.3	127.4	0.30	0.0011	0.0027	-1.19
Education	8495707.0	4673313.0	9.86***	86.4783	92.6265	-3.97***
Science and technology	653349.5	201948.2	4.52***	9.7541	3.2913	4.14***
Culture, sports and media	2501.5	2294.8	0.22	0.0288	0.0545	-1.25
Social security and employment	92948.9	44292.9	2.51***	0.6813	0.7102	-0.13
Hygiene and health	174711.7	916.3	5.20***	0.9967	0.0123	5.15***
Energy saving and environmental protection	331.5	427.2	-0.54	0.0055	0.0130	-1.23
Agriculture, forestry and water conservancy	183.5	294.9	-0.54	0.0015	0.0087	-1.32*
Transportation	5.2	120.4	-1.42*	0.0000	0.0016	-1.50*
Resource exploration information	4228.5	503.1	4.05***	0.0324	0.0094	3.23***
Territorial and Marine meteorology	256.0	496.2	-0.57	0.0056	0.0108	-0.56
Housing security	190792.5	163717.7	2.06**	1.9859	3.2271	-7.68***
Disaster prevention and emergency management	0	112.9	-11.29	0	0.0019	-0.61
Others	65.7	34.5	0.941	0.0007	0.0006	0.21
Total	9617434.0	5089894.0	10.95***	/	/	/
N	75	207	/	75	207	/

Note: \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

## 5. Findings

### 5.1 Expenditure characteristics

This study found a significant gap in the funding expenditures of China’s first-class universities, although the overall structure remains relatively stable, presenting a “one superpower and several major powers” pattern. Education constitutes the main part of the funding expendi-

ture, accounting for about 90% of the total expenditure of each school, followed closely by science and technology and housing security expenditure. Despite the existing gaps between universities, education, science and technology, and housing security remain the three principal expenditure areas for the best universities in China, represented by the C9 League, as well as other first-class universities. Specifically, these three expenditures account

for 98.22% of the total expenditure in China's best universities, while other first-class universities account for 99.14%.

## 5.2 Differences in expenditure scale

The Chinese government's funding support for the best universities in China significantly exceeds that of other first-class universities, resulting in a considerably higher expenditure level for these top institutions, with an average total expenditure 1.89 times that of other first-class universities. Expenditure items that surpass this ratio include science and technology, social security and employment, health and hygiene, transportation, and others. Notably, the gap in health and hygiene expenditure is the largest, with top universities in China spending 190.66 times more than other top universities. This disparity may be attributed to the relatively comprehensive affiliated medical system structure of the best universities in China. Additionally, other first-class universities exhibit higher expenditures in areas such as energy conservation and environmental protection, agriculture, forestry, water resources, transportation, national land, marine meteorology, disaster prevention, and emergency management, due to their unique professional focuses.

## 5.3 Differences in expenditure structure

For the best universities in China, areas such as science and technology, health and hygiene, and resource exploration information receive significant attention. Science and technology are the core of university development, and this expenditure is crucial for ensuring research efficiency and stability. Furthermore, top universities undertake responsibilities entrusted by the state and society. Conversely, for other first-class universities, education and housing security are currently the primary focuses of their expenditures. Education forms the foundation of university development, with increased education expenditure directly impacting teaching quality, teacher training, and the learning environment. Housing security expenditure alleviates the concerns of high-quality talents, enabling them to fully commit to university work.

## 6. Conclusion and discussion

With the deepening of public finance system reforms and the proposal to establish and improve a modern university system, the efficiency of university fund usage has become a prominent topic in higher education. Although theoretically, the most efficient mode of production is low input and high output, low input can introduce negative factors for development.<sup>[11]</sup> Hence, high input and high

output reflect the current status in higher education.<sup>[12]</sup>

This study conducted a comprehensive analysis of various university expenditures, including the resources consumed for normal operations, aiming to identify appropriate resource allocation models for different types of universities to meet their development needs.

Different types of universities should focus on different financial expenditures. While expanding funding, resources should be allocated according to the university's educational positioning, emphasizing support for advantageous disciplines and characteristic projects. This differentiated expenditure strategy can better fulfill the developmental needs of universities, ensuring effective fund utilization and enhancing the quality and level of the entire Chinese higher education system. However, this does not imply that any university should neglect certain expenditures. Each expenditure is essential, and in practical operation, they need to be coordinated and complemented to achieve the overall development goal of building China's "Double First-Class Initiative".

At present, issues such as extensive financial management, deficiencies in institutional mechanisms, and weak management foundations are becoming more pronounced, necessitating urgent solutions and improvements. Objectively, higher requirements are being placed on universities to use higher education funds efficiently. Concurrently, the higher education development strategy is shifting from large-scale expansion to connotative development. To ensure transparency and effectiveness in fund usage, universities need to promote information disclosure and strengthen performance evaluation. Establishing a scientific performance evaluation system to regularly assess fund usage will improve management levels and educational efficiency.

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