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## FINANCIAL PERFORMANCE EVALUATION USING FACTOR ANALYSIS: A CASE OF J University

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**Abstract:** *The main purpose of this paper is to build financial performance indicators and financial performance evaluation methods suitable for local universities, and to conduct an empirical analysis of local university's financial performance evaluation. With that objective, this paper reviews the literature on indicators and evaluation methods of financial performance in universities, constructs financial performance indicators of the university using factor analysis, and evaluates local university's financial performance based on J University's data. The research shows that: Firstly, the core factors that affect the financial performance of universities are teaching factors and scientific research factors. Secondly, the financial performance indicators mainly include the per funds for staff, the proportion of full-time teachers and staff, the input of funds per student, scientific research income per full-time teacher, the proportion of scientific research income to total income, the employment rate of graduates, the number of graduates, number of Humanities and social sciences, number of natural science projects, the annual growth rate of teaching activities income. Thirdly, the financial performance indicators and evaluation model constructed by factor analysis can evaluate J University's financial performance.*

**Keywords:** Financial Performance indicators, Evaluation Method, University

**JEL Classification:** M41

### 1. Introduction

With the gradual expansion of the scale of universities and the improvement of the gross enrollment rate of universities, the funding of Chinese universities has been increasing, but the education funds of universities are insufficient, the use efficiency of funds is not high, and the level of financial performance is not high. In 2018, the Central Committee of the Communist Party of China and the State Council, and the Ministry of Education 2019 required universities to accelerate the implementation of comprehensive budget performance management, optimize the allocation of educational resources, improve the using efficiency of educational funds and improve the quality of educational services, all of which put forward higher requirements for the financial performance of universities (Budget law of the people's Republic of China, Government accounting system, 2019).

At present, there are several problems in the financial performance of Chinese universities. Firstly, universities simply conduct financial analysis, lacking in-depth analysis of financial performance which reduces the financial performance of universities, and results in the coexistence of insufficient investment, waste of education resources, and low efficiency of funds (Xu, 2013). Secondly, financial performance indicators are not unified and practical. There are great differences between

different types of universities in terms of operation level, teaching level, and scientific research ability, leading to the lack of a unified specification and standard for financial performance indicators (Wang, 2010; Jin, 2011; Mao, 2013; Qiu, 2013, Lv, 2020). Thirdly, the evaluation methods of financial performance in universities are unreasonable (Huang, Wei & He, 2013; Xiao, 2019). As a local public university in Guangdong, J University also has problems such as impractical financial performance indicators, unreasonable financial performance evaluation methods, the low use efficiency of funds, and low level of financial performance (Liao & Li, 2013).

The three functions of a university are talent cultivation, scientific research and social services. To enhance the competitiveness of a university, problems on how to improve the teaching quality and cultivate highly qualified talent have attracted the attention of university administrators (Raponi, Maruotti & Martella, 2016). Whether universities can achieve sustainable development and become famous universities and whether they can obtain strong social influence depend on their talent cultivation. The quality of teachers has a great impact on the quality of students (Wang, 2018). As one of the functions of universities, scientific research is the research achievements made by teachers using scientific research funds, which reflect the scientific research level of teachers and the scientific research ability of universities, and are also the basis for universities to continue to carry out the relevant research (Wen, 2013). As a contributor of social value, universities' social influence is also changing. While cultivating talents, scientific research and serving the society, universities' value is also constantly improving (Jin, 2011).

It is necessary to know the status of universities for continuing the targeted activities of the universities in the field of research and technology. The performance evaluation system is a valuable help in achieving this goal. Therefore, strengths and weaknesses of universities can be recognized by performance evaluation systems (Hassan et al., 2016). Exploring the financial performance of local universities can improve the using efficiency of funds, optimize the allocation of resources, optimize the expenditure structure of local universities, and also improve the level of financial management and the quality of running a school (Shao, 2014; Xu, 2016; Deng, 2019). In the case of the shortage of education funds, the low use efficiency of university funds and the low financial performance, the first objective of this paper is to establish the indicators of financial performance suitable for local universities. The second is to establish a financial performance evaluation method suitable for local universities. The third is to empirically evaluate the local university's financial performance using J University data. With those objectives, this study aims to answer the following questions. What financial performance indicators should local universities adopt? What kind of financial performance evaluation method should local universities adopt? What is the financial performance level of J University?

The plan of the paper is as follows. In Section 2 we describe the literature review, introduce the indicators and evaluation methods of financial performance of universities. The research methodology is described in section 3, along with the measurements and the selection evaluation methods of financial performance, data collection and factor analysis. Findings are discussed in section 4, whereas section 5 provides conclusions.

## **2. Literature Review**

### **2.1 Financial Performance Indicators of Universities**

The relatively perfect financial performance indicators of the university in Britain are jointly established by the Association of University Presidents and the University Appropriation Committee, including input indicators such as resources, human resources and funds, process indicators reflecting the use of funds and financial management of the university, output indicators reflecting teaching and scientific research achievements of universities (The UK Association of Vice Presidents, Principals and University Grants Committee, 1986). The most representative of the United States is

Kentucky's higher education performance indicators, which include five aspects such as education quality, education training, equal opportunity, economic development and quality of life, and the spirit of coordination and initiative (Report of Kentucky Higher Education Commission: the concept paper on performance Funding, 1995). The most representative of China is the Comprehensive Evaluation of University Finance by Professor Yang Zhoufu of Nanjing University, which specifically includes financial benefit indicators, career development performance indicators, industrial benefit indicators, external service performance indicators, and scientific and technological achievements indicators (Yang, 2000).

At present, most of the research on financial performance indicators in universities is related to the selection of indicators and the determination of indicator weights. There are no operable, scientific and complete financial performance indicators. Most Chinese scholars design financial performance indicators of the university from the perspective of financial indicators, without considering non-financial indicators. Some financial performance indicators cannot be quantified, which makes it impossible to conduct the quantitative evaluation in the empirical analysis of the financial performance of universities. Some financial performance indicators of universities lack the analysis of the benefits of funds (He, 2014). Therefore, universities need to build scientific and complete financial performance indicators that are quantifiable, operable and suitable for the actual situation of universities.

According to the functions of talent cultivation, scientific research and social service in universities, the output of universities can be divided into three primary indicators of talent cultivation output, scientific research output and social service output. Each primary indicator can be further subdivided into several secondary indicators or tertiary indicators according to its content (Liu, 2018). Raponi et al. (2016) believed that it is crucial to evaluate university performance which accounts for the several university aspects namely productivity, teaching, fund-raising and research, and internationalization. For any local university, talent cultivation is the first task. When designing the financial performance indicator for talent cultivation, the quantity and quality of talent cultivation are mainly considered. The level of scientific research determines the value status of local universities. Therefore, the measurement of financial performance should have scientific research (Liu, 2021). Social services of universities are mainly reflected through teaching and scientific research achievements. The social service function is based on the two basic functions of talent cultivation and scientific research. Cultivating talents and developing science and technology are all in fact to serve society, but their service methods are relatively indirect (Liu, 2018). Baltaru (2018) believed student attainment, graduate employ-ability and research quality should be considered to the variables measuring the university performance.

The research group on the financial evaluation system of universities (1998) established the financial performance index system of universities, which mainly includes teaching performance, scientific research performance, industrial performance, self-financing performance and asset performance. Such indicators are quantifiable, operable and detailed from the financial perspective, which can systematically evaluate the use efficiency of the fund and operating performance of universities. Liu & Liao (2017) established an index system for financial management performance from five aspects such as teaching and management performance, scientific research performance, and social performance. They made an empirical analysis of the financial data of six local universities in Hunan province, and concluded that teaching performance indicators accounted for the largest proportion of the comprehensive financial performance indicators and were the most important. The teaching performance indicators include the ratio of students to teachers, per student expenditure, the proportion of full-time teachers and staff, per funds for staff and the proportion of personnel expenditure in total expenditure. The scientific research performance indicators include scientific research income per full-time teacher and the annual growth rate of scientific research income. Social

performance indicators include social reputation, the entrepreneurial success rate of excellent graduates and employment rate of graduates. Guo (2017) believed that the indicators of A University were initially divided into teaching performance, scientific research performance and so on. The teaching performance indicators include the ratio of student to teacher, the proportion of full-time teachers to staff, per student expenditure, the proportion of education expenditure to business expenditure, per student equipment expenditure, per funds for staff, annual growth rate of teaching activity income, the proportion of personnel expenditure to the total expenditure, and the ratio of income and expenditure. Scientific research performance indicators include scientific research income per full-time teacher, the rate of return on teaching achievements and the annual growth rate of scientific research income. Wang (2018) believed that the indicators of university career development performance were teaching achievements and scientific research achievements. The indicators of teaching achievements were the ratio of student to teacher, input of funds per student, the change rate of input of funds per student, the number of teaching awards and the number of graduates. The indicators of scientific research achievements are scientific research income per full-time teacher, the change rate of scientific research income per full-time teacher, the number of scientific research awards, and the number of national key projects. Through the gray correlation method to screen the indicators, the indicators of teaching achievements are the ratio of student to teacher and the number of teaching awards. Using the selected financial performance indicators and fuzzy synthesis, the result of budget performance evaluation in A University is generally good. Wang, Zhu & Feng (2018) believed that the budget performance indicators of universities were divided into teaching performance and scientific research performance. The teaching performance mainly included the ratio of student to teacher, the average business expenditure per student and per funds for staff. Scientific research performance mainly referred to scientific research income per full-time teacher and the annual growth rate of scientific research income. Cricelli, Greco, Grimaldi & Dueñas (2018) identified five university performance variables which are the number of published articles, the amount of public funds obtained by the universities for R&D projects, the number of the patents registered by each university, the number of the graduated bachelor students and the number of students of each university in any program. The universities' performance has been approximated by three variables: the number of defended doctoral theses, the number of publications and the number of publications in the first quartile (Sara, David, Nuria & María, 2018). Wei (2019) believed that the teaching performance mainly included the ratio of student to teacher, the number of key disciplines, and the completion rate of the teaching unit expenditure budget. The scientific research performance indicators included the number of scientific research projects per full-time teacher, the number of academic papers published and the citation rate per teacher. It is necessary to derive performance indicators that consider universities as providers of education, research, and services. The variables measuring the university performance are job-finding rates, No. of publications in KCI journals per full-time faculty member and No. of publications in SCI-equivalents journals per full-time faculty member (Lee & Kim, 2019). The indicators measuring teaching achievements are employment rate of students, teacher satisfaction, student satisfaction and so on (Zhang, Jiang & Liu, 2020).

To sum up, scholars generally believed that the teaching performance indicators include the ratio of student to teacher, the proportion of full-time teachers to staff, per funds for staff, annual growth rate of teaching activities income, the one-time employment rate of students, number of key disciplines and input of funds per student. The scientific research performance indicators include scientific research income per full-time teacher, the annual growth rate of scientific research income, the proportion of scientific research income to total income, the number of humanities and social science topics, the number of natural science projects, change rate of scientific research income per full-time teacher, and the number of national key projects. The social service indicators include social reputation, the entrepreneurial success rate of excellent graduates and employment rate of graduates.

## 2.2 Evaluation Method of Financial Performance of Universities

Academics have tried to explore many evaluation methods of the financial performance of universities from different perspectives. Most scholars used a single evaluation method, including Analytic Hierarchy Process (Zuo & Wang, 2020; Liang, Pang & Xiong, 2021), balanced scoring (Abouzar & Asghar, 2011, John & Claire, 2012), data envelopment (Villano & Tran, 2018; Tran & Villano, 2018) and factor analysis. Some scholars used radar analysis, fuzzy mathematics, efficiency coefficient and cloud computing. Some scholars used several methods to conduct quantitative empirical research on the financial performance of universities.

Ma (2010) believed that the factor analysis method solved the problem of index weight setting in the evaluation process and could objectively evaluate the level of financial performance in universities. Using the factor analysis method, Wu (2013) evaluated the financial performance of 25 universities in Wuhan city from five dimensions, including teaching performance, scientific research performance and so on. The results showed that the factors affecting the financial performance of universities were teaching performance and scientific research performance according to their degree of influence. Factor analysis can extract the influencing factors of financial performance in the university and avoid the influence of subjective factors to a certain extent. Li (2014) selected the financial data of 20 different types of undergraduate universities directly under the Department of Education of Henan Province in 2010, carried out calculation and analysis through SPSS software, and used the method of principal component analysis to calculate the comprehensive score of the sample's financial performance indicators. Yuan (2015) took 70 universities affiliated with the Ministry of Education as research samples and used factor analysis to conduct financial performance evaluation and analysis. The results showed that the financial performance level of universities affiliated with the Ministry of Education had obvious regional characteristics. It is believed that the factor analysis method could not only solve the problem of determining financial performance evaluation indicators, facilitate comprehensive analysis and evaluation, but also overcome the shortcomings of subjective determination of reference variables and weights in comprehensive indicator method and analytic hierarchy process, and ensure the objectivity and effectiveness of determining the weight of each financial performance indicator. Ge (2016) conducted an empirical analysis of the financial performance of some universities directly under the Ministry of Education using factor analysis. Yao (2017) used the factor analysis model to determine the financial performance indicators and indicator weights and ranked the financial performance of the sample universities. The results show that the financial performance level of the sample universities shows obvious regional characteristics and the gap between universities in the same region is large. The overall level of financial performance in universities is not high, and there is still much room for improvement.

To sum up, there are rich research achievements on financial performance indicators and advanced financial performance evaluation methods of universities. However, there are no breakthroughs in the research achievements of the financial performance of universities. The research on the financial performance of universities focuses on theory and ignores the operability of research achievements. The implementation of the new government accounting system, comprehensive budget performance management and the new budget law in China require that budget and project expenditure be subject to performance management, which puts forward higher requirements for the research on the financial performance of universities.

## 3. Research Methodology

### 3.1 Measurement of Financial Performance

Based on the above financial performance indicators and the availability of data, this paper selects 15 indicators from the statistical statements of education funds and final statements in local universities as indicators to measure financial performance. Specific indicators are shown in Table

1.

**Table 1. Financial Performance Indicators**

Measurement	Indicators	Symbol of Indicators	Definition
Talent cultivation	The ratio of student to teacher	X11	Number of students/full-time teachers
	Per funds for staff	X12	Total funds/number of staff
	The proportion of full-time teachers and staff	X13	Number of full-time teachers/total number of staff
	The annual growth rate of teaching activities income	X14	(Teaching activities income in the current year-teaching activities income in the previous year)/teaching activities income in the previous year
	The number of key disciplines	X15	
	Input of funds per student	X16	Input of funds/number of students
	Scientific research income per full-time teacher	X21	Scientific research income/number of full-time teachers
Financial performance	Change rate of scientific research income per full-time teacher	X22	(Scientific research income per full-time teacher of this year - Scientific research income per full-time teacher of last year)/Scientific research income per full-time teacher of last year
Scientific research	Annual growth rate of scientific research income	X23	(Scientific research income of this year-Scientific research income of last year)/Scientific research income of last year
	Proportion of scientific research income to total income	X24	Scientific research income/total income
	The number of Humanities and social sciences	X25	
	The number of natural science projects	X26	
	The number of national key projects	X27	
Social service	Employment rate of graduates	X31	Number of graduates employed/number of graduates
	The number of graduates	X32	

### 3.2 Selection of Financial Performance Evaluation Methods

The financial performance indicators designed by the balanced scoring method are mainly non-financial indicators, which cannot be quantified and are not conducive to empirical analysis. Data Envelopment Analysis (DEA) is mainly an input-output indicator, which evaluates the financial performance of the university from the input and output (Villano & Tran, 2018). Radar chart method is mainly used for university ranking (Huang, Wei & He, 2013). It is believed that due to the artificial assignment of weights in the analytic hierarchy process, the results would be subjective. The factor analysis method mainly adopts the idea of dimension reduction to concentrate the information of multiple financial indicators, which is conducive to the centralized evaluation of the financial performance of universities (Wu, 2013; Li, 2014; Yuan, 2015; Ge, 2016). Therefore, this paper

selects factor analysis to construct the main financial performance indicators of the university, and evaluate financial performance of the university.

### 3.3 Sample and Data Collection

The economy of Guangdong Province located in the southern coast of China is developing rapidly and its total economic volume is huge. Guangdong's GDP accounts for 10.87% of Chinese GDP, with an increase of more than 10%. It is the first economical strong province in China (China Bureau of Statistics). Guangdong province has second most number of local public universities. There are 38 local public universities in Guangdong province, accounting for 5.24% of the local public universities in China (The National Statistical Bulletin on the Development of Education issued by the Ministry of Education of China, 2021). J University which is one of the local public university in Guangdong province was selected as the sample.

The data required for the research was derived from the statistics of education funds of universities and the public data of final accounts of universities from 2010 to 2021. The financial performance of J University is evaluated using factor analysis through SPSS software.

### 3.4 Data Standardization

Wang (2013), Li (2014) and others believed that the data should be standardized before subjecting to factor analysis. The transformation formula is:  $X_{ij} = (X_{ij} - X) / S_t$ .  $X_{ij}$  is the Standardized data,  $X_{ij}$  is the original score,  $X$  is the total average value, and  $S_t$  is the standard deviation.

### 3.5 Factor Analysis

The purpose of factor analysis is to classify several closely related variables into the same category. Each category of variables becomes a factor, and a few factors reflect most of the information of the original data. The basic idea of factor analysis is to reduce dimensions. It is to synthesize various indicator variables with complex relationships into a few random variables through the study of various variables. That is to describe multiple indicators with a few random variables (Ma, 2010).

The first step is correlation test. Correlation test is the precondition of factor analysis. The second step is KMO test and Bartlett's sphericity test. In factor analysis, correlation analysis is required for the original variables. Bartlett sphericity test and KMO test were used by SPSS. Yuan (2015) believed that the larger the KMO value, the more common factors among variables, the more suitable for factor analysis. When  $KMO < 0.5$ , it means that factor analysis cannot be carried out. Li (2014) believed that Bartley spherical test was used to test whether the correlation matrix was a unit matrix. If the test result did not reject the unit matrix hypothesis ( $P > 0.05$ ), factor analysis should be used cautiously. The third step is factor extraction. Factor extraction generally only needs to extract factors with eigenvalues greater than 1. The fourth step is factor rotation. After factor rotation, the variables are divided into corresponding main factors according to the factor matrix after the rotation axis. The fifth step is to calculate the score of each main factor. The factor score coefficient matrix shows the factor score coefficient of each factor. A factor score equation is created according to the coefficient. The sixth step is to calculate the comprehensive score. With the variance contribution rate of each factor after the main factor is rotated as the weight, a comprehensive score equation  $F$  is established to calculate the comprehensive evaluation value.

## 4. Findings

### 4.1 Background J University

J University is a provincial public local university with more than 28000 full-time students. The university has trained more than 200000 talents for the society, and has trained many talents such as excellent teachers and engineers. The university is committed to serving the local economic and

social development. It has several influential industry university research collaborative innovation platforms, cooperates with many enterprises and institutions, and undertakes a large number of horizontal scientific research projects. At present, J University conducts simple statistics and analysis on the implementation progress of financial funds every month, and conducts comparative analysis on budget and final accounts in the annual financial report, but it does not integrate the concept of performance into financial analysis and financial management, and does not effectively analyze financial performance.

**4.2 Factor Analysis**

**4.2.1 Correlation test**

After the data is standardized, the SPSS statistical analysis software is used for correlation analysis. From the correlation coefficient matrix among variables, most of the correlation coefficients are greater than 0.3, and the commonality between variables is high.

**4.2.2 KMO test and Bartlett's sphericity test**

The value of KMO test is 0.568 which is greater than 0.5. Bartlett's sphericity test statistic is 485.465, and the corresponding probability sig is 000. Therefore, it can be considered that the correlation coefficient matrix is significantly different from the unit matrix, indicating that factor analysis is suitable.

**4.2.3 Factor extraction**

Factor extraction generally only needs to extract the factors whose eigenvalue is greater than 1. It can be seen from Table 2 that there are five values with eigenvalues greater than 1, which are taken as the main factors and named F1-F5. Its variance contribution rates are 30.293%, 25.143%, 16.021%, 8.948% and 8.009% respectively. The cumulative variance contribution rate of the five factor variables is 88.41%, which reflects most of the information of the original variables.

**Table 2. Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance		Total	% of Variance		Total	% of Variance	
		Cumulative %			Cumulative %			Cumulative %	
1	6.720	44.799	44.799	6.720	44.799	44.799	4.544	30.293	30.293
2	2.832	18.877	63.676	2.832	18.877	63.676	3.771	25.143	55.436
3	1.652	11.015	74.691	1.652	11.015	74.691	2.403	16.021	71.457
4	1.047	6.981	81.672	1.047	6.981	81.672	1.342	8.948	80.405
5	1.011	6.741	88.414	1.011	6.741	88.414	1.201	8.009	88.414
6	.797	5.316	93.730						
7	.380	2.530	96.260						
8	.233	1.554	97.814						
9	.182	1.211	99.025						
10	.137	.912	99.937						
11	.009	.063	100.000						
12	5.353E-16	3.568E-15	100.000						
13	3.599E-16	2.399E-15	100.000						
14	-	-	100.000						
	2.849E-17	1.900E-16							
15	-	-	100.000						
	2.110E-16	1.406E-15							

Note: Extraction Method: Principal Component Analysis.



#### 4.2.4 Factor rotation

Table 3 shows the results of orthogonal rotation with maximum variance. After factor rotation, the variables are divided into corresponding main factors according to the factor matrix after the rotation axis.

**Table 3. Rotated Component Matrix**

Variable	Component				
	1	2	3	4	5
X11	-.885	-.038	.028	.149	.124
X12	.885	.299	-.304	-.058	.021
X13	.966	.015	-.046	.028	-.045
X14	-.164	-.076	.033	.036	.955
X15	-.266	-.404	-.172	.139	.074
X16	.862	.269	-.251	-.251	-.172
X21	.296	.925	-.117	-.075	-.075
X22	-.490	.585	.139	.178	-.115
X23	-.048	-.831	.186	.038	.067
X24	.250	.952	.044	.013	-.004
X25	.513	.495	-.433	.322	-.033
X26	-.088	-.484	.603	.391	.155
X27	-.186	.348	-.405	.096	-.030
X31	.157	.114	.816	-.900	-.016
X32	.694	.179	.874	.069	-.433

Note: Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

The first factor is per funds for staff X12, proportion of full-time teachers and staff X13, and input of funds per student X16. These factors are mainly teaching performance and can be called teaching factors. The second factor is scientific research income per full-time teacher X21, proportion of scientific research income to total income X24. Such factors are mainly scientific research performance, which can be called scientific research factors. The third factor is employment rate of graduates X31 and number of graduates X32. These factors are mainly about social service which can be called social service factors. The fourth factor is number of Humanities and social sciences X25 and number of natural science projects X26. These factors are mainly about non-financial indicator which can be called non-financial indicator factors. The fifth factor is annual growth rate of teaching activities income X14.

#### 4.2.5 Scoring of each main factor

The component score coefficient matrix of table 4 displays the score coefficients of each component, and the factor score equation is created according to the coefficients.

**Table 4. Component Score Coefficient Matrix**

Variable	Component				
	1	2	3	4	5
X11	-.257	.051	-.170	.105	.007
X12	.215	.031	-.005	.036	.164
X13	.293	-.047	.135	.049	.075
X14	.072	.064	-.063	.011	.888
X15	.086	-.051	.398	-.056	-.032
X16	.193	.000	.065	-.139	-.027
X21	.018	.260	.053	.014	.043
X22	-.171	.217	.009	.152	-.130
X23	.071	-.224	-.010	.207	-.019
X24	.040	.291	.126	.060	.100
X25	.065	.120	-.201	.388	.087

X26	.124	-.077	.244	.196	.069
X27	.072	.175	.505	-.059	-.064
X31	-.001	-.033	.092	-.727	.027
X32	.091	-.033	-.109	.156	-.300

Note: Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

$$F1 = -0.257X11 + 0.215X12 + 0.293X13 + 0.072X14 + 0.086X15 + 0.193X16 + 0.018X21 -$$

$$0.171X22 + 0.071X23 + 0.04X24 + 0.065X25 + 0.124X26 + 0.072X27 - 0.001X31 + 0.091X32$$

$$F2 = 0.051X11 + 0.031X12 - 0.047X13 + 0.064X14 - 0.051X15 + 0.26X21 + 0.217X22 - 0.224X23 + 0.291X24 + 0.12X25 -$$

$$0.077X26 + 0.175X27 - 0.033X31 - 0.033X32$$

$$F3 = -0.17X11 - 0.005X12 + 0.135X13 - 0.063X14 + 0.398X15 + 0.065X16 + 0.053X21 + 0.009X22 - 0.01X23 + 0.126X24 -$$

$$0.201X25 + 0.244X26 + 0.505X27 + 0.092X31 - 0.109X32$$

$$F4 = 0.105X11 + 0.036X12 + 0.049X13 + 0.011X14 - 0.056X15 -$$

$$0.139X16 + 0.014X21 + 0.152X22 + 0.207X23 + 0.06X24 + 0.388X25 + 0.196X26 - 0.059X27 - 0.727X31 + 0.156X32$$

$$F5 = 0.007X11 + 0.164X12 + 0.075X13 + 0.888X14 - 0.032X15 - 0.027X16 + 0.043X21 - 0.13X22 -$$

$$0.019X23 + 0.1X24 + 0.087X25 + 0.069X26 - 0.064X27 + 0.027X31 - 0.3X32$$

#### 4.2.6 Comprehensive scoring

The factor analysis method is used to calculate the financial performance. With the variance contribution rate of each factor after the main factor is rotated as the weight, the comprehensive score equation F is established to calculate the financial performance.

$$F = (F1 * 0.3 + F2 * 0.25 + F3 * 0.16 + F4 * 0.09 + F5 * 0.08) / 0.88$$

According to the comprehensive score equation F in the table 4, the evaluation values of financial performance are the year of 2021, 2014, 2020, 2019, 2013, 2016, 2015, 2012, 2017, 2018, 2010 and 2011 in descending order. The F values are 0.96, 0.63, 0.33, 0.31, 0.22, -0.01, -0.10, -0.40, -0.41, -0.41, -0.44 and -0.68 respectively.

**Table 5. The Comprehensive Score**

Time	2021	2014	2020	2019	2013	2016	2015	2012	2017	2018	2010	2011
F	0.96	0.63	0.33	0.31	0.22	-0.01	-0.10	-0.40	-0.41	-0.41	-0.44	-0.68

### 5. Discussion and Conclusion

#### 5.1 Discussion

Firstly, from the table 2, there are five factors which are taken as the main factors affecting the financial performance of universities, its variance contribution rates are 30.293%, 25.143%, 16.021%, 8.948% and 8.009% respectively. According to the table 3, the first teaching factor is per funds for staff, proportion of full-time teachers and staff, and input of funds per student. The second scientific research factor is scientific research income per full-time teacher, proportion of scientific research income to total income. The third social service factor is employment rate of graduates and number of graduate. The fourth non-financial factor is number of Humanities and social sciences and number of natural science projects. The fifth factor is annual growth rate of teaching activities income. The core factors are teaching factors and scientific research factors. Liu & Liao (2017) concluded that teaching performance indicators were the most important. Wu (2013) also showed that the factors affecting the financial performance of universities were teaching performance and scientific research performance according to their degree of influence. From the table 4, the financial performance indicators of universities are mainly per funds for staff, proportion of full-time teachers and staff, input of funds per student, scientific research income per full-time teacher, proportion of scientific research income to total income, the employment rate of graduates, number of graduates, number of Humanities and social sciences, number of natural science projects, annual growth rate of teaching activities income. All these indexes of financial performance are also recognized according to the above literature review (Liu & Liao, 2017; Guo, 2017; Wang, 2018; Wang, Zhu & Feng, 2018). This achieves the objective to establish the indicators of financial performance suitable for local

universities in China and answers the research question what financial performance indicators should local universities adopt in China?

Secondly, using factor analysis can commendably evaluate the financial performance of local university in China. The financial performance scores in 2021, 2014, 2020, 2019 and 2013 are high according the table 5. To sum up, the factor analysis can construct the indexes of financial performance and obtain financial performance scores of university, so it is a good evaluation method which can effectively evaluate financial performance of university. Wu (2013); Li (2014); Yuan (2015) & Ge (2016) also agreed that the factor analysis method can well evaluate the financial performance of universities. This achieves the objective to establish a financial performance evaluation method suitable for local universities in China and to empirically evaluate the local university's financial performance using the data of J University in China. Then it answers the research question what kind of financial performance evaluation method should local universities adopt in China and what is the financial performance level of J University in China?

## 5.2 Conclusion

This paper constructs the financial performance indicators of universities from different angles, and uses factor analysis to construct a comprehensive evaluation model of financial performance in universities through factor scores, to evaluate J University's financial performance. The following conclusions are drawn from the evaluation results. Firstly, the core factors that affect the financial performance of universities are teaching factors and scientific research factors. Secondly, the financial performance indicators of universities are mainly per funds for staff, proportion of full-time teachers and staff, input of funds per student, scientific research income per full-time teacher, proportion of scientific research income to total income, the employment rate of graduates, number of graduates, number of Humanities and social sciences, number of natural science projects, annual growth rate of teaching activities income. The third is to use the financial performance model of universities to rank the financial performance of J University. The evaluation result is that the financial performance scores in 2021, 2014, 2020, 2019 and 2013 are high. In these years, the indicators of teaching, scientific research and social service of J University are in the forefront, with a high level. This reflects that J University has begun to implement comprehensive budget performance management in recent years, which has improved the financial performance level of J University.

Teaching and scientific research are the basic and primary tasks of universities in the process of running a university. It not only affects the level of financial performance in universities, but also affects the overall quality and level of teaching and scientific research of universities. Therefore, in order to improve the financial situation of universities, it is necessary to focus on the teaching and scientific research of universities, and fundamentally enhance the core competitiveness, so that universities can develop steadily for a long time.

The main limitation of this paper are as follows. Firstly, some financial performance indicators used in this paper may have different classification criteria, and there are still gaps between the calculation methods of some indicators and international calculation standards. When conditions are ripe, try to compare with the same criteria to make the comparison more consistent. Secondly, this paper standardized data when using factor analysis to conduct empirical research. The final comprehensive score of financial performance evaluation is only of relative significance and cannot represent an absolute level.

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