

# A Study on the Influencing Factors and Sensitivities of Regional Differences in Chinese-foreign Cooperation in Higher Education\*

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**Abstract**—Chinese-foreign cooperation in higher education is a way of cross-border education and an important part of China's higher education. The spatial distribution, scale and level of Chinese-foreign cooperation in running schools in different regions are affected by environmental conditions, making Chinese-foreign cooperation in running schools in different regions show obvious differences. Such differences have an impact on the balanced development of higher education and the development of Chinese-foreign cooperation in running schools. Based on provincial-level statistical data, this paper studies the influencing factors and sensitivities of regional differences in Chinese-foreign cooperation in higher education, and puts forward corresponding policy suggestions. The empirical analysis shows that: first, the level of regional economic development, regional internationalization, educational resources and government support have a significant role in promoting the development of Chinese-foreign cooperative in running schools; second, the financial expenditure of public education and the demand of international education resources in all provinces have an inhibitory effect on the development of Chinese-foreign cooperative in running schools; third, the difference of Chinese-foreign cooperative education between graduate students in different provinces is significantly related to the degree of government support and the level of regional economic development.

**Keywords**—higher education; Chinese-foreign cooperation in running schools; regional differences; influencing factors; sensitivity

## I. INTRODUCTION

In accordance with the regulations on "Regulations on Chinese-foreign Cooperation in Running Schools" and "Measures for the Implementation of Regulations on Chinese-foreign Cooperation in Running Schools", Chinese-

foreign cooperation in running schools means that Chinese educational institutions and foreign educational institutions jointly hold legal educational and teaching activities in China with Chinese citizens as the main target students [1]. Chinese-foreign cooperation in higher education is a school-running institution or project established by a university for the main purpose of undergraduate and graduate education. Chinese-foreign cooperation in running schools is of great significance to accelerating the development of higher education, promoting the diversification of higher education forms, optimizing the geographical distribution pattern of regional higher education, and realizing the balanced development of national higher education.

Over the past 40 years since reform and development, great achievements have been made in the scale, level and standard of Chinese-foreign cooperation in higher education. Guided by the strategic goal of internationalization of higher education, along with the deepening of national strategic layout and external development of "the Belt and Road Initiative", the development of Sino-foreign cooperation in running schools has entered a new stage of scale expansion, quality improvement, efficiency improvement and balanced development [2]. However, due to the influence and restriction of regional economic development level, distribution of educational resources, degree of opening to the outside world and other environmental factors, Chinese-foreign cooperation in higher education shows regional differences in spatial distribution, quality and scale of running schools. This difference has an impact on the distribution pattern and regional balanced development of China's higher education, as well as the development of Chinese-foreign cooperation in running schools. Then, what are the factors that affect the regional differences of Chinese-foreign cooperation in higher education? How much do different factors affect regional differences? To solve and balance the influence of these objective conditions has become an important problem in front of educational management decision makers.

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As for the regional development of Chinese-foreign cooperation in higher education, existing researches have been discussed from different perspectives, which can be roughly divided into the following three categories. In the first category, the overall regional differences of Chinese-foreign cooperative education in higher education are analyzed macroscopically, and the development status of public colleges, private colleges, cooperative schools and other higher education is analyzed according to provinces and geographical regions, so as to study regional differences, unbalanced characteristics, causes and influencing factors. For example, Li Jing and He Shengsheng constructed an indicator system to analyze the imbalance and difference of higher education in 31 provinces from the aspects of education scale, education infrastructure and education expenditure [3]; Chen Yue studied the problems, causes and countermeasures of uneven development of higher education and regional differences [4]; Hou Longlong and Xue Lan used the Theil index as the main index to analyze the regional development gap and imbalance of regional higher education [5]. The second category of research analyzes the present situation of Chinese-foreign cooperation in higher education in China and the overall regional characteristics of its development. Li Yang analyzed the number of Chinese-foreign cooperative school-running projects, school-running levels and regional distribution status and characteristics of cooperative universities in China, and pointed out the development orientation of the four regions of the east, west, central and northeast China [6]; Guo Qiang studied the regional characteristic model and its construction of Chinese-foreign cooperation in running schools in higher education [7]; Wang Haichao studied the characteristics, problems and countermeasures of Chinese-foreign cooperation in running schools along "the Belt and Road" Route [8]. The third category analyzes the factors influencing the development of Chinese-foreign cooperation in higher education. Chen Liping and Zhu Yucheng studied the attribution and countermeasures of problems in the education coordination of Chinese-foreign cooperative school-running provincial governments [9]; Yan Xiao has studied the influencing factors of introducing high-quality educational resources into Chinese-foreign cooperative education [10]; Zhong Kai studied the impact of cultural conflicts on Chinese-foreign cooperation in running schools [11]; and Guo Qiang pointed out in his research on the development of Chinese-foreign cooperation in running schools under the "the Belt and Road" perspective that economic development has a significant impact on Chinese-foreign cooperation in running schools in the region [12].

The above research literature on the development of Chinese-foreign cooperation in regional higher education has the following characteristics: first, there are many researches on the overall regional development of higher education, yet relatively few on the regional development of Chinese-foreign cooperation in higher education; second, there are more qualitative analysis and less empirical research; third, there are many studies on the differences and spatial distribution characteristics of Chinese-foreign cooperation in running schools in different regions, and lack of literature materials to specifically analyze the regional differences and

unbalanced objective factors of Chinese-foreign cooperation in running schools. In view of the above characteristics, this paper makes an empirical study on the influencing factors of regional differences in Chinese-foreign cooperative running schools in higher education in China by taking relevant data of Chinese-foreign cooperative running schools in 31 provinces of China and combining with relevant data such as China Statistical Yearbook and Educational Statistical Yearbook of China. This paper analyzes the support of local government, regional openness to foreign and local economic development level and the education development level on the effects of regional differences and the sensitive degree of Chinese-foreign cooperation in running schools, and, according to the results of the empirical analysis on the development of higher education area of Chinese-foreign cooperation in running schools and higher education in China the balanced development of countermeasures and suggestions are put forward.

## II. VARIABLE SELECTION, DATA SOURCE AND MODEL SETTING

### A. Variable Selection and Data Sources

In this study, the number of Chinese-foreign cooperative school-running projects and institutions of undergraduate and graduate students in 31 provinces (except Hong Kong, Macao and Taiwan) as of September 2018 is taken as the explanatory variable, and the level of economic development, openness to the outside world, the level of provincial fiscal expenditure, the number of teachers in universities and colleges, and the level of government support of 2018 according to the China Statistical Yearbook are taken as the explanatory variables. Variable data were obtained from the Chinese-foreign cooperative school-running supervision network of the ministry of education, China statistical yearbook, China statistical yearbook of education and so on.

1) *Number of Chinese-foreign cooperative school-running institutions and projects (NCFCP) for undergraduate and graduate students:* The NCFCP for undergraduate and graduate students accounts for 50% of the total [13], and Chinese-foreign cooperative education for undergraduate and graduate reflects the quality of the Chinese-foreign cooperation in running schools, so the undergraduate and graduate project of Chinese-foreign cooperation in running schools and institutions can objectively reflect the differences between such cooperative run schools in different provinces. Different from previous studies, the data of Chinese-foreign cooperative education projects and institutions in this study exclude the suspended projects in the evaluation of the cooperative education published by Chinese-foreign cooperative supervision network of the ministry of education, thus the data truly reflect the actual level and difference of Chinese-foreign cooperation in running schools in different provinces.

2) *Economic development level of each province:* The level of economic development is a sign to measure the

economic differences between regions and their development stage. Liu Cui, Bai Yanfeng et al. took economic factors as the main explanatory variables when analyzing the regional allocation and uneven development of higher education resources [14] [15]. Therefore, in this study, regional GDP, per capita GDP and regional residents' consumption level (CL), which measure the level of regional economic development, are also used as explanatory variables to measure regional differences in Chinese-foreign cooperative education.

3) *Proportion of Foreign Investment (PFI) to GDP*: PFI reflects the attractiveness of the regional investment environment and economic development to foreign capital, as well as the level of regional demand for international educational resources. The essence of Chinese-foreign cooperation in running schools is cross-border education, which reflects the introduction of international educational resources. Regions with backward higher education and scarce educational resources have strong demand for international educational resources to make up for the shortage of domestic higher education. Zheng Zhanpeng and Yue Shuai considered the influence of regional ability to absorb foreign capital when analyzing regional differences in higher education resources allocation [16], and this paper uses it for reference.

4) *Goods of Foreign-funded Import and Export (GFIE)*: The GFIE of each province reflects the degree of regional economic internationalization and openness to the outside world. Regions with high GFIE have significant differences with other regions in terms of international exchange and demand for international talents, providing soil for the development of Chinese-foreign cooperation in running schools. Chinese-foreign cooperation in running schools reflects the internationalization of education, and the internationalization of higher education is one of the goals of the current national education reform. This paper makes an exploratory analysis of commodity import and export volume as an alternative variable of regional openness and internationalization of higher education.

5) *Fiscal expenditure*: Regional macroeconomic development is the external environment of higher education development, affecting the development of higher education. And the level of regional higher education financial expenditure has a direct impact on higher education. Bai Yanfeng et al. studied the financial reasons for the unbalanced development of higher education and pointed out the relationship between regional education fiscal expenditure and higher education development [14]. This paper takes the educational spending (ES) and consumer spending (CS) of provincial governments as explanatory variables to analyze the impact of fiscal expenditure on the development of regional Chinese-foreign cooperation in running schools.

6) *Higher education resources*: The quality of the regional higher education resources has an important impact

on Chinese-foreign cooperation in running schools. Li Yang pointed out in his research on regional Chinese-foreign cooperation in running schools that regional universities, especially key ones, take the lead in using high-quality educational resources to carry out Chinese-foreign cooperation in running schools, introduce advanced foreign educational models and play a leading and exemplary role [6]. The number of key universities and normal ones, the number of college students, the level of teachers and the ratio of teachers to students are all indexes to measure the quality difference of higher education in different regions [17]. The process of Chinese-foreign cooperation in running schools relies heavily on the teaching staff of domestic universities. Therefore, in this paper, based on the requirements of Chinese-foreign cooperative education for teachers in Chinese-foreign cooperative universities and the measurement methods of Hou Longlong, Li Xiaohui and others [5], [18], the number of teachers (NT) in regional higher education is taken as the explanatory variable of the differences of Chinese-foreign cooperative education in regional higher education.

7) *Local of Government Support (LGS)*: LGS is the regional policy support for Chinese-foreign cooperation in higher education. Although national policies and regulations have unified requirements for Chinese-foreign cooperative education, different provinces have different degrees of support for Chinese-foreign cooperative education and different degrees of implementation of policies. LGS is one of the influencing factors of the differences between Chinese and foreign cooperative schools. Chen Liping and Zhu Yucheng studied the issue of education coordination of provincial governments in Chinese-foreign cooperative school-running, and demonstrated the impact of local government actions on Chinese-foreign cooperative school-running [9]. It is easy to get the influence of government behavior on Chinese-foreign cooperative education from the practical experience, but it is very difficult to compare the difference of government behavior between provinces and choose appropriate indicators to measure. This paper measures LGS by adding dummy variables, and distinguishes whether provinces participate in the "Chinese-foreign cooperative school-running provincial government education overall planning pilot project" of the ministry of education. Participation in the pilot programs shows a high LGS, while failure to participate in the pilot indicates a low LGS. Currently, Shanghai, Zhejiang, Beijing, Yunnan and other provinces are included in the pilot program of Chinese-foreign cooperative education at provincial level [19].

## *B. Model Setting*

The linear regression model can reflect the correlation between variables and reveal the correlation between regional differences in Chinese-foreign cooperative education and explanatory variables in higher education. This study adopts linear regression model to conduct

regression analysis and sensitivity analysis on the number of Chinese-foreign cooperative school-running institutions and projects (NCFCP) of undergraduate and postgraduate higher education in 31 provinces, municipalities directly under the central government and autonomous regions (excluding Hong Kong, Macao and Taiwan) and its influencing factors. Through the exploration and analysis of variable correlation coefficient and variable regression significance, the model is set as follows:

$$NCFCP = \alpha_0 + \alpha_1 CI + \alpha_2 PFI + \alpha_3 GFIE + \alpha_4 ES + \alpha_5 NT + \alpha_6 LGS + \delta \quad (1)$$

$$NCFCP_1 = \beta_0 + \beta_1 CS + \beta_2 PFI + \beta_3 GFIE + \beta_4 ES + \beta_5 NT + \beta_6 LGS + \theta \quad (2)$$

$$NCFCP_2 = \gamma_0 + \gamma_1 CI + \gamma_2 LGS + \mu \quad (3)$$

In the formula: NCFCP refers to the total number of Sino-foreign cooperative programs and institutions of undergraduate and graduate students in higher education of each province; NCFCP<sub>1</sub> refers to the number of Chinese-foreign cooperative school-running institutions and projects for undergraduate in higher education of each province; NCFCP<sub>2</sub> refers to the number of Chinese-foreign cooperative school-running institutions and projects for postgraduates in higher education of each province; CL represents the residents' consumption level of each province; PFI represents the proportion of foreign investment to GDP in each province; GFIE represents the goods of foreign-funded import and export; ES represents the education spending of each province; CS represents consumer spending by

residents in each province; NT represents the number of teachers in universities of each province; and LGS stands for local government support government support.  $\alpha_0$ ,  $\beta_0$ ,  $\gamma_0$  are constant terms.  $\alpha_i$ ,  $\beta_j$ ,  $\gamma_k$  ( $i, j = 1-6, k = 1, 2$ ) are partial regression coefficient, representing the sensitivity coefficients of influencing factors of NCFCP. They show the number that Chinese-foreign cooperative programs and institutions in higher education will change for every change in these factors by 1 unit.  $\delta$ ,  $\theta$ ,  $\mu$  are random perturbations, indicating the influence of other factors other than the above factors on Chinese-foreign cooperation in higher education.

### III. EMPIRICAL ANALYSIS

#### A. Data Standardization

Since the data units of selected variables are not uniform and the number of different indexes varies greatly, direct analysis tends to highlight the influence of large data on explained variables. In order to eliminate the influence of different data dimensions on regression results and interpretation of results, this paper firstly standardizes the data and adopted standard deviation as the unit of data analysis model to analyze the degree of influence of respective variables on dependent variables. The standardized formula is: (variable value - mean)/standard deviation. Stata15 is used to standardize all the variables in this paper. Descriptive statistics of all variables after standardization are shown in "Table I".

TABLE I. DESCRIPTIVE STATISTICS

VarName	Mean	SD	Min	Median	Max
NCFCP	0.00	1.00	-1.129012	-.4055457	2.393955
NCFCP1	0.00	1.00	-1.085851	-.4184498	2.362387
NCFCP2	0.00	1.00	-.656032	-.358158	3.315621
CI	0.00	1.00	-.9113705	-.4538645	2.742189
NT	-0.00	1.00	-1.665169	-.3888116	1.972921
ES	0.00	1.00	-1.499354	-.1830235	3.051435
LGS	0.21	0.42	0	0	1
PFI	0.00	1.00	-.8603407	-.5195042	2.941386
GFIE	-0.00	1.00	-.5474337	-.433979	3.416938

#### B. Exploratory Analysis

With so many factors influencing the regional distribution of Chinese-foreign cooperation in higher education, this paper uses a total of 24 explanatory variables or substitution variables of 7 categories to conduct exploratory analysis on the influencing factors of the explained variables in the process of constructing the above regression analysis model. It uses descriptive statistics and regression analysis to test the significance and correlation between variables, to avoid the autocorrelation and multicollinearity between explanatory variables in the model, and to conduct exploratory analysis on the influencing factors of Chinese-foreign cooperative education at the undergraduate and graduate levels respectively.

When considering the economic factors affecting the regional higher education, one can find that although provincial GDP or per capita GDP has a significant impact on the differences in Chinese-foreign cooperation in higher

education, which is highly correlated with the distribution of higher education resources, financial expenditure and other influencing factors, therefore in the modeling process, the household consumption level (CL), which also reflects the level of regional economic development and is highly correlated with GDP, is used as the substitute variable. As for regional higher education resource variables, the measurement indicators include the number of universities, the number of college students, the level of teachers, the ratio of teachers to students, etc., through exploration and analysis, therefore indicators such as the number of colleges and universities with high correlation with other variables and the teacher-student ratio are deleted, and only the number of teachers (NT) in college with high correlation with the number of Chinese-foreign cooperative schools is retained as the substitute variable. As for fiscal expenditure, the education expenditure (ES) and the final expenditure (CS) of each province have a significant impact on the number of Chinese-foreign cooperation in running schools in the region,

however, exploratory analysis finds that the final consumption expenditure of provincial residents is highly correlated with other variables (the correlation coefficient with CL is 0.96). Therefore, this variable is deleted when analyzing the total number of Chinese-foreign cooperative schools, but this variable has a greater impact on Chinese-foreign cooperative schools at the undergraduate level, so CS is used when analyzing the influencing factors of Chinese-foreign cooperative schools at the undergraduate level. Two variables, the proportion of foreign investment (PFI) to gross domestic product and the trade volume of commodity import and export (GFIE), have significant influences on the number of regional Chinese-foreign cooperative schools, and the correlation between the two variables is low. As for the local government support (LGS), numerous literatures theoretically analyze the impact of government support degree on higher education, but lack measuring indicators. The dummy variable introduced in this paper has significant correlation with Chinese-foreign cooperative education. The influence of regional infrastructure level on Chinese-foreign cooperation in higher education is also taken into consideration in the model. However, exploratory analysis found that the data of alternative variables, such as urban road area per capita, public transportation mileage and total passenger traffic, which measured the level of regional infrastructure, had a very low correlation with the number of Chinese-foreign cooperative schools (correlation coefficients were all less than 0.08), so the variable was deleted. Through exploratory analysis, the above three models are finally determined to study the influencing factors of regional differences in Chinese-foreign cooperative education in higher education.

The correlation coefficient between the total number of Chinese-foreign cooperative school-running projects and institutions and their explanatory variables is shown in "Table II". It can be seen that all independent variables and

dependent variables have significant correlation. Except that the correlation coefficient between the number of teachers (NT) in colleges and fiscal education expenditure of all provinces  $r=0.718$ , the correlation coefficient between other variables  $r<0.7$ , most of which are below 0.5. This shows the correlation is not strong and there is no serious multicollinearity in regression analysis.

TABLE II. CORRELATION COEFFICIENT OF EACH VARIABLE

	NCFCP	CL	NT	ES	LGS	PFI	GFIE
<i>NCFCP</i>	1.000						
<i>CL</i>	0.634***	1.000					
<i>NT</i>	0.622***	0.226	1.000				
<i>ES</i>	0.433**	0.221	0.718***	1.000			
<i>LGS</i>	0.387**	0.377**	0.079	0.120	1.000		
<i>PFI</i>	0.372*	0.593***	0.077	0.142	0.234	1.000	
<i>GFIE</i>	0.518***	0.613***	0.408**	0.585***	0.105	0.679***	1.000

<sup>a</sup> Lower-triangular cells report Pearson's correlation coefficients, upper-triangular cells are Spearman's rank correlation \*p < 0. 1, \*\* p < 0. 05, \*\*\*p < 0. 01

### C. Model Estimation

In this paper, multiple regression analysis of variables was conducted by using Stata15, and the results are shown in "Table III". Model (1) represents the regression analysis between the total number of Chinese-foreign cooperative education for undergraduate and graduate students in higher education and explanatory variables; model (2) represents the regression analysis between the number of undergraduate Chinese-foreign cooperative education projects and various variables in higher education; model (3) represents the regression analysis between the number and variables of Chinese-foreign cooperative education of postgraduates in higher education. The results of regression analysis show that the explanatory variables of model setting have high significance and degree of fitting.

TABLE III. REGRESSION ANALYSIS RESULTS OF THE NUMBER OF COOPERATIVE PROGRAMS AND INSTITUTIONS

<i>variables</i>	Model (1) <i>NCFCP</i>	Model (2) <i>NCFCP<sub>1</sub></i>	Model (3) <i>NCFCP<sub>2</sub></i>
<i>Household consumption level (CL)</i>	0.531** (2.80)		0.853*** (10.59)
<i>Number of teachers (NT) in colleges</i>	1.022*** (4.86)	0.919*** (3.42)	
<i>Fiscal education spending (ES)</i>	-0.966*** (-3.41)	-2.008*** (-5.04)	
<i>Local government support (LGS)</i>	0.600** (2.21)	0.809*** (2.89)	0.396* (2.06)
<i>Proportion of Foreign Investment (PFI)</i>	-0.499** (-2.29)	-0.510** (-2.50)	
<i>Import and export volume (GFIE)</i>	0.648** (2.60)	0.550* (1.86)	
<i>Household consumption spending (CS)</i>		1.353** (2.69)	
<i>_cons</i>	-0.129 (-1.14)	-0.173 (-1.42)	-0.085 (-1.01)
<i>R-Square</i>	0.866	0.752	0.861
<i>Adj. R-Square</i>	0.81	0.68	0.85

<sup>a</sup> Note: "t" statistic is in square brackets under regression coefficient; \*p < 0. 1, \*\* p < 0. 05, and \*\*\*p < 0. 01

D. Robustness Test

In order to verify the stability of the influence of explanatory variables on explained variables, the method of variable substitution is used in this paper to test the robustness. By means of step-up regression and replacement of explanatory variables and replacement of explained

variables, the significance of PFI, provincial GFIE, LGS and other factors on Chinese-foreign cooperative education was verified, and the significance between undergraduate and graduate students, the total number of Chinese-foreign cooperative programs of undergraduate, graduate, and other variables are studied respectively at the same time (as shown in "Table IV").

TABLE IV. REGRESSION ANALYSIS RESULTS WITH REPLACED EXPLANATORY VARIABLES

variables	Model (4) NCFCP	Model (5) NCFCP	Model (6) NCFCP	Model (7) NCFCP	Model (8) NCFCP
CL		0.531** (2.80)	1.672*** (4.28)	0.522** (2.53)	0.599*** (3.05)
NT	0.860*** (3.52)	1.022*** (4.86)		0.883*** (4.10)	0.956*** (4.38)
ES	-1.669*** (-4.73)	-0.966*** (-3.41)	-1.195*** (-3.07)	-0.511** (-2.37)	
LGS	1.061*** (3.94)	0.600** (2.21)	0.879*** (2.84)	0.354 (1.27)	0.583* (2.03)
PFI	-0.223 (-1.19)		-0.317 (-1.49)	-0.424* (-1.78)	-0.403* (-1.81)
GFIE	0.511* (1.89)	0.648** (2.60)	0.141 (0.52)		0.639** (2.32)
GDP	1.058** (2.54)				
Foreign investment volume		-7.641** (-2.29)			
Teacher-student ratio			0.357** (-2.58)		
Import-export ratio				0.400* (1.79)	
Total financial expenditure					-0.932*** (-2.92)
_cons	-0.227* (-1.98)	0.394 (1.57)	-0.188 (-1.48)	-0.076 (-0.63)	-0.125 (-1.05)
R-Square	0.786	0.796	0.742	0.766	0.775
Adj.R-Square	0.72	0.74	0.67	0.70	0.71

Note: "t" statistic is in square brackets under regression coefficient; \*p < 0.1, \*\* p < 0.05, and \*\*\*p < 0.01

"Table IV" shows the results of regression analysis with replaced explanatory variables. The explanatory variables are replaced on the basis of the main regression model (1): CL, which measures the level of regional economic development, is replaced with GDP in model (4); PFI is replaced with foreign investment volume in model (5); the number of teachers (NT) in colleges and universities in each province is replaced by the teacher-student ratio in model (6); GFIE is replaced by the import-export ratio to GDP in model (7); financial education spending (ES) is replaced by the total financial expenditure of the provinces in model (8). The results of regression analysis show that the replacement of explanatory variables did not change the sign of regression coefficient, and there was a high correlation between the replaced explanatory variables, and the overall regression model was still significant. The analysis results of replaced explanatory variables are similar to the regression analysis results of model (1), indicating that the model construction has good robustness.

IV. MODEL ESTIMATION RESULTS AND SENSITIVITY ANALYSIS

Since the standardized data are used for regression analysis of model estimation, the partial regression coefficient of explanatory variables is the standardized coefficient (sensitivity coefficient), and the variables are comparable. Therefore the regression coefficient reflects the sensitivity of explanatory variables to the influence of Chinese-foreign cooperative school-running projects and number of institutions, that is, the variation of standard deviation of the number of Chinese-foreign cooperative school-running projects and institutions in each province brought by 1 standard deviation for each influencing factor. The regression equation of the model:

$$NCFCP = -0.129 + 0.531 CL + 1.022 NT - 0.966 ES + 0.6 LGS - 0.499 PFI + 0.648 GFIE \quad (4)$$

Equation (4) shows that CL, NT, LGS and GFIE have significant positive influences on NCFCP, while ES and PFI have significant negative influences on NCFCP. Among

them, the number of teachers (NT) in colleges reflecting the differences in higher education resources among provinces has the highest impact sensitivity to the number of Chinese-foreign cooperative school-running projects and institutions (regression coefficient is 1.022). The results show that Chinese-foreign cooperative education projects rely heavily on the domestic teachers, which is consistent with the reality that Chinese-foreign cooperative education relies on the domestic teachers in these cooperatively run universities. The impact of regional trade volume reflecting regional internationalization and foreign development degree takes the second place (regression coefficient is 0.648). It shows that the internationalization of Chinese-foreign cooperation in running schools is remarkable, and the regional internationalization environment plays an obvious role in promoting Chinese-foreign cooperation in running schools. The ES coefficient is negative, contrary to the expectation set by the model, showing that the national education spending has not gone to Chinese-foreign cooperation in running schools, which is a supplement to public education by social capital. Provinces with higher public educational spending (ES) pay more attention to regional higher education. Government financial investment in public higher education reduces the input level and attractiveness of social capital and foreign educational resources, and inhibits Chinese-foreign cooperation in running schools. PFI coefficient is negative, indicating that provinces with a high proportion of foreign investment (PFI) in GDP have a good investment environment, strong ability to pool regional talents, relatively high level of higher education, and relatively weak demand for international education resources for the development of higher education, thus the PFI has a negative correlation with the number of Chinese-foreign cooperative education projects and institutions. When the robustness test is conducted by replacing explained variables with other variables remaining unchanged, the results prove that the total number of undergraduate projects, graduate projects, undergraduate and graduate projects has significant negative correlation with the financial ES and PFI of all provinces.

$$\text{NCFCP}_1 = -0.173 + 0.919 \text{ NT} - 2.008 \text{ ES} + 0.809 \text{ LGS} - 0.51 \text{ PFI} + 0.55 \text{ GFIE} + 1.353 \text{ CS} \quad (5)$$

Equation (5) shows that NT, LGS, GFIE and CS have a significant positive influence on NCFCP1, while ES and PFI and have a significant negative influence on NCFCP1. It is basically consistent with the regression results of equation (4). According to the supervision network of the ministry of education for Chinese-foreign cooperation in running schools, there were 848 (except for projects and institutions that have been suspended) Chinese-foreign cooperatively-run programs and institutions for undergraduate education nationwide, accounting for 80.2% of the total number of programs and institutions for undergraduate and graduate students. The regression results are consistent with the actual situation. Compared with equation (4), the difference in the number of Chinese-foreign cooperative school-running projects in the region has no significant relationship with the overall economic development level of the region (CL), but is closely related to the consumption spending (CS) of provincial residents, and the provincial residents' final

consumption expenditure is the most sensitive to the number of Chinese-foreign cooperative education projects and institutions. This shows that the financial expenditure of residents has an important impact on Chinese-foreign cooperative education, which is consistent with the high tuition fees of Chinese-foreign cooperative education.

$$\text{NCFCP}_2 = -0.085 + 0.853 \text{ CL} + 0.396 \text{ LGS} \quad (6)$$

Equation (6) shows that NCFCP2 has a significant positive influence on CL and LGS. The number of programs and institutions of Chinese-foreign cooperative education for graduate students measures the differences in the quality of Chinese-foreign cooperative education in different provinces. According to the supervision network of the ministry of education for Chinese-foreign cooperation in running schools, there are 185 Chinese-foreign cooperative programs and institutions for graduate students. Since the Chinese-foreign cooperative universities for graduates are small in numbers and belong to high-level academic education, they are very different from Chinese-foreign cooperation for undergraduate education and higher education in terms of overall situation. Compared with equation (4) and equation (5), the difference of Chinese-foreign cooperative education of postgraduates in different provinces is only affected by two factors. CL, which measures the level of regional economic development, has the highest impact sensitivity to the Chinese-foreign cooperative school-running projects and institutions of graduate students, with a sensitivity coefficient of 0.853, indicating that the level of economic development is the basis of high-quality Chinese-foreign cooperative school-running. In addition, the number of Chinese-foreign cooperative school-running programs and institutions for graduate students is also affected by the degree of government support, which indicates that government support plays an important role in the development of high-quality Chinese-foreign cooperative school-running.

## V. CONCLUSIONS AND SUGGESTIONS

### A. Conclusions

Through the empirical analysis of provincial statistical data, this paper studies the influencing factors and sensitivity of Chinese-foreign cooperative education differences in provincial higher education, and draws the following conclusions:

- The main influencing factors of regional differences in Chinese-foreign cooperation in running schools in higher education include regional economic development level, international demand for educational resources, regional internationalization, financial expenditure, educational resources, and government support, etc.
- Differences in Chinese-foreign cooperation between provinces and regions in running schools are significantly affected by educational resources, with the highest sensitivity to the level of teachers of higher education in each province, which reflects the heavy dependence of Chinese-foreign cooperation in higher education on domestic teachers.

- The level of economic development and government support of each province have a significant impact on Chinese-foreign cooperation in running schools in regional higher education, and a relatively great impact on regional differences in Chinese-foreign cooperation in running schools for graduate students, highlighting the prominent role of local economic construction and the government in promoting the development and quality improvement of Chinese-foreign cooperation in running schools.
- The degree of internationalization and opening to the outside world has a significant impact on the regional differences of Chinese-foreign cooperation in running schools and thus accelerating regional opening up and internationalization plays a significant role in promoting Chinese-foreign cooperation in running schools in higher education.
- There is a negative correlation between local education fiscal expenditure and the proportion of foreign investment in GDP and the development of regional Chinese-foreign cooperation in running schools. Chinese-foreign cooperation in running schools is developing faster in regions with low local education fiscal expenditure and high demand for international education resources, which highlights the complementary and regulating effect of Chinese-foreign cooperation in running schools on the uneven development of regional higher education.

#### *B. Policy Recommendations*

Studying the factors influencing the regional differences of Chinese-foreign cooperative education in higher education is of great significance for the development of Chinese-foreign cooperative education and the balanced development of regional higher education. It is also of certain reference value to the decisions on the construction of Chinese-foreign cooperative school-running projects in colleges and universities, the development plan of higher education in each province, and the realization of the internationalization goal of higher education. Based on the research conclusions of this paper, the following policy suggestions are proposed:

*1) Decisions on Chinese-foreign cooperative school-running projects and institutional construction:* Social subjects and universities should fully consider the external factors that affect the development of Chinese-foreign cooperation in running schools and make a comprehensive analysis of the factors that are significantly related to Chinese-foreign cooperation in running schools studied in this paper, such as the local teachers, the internal demand of introducing foreign educational resources, the degree of openness, and the support of local government, so as to make scientific decisions combined with their own resource advantages. For example, in recent years, Henan province has accelerated its step in constructing university teachers and intensified its efforts in the introduction of talents and the construction of central plains economic zone drives regional internationalization. Plus the government support,

Chinese-foreign cooperative education there has been developing rapidly. Out of 22 new Chinese-foreign cooperative education programs approved by the ministry of education in the first half of 2018, five undergraduate programs in Henan province were approved.

*2) Balanced development of higher education:* In areas where Chinese-foreign cooperation in running schools is backward, the government should increase the government support for Chinese-foreign cooperation in running schools according to the actual situation, so as to promote the balanced development of China's higher education. At present, Beijing, Shanghai, Heilongjiang, Shandong, Jiangsu and other places have high development level of Chinese-foreign cooperation in running schools; Henan, Hunan, Jiangxi, Yunnan and other places are developing very fast; Zhejiang, Guangdong and other provinces focus on improving the quality of Chinese-foreign cooperation in running schools on the basis of maintaining the original basis; Gansu, Inner Mongolia, Shanxi and other regions are developing slowly; and there are no Chinese-foreign cooperation in running schools yet in Tibet, Qinghai and Ningxia. This regional difference in Chinese-foreign cooperative education is related to the degree of local government support. Based on the analysis results of this paper, local governments and universities can find the influencing factors of their own differences, learn from each other, and promote the construction of Chinese-foreign cooperation in running schools according to local conditions, so as to promote the balanced development of higher education.

*3) Internationalization of higher education:* Internationalization of higher education is one of the strategic goals of national higher education. And promoting the development of Chinese-foreign cooperation in running schools is an effective way to internationalize higher education. Local governments should strengthen international exchanges and opening up, enhance the level of regional foreign development and internationalization through foreign trade, and objectively create a good external environment for the development of Chinese-foreign cooperation in running schools.

*4) Improving the quality of Chinese-foreign cooperation in running schools:* Provinces should bring in world-class educational resources in their development of Chinese-foreign cooperative education, accelerate the development of teachers in regional colleges and universities and increase government support, so as to run foreign cooperation project for undergraduate and graduate of high quality. All these will contribute to the entrance of a new stage of "improving quality and efficiency" of Chinese-foreign cooperative education.



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