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Typical Correlation Score between Economic Development Speed and Employment Rate

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Abstract

In order to discuss the relationship between the employment rate and the economic development speed, the typical correlation analysis between the development speed and the employment rate is made in the past 20 years. Three indicators of development speed are considered: per capita energy consumption, per capita GDP, fixed asset investment price index, and two indicators of employment rate are considered: number of graduates and number of employees. The results show that economic development has a great impact on the number of employment, and that economic development can increase the quantity of employment.

Keywords

Economic Development Speed, Employment Rate, Typical Correlation

1. Introduction

With the rapid development of society, the economy is in the process of normalization from high-speed growth to high-quality growth, and the employment situation and employment rate have also attracted people's attention. Whether a society's employment problem is solved well or not involves all aspects of society, and its influence is extremely extensive and far-reaching. Therefore, the relationship between employment rate and economic change is a topic worthy of discussion.

The speed of economic development refers to the relative number reflecting the degree of change of economic and social phenomena in time, which is an important indicator to measure the economic operation. The rate of employment and the speed of economic development are more worthy of discussion. Many scholars at home and abroad have also discussed this issue.

In order to understand the internal relationship between the employment rate

and the economic development speed objectively, we select the relevant indicators of the economic development speed and the employment rate, and make a typical correlation analysis based on the data of 2000-2018.

2. Literature Review

Wang et al. (2017) obtained that there is a long-term equilibrium relationship between economic growth and employment in Xinjiang based on the data from 1992-2014. Lin (2016) explored the role of labor employment in promoting economic development in China. Liu et al. (2016) analyzed the evolution characteristics of China's economic growth and employment quality index system. Chen et al. (2019) analyzed the changes in the employment situation of college graduates in China under the new normal of current economic development, studied the difficulties and incentives faced by college graduates in employment, and put forward the corresponding strategies in an exploratory way. Luo & Liu (2017) analyzed the current general employment situation of college graduates and the general economic trends at home and abroad, analyzed the main problems faced by college graduates in employment, and put forward corresponding countermeasures.

Chen & Rong (2019) based on the time series of women's employment in Northeast China from 2000 to 2016, used VAR model and cointegration test to examine the relationship between women's employment and economic growth, and used employment elasticity coefficient to analyze the relationship between women's employment and economic growth in Northeast China, and discussed the choice of women's employment industry in Northeast China. Yu (2017) analyzed the existing problems and some restrictive factors in the employment process of college students, such as national policies, social and economic development, professional structure of schools, curriculum setting, college students' personal orientation and employment attitude. Byerlee and Eicher (1974) pointed out that the problem of urban unemployment is becoming more and more serious and many economists changed the main development index to redefining development. Tsaliki (2009) discussed the dynamics of economic development and its impact on employment, indicating that high unemployment may also be consistent with normal capital employment. John Nkwoma Inekwe (2013) investigated the relationship between employment and foreign direct investment in manufacturing and service industries in Nigeria.

3. Canonical Correlation Analysis

Canonical correlation analysis is a multivariate statistical method to study the correlation between two groups of variables. According to the correlation between variables, we find a few pairs of comprehensive variables (linear combination of actual observation variables) and use them to replace the original observation variables, so as to focus the relationship between two groups of variables on a few pairs of comprehensive variables.

Let $X=\left(X_1,X_2,\cdots,X_p\right)'$, $Y=\left(Y_1,Y_2,\cdots,Y_q\right)'$ are two random vectors. Using the principal component theory, we find the i-th pair of typical related variables (U_i, V_i), where $U_i=a_{i1}X_1+a_{i2}X_2+\cdots+a_{ip}X_p=a_i'X$, $V_i=b_{i1}Y_1+b_{i2}Y_2+\cdots+b_{ip}Y_p=b_i'Y$, $i=1, 2, \ldots, m=\min(p, q)$; the canonical correlation coefficient between the m-th pair of canonical correlation variables is $\mathrm{Can}R_m=\mathrm{Corr}\left(U_m,V_m\right)$.

In this paper, the typical correlation analysis of energy consumption per capita, GDP per capita, fixed asset investment price index with the number of graduates and employment is carried out. For convenience, let x_1 be the per capita energy consumption, x_2 be the per capita GDP, x_3 be the fixed asset investment price index, y_1 be the number of graduates, y_2 be the number of employees (Table 1).

3.1. Typical Correlation Coefficient and Significance Test

Two typical correlation coefficients are given in Table 2, the first one is $\mathrm{Can}R_1=$

Table 1. Employment rate and development rate indicator.

Particular year	Annual per capita energy consumption (kg standard coal) x_1	GDP per capita (yuan) x_2	Fixed asset investment price index x_3	Graduation number (10,000 people) y_1	Number of Employed Persons (10,000 people) y_2
2000	132	7942	101.1	88,910	72,058
2001	136	8717	100.4	89,849	72,797
2002	146	9506	100.2	90,302	73,280
2003	166	10,666	102.2	90,976	73,736
2004	191	12,487	105.6	92,184	74,264
2005	211	14,368	101.6	94,197	74,647
2006	230	16,738	101.5	95,068	74,378
2007	250	20,494	103.9	95,833	75,321
2008	254	24,100	108.9	96,680	75,564
2009	264	26,180	97.6	97,484	75,828
2010	273	30,808	103.6	99,938	76,105
2011	294	36,302	106.6	100,283	76,420
2012	313	39,874	101.1	100,403	76,704
2013	335	43,684	100.3	100,582	76,977
2014	346.1	47,005	100.5	100,469	77,253
2015	365.4	50,028	98.2	100,361	77,451
2016	393.2	53,680	99.4	100,260	77,603
2017	415.6	59,201	105.8	99,829	77,640
2018	439.9	64,644	105.4	99,357	77,856

Data source: The National Bureau of Statistics.

Table 2. Canonical correlation analysis.

	Canonical Correlation	Adjusted Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation
1	0.979105	0.976708	0.009747	0.958647
2	0.146047	−0.035772	0.230675	0.021330

0.979105, the correction value is 0.976708, the standard error is 0.009747, CanR_{12} = 0.958647, the first typical correlation coefficient shows that the correlation between the first pair of typical correlation variables is high.

Table 3 shows the characteristic roots and the corresponding statistics. It can be seen that 99.9% of the total variation can be explained by the first pair of typical variables, and the second pair has little effect on the typical related variables, only 0.1% of the total variation can be explained, which can be ignored.

Table 4 shows the test of typical correlation coefficient. The results show that the F value of the first row is 18.53, p-value < 0.0001. Under the test level of 0.05, the original hypothesis is rejected, and the first correlation coefficient is not 0; the p-value of the second row is 0.8507, far greater than the significance level of 0.05, so only the first typical correlation coefficient is not 0.

Table 5 shows the results of F-test with all typical correlation coefficients of 0 by four multivariate statistical methods. The test results of the four methods in this case are completely consistent with the above, indicating that at least one typical correlation coefficient is not 0 at the significant level of 0.05.

3.2. Typical Variable Coefficient and Typical Structure

Because the units of the five indexes are not uniform, the standardized coefficient is considered. Table 6 and Table 7 show the typical variable coefficients expressed by standardized variables, and the relevant expressions of VAR variables (economic development speed) and WITH variables (employment rate) can be obtained as follows

$$V_1 = 1.3265x_1^* - 0.3316x_2^* - 0.0111x_3^* \quad (1)$$

$$W_1 = -0.3971y_1^* + 1.3742y_2^* \quad (2)$$

Among them, V_1 is the first typical variable of economic development speed, W_1 is the first typical variable of employment rate.

Formula (1) is the weighted difference between the per capita energy consumption and the per capita GDP approximately, with a greater weight in the per capita energy consumption and a coefficient of 0 in the fixed asset investment price index; Formula (2) shows that the first typical variable of employment rate, W_1, has the largest coefficient in the number of employed people.

Table 8 and Table 9 are the analysis results of the correlation between the original standardized variables and the typical variables of the matching group. The first typical variable W_1 of per capita energy consumption and per capita GDP and employment rate index has a strong correlation, indicating that the

Table 3. Characteristic roots and corresponding statistics.

	Eigenvalue	Difference	Proportion	Cumulative	Likelihood Ratio
1	23.18	23.16	0.999	0.999	0.040471
2	0.021		0.000	1.000	0.978670

Table 4. Test of the canonical correlations.

	Approximate F Value	Num DF	Den DF	Pr > F
1	18.53	6	28	<0.0001
2	0.16	2	15	0.8507

Table 5. Multivariate statistics and F approximations.

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.04047106	18.53	6	28	<0.0001
Pillai's Trace	0.97997675	4.80	6	30	0.0015
Hotelling-Lawley Trace	23.2037669	52.60	6	17	<0.0001
Roy's Greatest Root	23.18197214	115.91	3	15	<0.0001

Table 6. Canonical correlation analysis—standardized canonical coefficients for the VAR variables.

	V_1	V_2
x_1^*	1.3265	−5.5679
x_2^*	−0.3316	5.6455
x_3^*	−0.0111	0.5728

Table 7. Canonical correlation analysis—standardized canonical coefficients for the WITH variables.

	W_1	W_2
y_1^*	−0.3971	−3.4891
y_2^*	1.3742	3.2316

Table 8. Correlations between the VAR variables and the canonical variables of the WITH variables.

	W_1	W_2
x_1^*	0.9777	0.0073
x_2^*	0.9552	0.0274
x_3^*	0.0890	0.0557

faster the economic development is, the higher the employment rate is; the number of graduates and number of employees are positively correlated with the first typical variable V_1 of development rate. It shows that the development

speed has a positive role in promoting the employment rate.

3.3. Typical Redundancy Analysis

Table 10 is the proportion of variance explained by the normalized variance of the rate of economic development through its typical variables and paired typical variables. It can be seen that the proportion of shared variance explained by the index of economic development through its first typical variable is 65.23%, and the proportion of variance explained by the other's first typical variable is 62.54%, and its ratio 62.54/65.23 = 0.9586 is exactly CanR_1^2.

Table 11 is the proportion of variance explained by the standardized variance of the employment rate variable through its canonical and paired canonical variables. It can be seen that the proportion of the shared variance explained by the employment rate index through the first canonical variable is 91.70%, which is accounted for. The proportion of variance explained by the typical variable is 87.91%, and the ratio is also 0.9586.

Table 12 and Table 13 give the squares of the complex correlation coefficients between the original variables and the typical variables of the paired group, that

Table 9. Correlations between the WITH variables and the canonical variables of the VAR variables.

	V_1	V_2
y_1^*	0.9010	−0.0572
y_2^*	0.9728	−0.0165

Table 10. Standardized variance of the VAR variables explained by their own canonical and the opposite canonical variables.

Standardized Variance of the VAR Variables Explained by					
	Their Own Canonical Variables			The Opposite Canonical Variables	
Variable Number	Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1	0.6523	0.6523	0.9586	0.6254	0.6254
2	0.0611	0.7134	0.0213	0.0013	0.6267

Table 11. Standardized variance of the WITH Explained by their own canonical variables and the opposite canonical variables.

Standardized Variance of the WITH Variables Explained by					
	Their Own Canonical Variables			The Opposite Canonical Variables	
Variable Number	Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1	0.9170	0.9170	0.9586	0.8791	0.8791
2	0.0830	1.0000	0.0213	0.0018	0.8809

Table 12. Squared multiple correlations between the VAR variables and the first M canonical variables of the WITH variables.

M	1	2
	0.9558	0.9559
	0.9124	0.9131
	0.0079	0.0110

Table 13. Squared multiple correlations between the WITH variables and the first M canonical variables of the VAR variables.

M	1	2
	0.8118	0.8151
	0.9464	0.9467

is, the determination coefficients of the original variables and the typical variables. It can be seen that the first typical variable of the index of economic development has a fairly good explanatory power for the number of graduates (y_1) and the number of employed people (y_2). The first typical variable of the employment rate indicator has a fairly good explanatory power for per capita energy living consumption (x_1) and per capita GDP (x_2), while it has little explanatory power for the fixed asset investment price index (x_3).

To sum up, W_1, the first typical variable of economic development speed index, has quite good explanatory power to the number of graduates and the number of employed people. V_1, the first typical variable of employment rate index, has a good explanatory power to per capita energy consumption and per capita GDP, but has little explanatory power to fixed asset investment price index. The first typical variable of the speed index of economic development has the strongest ability to explain the number of employed people in the employment rate index, which shows that economic development has a great influence on the number of employed people, and at the same time, accelerating economic development can increase the number of employed people.

4. Conclusion

We mainly discuss a typical correlation analysis on the development speed and employment rate. The research results show that the first typical variable of the economic development speed index has the strongest ability to explain the employment index in the employment rate index, that is, economic development has a greater impact on employment, and accelerating economic development can increase employment.

The research on the promotion of college students' employment under the new economic situation is helpful for people to objectively understand the relationship between economic development and employment and its evolution trend, and has certain reference significance and application value for relevant

departments to make scientific decisions and formulate policies and measures. The quantitative research method of this topic enriches the research ideas of the relationship between economic development and employment, and broadens the methods for further study of this problem.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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