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Econometric Analysis on Education and Technology in Maoming

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Abstract

Science and technology play a great role in promoting the development of society. To promote the development of science and technology in Maoming, this paper employs econometric methods to carry out a quantitative analysis of the influencing factors of science and technology development in Maoming. In the regression analysis, all variables were tested, unreasonable variables were deleted, the model was modified, and tests such as heteroscedasticity and autocorrelation were performed on the modified model. The regression results show that: the number of people engaged in scientific and technological activities in Maoming is directly proportional to the number of students in ordinary colleges and universities, and there is a relatively stable positive correlation between them. Therefore, in order to promote the development of science and technology in Maoming, we should vigorously develop higher education in Maoming.

Keywords

Institutions of Higher Learning, Scientific Research Personnel, Science and Technology Innovation, Economic Development

1. Introduction

Scientific and technological resources are the precious wealth of human society, and have become the first resource of economic society. The development of science and technology represents innovation. Innovation is the soul of national progress and an inexhaustible driving force for the country's prosperity. The key to innovation lies in scientific and technological personnel. How to strengthen the cultivation of scientific and technological innovation talents has become a strategic issue related to the national economy and people's livelihood, and the key to solving this problem lies in the realization of education.

Liao et al. (2013) proposed that humanities education is of great significance to the cultivation of scientific and technological innovative talents. Humanistic education can effectively shape the independent personality of scientific and technological innovation talents, help them to establish correct values, noble moral quality and healthy psychological state; help to improve the innovative ability of scientific and technological innovation talents, stimulate innovative thinking and innovative spirit, and optimize innovative methods. Promote the comprehensive and healthy development of scientific and technological innovation talents. Tao & Meng (2014) also analyzed with the reform of German higher education in the 19th century. He believes that strengthening the comprehensive national strength depends on science and technology. The development of science and technology depends on the talents who master the science and technology. The cultivation of talents depends on education, especially higher education, which is in a dominant position and shoulders the task of cultivating high-quality and high-level talents.

At the same time, some scholars have proved through empirical research that the contribution rate of scientific and technological talents to economic growth generally shows an upward trend (Chen, Xiao, & Zhu, 2011). For contemporary education, modern science education has developed into science and technology education, which plays an important role in cultivating students' innovation and scientific inquiry capabilities. In terms of a relatively balanced level of education, the development of higher education is more urgent to accumulate a large amount of human capital, which has played a key role in economic development and reform and innovation. At the same time, some scholars have raised the issue of the quality view of higher education (Liao, 2012). The development of science and technology must promote the process of popularization of higher education. It is necessary to establish a quality view of development, a diversified quality view, and an overall quality view. We must correctly handle the relationship between higher education development and economic growth, and increase investment in higher education (Chen, Fu, & Fu, 2008). The purpose of education is ultimately to develop science and technology, to cultivate innovative ability and innovation awareness. The degree of development of scientific research technology directly affects the construction and development of the entire national innovation system, and is also the driving force to lead and support regional economic development.

Both for regional development and the development of a country, education and science and technology are two extremely important factors for development. Therefore, it is necessary to investigate the relationship between the two through different methods.

This article collects relevant data, establishes a model, and conducts an econometric analysis of the number of science and technology activities in Maoming and the number of people educated at different stages. After obtaining the relationship between the personnel engaged in scientific and technological activities and the number of people educated at each stage, according to the size of each factor coefficient in the model equation, analyze the main and secondary factors, so as to find the main starting point for the development of science and education in Maoming, and give some suggestions to develop science and education in Maoming.

Maoming is a prefecture-level city with a large population in Guangdong Province and a city with strong economic strength in the eastern and western regions of Guangdong. Its GDP has ranked first in eastern and western Guangdong for 14 consecutive years. At the same time, Maoming is the largest petrochemical base in South China, an important petrochemical production and export base in southern China, and an energy base in Guangdong Province. However, the current state of science and education in such a vibrant city is thought-provoking.

2. Model Establishment

2.1. Explanation of Variables and the Establishment of the Model

Through the above analysis we introduce 3 independent variables for analysis:

Y is said to engage in scientific and technological activities (person). B indicates that the other explanatory variables remain unchanged X_i per unit of change, Y average changes. X_1 is the number of students in ordinary colleges and universities (person). X_2 is indicates the number of students in secondary schools (person). X_3 is indicates the number of pupils in primary schools (person). μ is random error term.

According to the introduction of the variables set the following model.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu$$

2.2. Data Explanation

Here are data of social science and technology information from 1995 to 2012 (Table 1).

3. Model Parameter Estimation

The estimation results are shown in Table 2 using least square method and eviews software.

Model estimation can be got in the following.

$$Y = 4175.645 + 0.3979 X_1 - 0.0161 X_2 + 0.003 X_3 + \mu$$
$$(1.8930) \quad (3.246) \quad (-2.8102) \quad (1.1445)$$

$$R^2 = 0.5251,\ F = 5.1591,\ n = 18$$

Table 1. Data of social science and technology information from 1995 to 2012.

Year \ Index	Number of students in regular colleges and universities	Number of students in secondary schools	specialized middle school (ten thousand)	Secondary vocational schools (ten thousand)	Technical School (ten thousand)	Ordinary middle school (ten thousand)	Primary school students	Technologists
1995	1512	275,100	0.95	0.45	0.19	25.92	753,900	1324
1996	1560	302,000	1.14	0.33	0.27	28.46	786,900	2057
1997	1162	324,800	1.06	0.29	0.38	30.75	817,400	1966
1998	1147	345,300	1.18	0.33	0.51	32.51	834,900	2154
1999	3078	368,500	1.14	0.42	0.40	34.89	852,300	3354
2000	7975	405,700	0.88	0.54	0.45	38.70	858,400	2744
2001	9512	439,900	0.85	0.62	0.66	41.86	925,300	3239
2002	10,170	479,700	0.77	0.68	0.68	45.84	928,800	3533
2003	11,471	537,600	0.89	2.58	0.98	49.31	923,800	4835
2004	14,376	583,500	0.76	3.00	1.36	53.23	959,400	3018
2005	14,954	626,300	0.63	4.00	1.44	56.56	948,900	2584
2006	15,968	672,600	0.57	4.96	1.41	60.32	932,400	2103
2007	19,244	712,600	0.78	6.01	1.78	62.69	878,700	2443
2008	19,782	752,700	0.99	7.75	1.94	64.59	801,100	2486
2009	23,151	785,300	1.25	9.09	2.84	65.35	724,500	2877
2010	26,967	810,100	1.35	14.49	3.65	65.52	666,600	2618
2011	27,256	834,700	1.53	13.85	3.58	64.51	624,100	3645
2012	30,180	774,200	1.50	11.87	3.12	60.93	598,000	6810

Table 2. Regression results.

Dependent Variable: Y
Method: Least Squares
Date: 11/27/15 Time: 21:26
Sample: 118
Included observations: 18

	Coefficient	Std. Error	t-Statistic	Prob.
C	4175.645	2205.871	1.892969	0.0792
X_1	0.397900	0.122581	3.246016	0.0059
X_2	−0.016104	0.005731	−2.810205	0.0139
X_3	0.003029	0.002647	1.144530	0.2716
R-squared	0.525057	Mean dependent var	2988.333	
Adjusted R-squared	0.423284	S.D. dependent var	1237.301	
S.E. of regression	939.6293	Akaike info criterion	16.72198	
Sum squared resid	12360645	Schwarz criterion	16.91984	
Log likelihood	−146.4978	Hannan-Quinn criter.	16.74926	
F-statistic	5.159079	Durbin-Watson stat	1.634252	
Prob (F-statistic)	0.013082			

4. Model Checking

4.1. Economic Significance Test

1) β_0 = 4175.645, that is when the number of people in different stages of education to maintain the original size, Maoming city engaged in scientific and technological activities have about 4175 people. This result is consistent with reality. It is reasonable.

2) β_1 = 0.3979. In the case of other conditions unchanged, the number of ordinary colleges and universities in the number of students per 1, engaged in scientific and technological activities increased by 0.3979. The positive correlation between the two was in line with the economic reality.

3) β_2 = −0.0161. In the case of other conditions unchanged, the number of students in secondary schools increased by 1, and the number of students in the middle school was reduced by 0.0161. The negative correlation between the two is not consistent with the reality. Should consider adjusting variables or deleting variables.

4) β_3 = 0.003. In the case of other conditions unchanged, the number of primary school students increased by 1, the number of personnel engaged in scientific and technological activities increased by 0.003. The results are in line with reality, and it is reasonable.

4.2. Statistical Inference Test

1) Sample determination coefficient.

The value of R^2 is close to 1, which indicates that the fitting degree of regression line to the observation value is better; otherwise, the value of R^2 is close to 0, which indicates that the fitting degree of regression line is worse. The results obtained by the 1 parameter estimation can be obtained, and the sample decision factor R^2 = 0.5251 can be seen that the model fit is poor.

2) Adjusted sample coefficient.

Because the explanatory variables are multivariate, the adjusted goodness of fit is used to eliminate the influence of explanatory variables on the goodness of fit. After adjusting the R^2 = 0.4232, the fitting degree of the observed values of the regression line is poor.

4.3. Econometric Test

1) Multiple linear test.

a) Test.

According to the output results of Figure 1 can be $F = 5.1591 > F_{0.05}(3, 14) = 3.34$, show that the model from the overall perspective, Maoming city engaged in scientific and technological activities and explain the linear relationship between the variables. With EVIEWS software, the correlation coefficient matrix is shown in Table 3.

From the data in the table, the correlation coefficient between X_1 and X_2 is higher, and there is a high correlation.

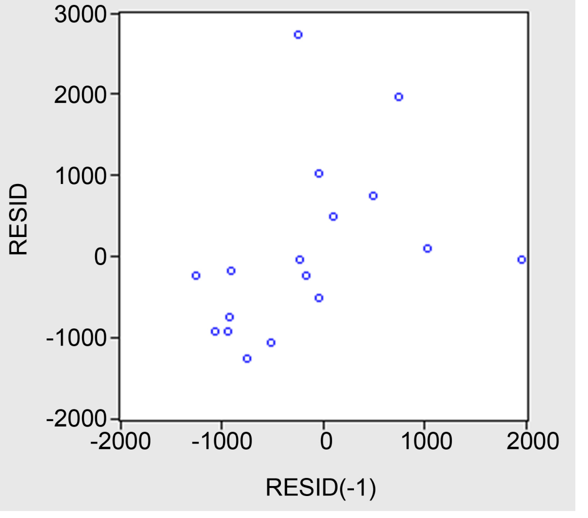

Figure 1. First-order autocorrelation test.

Table 3. Relationship matrix.

	X_1	X_2	X_3
X_1	1.000000	0.972687	−0.492280
X_2	0.972687	1.000000	−0.383061
X_3	−0.492280	−0.383061	1.000000

b) Fixed.

The use of stepwise regression method to remedy. Because the X_1 linear relationship is strong and the fitting degree is good, the X_1 is used as the basic variable, and then the other explanatory variables are brought into the X_1 regression equation, Table 4 and Table 5.

$$Y = 2126.201 + 0.0648\,X_1$$
$$(4.7243)\quad (2.3439)$$
$$R^2 = 0.2556,\quad F = 5.4941$$

$$Y = 5978.372 + 0.3196 X_1 - 0.0130 X_2$$
$$(3.8318)\quad (3.1102)\quad (-2.5492)$$
$$R^2 = 0.4806,\quad F = 6.9402$$

After comparison, it can be seen that the model fit is improved with the increase of X_2, and the variables are passed t test, but the parameters are not reasonable. Get rid of X_3, the introduction of X_2. It is shown in Table 6.

$$Y = 2572.605 + 0.0620 X_1 - 0.0004 X_3$$
$$(0.9992)\quad (1.8907)\quad (-0.1763)$$
$$R^2 = 0.2571,\quad F = 2.5962$$

Goodness of fit was decreased, and the parameters of the parameters were not consistent with the actual, and the F statistics were decreased. Remove X_3.

Table 4. Remedy using stepwise regression method.

Dependent Variable: Y
Method: Least Squares
Date: 11/29/15 Time: 16:57
Sample: 118
Included observations: 18

	Coefficient	Std. Error	t-Statistic	Prob.
C	2126.201	450.0607	4.724255	0.0002
X_1	0.064804	0.027648	2.343940	0.0323
R-squared	0.255608	Mean dependent var	2988.333	
Adjusted R-squared	0.209084	S.D. dependent var	1237.301	
S.E. of regression	1100.375	Akaike info criterion	16.94913	
Sum squared resid	19,373,204	Schwarz criterion	17.04806	
Log likelihood	−150.5422	Hannan-Quinn criter.	16.96277	
F-statistic	5.494057	Durbin-Watson stat	0.981010	
Prob (F-statistic)	0.032321			

Table 5. Remedy using stepwise regression method with X_2.

Dependent Variable: Y
Method: Least Squares
Date: 11/29/15 Time: 17:03
Sample: 118
Included observations: 18

	Coefficient	Std. Error	t-Statistic	Prob.
C	5978.372	1560.216	3.831760	0.0016
X_1	0.319590	0.102754	3.110241	0.0072
X_2	−0.012995	0.005098	−2.549193	0.0222
R-squared	0.480618	Mean dependent var	2988.333	
Adjusted R-squared	0.411367	S.D. dependent var	1237.301	
S.E. of regression	949.2876	Akaike info criterion	16.70031	
Sum squared resid	13,517,203	Schwarz criterion	16.84871	
Log likelihood	−147.3028	Hannan-Quinn criter.	16.72077	
F-statistic	6.940235	Durbin-Watson stat	1.351473	
Prob (F-statistic)	0.007348			

Therefore, the final function expression is $Y = f(X_1)$ is the best. The fitting results are as follows:

Table 6. Remedy using stepwise regression method with X_3.

Dependent Variable: Y				
Method: Least Squares				
Date: 11/29/15 Time: 17:13				
Sample: 118				
Included observations: 18				
	Coefficient	Std. Error	t-Statistic	Prob.
C	2572.605	2574.540	0.999249	0.3335
X_1	0.061961	0.032771	1.890731	0.0781
X_3	−0.000496	0.002816	−0.176283	0.8624
R-squared	0.257147	Mean dependent var	2988.333	
Adjusted R-squared	0.158100	S.D. dependent var	1237.301	
S.E. of regression	1135.287	Akaike info criterion	17.05817	
Sum squared resid	19,333,151	Schwarz criterion	17.20657	
Log likelihood	−150.5235	Hannan-Quinn criter.	17.07863	
F-statistic	2.596212	Durbin-Watson stat	0.978145	
Prob (F-statistic)	0.107590			

Table 7. Heteroscedasticity test.

Heteroscedasticity test: White				
F-statistic	3.338013	Prob.F(2,15)	0.0632	
Obs*R-squared	5.543842	Prob.Chi-Square(2)	0.0625	
Scaled explained SS	6.008799	Prob.Chi-Square(2)	0.04	
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 11/29/15 Time: 19:38				
Sample: 118				
Included observations: 18				
	Coeffcient	Std. Error	t-Statistic	Prob.
C	774824.9	872394.2	0.888159	0.3885
X_1	−120.5674	144.3419	−0.835291	0.4167
X_1^2	0.007191	0.004817	1.492622	0.1563
R-squared	0.307991	Mean dependent var	1,076,289	
Adjusted R-squared	0.215723	S.D. dependent var	1,834,411	
S.E. of regression	1,624,543	Akaike info criterion	31.59036	
Sum squared resid	3.96E+13	Schwarz criterion	31.73876	
Log likelihood	−281.3133	Hannan-Quinn criter	31.61083	
F-statistic	3.338013	Durbin-Watson stat	1.947175	
Prob (F-statistic)	0.063217			

$$Y = 2126.201 + 0.0648X_1$$
$$(4.7243) \quad (2.3439)$$
$$R^2 = 0.2556,\ F = 5.4941$$

2) Heteroscedasticity test (Table 7).

This shows that the model has no heteroscedasticity.

3) First-order autocorrelation test.

It can be judged that the model does not have autocorrelation.

So, it can be got as following.

$$Y = 2126.201 + 0.0648\ X_1$$

5. Conclusion

Through the study of this model and the analysis of different test results, it can be seen that education is important for scientific research, especially in higher education. We should regard the development of higher education as the main means of revitalizing the country and increase investment in scientific research in higher education institutions in order to better absorb talents. At the same time, correct the thinking of teachers and students. Teachers are not only disseminators of knowledge, but also scholars who lead students to explore unknown fields. Students are not only to receive knowledge, but also to learn how to freely and creatively explore the frontiers of knowledge. Only in this way can we create a good research atmosphere. The development of Maoming technology must first promote the construction of basic education, especially increase the popularization of higher education, and lay a good foundation for the scientific research development of Maoming. Only in this way can more technological talents serve the development of the economy and society.

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Conflicts of Interest

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

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