The Main Influencing Factors of Yunnan Province's Economic Growth and Empirical Research

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Abstract—**Based on the investment in fixed assets of 2000-2016 in Yunnan province, at the end of the working population, foreign investment, urbanization level, transportation infrastructure, the level of education, the total retail sales of social consumer goods and exports as a measure, using Eviews software for multiple linear regression. The regression results show that the total retail sales of social consumer goods, at the end of the working population, exports to play a positive and significant role in promoting economic development in Yunnan province, and they still have a lot of space for future economic development in Yunnan province, but the theory into reality is still a long way to go. Accordingly, some policy suggestions on the economic growth of Yunnan province are put forward.**

Keywords—economic growth; multiple linear regression; influencing factors; empirical analysis

I. INTRODUCTION

Yunnan province is located in the southwest frontier in China, and it is also our country facing southeast Asia, South Asia countries are important in the portal. It is important to promote the development of fast and sound economic development in Yunnan province bridgehead, both "western development" and "One Belt & One Road" strategy is put forward, Yunnan province has always been in an important position of "fulcrum", "link" and "low frontier". Therefore, since the reform and opening up 40 years ago, Yunnan province has made remarkable progress and improvement in economy, system, opening to the outside world, infrastructure, people's livelihood and ecological civilization. In addition, under the new normal, the strategic status of Yunnan province has been gradually improved, and the level of opening up to the outside world has been continuously improved, which has ushered in unprecedented opportunities and challenges. The future development of Yunnan province contains great potential and space.

However, through careful observation, we find that from 2012 to now, the GDP growth rate of Yunnan province has been 13%, 12.1%, 8.1%, 8.7%, 8.7% and 9.5% respectively, higher than the national average level in the same period, and even the third highest in China in 2017 and 2018. It is worth pondering that over the years, the GDP of Yunnan province has always been in the middle and lower reaches of the country, ranking 21st among the 31 provinces and municipalities in 2017. These two contradictory phenomena appear at the same time. Apart from the fact that the economic level of Yunnan province is indeed far behind the national level, are there any other problems worth exploring?

GDP is considered as the best indicator to measure a country's economic status. To explain the above contradiction and promote the economic development of Yunnan province, we must understand the composition of GDP and find the main influencing factors of GDP. Only in this way can we solve the actual problems in Yunnan province and help it develop better and faster.

II. LITERATURE REVIEW

GDP refers to the value of all final goods and services as produced in the economy of a country or region within a certain period of time (one year or one quarter). From the connotation of its definition, it can be seen that the measurement of GDP mainly includes two main aspects: product and service, but at the same time, many factors will have a great impact on GDP. Therefore, many scholars have made the following two studies on the impact of different model methods on economic growth from different perspectives.

One is to find the positive impact of economic growth to promote the factors. For example, Zhu (2018) estimated and analyzed the relationship between industrial structure, human capital and economic growth based on panel data, and concluded that the optimization of industrial structure and the improvement of human capital contribute to economic growth. Yu (2018) et al. studied the relationship between low-carbon consumption and economic growth based on DEA, and concluded that low-carbon consumption has a strong effect on economic growth. Zhao (2018) also adopted systematic GMM method to demonstrate that demographic dividend and structural dividend directly promote regional economic growth, and the influence effect of demographic dividend is larger. In addition, Li (2018) et al. found that regional credit and technological innovation have significant positive effects on regional economic growth from the perspective of spatial panel. On the other hand, it is to account for the negative impact of economic growth to be weakened. There representative He (2018) think the demographic change will negative impact on economic

growth, but can be by technological progress and human capital accumulation to weaken the influence, in the same way, Ji (2018) think that China's ageing population will have a negative effect on economic growth in a period of time, but we can correctly understand and fully grasp the aging process, to alleviate the negative impact.

The above scholars have indeed used multiple methods, theories and perspectives to measure the factors of GDP development, but all of them are only one aspect of economic development, without judging from multiple dimensions as a whole. We should know that the establishment and operation of the economic operation system are affected by multiple factors within and outside the system. Therefore, this paper uses Eviews to make an empirical analysis from multiple aspects affecting the economic operation system.

III. THEORETICAL ASSUMPTIONS

In economics, domestic demand, consumption and export are usually compared to the "troika" driving GDP growth, which is the most vivid and vivid expression of the principle of economic growth. However, it seldom involves the influence of employment, foreign investment, urbanization level, transportation infrastructure construction and other factors. Phillips in 1958, the economist published a 1961-1957, the British unemployment and the relationship between the money wage rate of change, with nearly 100 years of data validation is related to the economic growth and employment relationship, but macro economists think in Chinese when phase is mainly pulled by investment and economic growth and employment factors in spite of, but not obvious. Therefore, employment is an unavoidable factor in the study of economic growth at the present stage. Similarly, in 2009 Michael Spence, a Nobel laureate in economics, did a study on globalization that found no causal relationship between urbanization and economic growth, but a strong one. At the same time, from a global perspective, there seems to be a phenomenon that countries with a high urbanization rate have a higher overall development level, so the urbanization level can be used as a reference indicator for economic growth. According to the unique geographical location and realistic reasons of Yunnan, the backward transportation infrastructure and poor educational resources are the "shortest piece of wood" for the economic development of Yunnan province. Therefore, what kind of relationship exists between them and the economic development of Yunnan province is a problem that we must make clear. In addition, for the complete system of economic development of Yunnan province, the external influence on Yunnan province cannot be ignored, so it is reasonable to believe that foreign investment is an important factor affecting the economic development of Yunnan province.

To sum up, the existing and assumed fixed asset investment, the number of employed people at the end of the year, foreign investment, urbanization level, infrastructure and transportation facilities, education level, total retail sales of social consumer goods and exports are taken as the explanatory variables of GDP, and the econometric software Eviews is used for regression analysis.

IV. DATA SOURCE AND PROCESSING

The GDP (Y) (hundred million RMB) of Yunnan province from 2000 to 2017 is shown in "Table I" with the data of total fixed asset input (X1) (hundred million RMB), employed population at the end of the year (X2) (ten thousand), foreign investment (X3) (hundred million RMB), urbanization level (X4)(%), length of basic roads (X5) (miles), education level (X6) (ten thousand), total retail sales of consumer goods (X7) (hundred million RMB) and export volume (X8) (billion us dollars).

TABLE I. ECONOMIC INDICATORS OF YUNNAN PROVINCE FROM 2000 TO 2017

	GDP	TFAI	EP	FI	UL	R	EL	CG	EV
	Y	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*
2000	2011.19	697.94	2295.40	4819	23.4	16.36	9.04	583.17	11.75
2001	2138.31	734.81	2322.50	5377	24.9	16.40	11.90	640.80	12.44
2002	2312.82	828.65	2341.30	6055	26	16.49	14.34	711.25	14.30
2003	2556.02	1021.18	2353.30	7309	26.6	16.61	17.53	782.46	16.77
2004	3081.91	1330.60	2401.40	7892	28.1	16.71	20.06	915.31	22.39
2005	3462.73	1755.30	2461.3	8420	29.50	19.45	23.21	1041.29	26.42
2006	3988.14	2220.45	2517.6	10700	30.50	19.85	26.81	1204.75	33.91
2007	4772.52	2798.89	2573.8	11833	31.60	20.03	30.21	1422.57	47.36
2008	5692.12	3526.60	2638.4	14106	33.00	20.38	34.35	1764.74	49.87
2009	6169.75	4527.02	2684.80	15900	34.00	20.60	38.95	2052.83	45.14
2010	7224.18	5528.71	2765.85	17949	34.70	20.92	43.69	2555.80	76.06
2011	8893.12	6185.30	2857.24	20641	36.80	21.45	48.76	3105.89	94.73
2012	10309.47	7831.10	2881.90	22561	39.31	21.91	51.22	3597.85	100.18
2013	11832.31	9968.30	2912.36	24097	40.48	22.29	54.86	4112.56	159.59
2014	12814.59	11498.58	2962.25	25253	41.73	23.04	57.70	4632.87	188.02
2015	13619.17	13500.62	2942.50	32720	43.33	23.60	61.46	5103.15	166.26
2016	14719.95	16119.40	2998.89	33005	45.03	23.81	65.66	5722.90	115.82
2017	16531.34	18474.89	3047.91	35278	47.3	25.3	69.88	6423.06	114.3

[a.] Data source: 2000-2017 statistical yearbook of Yunnan, statistical bulletin of Yunnan national economic and social development

V. EMPIRICAL ANALYSIS

A. Model Assumption

According to the above data, the scatter plot is made to directly observe the correlation of economic variables, so as to reasonably determine the mathematical form of the model, as shown in "Fig. 1".
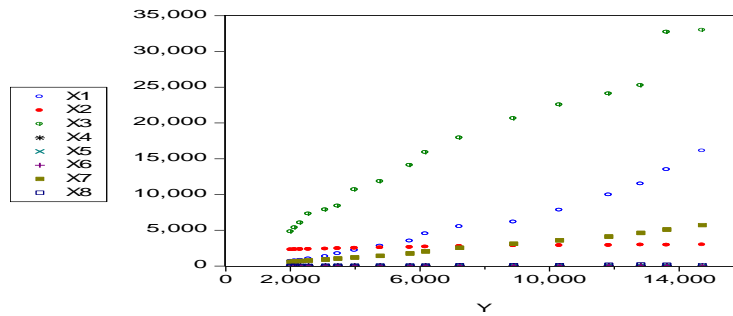

Fig. 1. Diagram of relationships between explanatory variables and explained variables.

According to the scatter plot, on the whole, Y increases with the increase of X, and there is a certain linear relationship. Therefore, based on the data, OLS model is assumed to be:

$$Y= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + U_i \quad (1)$$

Where, Y is the number of GDP, X1 is the total investment in fixed assets, X2 is the number of employed people at the end of the year, X3 is the total foreign investment, X4 is the degree of urbanization, X5 is the degree of education, X6 is the number of people with higher education, X7 is the total retail sales of consumer goods, X8 is the export value, and Ui is the random error term.

B. Parameter Estimation

Eviews is used to conduct linear regression of the 2000-2016 economic indicators in Yunnan province, and the results are shown in "Table II".

TABLE II.　　OLS REGRESSION RESULTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-19635.83	6701.512	-2.930060	0.0190
X1	0.079552	0.146250	0.543941	0.6013
X2	7.521825	3.094636	2.430601	0.0412
X3	0.046721	0.045060	1.036861	0.3301
X4	266.2040	77.98286	3.413622	0.0092
X5	-116.4756	89.70105	-1.298486	0.2303
X6	-135.9629	54.49210	-2.495095	0.0372
X7	1.387819	0.609986	2.275165	0.0525
X8	6.320858	1.888347	3.347298	0.0101
R-squared	0.999578	Mean dependent var		6799.900
Adjusted R-squared	0.999155	S.D. dependent var		4394.721
S.E. of regression	127.7183	Akaike info criterion		12.84258
Sum squared resid	130495.7	Schwarz criterion		13.28370
Log likelihood	-100.1620	Hannan-Quinn criter.		12.88643
F-statistic	2367.025	Durbin-Watson stat		2.473028
Prob(F-statistic)	0.000000			

The regression results are shown in the figure: Y=-19635.83+0.09552X1+7.52182X2+0.046721X3+266.2040X4-166.4756X5-135.9629X6+1.387819X7+6.320858X8　(2)

Among them:

T = (2.930060) (0.543941) (2.430601) (1.036861) (3.413622) (1.298486) (2.495059) (2.275165) (3.347298)

R2=0.999578, corrected R2=0.999155, F=2367.025

C. Model Test

It can be seen from the above regression statistical results that the model R=0.999578, indicating that the model established has a good fitting degree for the sample data. However, when a=0.05, t (2) = 2.430601, t (4) = 3.413622, t (6)= -2.495059, t(8)= 3.347298 are all greater than t(8)=2.306. Moreover, the sign of X5 and X6 is negative, which contradicts the actual situation. Therefore, the model may have multicollinearity.

1) Multicollinearity test: The correlation coefficient matrix method is used to determine whether there is multicollinearity. The correlation coefficient matrix is shown in "Table III".

TABLE III.   CORRELATION COEFFICIENT MATRIX TABLE

	X1	X2	X3	X4	X5	X6	X7	X8
X1	1.00	0.92	0.98	0.96	0.90	0.95	0.99	0.90
X2	0.92	1.00	0.96	0.98	0.97	0.99	0.95	0.91
X3	0.98	0.96	1.00	0.99	0.94	0.98	0.99	0.91
X4	0.96	0.98	0.98	1.00	0.97	0.99	0.98	0.92
X5	0.90	0.97	0.94	0.97	1.00	0.97	0.92	0.87
X6	0.95	0.99	0.98	1.00	0.97	1.00	0.97	0.91
X7	0.99	0.95	0.99	0.98	0.92	0.97	1.00	0.93
X8	0.90	0.91	0.91	0.92	0.87	0.91	0.93	1.00

It can be seen from "Table III" that the correlation coefficients of all the explanatory variables are above 0.9, which is close to 1. It can be judged that serious multicollinearity exists in model (1). In order to eliminate the influence of multicollinearity, the stepwise least square method was selected to solve the problem of multicollinearity, and the final regression model after the elimination of multicollinearity was selected. The operation results are shown in "Table IV".

TABLE IV.   OLS AFTER STEPWISE LEAST SQUARE METHOD

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-5529.784	1259.197	-4.391515	0.0007
X7	1.962252	0.087729	22.36710	0.0000
X2	2.748022	0.542946	5.061314	0.0002
X8	6.601516	1.911220	3.454085	0.0043
R-squared	0.998927	Mean dependent var		6799.900
Adjusted R-squared	0.998679	S.D. dependent var		4394.721
S.E. of regression	159.7132	Akaike info criterion		13.18696
Sum squared resid	331607.9	Schwarz criterion		13.38301
Log likelihood	-108.0892	Hannan-Quinn criter.		13.20645
F-statistic	4033.792	Durbin-Watson stat		1.537736
Prob(F-statistic)	0.000000			
	Selection Summary			
Added X7				
Added X2				
Added X8				

According to the results of Eviews, variables with insignificant estimated values of coefficients such as X1, X3, X4, X5 and X6 are discarded.

Therefore, the model is reset to:

$$Y = \beta 0 + \beta 1X7 + \beta 2X2 + \beta 3X8 + Ui \qquad (3)$$

The re-estimation results based on the model set in (3) are shown in "Table V".

TABLE V.   OLS REGRESSION TABLE

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5529.784	1259.197	-4.391515	0.0007
X7	1.962252	0.087729	22.36710	0.0000
X2	2.748022	0.542946	5.061314	0.0002
X8	6.601516	1.911220	3.454085	0.0043
R-squared	0.998927	Mean dependent var		6799.900
Adjusted R-squared	0.998679	S.D. dependent var		4394.721
S.E. of regression	159.7132	Akaike info criterion		13.18696
Sum squared resid	331607.9	Schwarz criterion		13.38301
Log likelihood	-108.0892	Hannan-Quinn criter.		13.20645
F-statistic	4033.792	Durbin-Watson stat		1.537736
Prob(F-statistic)	0.000000			

In this model, R=0.998927, R=0.998679, F=4033.792, the determination coefficient meets the expected value, and the model is relatively significant. Under the condition of significance level a=0.05, the regression model after eliminating multicollinearity is as follows:

$$Y = -5529.784 + 1.962252X7 + 2.748022X2 + 6.601515X8 \quad (4)$$

The signs of explanatory variables thus conform to the situation, that is, the total retail sales of consumer goods, total employment at the end of the year and total export are positively correlated with the GDP of Yunnan province.

2) Heteroscedasticity test: The existence of heteroscedasticity will reduce the accuracy of the model. Therefore, the existence of heteroscedasticity is first determined. White method is adapted to test (4) for the heteroscedasticity. The results of White's test are shown in "Table VI".

TABLE VI.   RESULTS OF WHITE TEST

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-171115.6	75785.82	-2.257885	0.0418
X7^2	-0.003360	0.001695	-1.982460	0.0690
X2^2	0.031060	0.012396	2.505547	0.0263
X8^2	-0.020633	1.238334	-0.016662	0.9870
R-squared	0.347611	Mean dependent var		19506.35
Adjusted R-squared	0.197060	S.D. dependent var		33366.77
S.E. of regression	29898.93	Akaike info criterion		23.65136
Sum squared resid	1.16E+10	Schwarz criterion		23.84741
Log likelihood	-197.0365	Hannan-Quinn criter.		23.67084
F-statistic	2.308925	Durbin-Watson stat		2.883008
Prob(F-statistic)	0.124325			

According to the data in the table, nR2=5.909387. According to the White test table, when a=0.05, (9) =16.919. Because nR2=5.909387< (9) =16.919, the model had no heteroscedasticity.

3) Autocorrelation test: First, the first-order autocorrelation is tested. According to the data in table 5, DW=1.537736. The d-w check table shows that dL=0.9, dU=1.71, and dL=0.9 The results of BG test for autocorrelation are shown in "Table VII".

TABLE VII.   BG TEST RESULTS TABLE

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-64.84380	1271.920	-0.050981	0.9602
X7	0.017691	0.090698	0.195058	0.8486
X2	0.026213	0.548322	0.047806	0.9627
X8	-0.658653	2.065962	-0.318812	0.7554
RESID(-1)	0.265790	0.300251	0.885226	0.3934
R-squared	0.061299	Mean dependent var		-2.12E-12
Adjusted R-squared	-0.251601	S.D. dependent var		143.9635
S.E. of regression	161.0592	Akaike info criterion		13.24135
Sum squared resid	311280.6	Schwarz criterion		13.48641
Log likelihood	-107.5515	Hannan-Quinn criter.		13.26571
F-statistic	0.195906	Durbin-Watson stat		1.624953
Prob (F-statistic)	0.935803			

As shown in "Table VII", TR=17*0.061299=1.042083 can be obtained in the detection of first-order autocorrelation, and the associated probability (P) is 0.3934. Therefore, under the condition of significance level a=0.05, the null hypothesis without autocorrelation is rejected, indicating the existence of first-order autocorrelation.

In the detection of second-order autocorrelation, TR=17*0.577282=9.813794, and the associated probability

(P) is 0.0037. Therefore, under the condition of significance level a=0.05, the null hypothesis without autocorrelation is not rejected, indicating that there is no second-order autocorrelation. In order to eliminate the influence of autocorrelation, the Cochron-Oakt iterative estimation method was selected to eliminate the autocorrelation. The calculated results are shown in "Table VIII".

TABLE VIII.   REGRESSION TABLE OF COCHRANE — OAKT ITERATIVE VALUATION METHOD

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5524.318	1887.128	-2.927368	0.0138
X7	1.981525	0.111587	17.75773	0.0000
X2	2.743919	0.804678	3.409961	0.0058
X8	6.008308	2.276105	2.639732	0.0230
AR(1)	0.260056	0.314665	0.826453	0.4261
R-squared	0.998905	Mean dependent var		7099.194
Adjusted R-squared	0.998507	S.D. dependent var		4356.239
S.E. of regression	168.3056	Akaike info criterion		13.33975
Sum squared resid	311594.4	Schwarz criterion		13.58118
Log likelihood	-101.7180	Hannan-Quinn criter.		13.35211
F-statistic	2509.470	Durbin-Watson stat		1.610801
Prob(F-statistic)	0.000000			
Inverted AR Roots	.26			

Under the premise of given significance level a=0.05, dL=1.71 Therefore, the final regression model results are:

$$Y=-5529.784+1.962252X7+2.748022X2+6.601515X8 \quad (5)$$

4) Test of prediction results: According to the above results, the forecast analysis of 2017 GDP is carried out, and the analysis results are shown in "Table IX".

TABLE IX.   GDP FORECAST AND ANALYSIS TABLE OF YUNNAN PROVINCE IN 2017

2000	⋯⋯	2017
1999.920	⋯⋯	16204.15

It can be seen from the calculation results that Y (2017) =16204.15, YFSE (2017) =250.3219, t (15)=2.1315. For a given confidence of 0.95, the confidence interval of predicted value Y is (15703.5062, 16704.7938). Obviously, 15703.5062<16204.15<16704.7938. The actual GDP in 2007 was 16531.34, and the gap between the forecast and the actual was within 2%, which was in line with the expectation, so the model was established.

VI.   CONCLUSION

A. Conclusion

Based on the empirical analysis of Yunnan's GDP, total retail sales of consumer goods, employment at the end of the year and total export at the end of 2016, the following conclusions are drawn: total retail sales of consumer goods, employment at the end of the year and total export will promote the economic development of Yunnan province.

B. Policy Suggestions

1) Stimulating domestic demand to boost consumption: According to the regression result, pull the GDP development in Yunnan province, the need to increase the social consumer goods, total investment and stimulating domestic demand, increase the residents' consumption expenditure can be from the following several aspects: first, perfecting the social security system, the improvement of the social security system effectively avoid the community's accumulated savings, and an increase in consumer spending as much as possible. Second, familiar with financial products, the use of financial instruments, within a reasonable range of credit, trust, fund products, help stimulate demand and advance consumption. Third, it is necessary to strengthen the contact between Yunnan province and surrounding countries and regions, and promote trade, cultural and economic exchanges and cooperation.

2) Adjusting the domestic industrial structure and the layout of foreign export products: The optimized industrial structure can not only effectively avoid the waste of resources, but also make more employed labor force in its "reasonable" position, which is helpful to increase the number of employed people. With the tide of China's economy changing from high-speed growth to medium-high growth and structural adjustment, optimizing the industrial structure and improving the utilization efficiency of resources will be the theme of future economic development, and the tertiary industry and service industry will be fully developed. In addition, the Yunnan province as a "bridgehead", "southwest gateway", should timely adjust the structure and layout of export products, increase the intensity of technology and science and technology innovation, increase the intensity of interaction with the neighboring countries trade export, confidence in Yunnan province and even China's products "go out", should give full play to the geographical location advantages in Yunnan province.

3) Strengthening investment attraction and provide sound policy protection: Due to its backward transportation and economy, Yunnan province fails to fully engage in material and cultural exchanges with developed countries and regions. Therefore, it does not do a good job in attracting foreign investment. From the results of model regression, it can be seen that foreign investment has a positive correlation with the economic development of Yunnan province. Although the influence degree is not very significant, it plays a very important role. To increase the intensity of foreign investment, we must provide a set of perfect policy protection, so that foreign businessmen can "willingly" "come in".

4) Improving the quality of employees: The enrollment number of Chinese college students is increasing year by year. While the quality education standard in China is rising, it is faced with the problem of disconnection between skills and social needs. Therefore, although the number of college students is increasing year by year, as shown in the regression results, it is negatively correlated with economic development to a certain extent. However, not only China, no matter which countries and regions are inseparable from the economic development of outstanding talents, so, to improve the quality of practitioners in line with social needs, not only quality education needs, but also social development needs.

5) Promoting urban development: Urbanization in the regression model has a significant positive correlation with economic development. The process of urbanization is the process of urban functional transformation and infrastructure construction, and it is one of the key factors driving domestic demand. The process of urbanization is to solve the process of urban and rural, industrial and agricultural, is to solve one of the key factors of rural labor productivity; The process of urbanization is the process of gathering production factors, and it is one of the key magic weapons for the rational distribution of industries within the region. Rapid urbanization is one of the driving forces for the economic development of Yunnan province and the

right choice to ensure the healthy, stable and sustainable development of Yunnan province.

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