Analysis of Influencing Factors of China's Economic Development

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ABSTRACT

The sustained and healthy development of China's economy is of great significance to the transformation and upgrading of the economic structure and modernization. In order to explore the influencing factors of China's economic growth and provide suggestions for promoting China's economic growth, this study selects GDP per capita as a measure of economic development, and establishes a fixed-effect panel data regression model to analyze the influencing factors of economic growth. The research results show that China's economic development level has risen with the increase of the percentage of urban population, urban population density, and employment rate, patent application number per 10,000 people, park green area per capita, and harmless treatment rate of domestic garbage. Finally, this article also puts forward specific suggestions for Chinese economic development based on the research conclusions.

Keywords: *economy, urban, GDP*

1. INTRODUCTION

Economic development is of great significance to a country. China's GDP has increased year by year for decades, and the economy has developed rapidly. GDP refers to the value of all the final products and services produced in the economy of a country or region in a certain period of time (usually a year). It is one of the most critical macroeconomic statistical indicators. It is a country or region that people understand and grasp. An effective tool for the operating conditions of the macroeconomic environment is an essential basis for formulating economic policies, an essential means for testing whether economic policies are scientific and practical, and an essential comprehensive indicator for evaluating the financial situation [1, 2].

The domestic researches on GDP are mainly to absorb and learn from foreign theories, to study the index system of China's national conditions [3]. Before 1985, the Chinese mainland's national economic accounting originated from the material balance system (MPS) that matched the former Soviet Union's planned economy. The SNA system which is internationally used was introduced to China in 1985, and GDP was used for national economic accounting [3, 4]. At the beginning of the 21st century, my country put forward a research and development theory on "green GDP" [5]. "Green GDP" refers to the green gross domestic product, which is an

adjustment to the GDP indicator, which is used to measure the accounting indicators of countries deducting the negative influence factors such as the ecological environment, to obtain the net GDP growth value [6]. China has made significant progress in the gradual deepening of green GDP research. Still, a complete scientific model has not yet been formed in an indicator system suitable for China's green economic development [7].

Regarding the factors that affect China's economic growth, domestic scholars have done a lot of research. Jiang et al. discussed the history of System of Environmental Economic Accounting [8], which was first released in 1993, used to solve the defect that SNA cannot reflect resource consumption and environmental pollution problems. In another Asian country, Japan, they set up a unique accounting agency for green GDP which is mainly for the accounting of single-type resources such as social-environmental resources and water resources. In their Draft of SEEA2003, they established indicators on the urban green area, eutrophication, greenhouse effect, waste disposal, etc [9].

This article mainly selects six variables (Percentage of urban population, Urban population density, Employment rate, Patent application number per 10,000 people, Park green area per capita, Harmless treatment rate of domestic garbage) from 30 provinces in China in

the past 15 years. The explanatory variable of GDP per capita is to study whether there is a stable relationship between per capita GDP and these indicators that are closer to the lives of ordinary residents [10, 11].

This article is going to perform correlation test and stationarity test on explanatory variables, use the Perdroni test and Kao test to perform co-integration test on panel data, and select appropriate models to regress per capita GDP and each explanatory variable [12].

2. METHODS AND MATERIAL

2.1. Variables and sources

This study chooses economic development as explained variable, and it is measured by GDP per capita (GC). The explanatory variables are Percentage of urban population (PUP), Urban population density (UPD), Employment rate (ER), Patent application number per 10,000 people (PAP), Park green area per capita (GAC), Harmless treatment rate of domestic garbage (HTR). They are shown in table 1.

Table 1 Variable meaning

Variable type	Variable name	Variable abbreviation
Explained variable	GDP per capita	GC
Explanatory variables	Percentage of urban population	PUP
	Urban population density	UPD
	Employment rate	ER
	Patent application number per 10,000 people	PAP
	Park green area per capita	GAC
	Harmless treatment rate of domestic garbage	HTR

The data comes from the 2005-2019 data recorded by the National Bureau of statistics. The total (or per capita) GDP announced each year is the total current price. To truly reflect the GDP growth, the GDP growth rate is the constant price growth rate, after deducting the price factor. So this research takes 2005 per capita GDP as a constant price and the per capita GDP from 2006 to 2019 is per capita GDP with 2005 as the constant price.

2.2. Correlation test

Before regression analysis, it is essential to test the correlation to evaluate the association between these variables.

2.3. Stationarity test

To prevent the "false regression" problem, ensuring the stationarity of the sequence before regression is necessary, that is to say, the unit root test is performed on the original variable sequence, judging the stationarity of the sequence. If the tested one is a stationary series, it can continue to be modeled; if the sequence is a non-stationary sequence, it's needed to perform difference processing or use analysis methods such as cointegration. The panel unit root test methods used in this paper are LLC test method, ADF-Fisher test method and PP-Fisher test method.

2.4. Cointegration test

When the analyzed time series variables are non-stationary series, in addition to the process of differencing the original series variables, cointegration analysis could also be performed. That is to say, to test whether the linear combination of these non-stationary variables is a stationary series, if the non-stationary series is If the linear combination is a static variable, it is considered that there is a long-term and stable relationship between these variables.

2.5. Regression analysis

The sample data used in this article is panel data which generally includes three forms: mixed regression model, fixed effect model and random effect model. In the process of selecting method of panel model form, this article first uses the F test to determine the mixed regression and individual effect models, and then uses Hausman's test to determine whether should establish a fixed-effects model or a random-effects model.

In the last, this article is going to give a linear regression equation between the explained variable and the explanatory variable, if the model is suitable to be established.

3. RESULTS AND DISCUSSIONS

3.1. Correlation test

Table 2 Correlation coefficient

Probability	GC	PUP	UPD	ER	PAP	GAC	HTR
GC	1.000000						
PUP	0.897975	1.000000					

UPD	0.018230	-0.075887	1.000000			
ER	0.408925	0.376332	0.045511	1.000000		
PAP	0.742558	0.723778	-0.013321	0.441746	1.000000	
GAC	0.515423	0.303097	-0.101205	0.354245	0.343036	1.000000
HTR	0.593081	0.410620	0.052213	0.356628	0.434767	0.572085	1.000000

Table 2 shows that the proportion of urban population, employment rate, patent applications number per 10,000 people, per capita park and green area, harmless treatment rate of domestic garbage and per capita GDP. The correlation coefficients are all significantly positive, indicating that there is a strong positive relationship between the proportion of the urban population, the employment rate, patent applications number per 10,000 people, the area of parks and green space per capita, the harmless treatment rate of domestic waste, and the per capita GDP. The correlation coefficient between the urban population density and per capita GDP is not significantly positive, indicating that there is a weak positive correlation between urban population density and per capita GDP.

In addition, the correlation coefficient absolute value between the two explanatory variables is below 0.8. It can be considered that the model which is going to establish does not have serious multicollinearity, and the model is reliable.

3.2. Stationarity test

The test results are as follows.

Table 3 The results of unit root test

Variables	Levin, Lin & Chu t*		ADF - Fisher Chi-square		PP - Fisher Chi-square	
	Statistic	Prob.**	Statistic	Prob.**	Statistic	Prob.**
GC	-2.34125	0.0096	31.3714	0.9992	30.4283	0.9995
PUP	-1.51389	0.0650	72.8990	0.1226	101.648	0.0006
UPD	5.50940	1.0000	14.7929	1.0000	13.4097	1.0000
ER	-1.80996	0.0352	64.3497	0.3269	85.0628	0.0184
PAP	3.65370	0.9999	41.8859	0.9637	38.0538	0.9879
GAC	9.06549	1.0000	6.76762	1.0000	3.65932	1.0000
HTR	6.25624	1.0000	12.0148	1.0000	4.71233	1.0000
D GC	-10.8604	0.0000	169.110	0.0000	220.615	0.0000
D PUP	-3.48280	0.0002	98.5491	0.0013	97.4052	0.0016
D UPD	-53.0421	0.0000	527.539	0.0000	550.479	0.0000
D ER	-12.0156	0.0000	252.652	0.0000	284.665	0.0000
D PAP	-1.58044	0.0570	93.6326	0.0036	162.629	0.0000
D GAC	-13.1505	0.0000	222.830	0.0000	280.498	0.0000
D HR	-15.6294	0.0000	305.151	0.0000	309.721	0.0000

Note: adding D before the variable means performing first-order difference processing on the variable.

Table 3 shows that per capita GDP, urban population ratio, urban population density, employment rate, patent application number per 10,000 people, per capita park and green area, The innocuous treatment rate of domestic waste cannot be tested under the LLC test method, ADF-Fisher test method and PP-Fisher test method to be less than 0.1 at the same time, that is, the original sequence of each variable cannot be simultaneously under the three test methods. Achieve a stationary state; after the first-order difference processing for each variable, it can be seen that the test P- value of each variable under the three test methods at this time is less than 0.1. That is, the first-order sequence of each variable is simultaneously under the three test methods Reach stable, indicating that each variable is first-order single integer.

3.3. Cointegration test

From the preceding, each variable sequence satisfies the precondition of the cointegration test. In this paper, Perdroni test and Kao test are mainly used to perform the co-integration tests on panel data. In these two tests, the null hypothesis is: there is no cointegration relationship between the sequences.

Table 4 shows that the results of P values of Panel v-Statistic, Panel rho-Statistic, and Group rho-Statistic under the Pedroni cointegration test are all greater than 0.1, Panel PP-Statistic, Panel ADF-Statistic, Group PP-Statistic, Group ADF- Statistic test P values are all less than 0.1. According to these test results it is impossible to judge whether there is a cointegration relationship, to check whether there is a long-term and stable relationship, the Kao cointegration test is performed below to further confirm.

Table 4 The results of Pedroni cointegration test

	Statistic	Prob.
Panel v-Statistic	0.514578	0.3034
Panel rho-Statistic	8.419125	1.0000
Panel PP-Statistic	-1.841397	0.0328
Panel ADF-Statistic	-4.722378	0.0000
Group rho-Statistic	9.957940	1.0000
Group PP-Statistic	-10.11511	0.0000
Group ADF-Statistic	-7.158235	0.0000

It can be seen in Table 5 that the Kao cointegration test statistic is -6.5988, the test P-value is 0.0000, and the 10% significance level test is passed. There is a long-term stable equilibrium relationship among the proportion, urban population density, employment rate, patent application number per 10,000 people, per capita park and green area, and the rate of innocuous treatment of domestic waste. The regression analysis is as follows.

Table 5 The results of Kao cointegration test

	t-Statistic	Prob.
ADF	-6.598800	0.0000

3.4. Regression analysis

The test results of the model are as follows.

The original hypothesis of the F test is "it is suitable for building a mixed regression model." This can be seen in Table 6 that the statistics of Cross-section F and the Cross-section Chi-square are 60.61 and 743.48 respectively, and the test P-value is both 0.0000, which is less than 10%, rejecting the original hypothesis. It is suitable for establishing a fixed-effects model. In order to test whether it's reasonable to select a fixed-effects model or a random-effects model, the Hausman test is then performed.

The original hypothesis of the Hausman test is "suitable for establishing a random-effects model." It can be seen in Table 7 that its statistic is 19.85, and the test P-value is 0.0029, which is less than 10%. The null hypothesis is rejected again, so the model finally chooses the fixed effects model.

Table 6 The results of F test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	60.607940	(29,411)	0.0000
Cross-section Chi-square	743.476246	29	0.0000

Table 7 The results of Hausman test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	19.847100	6	0.0029

3.5. Interpretation of regression results

Table 8 The regression results of factors affecting GDP per capita

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PUP	0.041441	0.001717	24.12949	0.0000
UPD	0.089742	0.013235	6.780813	0.0000
ER	0.043409	0.012855	3.376875	0.0008
PAP	0.004523	0.000466	9.710690	0.0000
GAC	0.019434	0.003269	5.944935	0.0000
HTR	0.004278	0.000398	10.74089	0.0000
C	2.493769	1.210797	2.059610	0.0401
R-squared	0.981470	Mean dependent var		10.24808
Adjusted R-squared	0.979892	S.D. dependent var		0.622819
S.E. of regression	0.088317	Akaike info criterion		-1.938658

Sum squared resid	3.205762	Schwarz criterion	-1.608251
Log likelihood	469.2901	Hannan-Quinn criter.	-1.808396
F-statistic	621.9831	Durbin-Watson stat	0.423585
Prob(F-statistic)	0.000000		

It can be seen from the regression results (Table 8) that R-squared is 0.9815, indicating that the model has a good degree of fit, the F statistic is 621.9831, and the test P-value is 0.0000, which indicates that the model has a very significant effect.

The regression coefficient of the proportion of urban population is 0.0414, the standard error is 0.0017, the t value is 24.13, and the test P-value is 0.0000, which is far less than 0.1. Passing the 1% significance level test, indicating that the proportion of urban population is Per capita GDP has a significant positive impact. The increase in the proportion of urban population has clearly driven per capita GDP. The regression coefficient of urban population density is 0.0897, the standard error is 0.0132, the t value is 6.78, and the test P-value is 0.0000, which is significant at the 1% level, indicating that urban population density significantly promotes per capita GDP, that is, the higher the population density Of cities have higher per capita GDP. The regression coefficient of the employment rate is 0.0434, the standard error is 0.0129, the t value is 3.38, and the test P-value is 0.0008. It has passed the 1% significance level test, indicating that the increase in the employment rate has significantly promoted per capita GDP. The regression coefficient of the patent application number per 10,000 people is significantly 0.0045 at the 1% level, indicating that patent applications per 10,000 people have a clear positive impact on per capita GDP. The regression coefficient of per capita park green area is 0.0194, the standard error is 0.0033, the t value is 5.94, and the test P-value is 0.0000, which is significant at the 1% level, indicating that the per capita park green area significantly increases the per capita GDP. The regression coefficient of the harmless treatment rate of domestic waste is 0.0043, the standard error is 0.0004, the t value is 10.74, and the test P-value is 0.0000, which is significant at the level of 1%, indicating the improvement of the harmless treatment rate of domestic waste Significantly promote the growth of per capita GDP.

4. CONCLUSIONS

This article mainly chose variables closely related to green GDP indicators and residents' lives as explanatory variables to study whether these variables have a long-term and stable relationship with GDP per capita in 15 years.

In the correlation analysis, it is found that the six variables (Percentage of urban population (PUP), Urban population density (UPD), Employment rate (ER), Patent application number per 10,000 people (PAP), Park green area per capita (GAC), Harmless treatment rate of domestic garbage (HTR) have a significant positive correlation with per capita GDP. There is no severe collinearity problem between the variables.

After stability test and co-integration test, it is proved that there is a long-term stable relationship between per capita GDP and the ratio of urban population, urban population density, employment rate, and patent application number per 10,000 people, per capita park and green area, and the rate of harmless treatment of domestic waste.

According to the conclusion of this study, China is at a critical stage of green development, and some factors related to environmental resources or people's livelihood in life play an essential role in economic development. Therefore, this study gives the following development suggestions. First, in the process of urbanization, pay attention to protecting the existing green space resources. Urban construction should not be based on sacrificing the environment. Second, the number of patents per 10,000 people has a significant role in promoting GPD per capita, and the country should continue to vigorously support investment in science and technology innovation. Third, the conversion rate of urban hazardous materials treatment is a good indicator of the city's investment in resource utilization and environmental protection. This is also a factor related to the living environment of urban residents. We should continue to invest in human resources and material resources in this area. Of course, we need more effective technological means to improve processing efficiency. Forth, the employment rate is also a factor directly related to economic development. In Chinese society after COVID-19, guaranteeing employment rates is also an essential step in economic recovery.

However, there are some limitations to this study. In addition to those variables chosen in this article, some other variables may influence economic development, such as environmental factors.

REFERENCES

[1] Zuo, S. (2011) An Econometric Analysis of the Factors Affecting GDP. China Securities Future s, (02): 168-169.

[2] Kang, B., & Dufour, J. M. (2021). Exact and a symptotic identification-robust inference for dyn amic structural equations with an application to

New Keynesian Phillips Curves. Econometric R eviews, 40(7), 657-687.

[3] Li, Z. (2000) Econometrics. Higher Education P ress.

[4] Pan, S. (2007) Econometrics. China Renmin Uni versity Press.

[5] Zhang, X. (2004) Guide to the use of economet rics software Eviews. Nankai University Press.

[6] Sun, X., Ping, Z. B., Dong, Z. F., Chen, K. L., Zhu, X. D., Li, B. L., ... & Xiong, W. (202 1). Resources and environmental costs of China 's rapid economic growth: From the latest theor etic SEEA framework to modeling practice. Jou rnal of Cleaner Production, 315, 128126.

[7] Wang, P., Wu, W., Zhu, B., & Wei, Y. (2013). Examining the impact factors of energy-related CO2 emissions using the STIRPAT model in G uangdong Province, China. Applied Energy, 106, 65-71.

[8] Jiang Y., Li X., Zhang S. (2021). Current status and enlightenment of international green GDP accounting. Land and Resources Information (0 2), 15-21.

[9] Zhang Q., Wu C. (2019). Experiences and enlig htenment of foreign natural resource accounting and evaluation. China Land (02), 49-51.

[10] Guo, X., Ren, D., & Shi, J. (2016). Carbon e missions, logistics volume and GDP in China: empirical analysis based on panel data model. E nvironmental Science and Pollution Research, 23 (24), 24758-24767.

[11] Jain, D., Nair, K., & Jain, V. (2015). Factors a ffecting GDP (manufacturing, services, industry): An Indian perspective. Annual Research Journa l of SCMS Pune, 3, 38-56.

[12] Schmidheiny, K., & Basel, U. (2011). Panel da ta: fixed and random effects. Short Guides to Microeconometrics, 7(1), 2-7.