

Factor Study: Factors Influencing GRP in Various Provinces of China

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Abstract. The development speed of China is evident throughout the world. However, the development speed within each province in China varies greatly. In order to explore the variables that would have an impact on the economy of various provinces in China, this paper examines the factors impacting GRP in various provinces by using a year-fixed effect model and official data from the China National Bureau of Statistics in 2017. Results indicate that household consumption expenditure, urban employment, and freight traffic are positively correlated with GRP. The above results provide a reference basis for subsequent research and policymakers. However, the number of higher education students has a negative impact on GRP, and this result needs to be further explored in subsequent research.

Keywords: GRP, Consumption Expenditure, Employment, Education, Freight Traffic.

1. Introduction

1.1. Research Background and Significance

In the past decade, China's economic development has been very rapid, to the point where many people marvel at China's system and booming productivity [1]. The development status of various provinces in China has always been a concern for both the government and the people. With the national economy expanding rapidly, some provinces have made significant contributions to this, while others are still in a backward economic situation [2]. The speed and equality of economic development are not only concerning of every government, but also the most fundamental issues in economics. Therefore, this study provides constructive suggestions and guidance for the economic development of various regions by exploring the impact of consumption expenditure, employment, education, and transportation on gross regional product.

1.2. Literature Review

The concepts of regional gross regional product (GRP) and GDP are almost identical, but their measurement ranges are different. GRP only displays the new value produced within a year within a region, which is also the dependent variable studied in this article [3]. Laura and Estefanía stated that the educational level is closely related to the economy, and higher education contributes a lot to regional economic development [4]. This is because the higher productivity and high production quality of labor brought about by higher education enable the economy to grow more effectively [5]. Besides, the better products they produce can also stimulate purchasing power, thereby increasing personal consumption expenditure [6]. In China, private consumption expenditure is an essential factor driving the fast growing of the Chinese economy [7]. Thus, the education level and household consumption expenditure are the focus of this study. More importantly, employment serves as a bridge between educational output, namely students, and social production. Therefore, the issue of employment has always been a concern for governments in various countries and regions. Due to the increasingly mature development of urbanization, the majority of the future labor force will come from cities, and they will also contribute significantly to regional development [8]. Thus, the employment situation in urban areas was also included in this study. In addition, freight volume and transportation also have an important impact on the regional economy [9]. Investing in freight

transportation means higher productivity and efficiency, which will also promote regional economic development [10]. Therefore, the impact of freight on GRP cannot be ignored.

1.3. Research Content and Framework

This article will first explain the selection of data, as well as the introduction and setting of each variable in the model. Next, multiple linear regression will be performed on the model, and the regression results will be displayed in the results section. Then, the paper will discuss the results of this study, analyze and compare the similarities and differences with previous studies, and provide suggestions and prospects at the end.

2. Method

2.1. Data Collection

This study used the data obtained from the National Bureau of Statistics of China (NBS), which is the official data collection and publication website in China. The NBS provides a large amount of multifaceted data about China as a whole and by region, and is a reliable and trustworthy data source.

The names of these data used in this paper are “Gross Regional Product”, which stands for the value newly produced by the regional economy, “Freight Traffic”, which refers to total actual quantity of goods transported by railway or highway wagons and vehicles, or by a variety of watercraft, “Number of Employed Persons in Urban Units”, “Household Consumption Expenditure”, which refers to the average consumer expenditure calculated on long-term residents, and “Number of Students Per 100 000 Population in Higher Education”. Meanwhile, the population of various provinces in China in 2017 is also selected for use in calculating per capita GRP.

The data for this study is all from China in 2017, because among all the variables, the latest data for household consumption expenditure is from 2017. Therefore, other variables in this model should be consistent with this data to make the model more accurate in exploring the impact of this variable on dependent variables. On the website of NBS, it is clear to found that in 2017, all the variables selected in this paper had data in all provinces and regions of China mainland, so the data chosen for this study is in 2017.

2.2. Data Analysis and Variable Setting

The dependent variable of this study is GRP, which stands for the "Gross Regional Product", with a unit of 100 million RMB. The independent variables are four discrete variables, namely HCE, EMPL, FT and HEDU, which represent Household Consumption Expenditure, Number of Employed Persons in Urban Units, Freight Traffic, and Number of Students Per 100,000 Population in Higher Education. The data summary of all variables is presented in Table 1, where the unit of HCE is yuan, the unit of EMPL is 10,000 people, FT is in 10,000 tons, and HEDU and the population in each province are in persons.

Table 1. Data Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
GRP	31	26841.819	22161.575	1349	91648.7
HCE	31	23349.419	10537.688	10990	53617
EMPL	31	569.148	426.971	33.3	1963.1
HEDU	31	2599.581	750.205	1391	5300
FT	31	152295.19	105094.61	2203	403426

3. Results

From the model in this study, it can be seen that the relationship between each independent variable and the speech variables is roughly consistent with prediction. Table 2 shows the results of this model after regression.

Table 2. Linear regression 1

GRP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HCE	.272	.092	2.97	.006	.084	.461	***
EMPL	44.704	4.588	9.74	0	35.273	54.135	***
HEDU	-2.716	1.244	-2.18	.038	-5.273	-.159	**
FT	.024	.011	2.28	.031	.002	.046	**
Constant	-1604.902	2515.604	-0.64	.529	-6775.799	3565.995	

Firstly, HCE, FT, and EMPL are positively correlated with GRP. The effect of HCE and FT on GRP is more significant. Through their coefficients, which are 0.27 and 0.02, respectively, their t-values are still significant at the 95% confidence interval due to their more minor robust standard deviation. Therefore, the impact of these two variables on GRP cannot be ignored. However, the coefficients of them are relatively small because each variable has a different statistical unit. In fact, these two coefficients represent an annual GRP of 27.24 million yuan for a single household consumption expenditure increase of 1 yuan, and an additional freight volume of 10000 tons will increase the GRP of 2.43 million yuan. Therefore, this result effectively demonstrates the significant positive impact of these two variables on the dependent variable.

Secondly, the impact of EMPL on GRP is also very significant. From the results, the coefficient of employment is positive and significant at the 5% level, indicating that 10000 additional urban unit employment will cause a GRP increase of 4.4 billion yuan. This result supports the idea that higher employment in urban units reflects higher labor productivity and eventually, economic output in a region. From the data, the top three cities in terms of urban employment-population are Guangdong, Jiangsu, and Shandong. Meanwhile, these three cities correspond to the top three cities in the national GRP ranking, and their order is consistent with the order of urban employment population. Similarly, Tibet, Qinghai, and Ningxia, the three provinces with the lowest EMPL, also had the lowest GRP in the nation in 2017. This outcome is in line with the model's regression findings. It amply demonstrates the strong correlation between the urban employment population and GRP. At the same time, the significant differences in data also indicate certain differences in regional economic development and employment opportunities. The result also implies that promoting employment in urban units could be an effective strategy to enhance regional economic growth and reduce income inequality in China.

Finally, it was unexpected to find the result that across different provinces, there is a negative but significant correlation between GRP and the number of students per 100,000 people participating in higher education. Table 2's results show that the coefficient of HEDU is negative but significant at the 5% level, which means that, if all other factors remained constant, one additional student per 100,000 people would result in a surprisingly drop in GRP of \$2.7 billion. Generally speaking, people with higher education have higher productivity, so it is relatively more reasonable to expect that regions with more people receiving higher education should have higher GRP.

However, when GRP was divided by the population of the region to obtain the per capita GRP, a simple linear regression model ran with only GRP per capita (GRPP) as the dependent variable and HEDU as the independent variable, the coefficient of HEDU becomes positive and still, significant at the 5% level, indicating that a one unit increase in the number of students per 100000 population in higher education is associated with 255 yuan increase in GRP per capita. Table 3 illustrates the positive correlation between HEDU and GRP per capita for each province in China in 2017.

Table 3. Linear Regression 2

GRPP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HEDU	.003	0	6.04	0	.002	.003	***
Constant	-.781	1.009	-0.77	.445	-2.844	1.283	

While, the provinces with the highest number of students in higher education per 100,000 population, which is Beijing, Tianjin, and Shaanxi, they are not exactly in the top three in terms of GRP per capita. For example, Shaanxi's per capita GRP can only be considered the average level in China. Reasonably, the provinces with the lowest number of that, which is Qinghai, Tibet and Xinjiang, have lower GRP per capita. Therefore, education does affect the Gross Regional Product. Still, it cannot be used as a single influencing variable because it cannot independently explain the changes in the dependent variable.

Through the comparison of these two regressions, it indicates that there may be multicollinearity in the original model. The existence of multicollinearity may lead to inaccurate estimation of HEDU coefficients in regression. Therefore, the variance impact factor (VIF) is used to detect multicollinearity in the model. The VIF values of each variable are shown in Table 4, which are all between 2 to 3, indicating the presence of multicollinearity among the data. Still, it is not severe and thus can be ignored.

Table 4. VIF Test

Variable	VIF	1/VIF
EMPL	2.870	0.348
HCE	2.600	0.385
FT	2.360	0.424
HEDU	2.100	0.476
Mean VIF	2.480	

4. Discussion

This study was targeted to examine the impact of household consumption expenditure (HCE), employment in urban units (EMPL), higher education level (HEDU), and freight traffic (FT) on gross regional product (GRP) in China. Using cross-sectional data for 31 provinces in 2017, a multiple linear regression model was estimated to test the hypothesis that these variables have positive effects on GRP, controlling for year effects. The results showed that all the explanatory variables were significant at the 5% level, except for the constant. The coefficients of HCE, EMPL, and FT were positive, indicating that higher levels of these variables were associated with higher GRP, holding other variables constant. However, the coefficient of HEDU was negative, indicating that higher education level had a detrimental effect on GRP, contrary to the assumption.

The positive effect of HCE on GRP is consistent with the Keynesian theory of aggregate demand, which states that higher consumption spending leads to higher income and output in the economy. This result is also in line with previous empirical studies that suggests that increased consumption has contributed to China's economic growth [7]. The positive effect of EMPL on GRP reflects the importance of labor as a factor of production and a source of income. Higher employment in urban units implies higher labor productivity and economic output in a region. This outcome is supported by previous research that found a positive impact of employment on economic growth [8]. The positive impact of FT on GRP suggests that freight traffic is a proxy for trade and transportation activities, which enhance regional economic development by cutting transaction costs, facilitating the exchange of goods and services, and increasing market access. This result matches up with previous studies that found a positive relationship between freight traffic and economic development [11].

The negative effect of HEDU on GRP is surprising and contradicts the human capital theory, which states that higher education level improves the skills and knowledge of workers, which in turn increases their productivity and income [5]. Additionally, this outcome differs from that of earlier studies that discovered a positive correlation between higher education and the boom in economy in China [12]. A possible explanation for this finding is that there may be a mismatch between the supply and demand of highly educated workers in the labor market. This could result in underemployment, unemployment, or brain drain of graduates who cannot find suitable jobs that match their qualifications and expectations. This would reduce their contribution to economic output and income.

Besides, as more students enroll in higher education, the quality of education may decline due to insufficient resources, facilities, faculty, and standards. This would lower the productivity and innovation potential of graduates, and thus their impact on economic growth [13].

5. Conclusion

This paper examined the impact of household consumption expenditure (HCE), employment in urban units (EMPL), number of students in higher education (HEDU), and freight traffic (FT) on gross regional product (GRP) in China. Using cross-sectional data for 31 provinces in 2017, a multiple linear regression model was estimated to test the hypothesis that these variables have positive effects on GRP, controlling for year effects. The results revealed that all the explanatory variables were significant at the 5% level. The coefficients of HCE, EMPL, and FT were positive, indicating that higher levels of these variables were associated with higher GRP, holding other variables constant. However, the coefficient of HEDU was negative, indicating that higher education level had a negative effect on GRP, contrary to the previous study. The t-value of EMPL was much larger than the others, indicating that employment in urban units had the strongest impact on GRP among the independent variables. Besides, the constant term was not significant, suggesting that there was no regional fixed effect on GRP. The VIF values of all the variables were between 2 and 3, indicating that there was little multicollinearity problem in the model. This study has some implications and contributions for policymakers, practitioners, and academics. For policymakers, this study provides evidence on how household consumption expenditure, employment in urban units, higher education level, and freight traffic affect regional economic growth in China. Based on these conclusions, policymakers can develop new policies that encourage consumer spending, job creation, quality of schooling, and transportation infrastructure in order to enhance regional economic growth. Furthermore, this can help to lessen income inequality in China, which can help to improve the country's general economic level and regional harmony. This study also provides recommendations for the workforce for decision-making and life planning. The results indicate that there are significant differences in the opportunities and challenges faced by different regions in China in terms of economic development and competitiveness, and this difference is closely related to the labor market and consumer market. Therefore, as a combination of these two identities, practitioners should adjust their plans according to the actual situation to adapt to the constantly changing market conditions in different fields and avoid problems such as unemployment. For scholars, this study has contributed to the study of the determinants of regional economic growth in China through the use of panel data and multiple linear regression models, which can serve as a reference. This study also found unexpected results in existing literature and proposed directions for future research.

This paper has some limitations that must be acknowledged and dealt with in future research study. The data used in this paper are cross-sectional, which means that they just capture the circumstance in different provinces in China in 2017. This limits the ability to analyze the dynamic and causal relationships between the variables over time. Future research could use panel data that cover multiple years and provinces to capture the temporal and spatial variation and evolution of regional economic growth in China. Second, the model used in this paper is a simple multiple-linear regression model that assumes a linear and additive relationship between the dependent and independent variables. This may not reflect the complex and nonlinear interactions and mechanisms involved in the economic growth process. Researchers in the future might use more advanced and flexible models such as nonlinear regression, spatial econometrics, or structural equation modeling to account for the possible nonlinearities, spatial dependence, and endogeneity issues in the information. Third, the model used in this paper only includes four independent variables: household consumption expenditure, employment in urban units, higher education level, and freight traffic. These variables may not capture all the relevant factors that affect regional economic growth in China. It is expected that future research could include more variables that reflect other aspects of regional development such as innovation, infrastructure, environment, governance, culture, etc. Besides, the regression model used

in this study controls for year effects but not for province effects, which may introduce omitted variable bias or endogeneity problems. Future research could use fixed effects or random effects models to investigate unobserved province-specific factors that may affect GRP.

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