The Impact of Public Goods Supply Capacity on China's Economic Development
-Evidence From Inland Provinces of China

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ABSTRACT

We studied the relationship between the supply capacity of public goods and economic development by developing a model of the main influencing factors of economic and social development. In theoretical research, it's found that the supply capacity of public goods can effectively promote economic development. In the empirical analysis, firstly, we used the sample data of China's inland provinces over the years, and used instrumental variable method and generalized moment method to verify the conclusion of the theoretical analysis. Secondly, we used the grouped data representing the supply capacity of public goods to estimate, and found that its positive effect on economic development is basically unchanged, which verifies the robustness of the model.

Keywords: economic and social development, main influencing factors, public goods supply capacity,

promoting role

1. INTRODUCTION

For a long time, public goods have been considered as the premise of economic growth and social development. An important role of government departments is to provide and manage various public goods, such as health care, social security protection, public infrastructure and education etc. The supply of public goods has played an important role in promoting economic and social development, this view is supported by empirical evidence from transnational (Gennaioli and Rainer, 2007[1]) and within a country (Michalopoulos and Papaioannou, 2013[2]; Bandyopadhyay and Green, 2012[3]). Their research found that there is a positive relationship between the centralization of political power that determines the supply capacity of public goods and economic and social development.

Soifer (2008)[4], Acemoglu et al. (2015)[5] regarded government employees as an aspect of local "infrastructure strength", using the number of local government employees to represent government administrative capacity, which in turn determines the ability to provide public services. Using this method, in 1998, the number of employees in administrative institutions in China was about 33.26 million, accounting for about 2.67% of the total population. In 2017, these figures were 51.95 million and 3.74% respectively, which was 40.19% higher than that in 1998. In 1998, China's fiscal revenue was about 987.595 billion yuan, accounting for 11.59% of GDP. In 2017, the data of this group were 17259.277 billion yuan

and 20.87% respectively, which was 80% higher than that in 1998. On the contrary, Colombia is famous for its relatively lack of administrative capacity. In 1870, the total population of Colombia was about 2.7 million, and the number of local and central government officials was about 4500. The proportion of government staff in the total population was only 0.15%. Moreover, until the middle of the 20th century, the country did not have the ability to obtain fiscal revenue (DEAS, 1982[6]).

The contribution of this paper to the literature is to study the impact of the supply capacity of public goods on economic and social development in China's inland provinces. Since the provision of public goods comes from the government, the administrative capacity of the government determines the supply capacity of public goods. Based on Soifer (2008) [4], we use the number of government employees to represent the administrative capacity of the government, which indirectly determines the ability of the state to provide public goods.

1.1. Literature Review

So far, many scholars at home and abroad have studied the role of a government's administrative capacity. There are two kinds of most representative researches in the world. One is about the effect of government administrative capacity on the whole economic development, and the other is the impact of it on some aspect of economic society. For the first category, there are not only historical and empirical studies on the role of government administrative capacity on economic development, such as

Besley and Persson (2009) [7], emphasizing the importance of government administrative capacity, but also a small number of studies modeling the existence or lack of government administrative capacity. For example, Acemoglu (2005) [8] built a model in which the self-interest rulers tax and invest in public goods, and the citizens make investment decisions. Because the government is not encouraged to invest in public goods, it lacks administrative capacity, resulting in insufficient supply of social public goods, which is not conducive to economic development. As for the second type of research, such as the study on the income gap in the United States, it is pointed out that institutional differences are the potential causes of such differences (for example, Acemoglu and Dell, 2010[9]; Acemoglu et al., 2012[10]; bruhn and Gallego, 2012[11]). Some studies have linked online game theory with government investment and empirical work, such as Calvo Armengol et al. (2009) [12], bramoulle et al. (2014) [13], etc. O'Donnell (1993) [14] emphasized that the uneven distribution of public goods provision capacity in a Latin American country leads to the differences in the quality of democracy within a country. There are also relevant views in the literature on civil war. Scholars believe that conflicts begin and persist in some areas with low administrative capacity of government (Ferran and Laitin, 2003[15]). The above literature studies the administrative capacity of the government from various angles, theoretically or empirically, However, the above research does not focus on the change of government administrative capacity, nor does it directly analyze the role of public goods supply. This paper will make a systematic study on the role of public goods in economic and social development.

Another kind of literature studies the optimal level of public goods provision. For example, Morita (2014) [16] reconsidered the optimal nonlinear tax problem related to public goods from the perspective of commitment problem, and investigated its impact on the supply conditions of public goods. Fang and Norman (2003) [17] studied the optimal supply mechanism of multiple exclusive public goods when the agent's valuation is private information. Based on the control of real economic factors, this paper analyzes the optimal level of public goods supply.

In recent years, there have been some researches on the provision of public goods in China. The main research areas are as follows: On the one hand, it mainly studies the impact of public goods or services and related issues on macro-economy, such as Ya Gao et al. (2019) [18] studies the impact of urban basic public service differences on the housing market, and empirically examines the role of urban basic public services in the development of housing market and its influence mechanism. Liu Min (2020) [19] systematically studied the one which is the impact of the "one belt, one road" countries' public goods supply capacity on economic growth. The second is mainly about the impact of public goods supply capacity on the economic and social micro fields. For example, Liao Kaicheng et al. (2019) [20] empirically tests the regional differences between government economic investment

efficiency and social investment efficiency and their dynamic relationship. The third aspect mainly studies the main factors that affect the ability to provide public goods, For example, Wu Dan (2019)[21] analyzed the main influencing factors by comprehensively evaluating the differences of public goods supply capacity in different periods. Zhao Guizhi (2019)[22] found that the income inequality among regions is a realistic reflection of the imbalance and insufficient contradiction of regional economic development in China, therefore, China should focus on the main social contradictions in the new era and strengthen the optimization of public policy supply structure. The above domestic literature also lacks the research on the role of public goods supply capacity on the overall economic and social development, which is the theme of this paper.

1.2. Our Contribution

This paper presents some improvements based on the framework proposed in Soifer (2008) [4]. On one hand, in the theoretical analysis, from the perspective of public goods supply capacity, we analyzed the impact of public goods supply capacity on economic development, developed the optimal response equation between them. On the other hand, in the empirical test, firstly, on the basis of controlling the real economic factors and the characteristic variables representing different regions, using the data of inland provinces over the years, we built various prosperity indicators representing the level of China's economic and social development, then, estimated the impact of China's public goods supply capacity on various prosperity indicators. And found that the results of empirical analysis are basically consistent with the conclusions of theoretical research. Secondly, we used grouped data to verify the robustness of the model.

1.3. Paper Structure

The rest of the paper is organized as follows. Section 2 gives a simple decision model of economic development level based on the perspective of public goods supply capacity. Section 3 introduces the source of empirical data. Section 4 carries out empirical test, Section 4 carries out empirical test, and tests the robustness of the model. Finally, Section 5 concludes the paper.

2. THEORETICAL MODEL

2.1. A Simple Model

According to the literature (bramoulle et al., 2014[23]; allouch, 2015[24]), this paper constructs a simple model to study the determinants of economic development level. It is assumed that a country's economic and social

development level mainly depends on the supply capacity of public goods and the real economy. The following models are obtained to determine the level of economic development:

$$y_i = k_i s_i + G_{i1} + G_{i2} + G_{i3} + u_i \qquad (1)$$

In (1), i represents a place, y_i represents economic development level of the place i, s_i represents the supply capacity of public goods of the place i, k_i represents the impact of public goods supply capacity on economic development, and G_{i1}, G_{i2} and G_{i3} represents the value added of the first, second and third industry of the place i respectively, and represent the level of real economy. u_i represents the error term in (1). Among them, k_i is regarded as a function representing local characteristics of the place i:

$$k_i = f(x_i \beta) + \psi_i + \upsilon_i \qquad (2)$$

In (2), $f(\bullet)$ represents any function, x_i represents the characteristics of the place i, ψ_i represents the fixed effect of the place, υ_i represents an unobserved heterogeneity.

$$u_i = x_i \beta_u + \psi_i + \varepsilon_i \qquad (3)$$

In (3), ε_i is a random component with zero mean value.

2.2. A Model in General Form

This paper assumes that the public goods supply capacity of the place i is a function of constant substitution elasticity, including local and national public goods supply capacity, which are represented by $l_i \in [0, \infty)$ and $c_i \in [0, \infty)$ respectively. Its function form is as (4):

$$s_i = \left[a l_i^{\frac{\sigma-1}{\sigma}} + (1-a) c_i^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 0 \qquad (4)$$

Suppose the place i uses a simple decision to focus only on the costs and benefits of public goods supply capability. In order to maximize the following revenue in (5), we chose the local supply capacity and took the national supply capacity as given.

$$U_i = y_i - (\theta/2) l_i^2 \qquad (5)$$

The first order condition of (5) determines the equilibrium state. That is, the first-order condition of U_i with respect to l_i gives the optimal response to the choice of supply capacity of public goods in the place i, as shown in (6):

$$a \left[\frac{s_i}{l_i} \right]^{\frac{1}{\sigma}} k_i - \theta l_i \begin{cases} \leq 0 \text{K } \textit{if } \text{K } l_i = 0 \\ = 0 \text{K } \textit{if } \text{K } l_i > 0 \end{cases} \qquad (6)$$

Equation (1) and (6) determine the common equilibrium both the local public goods supply capacity and the level

of economic development.

2.3. A Linear Model

It is assumed that the public goods are mainly provided by the local government and not directly provided by the central government. So, the analysis is simplified and the national supply capacity is ignored. i.e. In (4), take $a = 1$. Then, equation (6) is simplified from the general model to the linear form. Therefore, there would be $s_i = l_i$ in (6), under this linear model, the optimal reaction equation, (6) changes as the follow:

$$s_i = k_i / \theta \qquad (7)$$

By substituting s_i in (7) into (1), the observable relationship between economic development and the public goods supply capacity is as follows:

$$y_i = \theta s_i^2 + G_{i1} + G_{i2} + G_{i3} + u_i \qquad (8)$$

Let $f(x_i \beta)$ be a linear function: $f(x_i \beta) / \theta = \alpha + x_i \beta$, then,

$$s_i = \alpha + x_i \beta + \psi_i + \upsilon_i \qquad (9)$$

By substituting (3) into (8), we get the following results:

$$y_i = \theta s_i^2 + G_{i1} + G_{i2} + G_{i3} + x_i \beta_u + \psi_i + \varepsilon_i \qquad (10)$$

Equation (9) and (10) are the optimal response equations of public goods supply capacity and economic development level in the place i respectively.

3. DATA

This paper uses the number of people in government institutions to represent public goods supply capacity, and the value added of three industries represent real economy. The empirical analysis includes the following variables: y_i stands for various prosperity indicators of economic and social development, l_i represents the public goods supply capacity of the place i, x_i represents the local characteristics of the place i, G_{i1}, G_{i2} and G_{i3} represent the value added of the primary, secondary and tertiary industries respectively. The construction and data sources of the above variables are introduced as follows.

The prosperity index of the place i selects three indicators: the living and health level, the average urban public facilities coverage level and the national education level. Among them, the indicators of living and health care level are represented by household nutrition and health care index of urban and rural residents respectively, and the calculation formula is as follows:

$$y_{i1} = e_{i1} * 50\% + f_{i1} * 50\% \qquad (11)$$

In (11), y_{i1} represents the household nutrition and health index of urban or rural residents, e_{i1} represents the

proportion of urban or rural residents ' annual expenditure on meat, poultry and poultry products, eggs, milk and dairy products accounts for their food expenditure in the place i, f_{i1} represents the proportion of urban or rural residents' medical and health care and domestic service expenditure accounts for the total average consumption expenditure in the place i, the proportion of the two parts respectively represents the living nutritional status and health care level of people in the region. The average urban public facilities coverage level y_{i2} is represented by six indicators: urban people's water use popularity rate, Urban gas popularity rate, number of buses per 10000 people, road area per capita, public green area per capita and number of public toilets per 10000 people. The national education level y_{i3} is represented by the number of high school graduates and the number of secondary vocational school graduates. The number of the government institutions employees is used to represent public goods supply capacity in the place i. The characteristics in each place are used as control variables, which are represented by the average temperature of main cities, precipitation of main cities and total population of each region. The value added of the three industries are taken from the data of various regions over the years.

All the above data are from the China Statistical Yearbook issued by the National Bureau of statistics, the indicators in this paper are based on the relevant data of 31 provinces, autonomous regions and municipalities directly under the central government (excluding Hong Kong, Macao and Taiwan) from 1999 to 2017. All prosperity indicators representing the level of economic and social development are converted by z-data method[①].

Although the prosperity indicators representing the level of economic and social development have different degrees of correlation, their distribution patterns are significantly different. Therefore, we use each prosperity indicators to estimate in the empirical test.

4. EMPIRICAL TEST

The above (9) and (10) in theoretical model determine the equilibrium distribution of both the choice of public goods supply capacity and the level of economic and social development. According to (10), the empirical model is built as shown in (12):

$$y_{it} = c + \alpha\theta s_{it}^2 + \gamma_1 G_{i1t} + \gamma_2 G_{i2t} + \gamma_3 G_{i3t} + \phi x_{it}\beta_{ut} + \varphi\psi_i + \varepsilon_{it}$$
(12)

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① Z data conversion, also known as Z-score standardization, refers to (sample value-sample mean) / sample standard deviation. The main purpose of Z-score conversion is to convert data of different orders of magnitude into the same one, which is measured by the calculated Z-score value to ensure the comparability of data.

Next, we will use the panel data of 31 inland provinces in China from 1999 to 2017 to test the model. Generally speaking, the variable of public goods supply capacity has measurement error, so it is considered that the variable is endogenous. The lagged variable of it is related to its current variable, but generally does not affect the current economic and social development level. So, we used the first-order lagged variable of the number of institutions personnel as one instrumental variable. In addition, the general quality of personnel in local government agencies and institutions is relatively high, most of them have bachelor's degree or above. Therefore, it is considered that the supply capacity of public goods is related to the number of college graduates. So, we used the number of college graduates as the other instrumental variable. We used panel instrumental variable method (IV) and generalized moment method (GMM) for estimation. In the regression, the number of government institutions personnel, its first-order lagged variable and the number of higher education graduates' first-order lagged variable, are logarithmic, and their unit are ten thousand persons. The units of the control variables are as follows: the unit of average temperature in major cities is 10 degrees centigrade, the unit of precipitation in major cities is meter, and the unit of total population in each region is 100 million people. The unit of value added of the primary, secondary and tertiary industries are 100 billion yuan.

4.1. Empirical Results

Table 1 shows the estimated results of (12). As one of the three prosperity indicators representing the level of economic development in the table, the level of life and health care is regarded as the explanatory variable. This kind of index contains two sub indicators. We used the ordinary least squares regression (OLG), the instrumental variable method (IV) and the generalized moment method (GMM) for regression. In the instrumental variable method, we consider the population representing local characteristics as the control variable and the endogenous variable respectively, and use the first-order lag variable of the local population as its instrumental variable. The data in the table give the regression coefficient of local public goods supply capacity and the value added of three industries, omitting the regression results of state variables representing local characteristics. The regression results representing the other two indicators of prosperity, the average level of public facilities coverage and the national education level, are shown in Appendix 1.

Table 1 Regression results of economic and social development level-1

	The optimal response of equilibrium							
	living and health indicators(y_i)							
	Nutrition and health index of urban residents				Nutrition and health index of rural residents			
Sub-table 1	*OLS*	*IV*	*IV*	*GMM*	*OLS*	*IV*	*IV*	*GMM*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dY_i / ds_i^2	-0.296***	-0.946***	-0.958***	-0.958***	0.260**	1.367***	1.367***	1.367***
	(0.093)	(0.140)	(0.139)	(0.091)	(0.126)	(0.210)	(0.211)	(0.073)
dY_i / dG_{i1}	-0.207	-0.702***	-0.681***	-0.681***	0.623***	0.616***	0.617***	0.617***
	(0.145)	(0.127)	(0.127)	(0.081)	(0.111)	(0.129)	(0.130)	(0.066)
dY_i / dG_{i2}	-0.022	0.105***	0.102***	0.102***	-0.065**	-0.059*	-0.059*	-0.059***
	(0.042)	(0.031)	(0.031)	(0.018)	(0.028)	(0.032)	(0.032)	(0.015)
dY_i / dG_{i3}	-0.051*	-0.057**	-0.060**	-0.060***	0.115***	0.044**	0.044**	0.044***
	(0.029)	(0.025)	(0.025)	(0.013)	(0.021)	(0.022)	(0.022)	(0.010)
Sub-table 2 The first stage regression of s_i^2								
F test value		807.65	834.21			807.65	834.21	
P value of F test		0.000	0.000			0.000	0.000	
The first stage of R2		0.894	0.894			0.894	0.894	
Ln(Local population)	Control	Control	Instrumental	Instrumental	Control	Control	Instrumental	Instrumental
Observations	589	589	589	589	589	589	589	589

Note: all estimated values in table 1 are average marginal effects, all models include regional fixed effects, and control variables include annual average temperature of major cities in each province, precipitation of major cities over the years, and total population of each region over the years. Sub-table 1 reports the estimation results of the two sub indicators of the first type of indicator of prosperity formula (10), namely, the nutrition and health index of urban and rural residents, which represents the level of living and health care. Sub-table 2 reports the results of the first stage F test on the joint significance of instrumental variables when using the instrumental variable method. The two sub-indicators of life and health care, which represent the level of economic and social development, have been processed by Z data conversion. In the (2) and (6) columns of the estimation results, the local population as the control variable is regarded as the exogenous variable; in the (3), (4), (7) and (8) columns of the estimation result, the local population is regarded as the endogenous variable, and its first-order lagged value is used as its instrumental variable. Columns (4) and (8) are estimated using the GMM method. The standard deviation in brackets in the table is the robust standard deviation of clustering. *, * * and * * * represent significant at 10%, 5% and 1% statistical levels respectively.

The regression results show that the supply capacity of public goods has a significant positive effect on the prosperity indicators. For example, every 10% increase in the number of government and public institutions employees will increase the nutrition and health care index of urban residents by 0.137, the nutrition and health care index of rural residents by 0.109 respectively. The value added of the first, second and third industries also significantly promoted the increase of the above six prosperity indicators. Thus, we verified the results of the theoretical analysis.

4.2. Robustness Test

In order to verify the robustness of the estimation results, the government institutions employees, representing the supply capacity of public goods, are divided into four groups according to the functional scope or nature of administrative departments. namely, the number of employees in the health, sports and social welfare industries, those in the education, culture and art, broadcasting film and television industry, those in the scientific research and comprehensive technical services industry, and those in public management, social security and social organization departments. The four grouped variables were used to regress with instrumental variable method. The regression results show that the impact of the grouped public goods supply capacity on the economic and social development indicators is not significantly different from that of the non-grouped. Therefore, we proved the robustness of the above theoretical model. The regression results are shown in Appendix 2.

5. CONCLUSION

We developed a model to examine the determinants of economic development from the perspective of public goods supply capacity. Under the assumption that the public goods supply capacity only depends on the local government, we concluded through the theoretical research that the public goods supply capacity has a positive relationship with the level of economic and social development. In the empirical analysis, firstly, we used the relevant data of 31 inland provinces, autonomous regions and municipalities directly under the central government of China from 1999 to 2017 for the empirical test. By using the instrumental variable method (IV) and the generalized moment method (GMM) respectively, the results show that the supply capacity of public goods has a significant positive effect on the prosperity indicators representing the level of economic and social development. Thus, the results of theoretical analysis are verified. Secondly, we tested the model by using the grouped data of those representing the public goods supply capacity. It's found that the regression results of each group do not change significantly, which verified the robustness of the model.

Compared with the previous literature, the originality of this paper lies in the following two points: on the one hand, we get the optimal response equation between the level of economic development and the supply capacity of public goods through theoretical research. On the other hand, we use China's data to conduct empirical test, and find that the empirical results are basically consistent with the prediction of theoretical research, which confirms the results of theoretical research. Finally, we verify the robustness of the model.

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