Empirical Research of Economic Benefit of China's Rural Public Goods Supplying: Based on Partial Least Squares

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Abstract. At present, the research on the supply of rural public goods in our country is more concentrated on qualitative analysis and less on its economic benefits. Based on the Bloom's analysis of the influence of non-productive factors on economic growth, this paper constructs a matrix equation of the economic benefit of rural public goods supply, and uses the partial least squares method to make a quantitative analysis on the economic benefit of rural public goods supply. The research results show that: the supply of basic factors of production has significant economic benefits, in which capital and technology have a significant positive impact on economic benefits, and labor force has a significant negative impact on economic benefits; public goods such as medical treatment, rural relief and Water conservancy construction have a significant positive impact on economic benefits, and culture has a positive impact on economic benefits but is not significant.

1. Introduction
Since 2015, China's economic structural differentiation has become increasingly evident. In 2017, the Central Committee of the Communist Party of China and the State Council, with the background of the supply side reform, put forward the guidance of promoting the agricultural supply side structural reform. As an important aspect of the rural supply side reform, the supply of rural public goods is an important aspect. How to improve its supply level to realize the effective supply to promote the rural social and economic development has become a hot spot in the current government and social research.

For a long time, the drawbacks of the two yuan system in urban and rural areas have seriously hampered the development of China's economy and society. The difference in the allocation of resources, and then form a "heavy city, light rural" pattern. Wang Guohua and Li Keqiang (2003) through empirical analysis clearly point out that the urbanization tendency of public products is the root cause of the slow increase of farmers' income, the widening gap between urban and rural areas and the sudden outburst of the two yuan structure. Zhang Xue (2005) studies the relationship between the supply of rural public goods and the income of farmers, and points out that the widespread shortage of public goods in rural areas seriously restricts the rapid growth of farmers' income by. Zhang Xiusheng, Liu Fang (2007) and others' research show one of the main reasons for the slow growth of farmers' income is the imperfection of the supply system of rural public goods. Wang Junxia and Wang Jing (2008) constructed the performance rating system for the supply of public goods in rural areas by the standardized scoring method.
The above analysis is mostly limited to qualitative analysis while quantitative research also focuses on supply performance evaluation, and does not take into account the economic benefits of rural public product supply to the rural social and economic development and the increase of farmers' income. The study of the economic benefit of the supply of rural public goods can make us more intuitive to find the impact of the supply of rural public goods on the rural social economy and the benefit of increasing the income of the farmers. At the same time, we can find the "short board" in the supply of rural public goods in order to give feedback to the initial investment of the rural public products. Therefore, through the analysis of the index type production function, the paper constructs the economic benefit matrix equation for the supply of rural public goods by the research framework of non production factors for economic growth, and studies the supply of rural public goods by Partial Least Squares Method Economic benefits, in order to provide reference for rural public goods supply policy formulation.

2. Model Construction and Variable Selection

2.1. Model Construction

Under the framework of Bloom exponential production function, this paper analyzes the economic benefits of these non productive factors supplied by rural public goods. The effects of basic production factors (capital, labor, technology) and the supply of public products (medical, rural relief, culture, etc.) on the total output value of agroforestry, crop production, per capita income of farmers and the per capita consumption of farmers were investigated.

The function expression in this article is built by Bloom:

\[ y = aK^bL^cT^d e^{x1 + x2 + x3 + x4} \]  

(1)

The above formula shows that the non production elements are added to the basic production function, and these non productive elements can always play a role in a certain way and affect the whole economy with the factors of production, and take the logarithm of the expression (1) on both sides:

\[ \ln y = a + b \ln K + c \ln L + d \ln T + \sum_{i=1}^{n} \alpha_i x_i \]  

(2)

Considering the use of a single index to measure economic benefits, it will inevitably result in the problem of index mapping distortion, and the use of a single index can not be more comprehensive to measure the economic effect. Therefore, this paper will use multiple indicators (Y1, Y2 and Y3) to measure the economy brought by the supply of rural public goods. Benefit. The expression (2) is transformed into a variable, and the perturbation matrix is introduced.

\[ \ln[y_1, y_2, y_3] = A + \sum_{j=1}^{4} \beta_j \ln x_j + \sum_{i=1}^{n} \alpha_i x_i + E \]  

(3)

For (3) simplification:

\[ Y = A + BX1 + CX2 + E \]  

(4)

Expression (4) is the economic benefit model, in which Y represents the economic benefit matrix, X1 is the basic factor matrix of production factors, X2 is the supply variable matrix for public products, E is a perturbation matrix, and A, B and C are coefficient matrices respectively.

2.2. Variable Selection

On the basis of relevant theories, this paper selects 10 variables, including 7 explanatory variables and 3 explanatory variables, following the principles of science, representativeness, comparability and maneuverability. The explanatory variables are divided into two categories: one is the 3 basic production factor variables and the other 4 are the supply variables of rural public goods. The 3 explanatory variables are used to measure the economic benefits of the supply of public goods and the input of basic production factors. The data of this study are from the 1995 to 2014 "China Agricultural Statistics Yearbook", "China Statistical Yearbook" and "China Health and Family Planning Statistics Yearbook".

The basic factors of production include labor, capital and technology. Among them, labor (X1) is measured by the labor population of the rural first industry: the theory of economic growth thinks that labor is the most basic and most important factor of production in the process of production, and any
output can not be separated from the input of labor. Capital input (X2) is measured by the amount of the investment in rural fixed assets plus the financial three agricultural branches. Capital input provides an important guarantee for the growth of farmers' income, and any link in the production process of farmers will not be carried out if lack of capital investment. Technology (X3) is measured by the number of agricultural machinery lines (the sum of the number of large, medium and small agricultural machinery and the combined harvester). The most intuitive expression of the technological progress is the increase in productivity, and the input of technology will affect farmers' traditional backward production methods and realize their transformation into agricultural modernization, and the technology is also a farmer. Support is provided for the quality and production of industry output.

Supply of public goods: This article selects medical, rural relief, culture and water conservancy construction to measure the supply of public goods. Among them, medical care (X4) is measured by rural health expenditure in government financial payment: from the perspective of medical supply and economic benefits, on the one hand, public health care ensures the health of farmers, reduces the recessive cost, and the state's medical security (reimbursement cost) reduces the dominant cost; rural relief (X5) is used in rural areas. The sum of the amount of disaster relief and social relief can be measured: Rural disaster relief can reduce the destruction of natural disasters to the rural social and economic, and social relief can provide the minimum living security for farmers; culture (X6) is measured by the number of rural cultural stations and the number of cultural groups: the knowledge reserve of the labor force is the creation of social wealth. At the root of the rich, the accumulation of social capital can not be separated from the knowledge reserve of the labor force. The research shows that the reproduction of the labor force can produce more significant economic benefits when the labor has rich knowledge reserves, and the water conservancy construction (X7) uses the effective irrigation area to measure the natural conditions of the water conservancy construction that is not conducive to the agricultural production. To a large extent, it provides protection for the increase of agricultural products.

Economic benefits: considering the use of a single index to measure economic benefits may cause model setting deviation, this paper refers to the related methods of multivariate statistical analysis, and introduces several indicators to measure the economic benefits. This paper selects 3 variables: the total output value of agriculture, forestry, animal husbandry and fishery, the per capita income of farmers and the per capita consumption expenditure of farmers. The total output value of agroforestry and animal husbandry (Y1) is one of the important productive factors in the total output value of the rural society. It is also a form of monetary expression of the total scale and total results of agricultural production. The consumption tendency of Keynes doctrine is that the income of the consumer, the price level, the preconsumption, the consumer's preference, the national policy and the future of the people. Expectation and so on are the main factors affecting consumption expenditure. Therefore, this paper chooses farmers' per capita income (Y2) and farmers' per capita consumption expenditure (Y3) to reflect the average level of farmers' income and consumption in a region.

3. Empirical Analysis

3.1. Statistical description of data

In terms of economic benefits, from the original data, the total output value of agricultural and forestry and animal husbandry in China is increasing year by year, from 20340 billion yuan in 1995 to 102226 billion yuan, and the per capita income of farmers and the per capita consumption expenditure of farmers. The total output value of agroforestry and animal husbandry (Y1) is one of the important productive factors in the total output value of the rural society. It is also a form of monetary expression of the total scale and total results of agricultural production. The consumption tendency of Keynes doctrine is that the income of the consumer, the price level, the preconsumption, the consumer's preference, the national policy and the future of the people. Expectation and so on are the main factors affecting consumption expenditure. Therefore, this paper chooses farmers' per capita income (Y2) and farmers' per capita consumption expenditure (Y3) to reflect the average level of farmers' income and consumption in a region.

In terms of basic elements, the rural labor population in China has a downward trend in general. From 350 million in 1995 to 220 million in 2014, the decline is about 37%. In capital, the capital input of China's rural capital is on the rise, from 258 billion 200 million yuan in 1995 to 25244 billion yuan, and the increase of expenditure is about 10 times. In terms of technology, the number of farm machinery increased from 9 million to 24 million, but the growth rate slowed down after 2012. From the change of economic benefits and basic elements, the output of agriculture in China should mainly
come from capital and technology, which also shows that China's agriculture is changing to modernization, from the traditional coarse agriculture relying on a large number of labor force to intensive farming and technology increase.

With regard to the supply of public goods in rural areas, the quality of rural medical and health care has improved significantly from 91.5 billion yuan in 1995 to 935 billion yuan; The number of cultural stations and associations also showed a spurt of growth, from 80,000 to 440,000. The amount of rural relief nationwide increased from 2.652 billion yuan in 1995 to 121.678 billion yuan, an increase of 46 times. The effective irrigation area for rural water conservancy construction has shown a steady upward trend, increasing by more than 1,000 hectares per year. Judging from the changes in the supply of public goods, our country's public goods are mainly concentrated in the supply of water conservancy infrastructure, medical care and culture, which generally shows an increasing trend.

Since the absolute values of each index are too large, this paper compares the number of original data to the number to compare the trend of the index, and after the logarithm, the trend of the change is shown in Figure 1.

Fig. 1. Trends among indicators.

As can be seen in Figure 1, the supply of public goods in rural areas in China shows a slow growth trend, which indicates that the supply efficiency of rural public goods is still low.

3.2. Model Estimation

3.2.1. Model Estimation. Model estimation and test are run in R3.3.1 software. The relevant data from 1995 to 2014 are selected in this paper. The parameters of the runtime are as follows: validation="LOO", jackknife=TRUE, which are used to calculate PRESS and estimate the variance of regression coefficient by using a cross validation calculation and jackknife method respectively. The PRESS value, the adjusted PRESS value and the cumulative contribution rate of dependent variables under various principal components were calculated. The PRESS value is shown in the following table. It is shown in Table 1 that the value of Y1's PRESS value is smaller and smaller in the 1, 2, 3 and 4 principal components; the PRESS value of Y2 is smaller and smaller in the 1 and 2 principal components, and the PRESS value of Y3 is smaller and smaller in the case of 1, 2, 3 and 4. The case of the 2 category.

| Variable | Verify | Intercept | 1comp | 2comp | 3comp | 4comp | 5comp | 6comp | 7comp |
|----------|--------|-----------|-------|-------|-------|-------|-------|-------|-------|
| y1       | PRESS  | 1.026     | 0.1190| 0.1195| 0.1153| 0.1176| 0.2548| 0.2366| 0.2336|
|          | ad.PRESS | 1.026   | 0.1187| 0.1179| 0.1149| 0.1167| 0.2498| 0.2318| 0.2290|
| y2       | PRESS  | 1.026     | 0.0735| 0.0751| 0.0879| 0.0954| 0.1526| 0.1465| 0.1489|
|          | ad.PRESS | 1.026   | 0.0733| 0.0749| 0.0831| 0.0940| 0.1496| 0.1437| 0.1460|
| y3       | PRESS  | 1.026     | 0.1164| 0.1140| 0.1143| 0.1217| 0.2093| 0.2011| 0.2084|
|          | ad.PRESS | 1.026   | 0.1161| 0.1124| 0.1127| 0.1203| 0.2053| 0.1974| 0.2044|


The cumulative contribution rate of each variable under various principal components is calculated, as shown in the following table: The contribution rate of the variables can be seen that the contribution rate of the first principal component is over 85%. The contribution rate of each variable is smaller after the second principal component. Considering the results of PRESS, we choose 2 principal components to do the analysis.

Table 2. Contribution rate of each component accumulation.

| Variable | 1comps | 2comps | 3comps | 4comps | 5comps | 6comps | 7comps |
|----------|--------|--------|--------|--------|--------|--------|--------|
| X        | 93.08  | 94.50  | 95.29  | 98.59  | 99.86  | 99.93  | 100.00 |
| y1       | 98.72  | 99.21  | 99.21  | 99.22  | 99.26  | 99.42  | 99.42  |
| y2       | 99.56  | 99.58  | 99.72  | 99.72  | 99.72  | 99.75  | 99.75  |
| y3       | 98.78  | 99.31  | 99.36  | 99.38  | 99.38  | 99.43  | 99.46  |

Considering the results of Table 1 and Table 2 above, the number of principal components is selected as 2, and then the partial least squares method is calculated to obtain the estimated results of the equation. (see Table 3, 4, 5).

Table 3. y1 least square estimation results.

| Variable | 1comps | 2comps | 3comps | 4comps | 5comps |
|----------|--------|--------|--------|--------|--------|
| x1       | -0.2292| 0.0789 | 19     | -2.9050| 0.0091 (**) |
| x2       | 0.1961 | 0.0249 | 19     | 7.8622 | 2.167e-0 (***) |
| x3       | 0.1050 | 0.1065 | 19     | 0.9860 | 0.3365 |
| x4       | 0.0409 | 0.0721 | 19     | 0.6728 | 0.5092 |
| x5       | 0.2959 | 0.0609 | 19     | 4.8598 | 0.0001 (**) |
| x6       | 0.0638 | 0.0762 | 19     | 0.8376 | 0.4127 |
| x7       | 0.0873 | 0.0515 | 19     | 1.6961 | 0.1062 |

Table 4. y2 least square estimation results.

| Variable | 1comps | 2comps | 3comps | 4comps | 5comps |
|----------|--------|--------|--------|--------|--------|
| x1       | -0.1666| 0.1875 | 19     | -8.8870| 3.394e-08 (***) |
| x2       | 0.1629 | 0.0084 | 19     | 19.4867| 5.106e-14 (***) |
| x3       | 0.1336 | 0.0248 | 19     | 5.3929 | 3.331e-05 (**) |
| x4       | 0.1258 | 0.0187 | 19     | 6.7247 | 1.995e-06 (**) |
| x5       | 0.1834 | 0.0212 | 19     | 8.6355 | 5.288e-08 (**) |
| x6       | 0.1241 | 0.0198 | 19     | 6.2853 | 4.926e-06 (**) |
| x7       | 0.1367 | 0.0152 | 19     | 9.0032 | 2.777e-08 (**) |

Table 5. y3 least square estimation results.

| Variable | 1comps | 2comps | 3comps | 4comps | 5comps |
|----------|--------|--------|--------|--------|--------|
| x1       | -0.2321| 0.0874 | 19     | -2.6554| 0.0156 (**) |
| x2       | 0.1977 | 0.0287 | 19     | 6.8938 | 1.418e-06 (**) |
| x3       | 0.1037 | 0.1111 | 19     | 0.9336 | 0.3622 |
| x4       | 0.0451 | 0.0755 | 19     | 0.5969 | 0.5577 |
| x5       | 0.3011 | 0.0649 | 19     | 4.6382 | 0.0002 (**) |
| x6       | 0.0611 | 0.0703 | 19     | 0.8703 | 0.3950 |
| x7       | 0.0851 | 0.0575 | 19     | 1.4795 | 0.1554 |

Note: (* *), (*), (*) and (.) represent significant levels at 0.1%, 1%, 5% and 10% respectively.

3.2.2. The Explanation of the Model. In the total output value equation of Y1 agroforestry, the estimated values of labor, capital and rural relief are -0.229, 0.196 and 0.2959 respectively, and the estimated values of other variables are all positive, but not significant. In terms of technical use, technological progress has improved labor efficiency in the labor unit time; capital input has created conditions for agricultural production, and made up for the defects of not widely used technology; the input of labor factors has a negative impact on the value of agriculture, forestry, animal husbandry and fishery. And the benefits generated by technology are greater than the negative benefits generated by labor. On the whole, the scientific and technological agriculture and agricultural modernization are the...
direction of the future agricultural development. The supply of public goods, such as medical treatment and rural relief, can improve the living conditions of farmers, ensure the quality of the labor force and improve the labor efficiency, and the increase of labor efficiency increases the total output value of the agricultural and forestry and herding and fishery, and the influence of water conservancy construction to the total output value is also significant, and it can be reduced to a certain extent. Adverse effects of bad weather on crops.

In the per capita income equation of Y2 farmers, the basic production factors and the supply of rural public goods can significantly affect the farmers' income. All the variables are significant at the level of 0.1%, and the estimated value of rural relief is 0.1833, which is the main aspect of the farmers' income. Capital and technology stimulate agricultural output and increase farmers' income by promoting agricultural development and increasing agricultural production efficiency. In the field of rural public goods, perfect medical care provides a guarantee for the health of the farmers, indirectly improves the work efficiency of the labor force. At the same time, the efficient production efficiency reduces the cost of the farmers' use of the factors of production; finally, the perfect medical treatment enhances the farmers' ability to resist the disease. It also reduces the amount of medical expenses that farmers can spend, and can also use less expenditure to make reasonable use in exchange for more income. Culture can delight the mind and body and raise the knowledge reserves of farmers, thereby improving productivity and promoting income growth. Strengthening water conservancy and other basic construction can improve the ability of farmers to resist natural disasters, effectively guarantee the production of economic crops, on the other hand, it can promote income growth through the multiplier effect of investment.

In the Y3 farmers' per capita consumption expenditure equation, the estimated value of labor, capital and rural relief are more significant. The estimated values are: -0.2321, 0.1976 and 0.3011. It is known that rural relief has a greater impact on the consumption of farmers. According to consumption theory, capital and technology increase farmers' income by increasing farmers' income. Rural public goods research shows that the supply of rural public goods affects farmers' consumption in three ways. First of all, the supply of rural public goods provides a good consumption environment for farmers and stimulates farmers' consumption by stimulating the willingness of farmers to consume. Secondly, the effective supply of rural public products saves the cost of farmers' consumption and increases the income of farmers to stimulate consumption; finally, the effective supply of public products has reduced farmers. People's defensive savings stimulate farmers' marginal propensity to consume and then increase consumption.

The basic factors of production are the main factors that affect the economic benefits. The basic factors of production have a significant impact on agricultural output, farmers' income and farmers' consumption, and the most prominent role of capital and technology in the basic production factors; the economy of the supply of rural public goods. The benefit is not obvious, its supply only has a significant impact on the income of farmers, and has no obvious promotion effect on agricultural output value and farmers' consumption, and in the supply factors of rural public products, only rural relief has played a more significant role.

4. Conclusions and Suggestions
4.1. Research Conclusion
In this paper, by constructing the economic benefit matrix, the partial least square method is used to quantitatively study the economic benefits of the basic production factors and the supply of rural public goods, and to find out how the various variables affect the economic benefit. The results show that basic factors of production (such as: capital and Technology) promote agricultural production and reduce the cost of agricultural production by increasing production efficiency, thus promoting income growth and stimulating consumption with the increase of income. Rural public goods promote consumption by improving farmers' basic life and changing their consumption habits.

From the estimation results of the above equations, we find that capital and technology have significant positive effects on economic benefits in the basic production factors, the number of labor has a significant negative impact on economic benefits, and the effect of capital and technology on economic benefits is far greater than the effect of the number of labor. This means that the main role
of the production factors of BenQ is the main factor. Two factors of capital and technology, the number of rural labor force is no longer the main factor of increasing output value of agriculture, forestry, husbandry and fishery. Public products, such as medical treatment, rural relief and water conservancy construction, have a significant positive impact on economic benefits. Culture has positive impact on economic benefits but not significant. This shows that the main role of the supply of rural public goods is three major factors, medical, rural relief and water conservancy construction Limit.

4.2. Policy Suggestion

4.2.1. Promoting the Process of Urbanization. The government should continue to increase the supply of rural public products, promote the overall policy of urban and rural public goods supply, completely break the supply pattern of "heavy cities, light rural", and narrow the gap between urban and rural areas. At the same time, the government should attach importance to the supply of public products such as rural health care, infrastructure. The government should also increase the relief efforts of the rural areas; the relevant departments should constantly increase the financial expenditure in rural areas, in order to make up for the long-term shortage of rural public products.

4.2.2. Implementing a diversified supply mechanism led by the government. The characteristics of public products determine the low efficiency of the market supply. This low efficiency will directly harm the public interest and reduce the level of social welfare, so the government should be the main body of the supply of rural public goods. The government can constantly adjust the supply mode with public ownership as the main body, actively attract private enterprises to join, and at the same time, the government can attract private investors into the supply of public goods by means of tax relief and financial subsidies, or encourage the collective participation of rural communities to participate in the local public sector through joint stock cooperation. Product supply.

4.2.3. Reform the decision-making mechanism of rural public goods supply. On the basis of farmers' demand, it establishes a bottom-up expression mechanism, truly conveys the desire of farmers, and provides the government with correct decision-making suggestions to avoid the waste of public resources and realize the maximum value of the supply of public goods.

4.2.4. Establish a long-term mechanism to supervise rewards and punishments. We should strengthen the supervision of financial support for agriculture, public financial information, the establishment of a standardized public financial information release system, improve the awareness of farmers' supervision, strengthen the supervision of social public opinion, improve the self-restraint ability of cadres at the grass-roots level, and improve the reward and punishment mechanism.

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