

Research on the Structure of Public Fiscal Expenditure Based on the Cluster Analysis Methods

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Abstract

The paper extracts the principal component of China's expenditure per capita of local government based on the factor and cluster analysis method, to determine the structure of fiscal expenditure by category of basic services, senior services, economics, resource protection factor, etc. Then the paper analyzes the regional differences in the distribution of fiscal expenditure structure based on the systematic cluster analysis method. The conclusion is that Beijing, Tianjin and Shanghai are the advanced service category of expenditure growth pole, which drives around cities' technology as well as education spending, and promotes regional economic growth.

Keywords

Structure of Public Fiscal Expenditure, Factor Analysis, Cluster Analysis

1. Introduction

There exists a long-standing dispute between economic liberalism and government interventionism on whether government spending can promote economic growth or not. With the rise and integration of neo-liberalism and neo-Keynesian, the role of government expenditure on stimulating economic growth begins to be recognized, and it is considered that different fiscal expenditure structures produce different economic growth effects, so searching for the best financial expenditure structure to maximize stimulate economic growth is becoming the focus of academic research, as well as the main content of this paper attempting to explore.

2. Literature Review

Research on the relationship between the structure of fiscal expenditure and economic growth began in the 20th

century, to Solow [1] of the Solow model and the Swan [2] of the new growth model as a starting point, that education on economic growth and technological innovation has a significant impact. To the 1990s, Barro [3] and Lucas [4] use of endogenous growth model, the structure of government revenue and expenditure growth model introduced around the productive expenditure and non-productive expenditure on economic growth. The stimulatory effect was studied. Grier *et al.* [5], Aschauer [6], Easterly *et al.* [7] and other scholars in the United States developing empirical research for the study that is conducive to productive expenditure economic growth, while non-productive expenditure is a negative effect on economic growth. Research will finance the expenditure structure of productive expenditure and non-productive expenditure in recent years, more segments, Afonso *et al.* [8] mainly for OECD and EU countries to conduct studies on the size, structure and instability of the government on economic growth that social spending, government purchases, subsidies, government investment, the economy has a negative the growth effect.

Gong L.T., *et al.* (2001) [9], Gupta *et al.* [10], Guo Q.W., *et al.* [11] and other scholars believe that the role of productive expenditure growth is not obvious to the stimulation or negative, non-productive expenditure for economic growth has a positive impact. In recent years, academic research continues to focus on the structure of fiscal expenditure impact on economic growth. Ramey *et al.* [12] through the expenditure of US research analyze the role of government purchases to stimulate the economy, and government purchases due to temporary deficit may cause impact. Colombier [13] study the structural and economic growth in expenditure in Switzerland that in public expenditure, expenditure transportation infrastructure, education and administrative expenses to promote economic growth.

In addition to the research literature from the national level, domestic scholars in the local government and other regional areas, the structure of expenditure growth and economic relations have studied representative is Zhang Gang [14] with a regional perspective will be China's local government is divided into eastern, central and western regions, the structure of financial expenditure into capital expenditures, administrative expenses, education, science and health expenditures, expenditures and other agriculture production, the use of panel data and empirical economic growth the study.

Throughout the related fields of study abroad, mostly to the fiscal expenditure structure is divided into productive and non-productive expenditure, or further subdivided into constructive spending, consumer spending, as well as science, education spending, agriculture production and spending. Expenditure structure of financial impact of economic growth, the division is essential expenditure structure, and the current study for the division of fiscal expenditure structure often artificial division based on empirical judgment, lack of rigor, factor analysis can solve this problem. This paper attempts to use is the main factor analysis of fiscal expenditure structure is divided. In addition, studies of local government during regional analysis, only will be divided into eastern, central and west, there is no difference in the classification based on the specific expenditure structure of local government finances, the paper cluster analysis on the basis of principal component analysis as a basis for the structure of local government fiscal expenditure divided into five categories, to facilitate targeted policy recommendations.

3. Fiscal Expenditure Structure

First need to determine the structure of fiscal expenditure study important, factor analysis of 2012 local government expenditure projects to extract principal components to divide China financial expenditure structure of local government, to ensure that the structure of fiscal expenditure divided reality and rigor for the subsequent regression analysis foundation.

3.1. Data

This article uses the country's 31 provincial units as a sample to study the data source in 2013, "China Statistical Yearbook" per capita expenditure data form. Financial expenses include general public services, defense, public safety, education, science and technology, culture, sports and media, social security and employment, health care, environmental protection, urban and rural community affairs, agriculture, forestry and water affairs, transportation, exploration and the power of information and other matters, business services and other matters, financial regulatory affairs expenses, land resources and meteorological services, housing security spending, grain stockpiles affairs, debt servicing expenses, other expenses and 20. As the "other expenses" include items more vague, difficult to classify in the latter part of the analysis, the proportion of total fiscal revenue and expenditure

of only 2.77%, in the analysis of each item of expenditure of the project will be removed, the choice of expenditure for 19.

3.2. Factor Analysis

Factor analysis of the complex relationship between factors combined have a few representative factors, while the internal 19 items of government spending a certain degree of relevance, in order to follow-up study by factor analysis to extract the main components, namely factor dimensionality reduction.

Former factor analysis should first degree of correlation between the 19 expenditure items were KMO and Bartlett test of sphericity test, only KMO test coefficient greater than 0.5, Bartley sphericity approximate chi-square test statistic significance probability is less than 0.05 to be able to factor analysis. The result can be seen in **Table 1**.

As can be seen from **Table 1**, the coefficient of KMO is 0.797, greater than 0.5, a significant probability Bartley sphericity test was 0.000, less than 0.05, reject independence between the variables with the original hypothesis that this study 19 Financial expenditure variables suitable for factor analysis. Principal component analysis was used to extract principal components factor to obtain the main factor in the orthogonal rotation method. **Table 2** illustrates the situation for each component of the initial eigenvalues.

As can be seen the first three components of the cumulative variance contribution of up to 87.262%, characteristic values were 10.428, 2.793, 2.252, 1.108, greater than 1, the variance contribution rate was 54.882%, 14.699%, 11.853%, 5.829%, totaled 87.262%, the four principal components extracted can represent the state of local government expenditure.

3.3. The Main Component Extraction

Judging from the results of the factor analysis, 19 major financial expenditure information can be used on behalf of the four main ingredients, so get a load factor of each factor expenditure items by rotating the component matrix, factor rotation method is the maximum variance orthogonal rotation, results are as shown in **Table 3**.

Table 3 for each expenditure item factor analysis resulting in a load factor of four main components in the highest coefficient, the main ingredient in each factor loading highest expenditures are combined to obtain the financial expenditure structure consists of four main factors.

3.4. The Structure of Fiscal Expenditure Divided

Derived by factor analysis as shown in **Table 3**, the rotation matrix composition, and the results be sorted to obtain the structure of fiscal expenditure in **Table 4**.

Table 4 general public services, defense, public safety, education and the media, health care, environmental protection, agriculture, forestry and water affairs, transportation, resource exploration projects such as the power of information and other matters are spending most basic services and the like, and therefore classified as basic

Table 1. KMO and Bartlett test of sphericity.

Sampling sufficient degree of Kaiser-Meyer-Olkin measure	0.797
The chi-square approximation	814.948
Bartlett's test of sphericity	df
	171.000
	Sig.
	0.000

Table 2. The initial eigenvalues.

	1	2	3	4	5	6
Total	10.428	2.793	2.252	1.108	0.679	0.505
% Variance	54.882	14.699	11.853	5.829	3.572	2.66
Cumulative%	54.882	69.581	81.433	87.262	90.834	93.494

Table 3. Rotation matrix components.

Public expenditure items	Principal component			
	F1	F2	F3	F4
General public services	0.979			
Country anti	0.944			
Public safety	0.874			
Teach educate		0.691		
Science and technology		0.932		
Culture, sport and media	0.811			
Social security and employment			0.497	
Health	0.687			
Energy saving	0.645			
Urban and rural community affairs		0.895		
Agriculture, forestry and water affairs	0.901			
Transportation	0.831			
Resource exploration power information and other matters	0.760			
Business services and other matters		0.721		
Financial regulatory affairs expenses			0.878	
Weather and other matters of land and resources				0.661
Housing security spending			0.638	
Grain and oil stockpiles affairs				0.880
Debt servicing expenses			0.934	

Note: the extraction method for principal component method; Kaiser rotation method has standardized orthogonal rotation method; rotation after six iterations to converge.

Table 4. Fiscal expenditure structure.

F1 (Basic service category)	F2 (Advanced services category)	F3 (protection factor—economy)	F4 (protection factor—resources)
General public services	Teach educate	Social security and employment	Weather and other matters of land and resources
Country anti	Science and technology	Housing security spending	Grain and oil stockpiles affairs
Public safety	Urban and rural community affairs	Debt servicing expenses	
Culture, sport and media	Business services and other matters	Financial regulatory affairs expenses	
Health			
Energy saving			
Agriculture, forestry and water affairs			
Transportation			
Resource exploration power information and other matters			

service class. And education, science and technology, urban and rural community affairs, business services and other services for the most part in order to improve the standard of living, so that scientific and technological innovation and development expenditure, classified as high-level service class, and social security and employment, housing security spending, national debt also The interest expenses, financial regulation and other matters belong to the social security expenditure category, but tend to be more security spending in the economic field, and therefore classified as economic factors in child protection factor. Expenditure land resources and meteorological affairs, grain stockpiles affairs in these two areas are resource protection areas to protect the class, so it is classified as resource protection factor of sub-factors.

Basic service class, senior class service, guarantee factor (economy), protection factor (resources) of the four main components constitute the basic pattern of expenditure structure of local government finances, the research on the relationship between the structure of fiscal expenditure and economic growth in the subsequent offer foundation.

4. Cluster Analysis

Determined by factor analysis Chinese local government financial expenditure structure, and as explanatory variables and economic growth variables correlation analysis and regression analysis, high-level service class factor stimulating effect on economic growth, fiscal spending should increase high-level service class factor you can promote economic growth. Learn Chinese local government's fiscal expenditure structure and regional distribution differences contribute to propose appropriate policy recommendations targeted.

This part of the systematic approach of clustering structure of local government finance expenditure categories, tendentious analysis of various types of expenditure in the provincial government and to local government expenditure structural differences cause analysis, to improve the structure of fiscal expenditure provided recommendations. Cluster analysis mainly factor analysis of provincial government spending to get a score of basic data, using software SPSS18.0 clustering results obtained, as shown in **Table 5**.

Table 5 shows that the provinces are divided into five categories, which are divided into three categories of the second category. According to the provincial government further factor scores calculated the scores of various types of expenditure areas, as shown in **Table 6**.

Table 6 shows that: Integrated financial expenditure structure of local government in the country is more balanced. Where basic services category, advanced services category, protection factor—the economy, the protection factor—resources that expenditure score four little difference, respectively, of 0.724, 0.256, 0.202, 0.654 points, which may be the central government transfer payments narrowed each regional differences in the structure of fiscal expenditure; the presence of local government fiscal expenditure structure significant regional differences, Class I Beijing, Tianjin, Shanghai, the main factor tends to advanced services spending, expenditure in this area amounted to 2.822 score the most, has an important relationship with the level of development in these areas.

Fiscal expenditure structure type II region overall score is generally not high, but more balanced structure of financial expenditure score convergence, are concentrated around zero, the kind of area that contains 24 provinces, accounting for 77.42 percent of the total provincial, and local governments features similar overall expenditure.

Table 5. Local government expenditure clustering results.

Category	Province
Class I	Beijing, Tianjin, Shanghai
1st subcategories	Hebei, Liaoning, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu
Class II	Shanxi, Jilin, Heilongjiang
3rd subcategories	Hainan, Xinjiang
Class III	Inner Mongolia
Class IV	Tibet
Class V	Qinghai, Ningxia

Table 6. Expenditure regional scores.

Category	Basic service class	Advanced services category	Protection factor—economy	Protection factor—resources
Class I	−0.026	2.822	−0.314	−0.286
1st subcategories	−0.270	−0.359	−0.216	−0.390
2nd subcategories	−0.421	−0.396	−0.337	1.503
Class II	0.453	−0.307	0.332	−0.244
3rd subcategories	−0.079	−0.354	−0.074	0.290
Synthesize	0.022	0.298	−0.772	3.856
Class III	5.077	−0.397	−0.724	−0.114
Class IV	0.232	0.130	3.442	0.252
Class V	0.724	0.256	0.202	.654
Synthesize				

From this category is subdivided into three categories, subcategories provinces observe three characteristics of financial expenditure, Shanxi, Jilin, Heilongjiang fiscal spending in the protection factor—the higher expenditure of resources, and the protection factor—primarily land and resource expenditures Resources meteorological affairs, grain stockpiles affairs, which is rich in resources in Shanxi coal mine, Jilin and Heilongjiang rich aquatic resources led to increased expenses related to the grain reserve. Hainan, Xinjiang major classes tend to basic services and security factors—economic class, may be related to the remote terrain, the demand for basic services is the main reason for the high. The second category are classified as a subset of the other provinces, the categories including Hebei, Liaoning, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, in the structure of fiscal expenditure showed no significant differences, while a more balanced spending shortfalls.

Class III Inner Mongolia in the structure of fiscal expenditure tend to protect the main factor (resource), scoring 3.856, which may be due mainly to the grasslands of Inner Mongolia and other resource supply as the main feature, the maintenance of a large number of financial expenditure in grain and oil reserves, while Inner Mongolia's unique geographical location also makes it to increase spending in meteorology land resources.

Type IV for Tibet, Tibet on the main structure of fiscal expenditure category tend to basic services, and the differences in the financial structure of spending large class score 5.077 to basic services, and advanced services, protection factor—the economy, the protection factor—resource scores were is −0.397, −0.724, −0.114, indicating that the local government in Tibet and people are more inclined to demand basic services, this area is more than 90 percent of Tibet expenditure from the central transfer payments, and transfers the main The formation of a special fiscal expenditure structure [15] for basic services. On the other hand may be more related to national identity in Tibetan areas, ethnic composition and other factors lead to differences in demand for public services to bring the cost of public service delivery and economic and social development [16], while the other three should be noted expenditure is very weak, inadequate spending.

The first class V Qinghai and Ningxia, speaking generally higher from the fiscal expenditure structure, which safeguards factors—economic class spending the highest score of 3.442, while the protection factor—economics major expenditure including social security and employment, housing security spending, debt service expenditures, financial regulatory affairs spending, indicating Qinghai, Ningxia region at affordable expenses higher expenditure for the livelihood of the majority.

5. Conclusions

Principal component expenditure is as a variable system clustering; the financial structure of local government spending in the country is divided into five categories; the distribution of the difference is obvious. It should be mentioned as the economic development agenda on fiscal restructuring expenses, and in particular with the standard financial transfer payment to drive balanced developments among different regions.

From the scores of senior regional service expenditure structure factors, we can see that Class I of Beijing,

Tianjin, Shanghai maintains the highest degree; Class III and V are Inner Mongolia, Qinghai, Ningxia followed by the first class; Class II and IV of the total 25 regions' advanced services factor have the lowest level, suggesting that we should focus on improving the quantity and quality of expenditure of Shanxi, Hebei, Liaoning, Tibet and others to promote economic growth more effectively.

References

- [1] Solow, R.M. (1956) A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, **70**, 65-94. <http://dx.doi.org/10.2307/1884513>
- [2] Swan, T.W. (1956) Economic Growth and Capital Accumulation. *Economic Record*, **32**, 334-361. <http://dx.doi.org/10.1111/j.1475-4932.1956.tb00434.x>
- [3] Barro, R.J. (1991) Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, **98**, S103-S125. <http://dx.doi.org/10.1086/261726>
- [4] Lucas, R.E. (1990) Supply-Side Economics: An Analytical Review. *Oxford Economic Papers, New Series*, **42**, 293-316.
- [5] Grier, K.B. and Tullock, G. (1989) An Empirical Analysis of Cross-National Economic Growth, 1951-1980. *Journal of Monetary Economics*, **24**, 259-276. [http://dx.doi.org/10.1016/0304-3932\(89\)90006-8](http://dx.doi.org/10.1016/0304-3932(89)90006-8)
- [6] Aschauer, D. (1989) Is Government Spending Productive? *Journal of Monetary Economics*, **23**, 177-200. [http://dx.doi.org/10.1016/0304-3932\(89\)90047-0](http://dx.doi.org/10.1016/0304-3932(89)90047-0)
- [7] Easterly, W. and Rebelo, S. (1993) Fiscal Policy and Economic Growth: An Empirical Investigation. *Journal of Monetary Economics*, **32**, 417-458. [http://dx.doi.org/10.1016/0304-3932\(93\)90025-B](http://dx.doi.org/10.1016/0304-3932(93)90025-B)
- [8] Afonso, A. and Furceri, D. (2010) Government Size, Composition, Volatility and Economic Growth. *European Journal of Political Economy*, **26**, 517-532. <http://dx.doi.org/10.1016/j.ejpoleco.2010.02.002>
- [9] Gong, L.T. and Zou, H.F. (2001) Affect Growth and Volatility of Public Expenditure on Economic Growth. *Dynamic Economics*, **9**, 58-63.
- [10] Gupta, S., Clements, B., Baldacci, E., *et al.* (2005) Fiscal Policy, Expenditure Composition, and Growth in Low-Income Countries. *Journal of International Money and Finance*, **24**, 441-463.
- [11] Guo, Q.W., Lv, B.Y. and Zhang, D.Y. (2003) Fiscal Expenditure Structure and Economic Growth. *Economic Theory and Business Management*, **11**, 5-12.
- [12] Ramey, V.A. (2011) Can Government Purchases Stimulate the Economy? *Journal of Economic Literature*, **49**, 673-685. <http://dx.doi.org/10.1257/jel.49.3.673>
- [13] Colombier, C. (2011) Does the Composition of Public Expenditure Affect Economic Growth? Evidence from the Swiss Case. *Applied Economics Letters*, **18**, 1583-1589. <http://dx.doi.org/10.1080/13504851.2011.554361>
- [14] Zhang, G. and Duan, C. (2006) Empirical Study of Local Fiscal Expenditure Structure of Our Country and Economic Growth in the Region. *Journal of Zhejiang University (Social Science Edition)*, **2**, 88-94.
- [15] Kuang, X.P. and Yang, D.Q. (2013) Empirical Study of Chinese Local Fiscal Expenditure Structure Based on Factor Analysis and Cluster Analysis. *Chinese Administration*, **1**, 105-110.
- [16] Heshmati, A. (2001) On the Causality between GDP and Health Care Expenditure in Augmented Solow Growth Model. SSE/EFI Working Paper Series in Economics and Finance.