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Study on the Relationship between General Public Budget Revenue and Economic Growth in Inner Mongolia

-- An Empirical Analysis based on the VAR Model

Ke Zhang

[1] Kangbashi District Finance Bureau, Ordos Inner Mongolia 017010, China

[2] Institute of Finance and Economics, Ulaanbaatar 13381, Mongolia

Abstract

This study aims to explore the relationship between the general public budget revenue and economic growth in the Inner Mongolia Autonomous Region. The paper selects fiscal data from 1999 to 2021, with the general public budget revenue of Inner Mongolia as the dependent variable and GDP as the independent variable, and employs the Vector Autoregression (VAR) model for empirical analysis. The research results show that after second-order differencing, both the general public budget revenue of Inner Mongolia and GDP achieve stationarity, satisfying the conditions for VAR model construction. The optimal lag order is 4, and the Johansen cointegration test results indicate a long-term stable cointegration relationship between the general public budget revenue and GDP of Inner Mongolia. The Granger causality test further reveals a bidirectional causality between the general public budget revenue and GDP of Inner Mongolia. These findings provide important theoretical basis and empirical support for the formulation of fiscal policies and economic development planning in the Inner Mongolia Autonomous Region.

Keywords

General Public Budget Revenue; Economic Growth; VAR Model; Bilateral Causality.

1. Introduction

The Inner Mongolia Autonomous Region, as an important economic area in China, has always been the focus of economists and policy makers due to the relationship between its economic growth and public budget revenue. Inner Mongolia's economic structure is unique and resource-rich, with both prosperous mineral resources and vast space for agricultural and pastoral development, which gives its economic growth model and public budget revenue composition a distinctive character. However, this uniqueness also brings a series of issues, such as the instability and imbalance between economic growth and public budget revenue. Therefore, a thorough study of the relationship between the general public budget revenue and economic growth in Inner Mongolia has significant theoretical and practical implications for understanding the current economic development status and future trends of Inner Mongolia, as well as for formulating corresponding fiscal policies.

The theme of this paper is "A Study on the Relationship between General Public Budget Revenue and Economic Growth in Inner Mongolia - An Empirical Analysis Based on the VAR Model". We will use the Vector Auto Regression (VAR) model, a powerful tool for multivariate time series data analysis that can capture the dynamic interactions between variables. The application of the VAR model will help us more accurately reveal the intrinsic relationship between the general public budget revenue and economic growth in Inner Mongolia, providing policy makers with a more scientific basis for decision-making.

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In the context of globalization and domestic economic structural adjustments, how resource-rich regions like Inner Mongolia can achieve stable economic growth and increase public budget revenue through effective fiscal policies is an important issue currently faced. Therefore, the importance and relevance of this research are self-evident. We hope that through an in-depth study of the relationship between the general public budget revenue and economic growth in Inner Mongolia, we can provide useful references and insights for the formulation of fiscal policies in Inner Mongolia and even nationwide.

2. Literature Review

A considerable amount of research has been conducted by scholars on the empirical analysis of the relationship between local fiscal revenue and GDP, with several key observations and discoveries. Firstly, the study by Wang Yuhua and Liu Beibei (2009) [4] revealed a long-term stable relationship between local GDP and fiscal revenue in Shandong Province, thus proving that the growth of local fiscal revenue in Shandong Province accompanies GDP growth. However, this study also pointed out that due to the excessively large proportion of non-tax revenue in Shandong's fiscal revenue, the quality of fiscal revenue is not high, resulting in the insignificant impact of short-term GDP fluctuations on fiscal revenue. This observation provides important information for policymakers to improve revenue quality in order to enhance the relationship between revenue and GDP.

Secondly, the research by He Yinhui (2017) [1] employed regression models and error correction models to conduct an in-depth study of the relationship between fiscal revenue and GDP in Chongqing. The results showed a long-term equilibrium relationship between fiscal revenue and GDP in Chongqing, and suggested optimizing the economic structure and improving the tax collection and management system to further enhance the matching of fiscal revenue and economic development.

In addition, Meng Jinglei and Xiu Guoyi (2019) [2] studied the relationship between national fiscal revenue and national economic growth through the overall linear regression ECM function model, pointing out that the differences in national fiscal revenue are mainly affected by national macro policies, and there are significant differences between local fiscal revenues. This research result emphasizes the impact of macro policies on fiscal revenue differences and also reveals the diversity of local economic development. Zheng Jiawei's (2019) [5] research results show that local tax revenue in Guangdong Province is highly dependent on regional GDP growth, further supporting the relationship between GDP growth and fiscal revenue growth. Ren Zhuowen's (2021) [3] research proves that tax revenue in Xinjiang is the cause of economic growth, non-tax revenue has no significant impact on economic growth, and there is no substitution effect between tax revenue and non-tax revenue. This finding also has important implications for policymakers, that is, to pay attention to the quality of tax revenue and improve its contribution to economic growth.

Overall, these studies have to some extent revealed the relationship between fiscal revenue and GDP growth, providing a good theoretical and empirical basis for the research conducted in this paper. However, the aforementioned studies may overemphasize statistical relationships, neglecting the actual situation of specific regions, including the impact of policy environment, economic structure, and other factors on the relationship between local fiscal revenue and GDP. This paper draws on the research methods mentioned above, selects fiscal data from 1999 to 2021, establishes a VAR model, and empirically analyzes the relationship between the general public budget revenue and economic growth in Inner Mongolia, in order to propose countermeasures and suggestions conducive to the sustainable economic and fiscal development of resource-based regions.

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3. Model Construction and Indicator Selection

3.1. Model Construction

The VAR (Vector Auto-regression) model, also known as the vector auto regressive model, was first proposed by Sims (1980). This model internalizes the variables under study and then determines the lag values to test the dynamic relationship among multiple variables. Firstly, the final accounts data of fiscal revenue in Inner Mongolia from 1999 to 2021 selected in this paper are data from the same entity at different time points, suitable for time series models. Secondly, this study not only focuses on one variable, fiscal revenue, but also involves other variables such as GDP, tax revenue, etc. Therefore, this paper selects the Vector Auto-regression (VAR) model to empirically analyze the sustainability of fiscal revenue growth. The representative form of this model is:

$$Y_t = C + \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + \cdots + \varphi_p y_{t-p} + U_t, \ t=1,2,\ldots,T$$

Where C is the constant matrix of the equation, A is the matrix of coefficients to be estimated, Ut is the white noise vector, t is time, and p is the lag order.

3.2. Indicator Selection

Since this paper studies the relationship between general public budget revenue and economic growth, Gross Domestic Product (GDP) is an important indicator to measure the scale and level of regional economic development. Therefore, this paper selects the general public budget revenue in Inner Mongolia (variable symbol Y) as the dependent variable, and Gross Domestic Product (variable symbol X) as the independent variable.

To reduce the multicollinearity and heteroscedasticity effects of the original time series data, this paper performs a natural logarithm treatment on all data, represented as lnY and lnX respectively. The data used are from the "Inner Mongolia Statistical Yearbook", "Inner Mongolia Fiscal Yearbook" and the Zhongjing Network statistical database, and the analysis and test are conducted using Eviews10. The descriptive statistical results are shown in Table 1.

Table 1. Descriptive Statistics Results for Variables

Item	Observations	Man	Median	Maximum	Minimum	Std. Dev.
General Public Budget Revenue (InY)	24	6.544685	7.093624	7.946051	4.460953	1.214331
GDP(InX)	24	8.831907	9.083251	10.05013	7.229339	0.895376

4. Empirical Analysis

4.1. ADF Stationarity Test

The ADF unit root test is performed on the two variables, InY and InX, using three different specifications: intercept only (Test equation 1), intercept and trend (Test equation 2), and no intercept and trend (Test equation 3). The test results show that the variables InY and InX do not reject the null hypothesis at the 5% significance level, indicating that the original series are non-stationary. After first-order differencing, the variables InY and InX still do not reject the null hypothesis at the significance level, thus requiring second-order differencing. After second-

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order differencing, both InY and InX are stationary under all three specifications, satisfying the conditions for constructing the VAR model.

Table 2. ADF Unit Root Test Results

Item of test equation	Variables	t-Statistic	Test critical values 1%	5%	10%	Prob.*	Result
Test equation 1 (Intercept)	InY	-2.137463	-3.752946	-2.998064	-2.638752	0.2329	Unstable
	InX	-3.014172	-3.752946	-2.998064	-2.638752	0.0484	Stable
Test equation 2 (Trend and intercept)	InY	-3.299187	-4.571559	-3.690814	-3.286909	0.098	Unstable
	InX	-3.97331	-4.571559	-3.690814	-3.286909	0.0301	Stable
Test equation 3 (None)	InY	1.220233	-2.67429	-1.957204	-1.608175	0.9378	Unstable
	InX	1.586377	-2.67429	-1.957204	-1.608175	0.9681	Unstable
Item of test equation	Variables	t-Statistic	Test critical values 1%	5%	10%	Prob.*	Result
Test equation 1 (Intercept)	D(InY, 1)	-2.022236	-3.769597	-3.004861	-2.642242	0.2758	Unstable
	D(InX, 1)	-2.164853	-3.769597	-3.004861	-2.642242	0.2235	Unstable
Test equation 2 (Trend and intercept)	D(InY, 1)	-2.403052	-4.440739	-3.632896	-3.254671	0.3679	Unstable
	D(InX, 1)	-2.888264	-4.440739	-3.632896	-3.254671	0.1846	Unstable
Test equation 3 (None)	D(InY, 1)	-0.595019	-2.685718	-1.959071	-1.607456	0.4468	Unstable
	D(InX, 1)	-0.48738	-2.685718	-1.959071	-1.607456	0.4919	Unstable
Item of test equation	Variables	t-Statistic	Test critical values 1%	5%	10%	Prob.*	Result
Test equation 1 (Intercept)	D(InY, 2)	-5.725456	-3.78803	-3.012363	-2.646119	0.0001	Stable
	D(InX, 2)	-3.940906	-3.808546	-3.020686	-2.650413	0.0076	Stable
Test equation 2 (Trend and intercept)	D(InY, 2)	-3.933702	-4.498307	-3.658446	-3.268973	0.0299	Stable
	D(InX, 2)	-3.791276	-4.498307	-3.658446	-3.268973	0.0391	Stable
Test equation 3 (None)	D(InY, 2)	-5.854614	-2.679735	-1.958088	-1.60783	0.0000	Stable
	D(InX, 2)	-6.10865	-2.679735	-1.958088	-1.60783	0.0000	Stable

Note: D(InX, 1) represents the first-order difference of the variable, and D(InX, 2) represents the second-order difference of the variable.

4.2. Determining the Optimal Lag Order (Likelihood Ratio Test)

The optimal lag order is determined using the LR, PRE, AIC, SC, and HQ criteria. From Table 3, it can be observed that the LR, PRE, AIC, SC, and HQ test results indicate that the optimal lag order is 4.

Table 3. Results of Determining the Optimal Lag Order

Lag	LogL	LR	FPE	AIC	SC	HQ
1	60.57361	NA	8.90E-06	-5.955116	-5.756287	-5.921467
2	63.31916	4.335091	1.03E-05	-5.82307	-5.425411	-5.75577
3	65.99918	3.667397	1.22E-05	-5.684125	-5.087637	-5.583175
4	82.9646	19.64417*	3.33e-06*	-7.048905*	-6.253588*	-6.914306*
5	86.07079	2.942703	4.14E-06	-6.95482	-5.960673	-6.786571

4.3. Johansen Cointegration Test

To avoid spurious regression, the Johansen cointegration test is conducted. From Table 4, it can be observed that both the Trace test and Maximal Eigenvalue test reject the null hypothesis of "no cointegration equation" at the 5% significance level. The results indicate that there is at most 1 cointegrating equation, suggesting a long-term stable cointegration relationship between local fiscal revenue and GDP in Inner Mongolia.

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Table 4. Johansen Cointegration Test Results

Hypothesized	Trace Test			Maximum Eigenvalue Test		
	Statistic	Critical Value	Prob.**	Statistic	Critical Value	Prob.**
None *	56.38953	15.49471	0	53.00467	14.2646	0
At most 1 *	3.384857	3.841466	0.0658	3.384857	3.841466	0.0658

4.4. Granger Causality Test (Exogeneity Test of Variables)

The Granger causality test is conducted on local fiscal revenue and GDP in Inner Mongolia to examine the causal relationship between the variables. From Table 5, it can be observed that lnY and InX are mutually Granger causal, indicating a bidirectional influence between the two variables. Local fiscal revenue has predictive power for GDP growth, and GDP is an important factor causing changes in local fiscal revenue.

Table 5. Granger Causality Test Results

Dependent variable: INX			
Excluded	Chi-sq	df	Prob.
INY	88.94123	4	0
All	88.94123	4	0
Dependent variable: INY			
Excluded	Chi-sq	df	Prob.
INX	16.28288	4	0.0027
All	16.28288	4	0.0027

4.5. Impulse Response Analysis

Due to the presence of error terms, the relationship between endogenous variables may exhibit different dynamics over time. Impulse response analysis helps to examine the differences and dynamic interactions between variables. Using Eviews, impulse response analysis is conducted for the VAR model. The results are shown in Figure 4-5.

In the first row of the figure, the impulse response of InX to InY is depicted. It can be observed that the impact of GDP on local fiscal revenue initially shows a positive effect, reaching its maximum impact in the 4th period and then declining. From the 6th period onwards, it exhibits a negative effect, with the negative impact increasing over time. This indicates that in the short term, GDP has a positive influence on local fiscal revenue in Inner Mongolia, but in the long term, it has a negative impact.

In the second row of the figure, the impulse response of InY to InX is shown. It can be seen that local fiscal revenue has a positive impact on GDP, indicating that as local fiscal revenue in Inner Mongolia continues to grow steadily, the overall GDP will also increase.

Afterwards, impulse response analysis and variance decomposition analysis were conducted. The impulse response analysis shows that in the short term, the local GDP of Inner Mongolia has a positive effect on the general Public budgeting income, while there is a long-term negative effect. Variance decomposition analysis shows that after Phase 1, the variance contribution rates of InY to itself and InX have reached a stable state, with InY maintaining a variance contribution rate of around 60% to itself and a variance contribution rate of around 40% to InX.

5. Conclusions and Suggestions

5.1. Research Conclusions

The results of this study show that the general public budget revenue in Inner Mongolia (lnY) and GDP (lnX) are stationary after second-order differencing, which meets the modeling

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conditions of the VAR model. This means that the changes in these two variables depend not only on their own past values but also on the past values of the other variable, revealing the dynamic interrelationship between the general public budget revenue and GDP in Inner Mongolia.

The optimal lag order is determined to be 4, which means that the current values of the general public budget revenue and GDP in Inner Mongolia are influenced not only by their own past 4 periods but also by the other's past 4 periods. This further emphasizes the close connection between these two variables.

The results of the Johansen cointegration test show that there is at most one cointegration relationship between the general public budget revenue and GDP in Inner Mongolia, which means that there is a long-term stable relationship between these two variables. This indicates that although the general public budget revenue and GDP in Inner Mongolia may be subject to short-term shocks, they will tend towards a stable equilibrium state in the long run.

The results of the Granger causality test show that there is a bidirectional Granger causality relationship between the general public budget revenue and GDP in Inner Mongolia, which means that these two variables not only influence each other but can also predict each other. This indicates that by observing the changes in the general public budget revenue in Inner Mongolia, we can predict the changes in GDP, and vice versa.

These results are consistent with our research objectives, revealing not only the dynamic interrelationship between these two variables but also their long-term stable relationship. In addition, this study also has some unique findings, such as our discovery that the optimal lag order of the general public budget revenue and GDP in Inner Mongolia is 4, which may be due to the special economic structure and fiscal policy of Inner Mongolia.

5.2. Policy Suggestions

Firstly, enhance the stability of fiscal revenue. Since there is a long-term stable cointegration relationship between the general public budget revenue and GDP in Inner Mongolia, it is necessary to optimize the tax structure and enhance the stability of fiscal revenue to cope with the impact of economic fluctuations. For instance, reliance on more stable direct taxes (such as personal income tax, corporate income tax) can be appropriately increased, while dependence on indirect taxes (such as value-added tax, consumption tax), which are more affected by economic fluctuations, can be reduced.

Secondly, optimize resource allocation. Since there is a bidirectional Granger causality relationship between the general public budget revenue and GDP in Inner Mongolia, it is necessary to optimize resource allocation and improve the predictive ability of public budget revenue for GDP to promote sustained and stable economic growth. For example, investment in areas such as education, technology, and health can be increased to improve the quality and efficiency of human capital and technological innovation.

Thirdly, develop a diversified economy and enhance technological innovation capabilities. Since Inner Mongolia is a resource-based region, it should reduce reliance on resources by developing a diversified economy and enhance the economy's ability to resist risks. For instance, non-resource-based industries such as the service industry and high-tech industries can be developed to increase the diversification of the industrial structure. Furthermore, Inner Mongolia should enhance its technological innovation capabilities, drive sustained and stable economic growth through technological innovation, and achieve high-quality development. For example, investment in research institutions can be increased, and the treatment and incentives for researchers can be improved; the transformation of scientific and technological achievements can be strengthened to increase the commercialization of technological innovation.

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Fourthly, deepen fiscal system reform. In the future, Inner Mongolia should continue to deepen fiscal system reform, improve the efficiency and fairness of fiscal revenue, and support sustained and stable economic growth. For example, tax system reform can be furthered to improve the fairness and efficiency of taxation; budget system reform can be furthered to improve budget transparency and public participation.

Lastly, strengthen environmental protection. Inner Mongolia should steadfastly follow the path of "ecology first, green development", strengthen environmental protection, and achieve a harmonious coexistence of economic development and environmental protection to achieve sustainable development. For example, investment in environmental protection industries can be increased, and the research and application of environmental protection technologies can be improved; the enforcement of environmental protection regulations can be strengthened to improve environmental awareness and behavior.

References:

[1] Yin-Hui He. 2017. Empirical Analysis of Fiscal Revenue and Economic Growth in Chongqing City. Master's degree, Chongqing University.

[2] Jing-Lei Meng & Guo-Yi Xiu. 2019. Empirical Analysis of the Relationship Between Local Fiscal Revenue and Economic Growth. Statistics and Decision, 35, 171-175.

[3] Zhuo-Wen Ren. 2020. Empirical Analysis of the Relationship Between Tax Revenue, Non-tax Revenue, and Economic Growth in Xinjiang. Guangxi Quality Supervision Guide, 43-45.

[4] Yu-Hua Wang & Bei-Bei Liu. 2009. Empirical Analysis of Shandong Province's GDP and Fiscal Revenue. Dongyue Tribune, 30, 53-58.

[5] Jia-Wei Zheng. 2019. Empirical Analysis of the Relationship Between Local Fiscal Tax Revenue and Changes in Gross Regional Product in Guangdong Province. Think Tank Times, 36+58.