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China's local government debt risk assessment and countermeasures under the influence of COVID-19

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Abstract

Under the influence of COVID-19, the global economic and social development is facing great challenges. With the increase of government financial pressure and the decrease of debt paying ability, the problem of debt risk of local governments in China is attracting wide attention. In order to measure the level of China's local government debt risk under the influence of COVID-19, this paper takes China's Sichuan Province as an example, collects the core indicators data of measuring local government debt risk in 2017-2020 years, and uses AHP-TOPSIS method to make a comprehensive analysis of the local government debt risk situation in different periods before and after COVID-19. It is found that the local government debt risk in Sichuan Province is generally controllable. However, influenced by COVID-19, in 2020, the overall level of local government debt risk in Sichuan province expanded by 22.1% compared with 2019, this is mainly due to the further expansion of debt scale and slower economic growth. This paper suggests that the Chinese government should speed up the construction of comprehensive early warning and supervision system of local government debt risk, and prevent and resolve the debt risk of local government in advance.

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Keywords: Local government debt; COVID-19; Debt risk assessment; AHP-TOPSIS

1. Introduction

In recent years, with the increasing scale of China's local government debt, the risk of local government debt has attracted the attention of all walks of life. According to the latest statistics of China's Ministry of finance, by the end of 2020, China's local government debt balance has reached 25.66 trillion yuan [1]. Influenced by COVID-19, the global social and economic development is facing great challenges. The increase of government...
financial pressure will undoubtedly aggravate the possibility of local government debt risk. How to evaluate the debt risk of local government effectively and prevent the risk of local government debt is an important problem that needs to be solved urgently.

At present, many scholars have put forward corresponding debt risk identification and early warning models for local government debt risk. MA at al designed a set of demonstrative local government debt risk early warning index system for a hypothetical developing country by analyzing the cases of Ohio's "local financial monitoring plan and financial crisis law" and Brazil's "local government borrowing restriction"[2]. Cevik et al used the principal component analysis method to build an early warning model of local government debt risk [3]. These studies provide relevant exploration for local government risk assessment.

Based on the relevant research of scholars [4-11], this paper selects the indexes system to measure the debt pressure, solvency and macroeconomic development, and uses AHP-TOPSIS method to comprehensively analyze the risk debt level of Sichuan Province from 2017 to 2020. The results show that: at present, the debt risk of local governments in Sichuan Province is generally controllable, but the debt risk level of individual regions is in a medium risk state for a long time, so it is necessary to strengthen the local debt risk management and control. Influenced by COVID-19, Sichuan's local government debt risk level expanded by 22.1% in 2020 compared with 2019, which is mainly due to the further expansion of debt scale and slower economic growth. This paper suggests that the Chinese government should speed up the construction of the comprehensive early warning and supervision system of local government debt risk, realize the all-round control from the aspects of debt issuance, capital use and debt repayment, and actively prevent and resolve various possible risk events.

2. Government debt risk assessment based on AHP-TOPSIS method

This paper uses debt pressure, financial capacity and macroeconomic indicators to evaluate the level of local government debt risk. According to the international debt early warning standards and industry experience, the value of each indicators is not the bigger or smaller the better, but needs to be within a reasonably safe range, so this paper divides the interval of local government debt risk assessment indicators, 1 represents Normal range, 1-2 represents Low risk, 2-3 represents Medium risk, 3-4 represents High risk [7-8]. Local debt risk indicators and interval division are shown in Table 1.

| Rule layer | Index layer | Normal range | Low risk | Medium risk | High risk |
|------------|-------------|--------------|---------|-------------|----------|
| Debt pressure | Government debt ratio | [0,20%] | (20%,25%] | (25%,30%] | (30%,+∞) |
| Debt burden ratio | [0,80%] | (80%,100%] | (100%,120%] | (120%,+∞) |
| Debt service ratio | [0,20%] | (20%,40%] | (40%,60%] | (60%,+∞) |
| Debt replacement ratio | [0,25%] | (25%,50%] | (50%,75%] | (75%,+∞) |
| Fiscal self-sufficiency rate | [60%,100%] | [40%,60%] | (20%,40%] | (0,20%] |
| Land financial dependence | [0,25%] | (25%,50%] | (50%,75%] | (75%,+∞) |
| Solvency | General budgetary revenue growth rate | [6%,12%] | (0,6%] | (-6,0] | (<-6,-6]) |
| | | | (12%,18%] | (18%,24%] | (24%,+∞) |
| GDP growth rate | [5%,10%] | [0,5%] | [-5,0] | (<-5,-5]) |
| Macro-economy | Financial deepening rate | [80%,100%] | (100%,120%] | (120%,140%] | (140%,+∞) |
| Growth of fixed assets investment | [7.5%,15%] | [0,7.5%] | [-7.5,0] | (<-7.5,-7.5]) |

Table 1. Local government debt risk assessment indicators and risk interval division
2.1. Using AHP to determine indicators weight

First of all, through consulting a number of debt management experts and combining with the actual situation of local government debt in China, this paper uses AHP method to solve the weight of each evaluation indicators, and then uses TOPSIS method to obtain the risk assessment results of local government debt. This combination of qualitative and quantitative method can systematically and scientifically assess the local government debt risk. The weight of each indicators is shown in Table 2.

Table 2. The weights of local government debt evaluation indicators

| Rule layer | The weights of rule layer | indicators layer | The weights of indicators layer |
|------------|--------------------------|------------------|---------------------------------|
| Debt pressure | 0.4126 | Government debt ratio | 0.1182 |
| | | Government debt burden ratio | 0.0836 |
| | | Debt service ratio | 0.1406 |
| | | Debt replacement ratio | 0.0703 |
| Solvency | 0.3275 | Fiscal self-sufficiency rate | 0.1351 |
| | | Land financial dependence | 0.0851 |
| | | General budgetary revenue growth rate | 0.1072 |
| | | GDP growth rate | 0.1007 |
| Macro-economy | 0.2599 | Financial deepening rate | 0.0440 |
| | | Growth of fixed assets investment | 0.1153 |

2.2. Using TOPSIS method to evaluate debt risk

TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) is a very effective method to solve multi-objective scheduling problem. Its basic idea is to first select a positive ideal solution and a negative ideal solution, and then find out the scheme which is closest to the positive ideal solution and farthest from the negative ideal solution as the optimal scheme. In TOPSIS, relative closeness is introduced to weigh the two distances, so as to judge the solution. The steps are as follows:

Step1: Firstly, this paper divides the risk intervals of the indicators according to table 1, 1 represents the normal interval, 1-2 represents the low risk, 2-3 represents the medium risk, 3-4 represents the high risk, and then obtains the risk interval values of $M$ debt risk evaluation indicators of $P$ regions, Matrix $Y = (y_{ij})_{p 	imes m}$.

Step2: Construction of weighted normalized decision matrix $Z$.

$$Z = (z_{ij})_{p 	imes m}, \text{among } z_{ij} = w_j \cdot y_{ij} \quad (j = 1, 2, ..., m) \quad (1)$$

$w_j$ is the weight value of evaluation indicators obtained by AHP.

Step3: Determining the positive ideal solution $S^+$ and negative ideal solution $S^-$ of the evaluation object. In this paper, the local government debt risk assessment problem, the ideal value of all indicators is 1 and the worst value is 4, so the positive ideal solution and negative ideal solution are

$$S^+ = (1, 1, 1, 1, 1, 1, 1, 1, 1, 1), S^- = (4, 4, 4, 4, 4, 4, 4, 4, 4, 4)$$

Step4: The distances from the evaluation object to the positive ideal solution and the negative ideal solution are as follows:

$$D_i^+ = \sqrt{\sum_{j=1}^{m} (z_{ij} - S^+)^2} \quad (i = 1, ..., p) \quad (2)$$

$$D_i^- = \sqrt{\sum_{j=1}^{m} (z_{ij} - S^-)^2} \quad (i = 1, ..., p) \quad (3)$$
Step5: Calculating the relative progress of debt risk with positive ideal solution and negative ideal solution.

\[ \eta_i = \frac{D_i^+}{D_i^+ + D_i^-} \] (4)

According to the value of \( \eta_i \) \((0 \leq \eta_i \leq 1)\), the closer the value of \( \eta_i \) is to 1, the greater the risk of government debt is.

2.3. Interval classification of local government debt risk

According to the evaluation results of AHP-TOPSIS method, the closer the value of \( \eta_i \) is to 1, the greater the government debt risk is. Therefore, this paper divides the risk level of local government debt into three intervals, and the interval division of local government debt risk is shown in Table 3.

Table 3. Interval classification of local government debt risk

| Interval classification | Low risk | Medium risk | High risk |
|-------------------------|----------|-------------|-----------|
| \( \eta_i \)             | (0,0.33] | (0.33,0.67] | (0.67,1]  |

3. Risk assessment of local government debt

This paper collects the data of relevant debt indicators of Sichuan Province from 2017 to 2020, relevant data are from the statistical yearbooks, financial budgets and final accounts published by the municipal statistics bureaus and finance bureaus of Sichuan Province. According to the interval division standard of the above evaluation indicators, the data is numerically processed, and then the AHP-TOPSIS method is used to evaluate the debt risk of Sichuan Province in China. The relevant evaluation results are shown in Table 4.

Table 4. Sichuan debt risk assessment results in 2017-2020 years

| Administrative regions | 2017            | 2018            | 2019            | 2020            |
|------------------------|-----------------|-----------------|-----------------|-----------------|
| Bazhong                | 0.5725(Medium risk) | 0.5715(Medium risk) | 0.6274(Medium risk) | 0.6098(Medium risk) |
| Ziyang                 | 0.5563(Medium risk) | 0.4854(Medium risk) | 0.5889(Medium risk) | 0.5782(Medium risk) |
| Guangyuan              | 0.5029(Medium risk) | 0.5260(Medium risk) | 0.5414(Medium risk) | 0.5406(Medium risk) |
| Nanjiang               | 0.5411(Medium risk) | 0.4999(Medium risk) | 0.4976(Medium risk) | 0.5218(Medium risk) |
| Zigong                 | 0.4535(Medium risk) | 0.4417(Medium risk) | 0.4123(Medium risk) | 0.5127(Medium risk) |
| Guang'an               | 0.4455(Medium risk) | 0.3652(Medium risk) | 0.3675(Medium risk) | 0.4888(Medium risk) |
| Neijiang               | 0.5182(Medium risk) | 0.3997(Medium risk) | 0.4125(Medium risk) | 0.4592(Medium risk) |
| Meishan                | 0.5213(Medium risk) | 0.4275(Medium risk) | 0.3735(Medium risk) | 0.4098(Medium risk) |
| Dazhou                 | 0.4993(Medium risk) | 0.4257(Medium risk) | 0.4312(Medium risk) | 0.3986(Medium risk) |
| Luzhou                 | 0.2947(Low risk) | 0.3386(Medium risk) | 0.3294(Low risk) | 0.3900(Medium risk) |
| Ganzi Prefecture       | 0.3968(Medium risk) | 0.3454(Medium risk) | 0.3194(Low risk) | 0.3833(Medium risk) |
| Mianyang               | 0.4227(Medium risk) | 0.3201(Low risk) | 0.3366(Medium risk) | 0.3832(Medium risk) |
| Leshan                 | 0.4040(Medium risk) | 0.2938(Medium risk) | 0.2755(Low risk) | 0.3790(Medium risk) |
| Suining                | 0.4412(Medium risk) | 0.4081(Medium risk) | 0.3912(Medium risk) | 0.3764(Medium risk) |
According to the analysis results, it can be found that during 2017-2020, the overall risk value of local government debt in Sichuan Province is between 0.2749-0.3706, which is in the low risk and medium risk range. Among them, the debt risk level of Bazhong, Ziyang and Guangyuan is relatively high, while the debt risk of Chengdu, Yibin, Liangshan and Panzhihua is relatively low. In 2020, 17 cities in Sichuan Province are in a medium risk state, and the regulatory authorities need to strengthen the debt supervision of these cities to prevent further expansion of debt risk.

Affected by COVID-19, compared with 2019, the risk of local government debt increased further in Sichuan Province in 2020, as shown in figure 1. The local government debt risk reached 0.3582 in the whole province, which was mainly due to the slower growth of regional economic development and the further expansion of regional debt scale. Therefore, under the situation of COVID-19 uncertainty, it is necessary for the central government to strengthen the supervision of local government debt. Only in this way can we prevent and resolve the local government debt risk in advance and prevent the further expansion of the local government debt risk.
4. Local government debt risk prevention and Countermeasures

China's local government debt is mainly used for regional public services and infrastructure construction. Reasonable use of debt financing can promote regional economic and social development, but excessive debt will cause debt default risk.

At present, the main problems of local government debt in Sichuan Province are the large scale of local government debt, and the debt is facing the situation of concentrated maturity. The solvency of cities in the West and northeast of Sichuan Province is weak, and the economic level of different cities in the province varies greatly. Therefore, the regulatory authorities need to focus on the debt situation of medium risk areas to prevent the occurrence of debt risk.

According to the current situation of Sichuan local government debt risk, this paper suggests that the regulatory authorities should speed up the construction of comprehensive early warning and regulatory system of local government debt risk, and realize the comprehensive control from the aspects of debt issuance, capital use and debt repayment. Secondly, local government officials need to further strengthen debt risk awareness and management ability, and take the initiative to prevent the occurrence of debt risk. Finally, local governments need to ensure the efficient use of debt funds, let the debt promote the economic and social development of the region, rather than fall into the debt crisis.

5. Conclusions

Influenced by COVID-19, the social and economic development of various countries is facing great challenges. Facing the financial contraction and the expansion of debt scale, the situation of China’s local government debt risk has aroused concern from all sectors. Taking Sichuan Province as an example, this paper uses AHP-TOPSIS method to analyze the risk level of local government debt in Sichuan Province. The results show that: at present, the debt risk of Sichuan Province is generally controllable, but the debt risk value of Bazhong, Ziyang, Guangyuan, Nanchong and Zigong is above 0.5, so it is necessary to strengthen the debt risk monitoring and debt management.

Influenced by COVID-19, the overall level of local government debt risk in Sichuan province expanded by 22.1% in 2020 compared with 2019, mainly due to the slower growth of economic and social development and the further expansion of regional debt scale. In the face of the long-term impact of COVID-19, China’s government should accelerate the comprehensive early warning and supervision system of local government debt risks, and prevent and resolve any possible risk events ahead of schedule.

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