

# Measurement of Local Fiscal Sustainability

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**Abstract:** As a foundation and important pillar of national governance, timely assessment of local fiscal sustainability can identify fiscal risks and pressures, furthermore, it can prevent fiscal risks from causing systemic financial risks and provide a stable financial and fiscal environment for high-quality economic development and building a new development pattern. Based on the panel data of 246 prefecture-level cities from 2008 to 2019, this paper firstly elaborates on local fiscal sustainability at the theoretical level, secondly constructs a fiscal reflection function to empirically measure local fiscal sustainability, and finally uses the DEA-Malmquist index method to measure the fiscal expenditure efficiency value  $fe$ , and uses  $fe$  to measure the local government's "effective fiscal space" of local governments in China is measured with the help of  $fe$ . The measurement results show that most regions in China have high fiscal space, i.e. most local governments have strong fiscal sustainability.

**Keywords:** Local financial sustainability, Financial space, System GMM.

## 1. Introduction

China's 1994 tax sharing reform, while strengthening the central government's financial concentration and enhancing macro-control capabilities, also incentivised local governments to engage in "economic tournaments" and "political promotion tournaments" through decentralisation, effectively promoting the rapid growth of China's economic output. However, the Chinese style decentralisation system is not as effective as the However, the asymmetrical nature of the Chinese decentralisation system between the "upward transfer of financial powers and the decentralisation of affairs" has led to difficulties and vertical imbalances in local government revenues and expenditures. Since 2008, China has been implementing a proactive fiscal policy, and the balance between the general public budget and revenue has risen from RMB 778.1 billion in 2009 to RMB 627.65 billion in 2020. Although the new Budget Law promulgated in 2015 gave local governments the right to issue debts to obtain fiscal revenue, a change that has put government debt management on the path of transparency and standardisation, local governments have gradually embarked on the path of illegal debt raising in order to raise development funds based on development pressure and promotion pressure. As government-social capital cooperation, government purchases and government investment funds developed into new manifestations of local hidden debt, the scale of local government debt expanded rapidly, directly impacting the sustainability of local finances and regional economic security in a major way.

The existing literature on fiscal sustainability has been developed in two main ways: firstly, from the connotation of fiscal sustainability. Buiter (1985) was the first to propose the concept of fiscal sustainability and defined it as a state of survival and capacity of state finances. Liu Shangxi (2003) put forward the concept of fiscal unsustainability from the opposite perspective. The definition of fiscal sustainability by domestic and foreign scholars is mainly developed from the perspectives of government debt and fiscal revenues and expenditures. Regarding the fiscal balance perspective, Buckle & Cruickshank (2012) define fiscal sustainability as the ability of a government's fiscal position to maintain its current policies without major adjustments in the future.

According to Deng et al. (2013), fiscal sustainability refers to a state of equilibrium that can be achieved by the government's fiscal and revenue behaviour under the constraints of certain institutions and rules, i.e. the government's fiscal revenues and expenditures are maintained at an appropriate scale and reasonable structure, and both are reasonably distributed and highly matched in terms of time, scale and structure, so that they do not trigger a serious financial crisis when encountering large internal and external shocks. According to Li et al. (2018), the problem of local fiscal sustainability is fundamentally a matter of local fiscal revenues continuously covering fiscal expenditures. Regarding the debt perspective, the first is borrowing capacity, i.e. whether the government can finance itself through the debt paper market (Rubio et al., 2010; Hong Yuan, Li Li, 2006); the second is debt servicing capacity, i.e. the government's ability to pay its debt service on time (Wilcox, 1989; Zhang Chunlin, 2000). The second is the research approach to fiscal sustainability. Hamilton and Marjorie (1986) derived the conditions for fiscal sustainability based on the government's intertemporal constrained budget condition, and used unit root or cointegration tests to test these conditions. Bohn (1998) demonstrates that government debt satisfies the intertemporal budget constraint condition when there is a positive reaction relationship between government budget surpluses and opening debt balances. However, Ostry et al. (2010) argue that Bohn's linear fiscal response function does not take into account the existence of "fiscal fatigue", i.e. the government's ability to adjust the underlying budget surplus is limited, and they propose to use a non-linear fiscal response function to fit the relationship between the underlying fiscal surplus rate and the government debt ratio, and define The concept of "fiscal space" is defined. Blanchard et al. (1990) use the steady state of a theoretical model to characterise sustainable government debt and discuss the conditions necessary for government debt to be sustainable from a long-term perspective.

Fiscal sustainability is an important guarantee for maintaining the stable operation of the macroeconomic and financial system, and is a constraint that governments must face when implementing active fiscal policies. Therefore, it is of great practical significance to assess the fiscal sustainability of local governments in China. This paper

defines local fiscal sustainability as a situation where, in the face of rising debt levels or deteriorating fiscal conditions, local governments take the initiative to adjust their fiscal behaviour, such as reducing expenditure, increasing revenue and controlling the scale of debt, in order to improve their fiscal position and reduce fiscal risk. Based on a panel of 246 prefecture-level cities from 2008 to 2019, this paper first assesses local fiscal sustainability based on the fiscal reflection function, and then uses the measured "effective fiscal space" to quantify local fiscal sustainability.

## **2. Theoretical Analysis**

### **2.1. Related theories**

#### **2.1.1. Financial Economics**

The theory of fiscal economics, which includes the two theories of revenue and expenditure, is a central part of modern fiscal theory. The study of revenue theory is conducted mainly to limit the local government's right to share revenue, which includes both taxes and public debt. Fiscal revenue and expenditure theory considers that fiscal sustainability can only be achieved when fiscal balance is reached in the long term, and therefore the theory focuses on local fiscal sustainability in two dimensions: increasing revenue and reducing expenditure. The current requirements for fiscal policy in China are to increase efficiency and maintain the necessary intensity of fiscal expenditure, as the question of how to improve the local fiscal expenditure system and improve the performance of expenditure, while maintaining the intensity and requirements of local fiscal sustainability, is an urgent issue to be resolved.

### **2.2. Management Finance**

Fiscal management has a strong applied focus, with the core elements of fiscal budget theory and local debt theory. Fiscal sustainability, or sustainability in all management, has five basic characteristics, including planning, homogeneity, openness, rule of law and annuality. Since the General Office of the State Council required the publication of budgets in 2016, it has both curbed some corruption and improved local financial management, providing an improved direction for fiscal reform while also pushing for regional fiscal sustainability through institutionalisation and transparency. Local debt has different connotations before and after the 2015 reform, with local debt before the reform referring to local government debt. Local government debt has a specific connotation and refers to debts formed by local governments (including government departments and agencies), funding-subsidised utilities, public utilities, government financing platform companies and other undertakings that are directly borrowed, in default or as a result of providing credit support such as guarantees and buybacks, in order to support the construction of public projects. In terms of statistical calibre, the Audit Office classifies local government debts into three categories: directly liable for repayment, liable for guarantee and potentially liable for bailout, a classification that emphasises the responsible subject. After the reform, legal local debt refers to local government debt and legal contingent debt. In particular, local government debt is local government bonds issued by provinces, municipalities and autonomous regions within the limit and included in the budget management, as well as the stock of government debt in the form of non-government bonds identified through clean-up and screening as of the end of 2014. Legitimate

contingent debts are debts that are strictly limited to the scope of local government guarantees and are legally assumed under guarantee contracts. In recent years, the scale of local government debt has been high, and debt risk and financial risk are increasing day by day. Strengthening the theory of local debt management will help to avoid the occurrence of fiscal risks, prevent the formation of fiscal crises and improve fiscal sustainability.

### **2.3. Reasons affecting financial sustainability**

#### **2.3.1. Fiscal revenue and local fiscal sustainability**

Fiscal revenues affect local fiscal sustainability in two main ways: by influencing the share of indirect and direct taxes and the share between tax revenues and non-tax revenues. Firstly, increasing the share of tax revenue contributes to local fiscal sustainability. Compared to non-tax revenues, tax revenues have clear criteria for collection and are easier to collect due to the mandatory nature of tax laws. Secondly, the division of taxes into direct and indirect taxes has an important impact on policy effectiveness and social equity. As indirect taxes can be passed on, in the case of tax increases, businesses can make consumers bear the burden of the tax, which defeats the initial policy expectation and significantly reduces the effectiveness of fiscal policy. In addition, the most prominent indirect taxes are VAT and consumption taxes, which have a large tax base and are closely related to people's lives, while direct taxes are mainly aimed at high-income groups and individuals with substantial personal assets. If the proportion of indirect taxes is too high, it will increase the burden of living of the general income group, which is not conducive to building a harmonious society. Moreover, in the long run, the taxation function of the treasury does not reach its maximum potential to the detriment of the acquisition of local revenue, which further threatens the sustainability of local finance.

#### **2.3.2. Fiscal expenditure and local fiscal sustainability**

Fiscal expenditure reflects the focus of government, and both the scale and structure of fiscal expenditure have an impact on local fiscal sustainability. The structure of fiscal expenditure refers to the proportion of various types of expenditure in the total expenditure. The structure of fiscal expenditure can reflect the development direction and objectives of a region, with the structure of fiscal expenditure in developed countries mainly focusing on livelihood projects, while developing countries still spend more on infrastructure development. The scale of fiscal expenditure refers to the total amount of fiscal expenditure in a region and the amount of expenditure on a specific project. On the one hand, only when the total fiscal expenditure reaches a certain scale can the scale of livelihood expenditure be large, and thus fiscal targets can be achieved. On the other hand, livelihood-based projects cannot bring direct income because excessive investment in livelihood-based industries may lead to investment inefficiency and thus be detrimental to local fiscal sustainability.

#### **2.3.3. Financial management and local financial sustainability**

The management of finance can be described in two dimensions, one is to keep the size of local government debt within certain limits, and the other is the regulation of local government behaviour. First, local government debt. The history of debt issuance in China can be traced back to as early as 1894, when the government issued bonds in order to raise funds for armaments. China's government debt management has undergone a series of reforms from 1985 when the State Council explicitly banned local governments from raising

debt financing to 2011 to 2014 when it was piloted, and it was only in 2015 that the right of local governments to raise debt financing was systematically liberalised. Although local governments were only allowed to raise debt financing in 2015, government financing could have existed as early as 1994 in the form of municipal bonds, and in 2008 the central government responded to the financial crisis with a "four trillion investment plan", and the following year encouraged local governments at all levels to set up investment and financing platforms to provide matching funds for the central government bond projects. After 2015, the new debts of the financing platforms no longer belonged to the government, but the relevant data show that the scale of local financing platforms and the urban investment debts found in them still showed an upward trend from 2015 to 2018. In recent years, local government and social capital cooperation, government purchases and government investment funds have gradually become new forms of hidden debt, but it is difficult to fully account for these debts based on the highly concealed nature of hidden debt and this feature. The concept of "hidden local government debt" was first introduced in 2017 to address the chaos of extra-legal local government borrowing, and the Central Economic Work Conference in 2020 and 2021 for two consecutive years has put forward clear requirements to curb new local hidden debt and to effectively address the risk of hidden debt. The Central Government's economic work conferences in 2020 and 2021 have put forward clear requirements to curb new local hidden debts and to tackle the risk of hidden debts. On the one hand, the government can borrow financing to obtain financial resources to achieve its economic and social development goals, but on the other hand, excessive government debt can create the risk of debt default and crowd out private investment, which are not conducive to the sustainability of local finances. Therefore, the sustainability of local debt will have a direct impact on the sustainability of local finances. Second, local government behaviour. One of the unique features of our decentralised system is that local governments have a high degree of autonomy in arranging the expenditure of financial resources and can invest them in the projects that are most beneficial and most necessary to them. In order to solve the problem of insufficient own revenues, the government will invest large amounts of money in productive and constructive projects with a high rate of return and a short cycle, an action that can lead to insufficient expenditure on people's livelihoods and innovation, to the detriment of optimising the allocation of resources, the development of innovative activities and the quality of life of the population. However, the government can generate revenue to improve the sustainability of local finances. At the same time, the government performance appraisal mechanism and fiscal transparency assessment also provide institutional safeguards in improving the sustainability of local finances.

### 3. Measurement and Analysis of Local Fiscal Sustainability

#### 3.1. Measurement methods

Drawing on Ghosh et al. (2013) and Du Weitong et al. (2019), this paper introduces a one-period lag of the primary fiscal surplus rate, given that the local primary fiscal surplus rate is a dynamic process and the local primary fiscal surplus rate is affected by the primary surplus rate in the previous year. In addition, given that there is a time lag in fiscal response,

government debt with a one-period lag is used as the explanatory variable. The model is set up as follows:

$$bs_{i,t} = \alpha + \beta bs_{i,t-1} + f(debt_{i,t-1}) + \delta X_{i,t} + \mu t + \varepsilon_{i,t} \quad (1)$$

The budget constraints met by local governments are:

$$debt_{i,t} - debt_{i,t-1} = (r_{i,t} - g_{i,t})debt_{i,t-1} - bs_{i,t} \quad (2)$$

where  $bs_{i,t}$  denotes the primary surplus rate in period  $t$  of prefecture-level city  $i$ , expressed as the difference between fiscal revenue and fiscal expenditure as a proportion of regional GDP;  $debt_{i,t}$  denotes the government debt rate in period  $t$  of prefecture-level city  $i$ , expressed as the ratio of government debt balance to GDP, and  $f(debt_{i,t-1})$  is a cubic function on debt, with  $X$  being the control variable, including real GDP growth rate, industrial structure, trade openness, output gap and fiscal spending gap ratio. The real GDP growth rate is calculated by the GDP index, the industrial structure is expressed by dividing the total output value of the tertiary industry by the total output value of the secondary industry, the trade openness is expressed by dividing the import and export trade by GDP, the output gap is measured by the hp filter, and the fiscal gap ratio is calculated by the formula of fiscal gap ratio = (per capita general budget revenue - per capita general budget expenditure)/per capita general budget expenditure.  $R_{i,t}$  denotes the interest rate of prefecture-level city  $i$  in year  $t$ , derived from the Wind database of coupon rates of municipal bonds issued from 2008-2019, calculated as the average of coupon rates of municipal bonds in each year.  $\varepsilon_{i,t}$  is the random disturbance term,  $g$  is the real economic growth rate.

When the debt ratio reaches the ceiling, that is to say:

$$debt_{i,t} - debt_{i,t-1} = (r_{i,t} - g_{i,t})debt_{i,t-1} - bs_{i,t} = 0 \quad ,$$

From (1) and (2) it follows that:

$$f(debt_i) + (\beta - 1)(r_i - g_i)debt_i + \delta X_i + \varepsilon_i = 0 \quad (3)$$

The larger of the values solved for in equation (3) is the debt rate on line  $debt^*$ .

The formula for calculating effective fiscal space is:

$$sustain_{i,t} = \frac{debt_{i,t}^* - debt_{i,t}}{1/fe_{i,t}} \quad (4)$$

where  $sustain_{i,t}$  denotes the effective fiscal space of prefecture-level municipality  $i$  in period  $t$ ,  $debt^*$  denotes the upper limit of local government indebtedness, and  $debt$  denotes the actual indebtedness ratio of local governments.  $fe$  is the fiscal expenditure efficiency value calculated based on the DEA-Malmquist index method, and this paper selects science expenditure, education expenditure, medical and health expenditure, and social security and employment expenditure. In this paper, we select science expenditure, education expenditure, health expenditure and social security and employment expenditure as input indicators, and the number of employees in scientific research, technical services and geological exploration, the number of university students per 10,000 people, the number of books in public libraries, the number of participants in unemployment insurance, the number of beds in hospitals and health centres, the number of post offices at the end of the year, and postal service revenue

as output indicators after per capita processing.

### 3.2. Description of variables and data

Up to now, there is no comprehensive official database specifically for local government debt in China, and the data on local debt audits made public by the National Audit Office are very limited, coupled with the fact that local debt includes both local government bonds issued by the Ministry of Finance on behalf of local governments and bonds issued by financing platforms and state-owned enterprises, making it very difficult to obtain data on local debt. Drawing on Mao Jie and Huang Chunyuan (2018), this paper allocates the provincial-level government debt balance for the year to each municipality according to the ratio of each prefecture-level municipality's GDP to the provincial GDP, and records it as prefecture-level municipality debt1; the municipal investment debt balance of each prefecture-level municipality is recorded as prefecture-level municipality debt2; and prefecture-level municipality debt1 and prefecture-level municipality debt2 are summed to obtain the prefecture-level municipality debt balance for the year. Data on municipal debt can be found

from the wind database, and exact duplicate observations were excluded from the collation process. In particular, local debt balances for 2015-2019 can all be found in the national fiscal accounts published by the Ministry of Finance. Because the sum of general and special debts of local governments published by the Ministry of Finance can basically be matched with the debts for which the government is liable to repay (Diao, Weitao, 2017), the debt balance data for 2008-2014 in this paper are the debt balances for which local governments are liable to repay according to the Audit Office. It should be additionally added that the sample span of variables in this section is extended to 2008-2020 because the local fiscal response function involves the issue of lagged terms of explanatory variables. The raw data for all variables in this paper were obtained from the 2010-2020 China Urban Statistical Yearbook, China Regional Economic Statistical Yearbook, China Urban Construction Statistical Yearbook, wind database, Ministry of Finance Fiscal Information Data Network, as well as municipal statistical yearbooks, statistical information and relevant statistical websites. The statistical description of each variable is shown in Table 1.

**Table 1.** Descriptive statistics for each variable

Classification	Symbols	number	Average value	Standard deviation	max	min
Explained variables	bs	2952	-0,0011	0,0009	0,0007	-0,0138
	Explanatory variables	debt	2952	0,2384	0,1151	0,9193
gdprate		2952	0,0949	0,0297	0,1780	-0,0250
ins		2952	0,0090	0,0043	0,0467	0,0014
Control variables	open	2952	0,0018	0,0032	0,0602	0,0000
	fe_gap	2952	-0,0018	0,0016	0,0007	-0,0142
	yvar	2952	-0,0000	0,0019	0,0052	-0,0066

### 3.3. Analysis of measurement results

As the form of the fiscal response function is not unique, this paper sets up a linear fiscal response function and a non-linear fiscal response function respectively in quantifying the degree of local fiscal sustainability. Table 2 shows the regression results of the fiscal response function, where the results of the linear fiscal response function in column (1) and the results of the non-linear fiscal response function in quadratic form in column (2) both indicate that the core explanatory variable, local government debt ratio, is not significant, which means that both the linear fiscal response function and the non-linear fiscal response function in quadratic form are contrary to reality. In column (3), the results of the non-linear fiscal response function in the cubic form show that the significance and effects of the core explanatory variables and the control variables are well fitted to the reality. Therefore, the results in column (3) are chosen for the measurement of fiscal space. Substituting the measured coefficients of the variables in column (3) into equation (4), the collation yields:

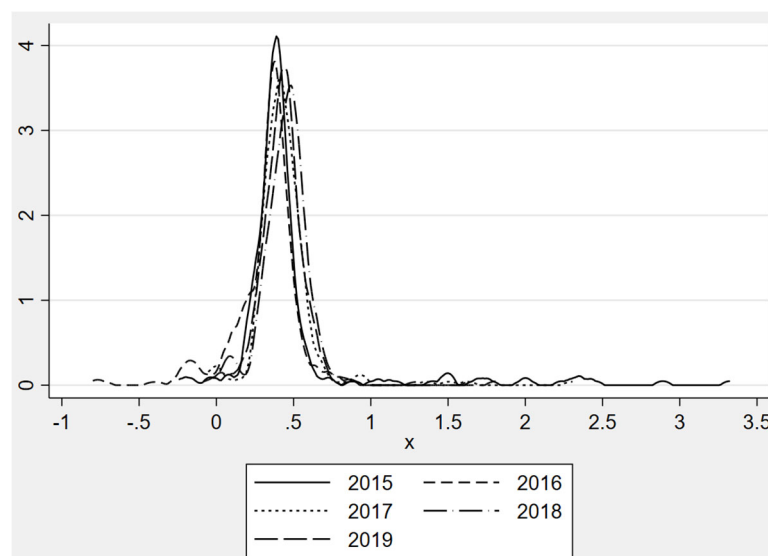
$$1.0869debt_i^3 - 1.3073debt_i^2 + [0.4264 - 1.3070(r_i - g_i)]debt_i + 0.1453gdprate_i + 0.1457open_i + 0.1177ins_i + 0.1384fe\_gap_i - 1.7713yvar_i - 0.0533 = 0 \quad (5)$$

By substituting all variables except the local government debt ratio (debt) from 2009 to 2019 into equation (6), we can obtain a cubic equation for debt, and the larger real root obtained by solving this equation is the upper limit of local government debt, debt\*. On this basis, equation (6) can be used to obtain the "effective fiscal space" of each region. Figure 1 shows the kernel density of 246 prefecture-level cities in China from 2015 to 2019, which shows that the fiscal space values of most regions are concentrated between 0.4 and 0.8, indicating that most regions in China have high fiscal space. The higher fiscal space indicates that there is a large gap between the actual debt ratio and the upper debt ratio, and therefore local governments have the realistic conditions to establish a positive fiscal feedback mechanism through adjusting their fiscal behaviour and optimising the improvement of their local fiscal situation, i.e. local finances are more sustainable.

**Table 2.** Estimated results of the financial response function

Explanatory variables	Explained variables: Underlying Surplus Ratio		
	(1)	(2)	(3)
L.bs	-0.3146*** (0.0592)	-0.3851*** (0.0863)	-0.3070*** (0.0816)
debt <sub>1</sub>	0.0022 (0.0025)	0.1423** (0.0710)	0.4264** (0.2126)
debt <sub>2</sub>		-0.2196** (0.0998)	-1.3073** (0.6436)
debt <sub>3</sub>			1.0869** (0.5291)
gdprate	-0.0033 (0.0023)	-0.0427** (0.0204)	0.1453** (0.0727)
open	0.0049 (0.0448)	0.2165 (0.1354)	0.1457** (0.0684)
ins	-0.0521 (0.0403)	-1.4570*** (0.5428)	0.1177 (0.1125)
fe_gap	1.3478*** (0.3706)	0.7219* (0.4084)	0.1384 (0.1706)
yvar	0.0715 (0.0712)	-1.7348*** (0.5808)	-1.7713* (0.9200)
_cons	0.0012* (0.0006)	-0.0014 (0.0037)	-0.0533** (0.0263)
<i>N</i>	2706	2706	2706
ar2	0.498	0.377	0.107
sargan	0.003	0.664	0.619

Note: Robust standard errors in brackets, \*\*\*, \*\* and \* denote significant at the 1%, 5% and 10% levels respectively. debt<sub>1</sub> is the one-period lagged debt, debt<sub>2</sub> is the square of the one-period lagged debt and debt<sub>3</sub> is the cube of the one-period lagged debt.

**Figure 1.** Local fiscal space kernel density distribution map

#### 4. Conclusion

This paper measures local fiscal sustainability in China through panel data of 246 prefecture-level cities from 2008 to 2019, firstly by elaborating on fiscal sustainability at the theoretical level, secondly by constructing a fiscal reflection function to measure local fiscal sustainability empirically, and finally by using the fiscal expenditure efficiency value *fe* calculated by the DEA-Malmquist index method, with the help of *fe*. The results show that most of the local governments in China have a large fiscal space. The results show that most regions in China have a high fiscal

space indicates that there is a large gap between the actual debt ratio and the debt ceiling ratio, and therefore local governments have the realistic conditions to establish a positive fiscal feedback mechanism through adjusting their fiscal behaviour and optimising the local fiscal situation, i.e. local finance is more sustainable.

The sustainability of local finances is the cornerstone of the sustainable and healthy development of the local economy, and the sustainability of finances will directly contribute to the sustainable and healthy development of the regional economy. Similarly, the development of the local economy cannot be achieved without the support of local finances, and the livelihoods of residents are also closely related to local

finances. Only fiscal sustainability can play a significant role in resource allocation, economic development and improving people's livelihood. In order to further promote the sustainability of local finances, this paper makes the following recommendations:

First, fiscal management should be strengthened to improve the fiscal management system. Sustainable development means focusing on longer-term development issues and ensuring a better fiscal management system. Fiscal management should focus on local government debt management and government financial transparency management. Firstly, control the scale of local government debt issuance, the larger scale of local government debt will inevitably result in unsustainable local government financial development; secondly, focus on the management of provinces with larger scale debt to prevent and resolve debt risks; then, focus on creating financial transparency, make all budget arrangements open and transparent, and guide the public to participate in the preparation and supervision. Finally, smooth the information sharing mechanism. In the digital era, it is necessary to strengthen more the interconnection between government departments to improve the efficiency of fiscal operations. It is even more important to strengthen the feedback mechanism on the effects of fiscal policies, so as to quickly understand the effects of policies and respond to various unexpected situations.

Secondly, to achieve performance management and improve the efficiency of the use of debt funds. In the process of debt fund management, we should actively adjust the structure of fiscal expenditure, ensure the performance of expenditure, improve the fund management system and enhance the ability of fund investment management. In the process of debt fund allocation and management, we should actively focus on the spillover of investment structure on economic development, establish an investment performance assessment mechanism, increase the proportion of investment in industries with long-term performance and lasting development, such as technological innovation and health care, and give full play to the role of investment structure adjustment in promoting economic development and influence on industrial structure adjustment.

Third, promote the transformation and upgrading of industrial structure to match the resource endowment and people's needs. The transformation and upgrading of the industrial structure should combine the advantages of local natural resource endowment with the objective requirements for the development of special industries, so as to achieve the development of disadvantaged industries driven by advantageous industries. At the same time, we should also actively guide the industrial structure to match the structure of regional resource endowments and the actual needs of residents, so as to avoid the development of some advantageous industries being disconnected from the actual local needs and to avoid the negative effects brought about by "pulling up seedlings to help them grow".

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