

Study on the Chinese Local Government Financing Efficiency Based on Entropy Method

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Abstract—After the tax-sharing reform in 1994, The Chinese local governments have been in a state of financial deficiency for most of the time under the circumstances of financial and administrative asymmetry. The Chinese local governments have tried various approaches to finance. This paper presents decision support for the local governments choosing optimal financing approach. The four financing approaches commonly used by the local governments at present are reviewed and then by using entropy method, the efficiencies of the four financing methods are evaluated and compared. The result shows that the efficiency of local bonds financing is higher than that of land financing, platform financing and financial allocation by the central. It should be the main financing channel of the local governments. Land financing and platform financing have relatively low financing efficiency.

Index Terms—entropy method; financing efficiency; local government bonds; financing platform

I. INTRODUCTION

At present in China, the local governments shoulder the responsibilities of providing local infrastructure and public services and promoting the economic growth. However, since the tax sharing reform in 1994, the local governments have been in a state of financial deficiency for most of the time. Especially since the outbreak of financial crisis in 2008, the central government has launched a large-scale economic stimulus plan, which requires the local governments present a large amount of counterpart funds. Facing the great fund need, the local governments have tried various financing approaches to acquire fund with each having its own advantage and disadvantage. How should the local governments choose the optimal financing method to finance? In China, there are a lot of articles about enterprise financing efficiency and many documents introducing the various financing styles of local governments separately [1]-[2], however, this paper aims to make a comprehensive and comparative evaluation on the four financing methods commonly used by the local from the perspective of efficiency standard to differentiate their advantages and disadvantages so as to provide reference for the local governments choosing the optimal financing way.

In the second part of this article, the four financing

approaches commonly used by the local governments are reviewed. The third part is the evaluation and comparison of the four approaches. The fourth part is the conclusion.

II. THE LOCAL GOVERNMENT FINANCING APPROACHES

At present in China, the imbalance between local government expenditure and revenue are obvious. Generally, the scale of local government expenditure can be measured by its proportion to overall fiscal expenditure. According to Table 1, it can be seen that the local government expenditure had increased from 3330.24 billion in 1993 to 61044.14 billion in 2009, at the speed of more than 42% per year which is faster than that of growth of the national fiscal expenditure. Local government expenditure made up 70% of the overall fiscal expenditure.

The structure of local government expenditure refers to the mixture and proportion of various expenditure of the local government expenditure. From the aspect of local government expenditure structure, the expenditure on education and social welfare in China local government expenditure still lags far behind compared to the American-like developed market-economic countries. It needs Chinese local government to continuously increase expenditure. In addition, with the development of economy and society, environment, resources, climate protection and problems correlative with these are very important to a nation's sustainable development. The fiscal expenditure in these areas will increase in foreseeable future. Moreover, besides the local governmental regular expenditure, when central government faces economy downturn or crisis stuck, new plans will come into being to stimulate economy. For example, after the world financial crisis outbreak in 2008, the central government released large-scale plans to stimulate economy, which needs local governments to provide massive supporting funds. In short, local government expenditure has a continuously expending trend and rigidity.

However, from the aspect of the local government fiscal revenue, after the tax-sharing reform, financial power has a clear concentration trend to central government. The local governments shoulder more responsibilities. At the same time, local financial resources haven't correspondingly increased. It can be seen from Table 1, the proportion of local government fiscal revenue to the overall revenue has maintained about 47% since 1994, which is obviously lower than the proportions of the local government expenditure to the national fiscal expenditure.

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TABLE I. THE IMBALANCE BETWEEN LOCAL GOVERNMENT EXPENDITURE AND REVENUE (100 MILLION YUAN)

Year	Local fiscal expenditure	National fiscal expenditure	The proportion (%) (2)/(3)	Local fiscal revenue	National fiscal revenue	The proportion (%) (5)/(6)
1993	3330.24	4642.30	71.7	3391.44	4348.95	78.0
1995	4828.33	6823.72	70.8	2985.58	6242.20	47.8
1997	6701.06	9233.56	72.6	4424.22	8651.14	51.1
1999	9035.34	13187.67	68.5	5594.87	11444.08	48.9
2001	13134.56	18902.58	69.5	7803.30	16386.04	47.6
2003	17229.85	24649.95	69.9	9849.98	21715.25	45.4
2005	25154.31	33930.28	74.1	15100.76	31649.29	47.7
2007	38339.29	49781.35	77.0	23572.62	51321.78	45.9
2009	61044.14	76299.93	80.0	32602.59	68518.30	47.6

It can be seen from Figure 1 that the imbalance of local governments in fiscal expenditure and revenue is expanding continuously. Facing enormous fund demand, the local governments have tried various financing methods.

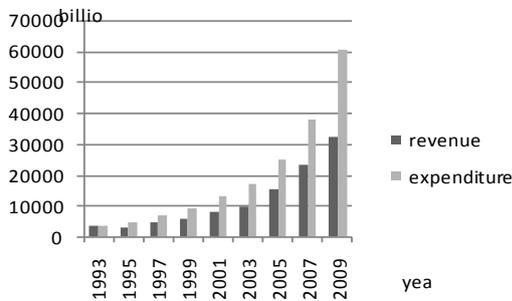


Figure 1. the local imbalance in expenditure and revenue

Generally speaking, the local governments can finance by financial allocations, debt financing, assets (resources) financing and equity financing. At present in China, four financing approaches are commonly used by the local. They are financial allocation by the central (AF), land financing (LF), platform financing (PF) and local bonds financing (BF).

Financial allocation by the central (AF) refers to special financial allocation for the local governments from the central and the free national debt fund transferring to the local. The special financial allocation from the central generally has a strict appropriate condition and the fund has a specific application range. The national debt fund transferring to the local is a common financing style in the past few years.

Land financing (LF) means the local governments acquire fund by selling local land use right. Nowadays, China local governments monopolize local land use market. Through bidding, auction and publicly granting land use right, local governments acquire a huge sum of land grant fee. The land financing from this has become the most important financing methods for many local governments. Many local government finances have become land finances. It can be seen from Table 2, since 2001, land grant fee increases rapidly. By 2010, it has reached to 2700 billion at the speed of more than 40% per year. The proportion of land grant fee to local government revenue has run high, and increases to

50.9% in 2007. It illustrates that at current situation many local governments in China have over-relying on land financing. But in fact a series of problems exist in and the fund use process, the land financing need serious supervision.

TABLE II. THE PROPORTION OF LAND GRANT FEE TO LOCAL REVENUE

Year	Land grant fee (100 million yuan)	Local fiscal revenue (100 million yuan)	The proportion (%)
2004	5894	11893.37	49.6
2005	5505	15100.76	36.5
2006	7000	18303.58	41.9
2007	12000	23572.62	50.9
2008	9600	28649.79	33.5
2009	15900	32602.59	48.8

Data source: Chinese Sta. Almanac (2010) and [4]

The local governments now acquire a great deal of fund by incorporating governmental investment companies. Local platform financing (PF) is a new way for the local dealing with financing need without any mature mechanism. The general framework is:



At current, the local governments are permitted to borrow money from bank directly by the laws, but many local governments acquire credit funds from bank through setting up various government-invested companies (financing platforms). Platform financing is an innovation measure under the current system to solve the financing gap. This financing method has played a very important role in local economic and social development and becomes one of the major local government financing methods. Under this financing method, local governments support the establishment of government-invested companies through fiscal fund infusion, injection of state-owned assets, land revenue investment, granting franchise rights and other methods to form a platform and carrier replacing local governments undertaking construction projects, financing, recommendation and other tasks. Local governments acquire

a large amount of recommendation fund through local financing platform, but government-invested companies do not run standard; platform financing behavior is not regular enough and has a high leverage; loan repayment capacity cannot be guaranteed and debt risk increases continuously. According to experts' estimation, at present China local financing platform is indebted for 6000 billion yuan and 80% of the debt is from the bank credit.

Local bonds financing (BF) refers to the local governments financing by issuing the local bonds. At present, the local government bonds take the measure of nation substituting issuing by the way of market representing bidding.

It issued interest rate depends chiefly on the overall interest rate level of the bonds market. Up till now, the market rate of return of local government bonds and that of book entry treasury bill of the same period are about the same, with the former a little higher. Now local government bonds take the measure of nation substituting issuing and listing into local financial budget, which has a high fund sufficiency rate, and the fund utilization has a clear regulation and a close supervision. The fund is mainly used in central government projects and livelihood field.

The Treasury Department substitutes issuing, and handling repaying capital with interest for the local government bond financing, and the local governments take the responsibility of repaying capital with interest and paying issuing cost and turn over its bond cost and interest, and issuing cost to the state. As for those in arrears, the state count the default interests based on their overdue situations. And while the state handling accounts settlement with local governments, it will withhold the exact amount. The payment of bond fund is guaranteed.

Generally, the financing efficiency can be evaluated from specific Indicators. Here six indexes are chosen to review the four financing approaches. They are financing cost(x_1), fund utilization(x_2), financing standard degree(x_3), financing time-limit(x_4), subject freedom degree(x_5) and repaying capacity(x_6).

As to financing cost(x_1), the higher the financing cost, the lower the financing efficiency. The financial allocation by the central is almost free. The local governments acquire financial fund by selling local land use right and its direct financing cost is low. The local government bonds are issued by market representing bidding. Its issued interest rate depends on the interest rate level of the bonds market. Up till now, the market return rate of local bonds and that of book entry treasury bill of the same period are about the same, with the former a little higher. The local governments can get preferential interest rate from bank through the platform, so the interest rate of the platform financing is a little lower than the bank lending rate of the same period, plus the loan guarantee and mortgage, its financing cost is higher than that of local bonds financing. Therefore, the financing cost of AF is very low, LF is relatively low, PF is high and BF is slightly high.

From the perspective of fund utilization(x_2), the local governments acquire a large amount of land grant fund and the fund has a clear expenditure range. However, the fund is not listed into the local financial budget and according to the

Audit Commission's auditing results, many cities make prohibited use of the land grant fund. The fund utilization is slightly low [3]. At the present stage, the fund from financing platform is mainly put into the projects of local infrastructure construction and public services. The platform is requested to acquire fund from bank and the loan user is the construction projects, while the local governments decide the specific construction projects. The fuzziness of responsibility leads to its low real fund utilization. The local government bonds nowadays take the measure of nation substituting issuing and listing into local financial budget, the fund has a clear application range and a close supervision by the NPC. The fund utilization is very high.

As to financing standard degree(x_3), the local financing platform is a new way for the local dealing with financing need without any mature mechanism. As to the standard degree of financing mechanism, it is the worst of the four methods. This is why the local platforms are criticized extensively. Land financing, through bidding, auction and publicly granting land use right to acquire fund, is more standard than platform financing. At present, the central uses the more mature national debt issuing channel to make local government bond financing. Therefore, the financing standard degree of BF is very high, the efficiency of AF is low on this aspect, LF is slightly low and PF is very low.

The financial allocation by the central needs not repay, that is, the financing fun is indefinite. So does the land financing. While the fund from platform financing and local bonds financing have a limitation of payment deadline. The time-limit of BF is 3 years now and that of PF is about 3-5 years.

Subject freedom degree(x_5) refers to the freedom degree of the financing body. As to LF, the nation has a clear regulation for the expenditure of the fund acquired. The limited land resources and the outside influences from land financing have led to strict limitations to this financing style. The body freedom degree of LF is more and more small. Effective supervision and risk management are difficult to enforce throughout the platform financing process. Therefore, the freedom degree of PF is becoming low. The fund from BF is mainly used in central government projects and livelihood field. The space for its application is much bigger than LF and PF. AF is a commonly used financing style in the past few years.

As to repaying capacity(x_6), the land financing and the allocation by the central has no payment problem. The Treasury Department substitutes issuing and handles repaying process for the local government bonds financing and the local governments take the responsibility of turning over repaying capital with interest and issuing cost to the state, so the payment of local bonds financing is guaranteed by the central government. The local now loan as much as possible from banks through the financing platform, but in fact the financing process is not regular and its fund solvency is hard to guarantee.

Therefore, the characteristics of the four financing methods' efficiency can be summarized from these six aspects based on the exiting literatures from the perspective of efficiency. See table 3.

TABLE III. REVIEW OF DIFFERENT FINANCING METHODS

OBJECT	Financing cost (x ₁)	Fund utilization (x ₂)	Financing standard degree(x ₃)	Financing time-limit (x ₄)	Subject freedom degree(x ₅)	Repaying capacity (x ₆)
allocation by the central (AF)	Very low	slightly low	low	indefinitely	slightly high	need not repay
land financing (LF)	low	slightly low	slightly low	indefinitely	Very low	need not repay
platform financing (PF)	high	low	Very low	relatively short	low	Very low
local bonds financing(BF)	slightly high	Very high	Very high	relatively short	high	high

It can be seen that each approach has its own advantage and disadvantage. The cost of AF is low and the fund need not repay. LF is free to pay and the fund has no time-limit. PF is a new way for the local. BF has high efficiency at repaying capacity and fund utilization. So how to make a comprehensive and comparative assessment on the four financing approaches? The entropy method is a way.

financing efficiency standard. The higher the financing efficiency, the greater the score will be. As to financing cost(x₁), the lower the financing cost, the higher the score of financing efficiency, while the higher the value of the other five indexes, the higher the scores of financing efficiency. Suppose the score is between 0 and 1 and the result will be got. See Table 4.

III. THE EVALUATION BASED ON ENTROPY METHOD

In the theory of information, information entropy is measurement of uncertainty degree of a system. The lower the entropy value, the lower the uncertainty degree of a system. The greater the variation among the index values, the greater the function of the index in the comprehensive evaluation. On the other hand, the higher the entropy value, the higher the uncertainty degree of a system. The smaller the variation among the index values, the smaller the function of the index in the comprehensive evaluation. Therefore, according to the entropy value of each index, the variation degree of the index values of each index can be ensured. Calculate the proportion of each index, and then make a multi-index comprehensive evaluation.

TABLE IV. THE SCORES OF THE FINANCING EFFICIENCY

OBJECT	x ₁	x ₂	x ₃	x ₄	x ₅	x ₆
AF	0.9	0.4	0.3	1	0.5	1
LF	0.8	0.4	0.4	1	0.2	1
PF	0.5	0.3	0.2	0.5	0.3	0.2
BF	0.6	0.9	0.9	0.6	0.8	0.8

Based on the data in Table 2, according to (1), the proportion *p_{ij}* of the index value can get.

TABLE V. THE SCORES OF THE PROPORTION

<i>p_{ij}</i>	x ₁	x ₂	x ₃	x ₄	x ₅	x ₆
AF	0.321	0.2	0.167	0.323	0.278	0.333
LF	0.286	0.2	0.222	0.323	0.111	0.333
PF	0.179	0.15	0.111	0.161	0.167	0.067
BF	0.214	0.45	0.5	0.194	0.444	0.267

Suppose there are n evaluation objects and m evaluation indexes which form an original index data matrix R. Then use entropy method to make a comprehensive evaluation which includes the following steps:

(1) Quantize the index values and calculate the proportion *p_{ij}* of the index value of the *i*th object under the *j*th index.

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^n x_{ij}} \tag{1}$$

(2) Calculate the entropy value *e_j* of each index, accordingly acquire the difference coefficient *d_j* of the index, in which

$$e_j = -k \sum_{i=1}^n p_{ij} \ln p_{ij} \tag{2}$$

$$d_j = 1 - e_j \tag{3}$$

(3) Based on the difference coefficient of the index, set the index proportion *a_j*.

$$a_j = \frac{d_j}{\sum_{j=1}^m d_j} \tag{4}$$

(4) Calculate the comprehensive evaluation value *v_i* of the *i*th evaluation object.

$$v_i = \sum_{j=1}^m a_j p_{ij} \tag{5}$$

Based on the above analysis about the local government finance and Table 3, this paper tries to score the four financing methods on the six aspects from the perspective of

Then, according to (2)(3)(4), use entropy method to calculate the entropy value *e_j* and difference coefficient *d_j*, and further obtain the proportion *a_j* of each index. See Table 6.

TABLE VI. THE CALCULATION OF EACH INDEX PROPORTION

	x ₁	x ₂	x ₃	x ₄	x ₅	x ₆
<i>e_j</i>	0.983	0.930	0.884	0.969	0.909	0.914
<i>d_j</i>	0.017	0.070	0.116	0.031	0.091	0.086
<i>a_j</i>	0.041	0.170	0.282	0.075	0.221	0.209

From the above analysis, it can be seen that financing system standard degree(x₃), financing subject freedom degree(x₅), repaying capacity(x₆), and fund utilization(x₂), these four indexes take large a proportion, which indicates that different financing methods have great disparity in these four indexes. This is also the main reason for the differences of the financing efficiency among the four financing methods.

Then, according to (5), calculate the comprehensive evaluation value *v* of each object. See Table 7.

TABLE VII. THE RESULT OF COMPREHENSIVE EVALUATION

OBJECT	V	Rank
AF	0.250	2
LF	0.227	3
PF	0.127	4
BF	0.395	1

It shows that BF, from the perspective of efficiency, is superior to PF, LF and AF. PF has relatively low financing efficiency.

IV. CONCLUSION

The Chinese local governments have tried various financing methods. Based on the exiting literatures, this paper chooses eight indexes and uses entropy method to make a comprehensive evaluation of the four financing methods commonly used by the local governments. From the efficiency evaluation, it can be seen that local government bonds financing is the best choice at present. It should be the main financing channel of the local governments.

Land financing and platform financing have relatively low financing efficiency, but they have advantages in some aspects. If the local governments continue to use these two financing methods, the efficiency of land financing and

platform financing must be improved, a more complete and standard financing system should be established, the financing fund utilization should be increased, and the fund repaying capacity should be enhanced as much as possible. Moreover, the local financing platforms should be regulated to improve their development. The land market should be developed rationally and the local government treasury should be improved so as to change the over-relying on land financing situation in local governments.

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