

# A network service composition strategy based on trust reasoning and evolution

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**Abstract.** In recent years, under this premise that more attention has been paid to the local debt in China, the risk management has become a major issue faced by governments at all levels. The issuance of local government bonds, an important financing means used by government in the past, promotes rapid development of economy and society in China. From the perspective of local debt, the Paper researches its impact on the equalization level of basic public services, and provides the suggestions to dispose the local debt reasonably. Based on the empirical analysis of data on issuance debt and basic public services of all provinces (city) in China from 2009 to 2013, it believes that local debt scale will significantly reduce the equalization level of basic public service, reduce the cost of issuing bonds, strengthen macro-control, increase the degree of transfer payment from the exchequer to reduce the risk of debt, and improve the equalization level of basic public services at the same time.

**Key words.** Local debt, Basic public services, Equalization, Risk.

## 1. Introduction

After the global financial crisis in 2008, the sovereign debt crisis in Europe has gradually surfaced, and there are more and more discussions about the local government debt in China. As local debt grows into the public eye, especially in July 2015, the Greek debt crisis, called their bluff (failing to pay \$1.7 billion of debt for IMF in time), became the first developed economy defaulted of IMF in the 70 year history, resulting in that the government debt once again became the focus of attention. McKinsey & Co, in February 2015, reported that China's total debt (including the financial sector) rose rapidly from \$ 7.4 trillion in 2007 to \$28.2 trillion in the medium-term of 2014.

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## 2. Theoretical analysis and hypothesis

### 2.1. Overview of local debt

Due to financial constraints, local governments need to raise funds through the financing platform in the construction of public facilities, naturally forming local debt. After the implementation of system of tax distribution in 1994, the local government has insufficient financial resources, and gradually began to set up financing platform for small-scale financing, mainly for urban infrastructure construction. The rapid increase in the number of financing platforms has two critical points, namely, the Asian Financial Crisis in 2008 and the Global Financial Crisis in 1997. Especially after the outbreak of the global financial crisis in 2008, the central government used 4 trillion yuan to stimulate the economy. Most of these funds were raised by local governments themselves, and local debts began to grow on a large scale. Compared to the bonds directly issued by the local government or issued by the Ministry of Finance, the amount and scale issued by Quasi-municipal Bond is much larger. The sum of local government bond and Quasi-municipal Bond to represent the local government bonds is more scientific and reasonable, more nearing to reality.

#### (1) Local government bonds

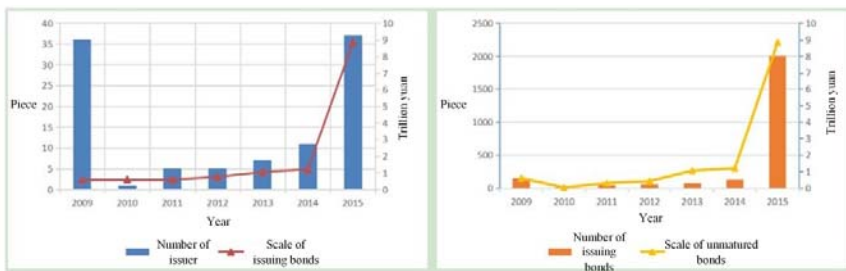


Fig. 1. Issuance of local government bonds in china from 2009 to 2015

In 2009, Xinjiang, Anhui, Henan and other 36 provinces and municipalities issued bonds in the name of the government, totaling 50, with 200 billion yuan, all of which are payment fixed interest rate, paid 3 times in 3 years. From 2010 to 2014, except that Guangdong, Shanghai, Zhejiang and other few provinces and cities continued to issue government bonds, most of provinces and cities issued the bonds via national Ministry of Finance. New Budget Law in 2015 allowed the local government to borrow by issuing government bonds after a certain approval process. Since the scale of matured debts in 2015 was large, approved by the State Council, the Ministry of Finance issued a quota of 1 trillion yuan of local government bonds in March for replacing stock debt in order to optimize the debt structure, and new bonds are issued by bond replacement, resulting in the great increase in the number of issuing government bonds. The Fig. 1 shows that, the number of issuer, number of issuing bonds and scale of issuing bonds in 2009 and 2015 are obviously higher than other years.

#### (2) Quasi-municipal Bond

The issuance quantity and scale of Quasi-municipal Bond is increased by year (Fig. 2), in 1997, the first Quasi-municipal Bond with real meaning was issued by the local state-owned enterprise: Shanghai Municipal investment (Group) Co., Ltd. The issuance process of Quasi-municipal Bond shows that (1) Bond issuers tend to pluralism, no longer limited to state-owned enterprises, which not only reduces the financial fallback burden, also can reduce the risk of issuing bonds. (2) The field of bond investment is expanding and is no longer limited to infrastructure construction, and the socialist market economy is more perfect, open and inclusive, reflecting that Quasi-municipal Bond plays an important role in promoting the development of local economy from one side.

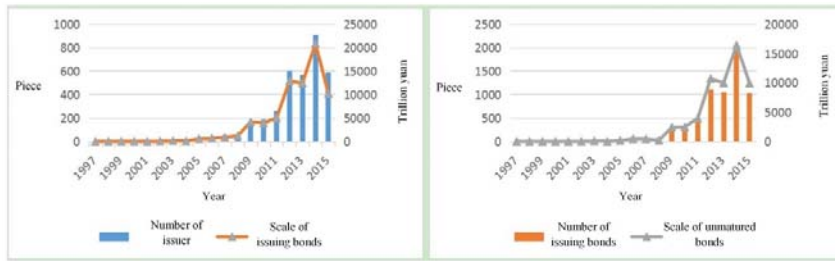


Fig. 2. Issuance of quasi-municipal bond in china from 1997 to 2015

## 2.2. Equalization of basic public services

The basic public service belongs to the public goods and shall be provided by the government. In order to realize the equalization, the most direct but not necessarily effective way is to ensure the equal distribution of financial funds among each citizen. The study of the equalization of public services by foreign scholars focuses on fiscal equalization, while the theoretical study of fiscal equalization is based on the theory of public goods and fiscal decentralization. Breuss and Eller (2004) summarized the related research results: scholars who support fiscal decentralization demonstrate their rationality from regional differences in preferences of residents, information superiority, inter district competition and vertical division of labor, and the objectors respond from economies of scale and spillover effects of interregional public services. Western public economists such as Samuelson, Musgrave and Buchanan interpret the meaning of basic public services from the perspective of public goods, and believe that the basic public service is “the related activities, established by the people, serve the citizens, safeguard the collective interests and undertake the corresponding obligations”.

To improve and promote the public finance system of equalization of basic public services including two aspects, one is to have sufficient financial resources, as the people can be stronger based on national wealth, and try to make a larger “cake”; and the other one is to promote the equalization and distribute “cake” well to make citizens of different regions, different nationalities and different occupations enjoy equal economic development results. Under the system of fiscal decentralization, through the transfer payment (general transfer payment and special transfer pay-

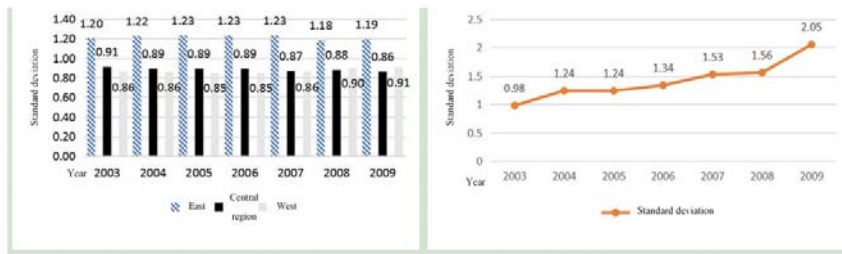


Fig. 3. Equalization process of overall security level for inter-area and inter-provincial basic public services in china

ment), the Central Government increases the financial power of local governments and regulates the gap between regions, urban and rural areas, and classes, and the Central Government paid 4.68 trillion to the local government in 2014, accounting for 70% of the revenues collected by the Central Government, playing a key role in accelerating the development in poverty-stricken areas. Transfer payments also have an impact on the expenditure structure of local finance. Li Yongyou and Shen Yu (2009) researched on the relation between massive transfer payments and decision of local fiscal income by constructing the response function, of which the conclusion is that the increase in transfer payments will boost the level of local fiscal expenditure.

On the basis of the foregoing analysis, the research framework shown in Figure 4 is provided. It is assumed that (1) the scale of local government debt issuance is positively related to the equalization of basic public services, the larger the issuance scale is, the higher the equalization level of basic public services is; (2) The cost of local government debt issuance is negatively related to the equalization level of basic public services, the higher the costs are, the improvement of equalization level of basic public services will be limited; (3) The transfer payment of Central Government is conducive to the improvement of equalization level of basic public services.

### 3. Data and variable description

#### 3.1. Data selection

With respect to the data from Quasi-municipal Bond (since 1997) and data from local government bonds (since 2009), considering the continuity of the data, we research the data of local government bonds and Quasi-municipal Bond from 2009 to 2013 and gather statistics of bonds issuance from more than 30 provinces and municipality directly under the central (except Hong Kong, Macao, Taiwan and Tibet) in recent years, respectively.

The data of basic public services is selected regarding education, culture, health, environment, employment and social security of all provinces from 2009 to 2013, mainly sourced from China Statistical Year, China Education Yearbook, China Health Statistical Yearbook, China Labor Statistical Yearbook, China Labor and So-

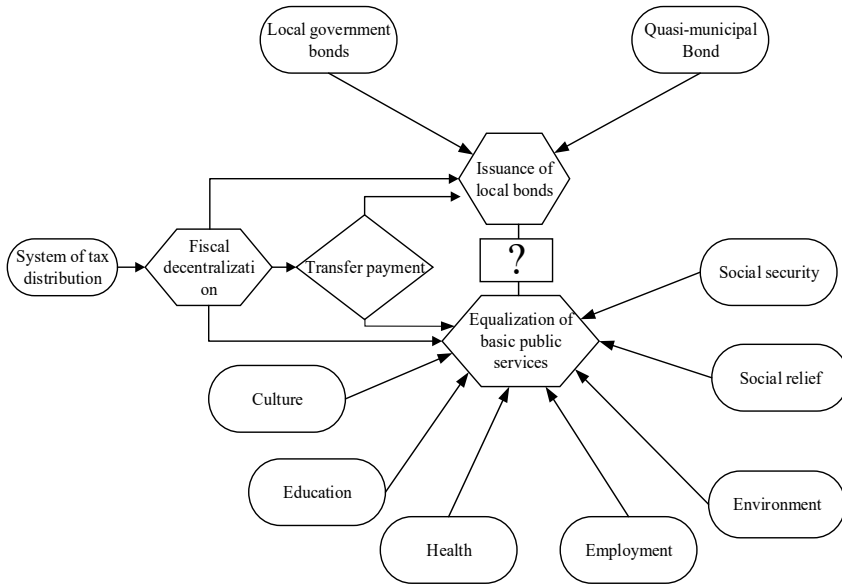


Fig. 4. Research framework of equitation for local debt and basic public services

cial Security Statistical Yearbook, China Environmental Yearbook and China Civil Affairs Statistical Yearbook.

**3.2. Variable description**

Related variables of local bonds include number of issuing bonds , scale of issuing bonds *Scale*, weighted deadline *Duration* and weighted interest rate *Yeild*. Number of issuing bonds refers to the number of bonds issued in the region in that year, measuring the frequency. Scale of issuing bonds refers to the total amount of bonds issued in the region in that year. Weighted deadline means the bond duration treated by weighting, measuring comprehensively the average duration of bonds issued in the region in that year. Weighted interest rate represents the bond rate treated by weighting, measuring the average rate of bonds issued in the region in that year.

Fiscal decentralization is directly related to the local debt and basic public services, so that the fiscal decentralization variable *Decentral* is introduced. Chen Shuo and Gao Lin (2012) performed a objective contrast for three popular methods of measuring fiscal decentralization and found that “income”, “expenditure” and “financial autonomy” is applied to its own scope, and if the scope of the inspection is not large, and there is no major financial reform during the period (such as the reform of system of tax distribution), the financial autonomy is more effective to reflect the differences across the regions. The Paper calculates the degree of fiscal decentralization of *x* province in *y* year via formula (1).

$$\text{Degree of fiscal decentralization} = \frac{\text{Budget revenue of the whole province}}{\text{Budget revenue of the whole province}_{xy} + \text{transfer payment income}_{xy}} \tag{1}$$

Table 1. Index arrangement of equitation for basic public services

Category	First grade index	Secondary index	
Education	Input	Number of students enrolled in ordinary junior high school	Student to teacher ratio in general primary schools
		Number of full-time teachers in ordinary junior high schools	Student to teacher ratio in ordinary junior high schools
		Number of students enrolled in general primary schools	Educational expenditure
		Number of full-time teachers in general primary schools	
	Benefit	Years of schooling	Number of students in school of kindergarten
		Number of graduates in ordinary junior high schools	Number of students in school of general primary schools
Culture	Input	Total number of books printed sheet	Total number of newspaper printed sheet
		Total number of periodical printed sheet	
	Benefit	Audience attendance of domestic performance of art performance troupes	Total circulation of public libraries
		Audience attendance in art exhibition venue	Seat number of reading room in public libraries
		Reserve of public libraries	
	Health	Input	Number of medical and health institutions
Number of health personnel			Number of rural health clinics
Population mortality		Diagnosis and treatment of community health service centers	
Benefit		Number of beds in hospitals and health centers	Compensation benefit ratio of NCMS
		Number of beds in hospitals and health centers of agricultural population	
Environment	Input	Completion of forestry investment	Complete investment of wastewater treatment project
		Total afforestation area	Complete investment of Waste gas control project

Table 1. Continued.

		Comprehensive utilization of industrial solid waste	Complete investment of industrial pollution control
	Benefit	Nature reserve area	Industrial wastewater treatment facilities governance capacity
		Disposal of municipal solid waste	Industrial wastewater treatment capacity
		Harmless disposal of municipal solid waste	Waste gas treatment facilities treatment capacity
		Water resources	
Employment	Input	Number of social workers trained in technical schools	Number of people trained in employment
		Employment training center coverage	Number of grass-roots trade union organizations
		Student to teacher ratio of employment training center	Union membership
		Employment training centre fund	Training time of trade union vocational training institution
	Benefit	Number of social worker graduating from technical school	Number of closing cases of labor disputes
		Number of personnel and time of success introduction by trade union employment agency	Number of people graduating from employment training center
		Number of people acquired vocational skills certificate	
	Social security	Input	Expenditure on basic endowment insurance for urban employees
Minimum living expenses for rural residents			Maternity insurance fund expenditure
Social security financial expenditure for this year			
Benefit		Number of beds in urban pension service institutions	Number of unemployment insurance benefits
		Number of beds in rural pension service institutions	Number of people who enjoy work-related injuries

The equalization level of public services *Equalization* in different provinces and municipalities each year is obtained by arithmetic mean of scores of six services. Fig.5 intuitively shows the relative equalization level of public services in all provinces and cities from 2009 to 2013.

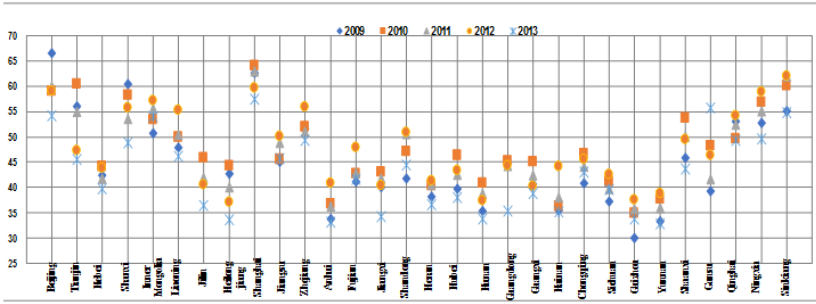


Fig. 5. Equalization level of public services in all provinces and cities from 2009 to 2013

### 4. Empirical analysis

#### 4.1. Model building

According to the aforementioned research hypothesis, the following empirical models are established:

$$Equalization_{kt} = \alpha + \beta Debt_{kt} + \gamma \sum Control_{kt} + \mu_k + \varepsilon_{kt}. \tag{2}$$

The equalization level of basic public services (hereafter referred to as equalization) is the dependent variable,  $Equalization_{kt}$  represents the annual equalization level of  $k$  province in  $t$  year,  $Debt_{kt}$  refers to the local debt of  $k$  province in  $t$  year, and  $Control_{kt}$  means the control variable.  $Debt_{kt}$  includes number of issuing bonds  $Snum_{kt}$  (total number of bonds issued in  $k$  province in  $t$  year), scale of issuing bonds  $Scale_{kt}$  (total scale of bonds issued in  $k$  province in  $t$  year), debt deadline  $Duration_{kt}$  (weighted deadline of bonds issued in  $k$  province in  $t$  year is calculated by weighting scale of each bond) and costs of issuing bonds  $Cost_{kt}$  (interests rate of bonds issued in  $k$  province in  $t$  year is calculated by weighting scale of each bond, and  $Cost_{kt}$  is replaced with  $Scale_{kt} * Yield_{kt}$ ).  $Control_{kt}$  consists of the following items: (1) degree of fiscal decentralization  $Decentral_{kt}$ . (2) financial deficit  $Deficit_{kt}$ , the gap of local fiscal expenditure will influence the arrangement of funds. (3) population density  $Density_{kt}$ , the size of density directly affects the efficiency of supply and quality of basic public service. (4) growth rate of population  $Population_{kt}$ , population is the denominator of equalization, and the growth rate will affect the level of equalization. (5) gross regional domestic product  $GDP_{kt}$ , measuring the overall development level of provinces and cities, at the same level of equalization, the abundance and scarcity of material resources make people feel different, and the demand for public services varies from place to place. (6) fixed investments  $Invest_{kt}$ , dominant in the whole society, is the basis of reproduction and an important embodiment of the fruits of economic and social development. In order to eliminate heteroscedasticity of each variable, natural logarithm is used for each data.  $\alpha$  means the constant term,  $\mu_k$  represents the individual effect and  $\varepsilon_{kt}$  refers to the random error. Checked by Hausman, the fixed effect OLS model is decided. There are 150 samples in 5 years. The statistical description of each data item is shown in Table 2 and the equalization of provinces and cities and the regression results of and local debt issuance are shown in Table 3.



Table 2. Statistical description of each variable

Variable	Number of samples	Mean value	Standard deviation	Minimum value	Maximum value
Equalization		3.811	0.176	3.403	4.198
Snum		22.153	25.839	0	192
Scale		410.274	406.475	2.45	2788.89
Duration		4.749	0.945	2.317	9.934
Yeild		0.127	0.507	0.01	4.071
Decentral	150	0.515	0.187	0.156	0.874
Density		453.645	674.101	7.711	3833.333
Deficit		0.123	0.096	0.015	0.514
Invest		10682.26	7267.067	798.23	36789.07
Population		8.176	0.745	6.323	9.273
GDP		16877.42	13146.75	1081.27	62474.79

Table 3. Regression results of the equalization of basic public services and local debt

	Equalization of Basic Public Services			
	(1)	(2)	(3)	(4)
Number of issuing bonds	0.00184 (0.00886)			
Debt scale		-0.0179*** (0.00519)		
Debt deadline			0.0651** (0.0259)	
Costs of issuing bonds				-0.0103* (0.00533)
Fiscal decentralization	-0.115* (0.0576)	-0.103* (0.0632)	-0.119* (0.0706)	-0.110* (0.0601)
Financial deficit	0.107 (0.0647)	0.137** (0.0662)	0.140* (0.0731)	0.126* (0.0652)
Population density	0.869* (0.477)	0.891** (0.415)	0.901* (0.501)	0.896* (0.446)
Growth rate of population	-1.381*** (0.352)	-1.348*** (0.285)	-1.309*** (0.353)	-1.358*** (0.319)
Gross regional domestic product	0.215* (0.115)	0.198 (0.119)	0.194* (0.109)	0.201 (0.124)
Fixed investments	-0.382*** (0.0974)	-0.345*** (0.0946)	-0.387*** (0.0918)	-0.346*** (0.0984)
Constant	12.36*** (1.863)	11.92*** (1.760)	11.77*** (1.832)	11.87*** (1.816)
Number of samples	145	150	150	150
R <sup>2</sup>	0.604	0.619	0.614	0.608
Number of sections	30	30	30	30

Notes: (1) \*\*\*, \*\* and \* respectively represent that it is significant in the level of 1%, 5% and 10%. (2) t value is in the bracket.

## 4.2. Robustness check

To validate the robustness of the empirical model, the Paper selects to introduce other control variables: urban area and consumption level. Urban area, directly related to the urbanization rate, is an important indicator of the process of urbanization in China, reflecting the level of development of a region. The household consumption level reflects the standard of living and quality of the people, closely related to the level of equalization. The data are validated and the fixed effect OLS model is selected continuously. The regression results are shown in Table 4.

Table 4.

	Equalization of basic public services			
	(1)	(2)	(3)	(4)
Number of issuing bonds	0.0129 (0.00867)			
Debt scale		-0.00705* (0.00503)		
Debt deadline			0.0803*** (0.0267)	
Costs of issuing bonds				-0.00435* (0.00462)
Degree of fiscal decentralization	-0.108** (0.0460)	-0.0941* (0.0470)	-0.100* (0.0534)	-0.0962** (0.0450)
Financial deficits	0.105* (0.0607)	0.129** (0.0600)	0.145** (0.0692)	0.124** (0.0594)
Population density	0.0828 (0.466)	0.232 (0.434)	0.145 (0.467)	0.196 (0.435)
Growth rate of population	-0.837** (0.364)	-0.910*** (0.313)	-0.760** (0.346)	-0.885*** (0.321)
Gross regional domestic product	0.811*** (0.168)	0.720*** (0.171)	0.802*** (0.142)	0.752*** (0.172)
Fixed investments	-0.357*** (0.103)	-0.341*** (0.0951)	-0.358*** (0.0920)	-0.339*** (0.0961)
Urban area	0.139* (0.0736)	0.153** (0.0606)	0.157** (0.0593)	0.158** (0.0625)
Household consumption level	-0.726*** (0.145)	-0.611*** (0.145)	-0.730*** (0.133)	-0.649*** (0.139)
Constant	11.91*** (1.659)	11.36*** (1.554)	10.93*** (1.539)	11.30*** (1.581)
Number of samples	145	150	150	150
R <sup>2</sup>	0.612	0.623	0.619	0.615
Number of sections	30	30	30	30

Notes: (1) \*\*\*, \*\* and \* respectively represent that it is significant in the level of 1%, 5% and 10%. (2) t value is in the bracket.

The analysis on data in Table 4 shows that, as for several indexes of local debt, the coefficient plus and minus sign is unchanged, and the statistical level of signifi-

cance is not changed very much, proving the reliability of model and credibility of empirical results. The coefficient of urban area is positive, reflecting that the urbanization process is conducive to the improvement of equalization, further showing the difference between rural and urban development from one side. If the coefficient of household consumption level is negative and significant in the statistical level of 1%, the increase of the consumption level leads to the decline of the equalization level, of which the possible reason is that the living standards of the people have improved, but the gap between the rich and the poor has been widening, and the process of equalization has not kept pace with the pace of economic and social development.

## 5. Conclusion and discussion

The main conclusions of this Chapter include: (1) the issuance of local government bonds will significantly affect the equalization level. (2) Reducing the local government debt, debt risk and debt paying pressure are conducive to the improvement of the equalization of basic public services. (3) The transfer payment of Central Government is necessary to speed up the equalization of basic public services. (4) Good regional economy does not mean higher level of equalization of basic public services (equalization level of some provinces and cities in the central part of China is lower than that in the Northwest), and the key depends on how much the government invests in basic public services.

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