Original Paper

Fiscal Decentralization and Natural Disaster Relief in China

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Abstract

This paper analyzes the impact of fiscal decentralization on the level of government relief for natural disasters using 30 provincial-level data from 1997 to 2017 in China. The results show that fiscal decentralization positively impacts local government expenditure on natural disaster relief. Although it is different from the existing conclusion that fiscal decentralization inhibits the supply of local non-economic public goods, this conclusion can be explained by the literature on disaster prevention and control; the incentive of decentralization to increase government revenue increases the opportunity cost of disaster prevention and control investment, which makes the pre-disaster funds insufficient, and the post-disaster financial expenditure of natural disaster relief increase accordingly.

Keywords

Fiscal decentralization, Non-economic public goods, Natural disaster relief

1. Introduction

In recent years, Andreas and Timo (2008) and Jia et al. (2014) noted that China's decentralization reforms had pushed local governments to favor economic public goods services to promote regional economic growth. In addition, China's tax-sharing reform has created significant incentives for local governments to rely on land finance, which further skews local governments toward economic public goods services (Ding et al., 2014; Hui Li, 2017). However, as a non-economic public good, the public goods of disaster prevention, mitigation, and relief have achieved different results under China's fiscal decentralization system. It has been nearly 30 years since China implemented the tax-sharing reform in 1994. Apart from the earthquake in Wenchuan County in 2008, the financial expenditure on natural disaster relief has reached an all-time high; from 2000 to 2017, the overall Natural disasters in China fiscal spending on bailouts showed an upward trend (Figure 1). This makes it necessary to consider whether fiscal decentralization impacts public goods of disaster prevention, mitigation, and relief differently than general public goods.
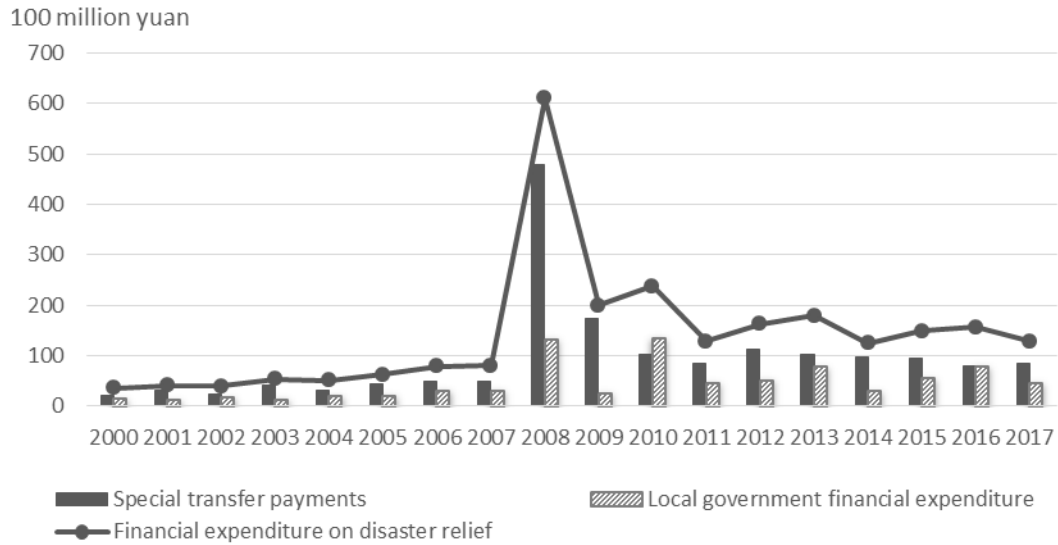
Figure 1. Spending on Natural Disasters in China from 2000 to 2017

It is now widely accepted that decentralized government is more effective in disaster prevention and mitigation than centralized government (Rumbach, 2016) because natural disasters are limited to a particular geographical area and rarely affect the whole country. Therefore, for local governments that have complete control of regional information, knowledge, and resources, decentralization helps prevent and mitigate regional disasters. In addition, numerous studies have shown that countries with greater decentralization have higher budgets for disaster prevention and mitigation (Fahlevi et al., 2019) and fewer deaths from disasters (Skidmore & Toya, 2013), and the impact is more pronounced in developing countries (Escaleras & Register, 2012). In short, according to the existing research, there is relatively little literature on the financial expenditure of natural disaster relief. Much research has been carried out on fiscal decentralization and natural disaster prevention. It is generally believed that fiscal decentralization is conducive to reducing the impact of natural disasters on the economy and society. Under the specific condition of government aid standards, the scale of government aid to natural disasters is directly related to the impact of economic and social disasters. What is the effect of China's fiscal decentralization on local government disaster prevention, and how does that affect natural disaster relief, which is an important topic discussed in this paper?

2. Theoretical Basis and Research Hypothesis

How local governments use and control the fiscal revenue of decentralization depends on the specific characteristics of fiscal decentralization. For China's tax-sharing reform in 1994, the following two specific features: the central government's fiscal revenue has been increased, giving the central government more room for policy adjustment. The central government can use the transfer payment to regulate the equalization of regional public services. On the other hand, the core measure of tax-sharing reform is the "Tax-sharing system" change. The tax revenue is divided into three parts: state, local, and

21

shared tax. The state tax is obtained by the central government, local governments obtain local taxes, and shared taxes are divided between the central and local governments in a particular proportion. At the same time, the fiscal responsibility of local governments has not been changed, and local governments still bear nearly 80% of public goods expenditures in all regions. However, this heavy expenditure responsibility is the political promotion incentive that decides the official promotion by the performance appraisal. This fiscal decentralization system incentivizes local governments to develop the economy and generate tax revenue. As for the public goods of disaster prevention, reduction, and relief, although they are non-economic public goods, they play an essential role in supporting regional economic growth. Specifically, China's financial investment in disaster prevention, mitigation, and public relief goods include financial investment in disaster prevention and control and financial investment in disaster relief. Pre-disaster disaster prevention and control funding are critical to improving the region's resilience to natural disasters, reducing disaster losses, and achieving sustainable economic development (Cohen & Werker, 2008). The financial input of disaster relief after the disaster benefits the economic recovery of the disaster-stricken areas. However, under the decentralized system, local governments prefer economic public goods services, increasing the opportunity cost of disaster prevention and control investment correspondingly increase, thus reducing the investment of disaster prevention and control funds. As Burby (2006) puts it, the local government paradox is that local officials see natural disasters as a secondary issue and are reluctant to invest in disaster mitigation. In addition, most natural disaster relief funds for local governments in China come from special transfer payments from the central government, meaning that the state fully ensures economic losses caused by natural disasters. Therefore, at the local government level, there is a trade-off between the supply of economic public goods and the optimal input of public goods for disaster prevention, mitigation, and relief. The change in financial expenditure for natural disaster relief will be the result of this trade-off.

In order to simplify the study, we take a single local government as an example to explore the local government's financial expenditure on the trade-off problem. Local governments provide economic and non-economic public goods for their jurisdictions according to the tax and transfer payment revenue they receive. Suppose g_1 is an economic public goods expenditure, g_2 is a non-economic public goods expenditure, and x is the ratio of economic public goods expenditure to non-economic public goods expenditure ($x > 0$):

$$g_1 = x * g_2 \qquad (1)$$

Assuming that the central government uniformly determines the national, local, and shared tax rates, the statutory tax rate is t ($0 < t < 1$). If the regional economic output is Y ($Y > 0$) and the level of decentralization of local government revenue is e, then the local government revenue sharing is $t \cdot e \cdot Y$. In order to simplify the study, local government debt and other funds outside the system are not taken into account; the total fiscal revenue F received by local governments consists of two funds,

tax-sharing revenue ($t \cdot e \cdot Y$) and central transfer payment (including general transfer payment T_1 and unique transfer payment T_2), that is:

$$F = t \cdot e \cdot Y + T_1 + T_2 \qquad (2)$$

Assuming that the local government investment in disaster prevention and control is h, it is mainly used to invest in the modification of disaster prevention works, special expenses of disaster forecast and detection, propaganda of disaster prevention and reduction, personnel training, etc. Suppose the ratio of disaster loss to local economic output is L. In that case, the ratio of disaster loss (L) and the capital input for disaster prevention and control (h) shows a reverse decreasing relationship (Zhuo & Duan, 2012), that is, $L = D(h), (L \in [0,1])$, and satisfy $D'(h) < 0,\ D''(h) > 0$. Suppose that the probability of a regional natural disaster is p and that the probability of a disaster occurring in one region is independent of the probability of a disaster occurring in another region since most natural disasters are inevitable but predictable (Nagasaka, 2008). Therefore, this paper assumes that the probability value p of a natural disaster is an exogenous variable and a known constant at the same time. Assuming that the initial social capital stock of an area is K, the social capital stock affected by natural disaster risk E_k can be expressed as:

$$E_k = p[1 - D(h)]K + (1 - p)K \qquad (3)$$

Suppose that the proportion of natural disaster relief expenditure to non-economic public goods expenditure is m. The proportion of special funds for disaster prevention and control to total disaster prevention and control funds is n, the proportion of the special expenditure of economic public goods to the total expenditure of economic public goods is a the proportion of the special expenditure of other non-economic public goods to the total expenditure of non-economic public goods is b, then the financial expenditure of natural disaster relief is $S = mg_2$, and there are:

$$T_2 = ag_1 + bg_2 + mg_2 + nh \qquad (4)$$

Barro's (1990) endogenous economic growth model uses a production function that includes both private capital and public expenditure in its inputs and is therefore widely adopted (Davoodi & Zou (1998)). In this paper, we construct the regional output function with reference to its expression as follows:

$$Y = Ag_1^{\beta} E_k^{\gamma} \qquad (5)$$

Where Y is the economic output of the region, and A is the other factors (such as technical factors) that affect the economic output of the region other than economic public goods expenditure and capital stock, β reflects the degree of economic public goods expenditure affecting the economic output of the region ($\beta > 0$), γ reflects the degree of capital stock affecting the economic output of the region ($0 < \gamma < 1$). On the premise of other constant factors, the increase of social capital stock or economic public goods expenditure level will promote the local economic output level.

23

For local governments, the goal is to increase economic output and non-economic public goods expenditure such as education, health care, and social security to maximize the utility of local governments. With reference to Cai & Treisman (2005), the utility function of local government is a utility maximization problem as follows:

$$max Y^\theta g_2^{1-\theta}$$

$$s.t. \, g_1 + g_2 = teY + T_1 + T_2 \tag{6}$$

Among them, θ denotes the importance of regional economic output affecting the utility of local government ($0 \le \theta \le 1$). From the equations (1)(2)(4) and (6):

$$g_2 = \frac{teY + T_1 + nh}{1 + (1-a)x - (m+b)} \tag{7}$$

According to the practical significance, the local government's economic public goods expenditure g_1 and non-economic public goods expenditure g_2 should be greater than zero, so the following inequality holds:

$$1 + (1-a)x - (m+b) > 0 \tag{8}$$

Combined (5)(6) and (7) can transform local government utility maximization problems into:

$$max f(h) = [A(xg_2)^\beta E_k^\gamma]^\theta [\frac{teY + T_1 + nh}{1 + (1-a)x - (m+b)}]^{1-\theta} \tag{9}$$

Formula (9) is the derivative of the investment in disaster prevention and control fund h, and partial $\frac{\partial f}{\partial h} = 0$, so that the optimal utility function of local government should satisfy the following condition formula:

$$m = 1 + (1-a)x - b - \frac{(1+\theta\beta-\theta)nE_k}{rpKD'(h)g_2} \tag{10}$$

According to Formula (10), when the utility function of local government can be optimized, the financial expenditure of natural disaster relief $S = mg_2$ can be further expressed as:

$$S = [1 + (1-a)x - b]g_2 - \frac{(1+\theta\beta-\theta)[1-pD(h)]n}{rpD'(h)} \tag{11}$$

From equations (4) and (8), we know that $0 < a < 1$ and $1 + (1-a)x - b > 0$. Therefore, from formula (11), we know that the financial expenditure of natural disaster relief S increases with the ratio x of economic public goods expenditure to non-economic public goods expenditure. Secondly, after considering the input of funds for disaster prevention and control, the more the proportion of special funds for disaster prevention and control (n), the less the proportion of funds for disaster prevention and control in general transfer payment is, the financial expenditure of natural disaster relief

(S) increased. Finally, the degree parameter β, which reflects the influence of economic public goods expenditure on regional economic output, is positively correlated with the financial expenditure of natural disaster relief, that is, the greater the impact of economic public goods expenditure on regional economic output, the greater the impact of economic public goods expenditure on regional economic

24

output, so economic public goods fiscal expenditure is more conducive to regional economic growth, thus bringing more fiscal revenue for local governments, the overall level of public goods fiscal expenditure of local governments.

Overall, China's tax-sharing reform makes local governments favor economic public goods supply. This financial expenditure bias is further reflected in the public goods of disaster prevention, mitigation, and relief. In terms of disaster risk response, while the central government is in the best position for political centralization, it is understood in advance for local governments. It takes into account future disaster relief actions by the central government; any ex-post adjustment of transfer payments by the central government will further distort the regional incentive mechanism and lead to insufficient ex-ante investment to further stimulate local governments, the final performance of the disaster prevention and control funds to reduce and increase the financial expenditure of natural disaster relief. Therefore, we get the following theoretical hypothesis:

H1: There is a positive correlation between the degree of the financial income distribution ($fdr_{i,t}$) and the local government expenditure on natural disaster relief ($diseff_{i,t}$);

H2: fiscal decentralization reduces local government funding for disaster prevention by affecting local government preferences for economic public goods service; this, in turn, leads to an increase in local financial expenditure on natural disaster relief ($exp_{i,t} * ps_{i,t}$).

3. Model Settings, Variable Descriptions, and Data Sources

3.1 Model Settings

To test H1, we constructed the following econometric model:

$$diseff_{i,t} = \beta_0 + \beta_1 fdr_{i,t} + \beta_2 Control_{i,t} + v_t + \theta_p + \varepsilon_{i,t}$$

Where i stands for region and t for year. β_0 is the intercept term, θ_p is the region fixed effect, v_t is the year fixed effect, $\varepsilon_{i,t}$ is the residual term. The disease $diseff_{i,t}$ is the explanatory variable of this paper, which represents the financial expenditure of the local government in the natural disaster relief of i area in the t year. $fdr_{i,t}$ is the explanatory variable, representing the share of local government revenue in i area in the t year. $Control_{i,t}$ was the control variable, β_1 and β_2 were the coefficients.

In order to test H2, we add in the interaction terms to verify that the local government economic public goods service bias affects the financial input of disaster prevention and control, and then affects the financial expenditure of local natural disaster relief, and construct the model as follows:

$$diseff_{i,t} = \beta_0 + \beta_1 ps_{i,t} * exp_{i,t} + \beta_2 Control_{i,t} + v_t + \theta_p + \varepsilon_{i,t}$$

The interactive item $ps_{i,t} * exp_{i,t}$ is the explanatory variable, in which $ps_{i,t}$ is the disaster prevention

fund input of local government in i area in t year.

3.2 Variable Description

The Financial Expenditure Index of natural disaster relief ($diseff$) is the explained variable in this paper. To eliminate the influence of outliers and make the data more stable to weaken the collinearity and heteroscedasticity of the model, we take the logarithmic values in the empirical process.

Fiscal decentralization (fdr) is the core explanatory variable in this paper. Based on the theoretical analysis, this paper analyzes the impact of fiscal decentralization on the financial expenditure of natural disaster relief from the perspective of fiscal decentralization. Therefore, this paper adopts fiscal revenue distribution (fdr) as the explanatory variable and fiscal expenditure distribution (fds) as the substitute variable for the robustness test.

$$fdr = \frac{\text{Per budgetary revenue of province}}{\text{Per budgetary revenue of province} + \text{Per budgetary revenue of the central government}}$$

$$fds = \frac{\text{Per budgetary expenditures of province}}{\text{Per budgetary expenditures of province} + \text{Per budgetary expenditures of the central government}}$$

This paper uses the ratio of economic public goods expenditure to total public goods expenditure (exp) to measure the change in local government's public goods supply preference. The so-called economic public goods service is a public product that can bring direct economic effects to the region's development, including transportation, energy, communication, and other infrastructure. A fundamental fact of public investment (ps) in disaster prevention and control is difficult to measure the number of funds invested in disaster prevention and control in a region. Therefore, to measure public investment performance in disaster prevention and control, existing studies have used indicators such as disaster-affected populations or disaster economic loss (Escaleras & Register, 2012; Skidmore & Toya, 2013). In this paper, the ratio of direct economic loss due to disasters to the GDP of the whole province is used to replace the public investment (ps) in disaster prevention and control, and the ratio of disaster-affected population to the total population of the whole province (szrk) is used for the robustness test.

Through reviewing the literature, we find that both the density and the urban are considered to be the factors that affect the probability of death from natural disasters, and the consumption index will affect the level of disaster relief. Given the above three factors will directly affect the results of this study, so as a control variable in the empirical model. In addition, Seth (2008) study shows that transportation systems are an essential factor in local natural disaster population loss. Therefore, this paper takes the area of per capita road (pertraffic), regional passenger traffic level (pass), and other indicators as control variables.

3.3 Data Sources

Due to the following data limitations, the decision of this study cycle. Since 1997, when Chongqing became a municipality, the country has been divided into 34 province-level divisions (four

26

municipalities, 23 provinces, five autonomous regions, and two special administrative regions) and long-term stability. Second, China began to implement the tax-sharing system reform in 1994, and by 1997, has experienced several years of adjustment and improvement, and the system tended to mature. Third, China's natural disaster relief expenditure of the latest figures until 2017. Therefore, we chose data for the period 1997-2017. In addition, we exclude Tibet, Taiwan, Hong Kong and Macau, and select provincial panel data from 30 regions across China from 1997-2017, taking into account data availability and comparability issues. The empirical analysis was conducted using STATA 16.0. The data of each variable are derived from the *Chinese statistical yearbook, Chinese Financial Statistical Yearbook, Chinese Civil Statistical Yearbook*, and Wind database.

4. Empirical Results and Their Explanations

Table 1 shows the regression results of empirical model 1 and empirical model 2. The R 2 of Model 1 and Model 2 are above 0.5, which shows that the fitting effect of the model is better. From the regression results of Model 1, it can be seen that fiscal decentralization has a significant positive effect on the growth rate of fiscal expenditure on natural disaster relief, which is significant at the 10% level. It shows that the greater the degree of decentralization of fiscal revenue, the greater the degree of local government expenditure on natural disaster relief. So suppose that H 1 is supported empirically. From the regression results of Model 2, fiscal decentralization has a significant positive impact on the proportion of local government economic public goods expenditure, and the statistical results are significant at 5% significance level. It shows that fiscal decentralization makes local governments have obvious economic expenditure bias. From Model 2(2), it can be seen that the interaction between the proportion of economic public goods expenditure and the proportion of disaster economic loss has a significant positive effect on the growth rate of financial expenditure of natural disaster relief and the statistical results were significant at the 1% significance level. It shows that the economical expenditure of local government influences the financial expenditure of natural disaster relief by affecting the intensity of disaster prevention and control.

Table 1. Results of Basic Model Regression

	Model 1	Model 2	
		(1)	(2)
	lndiff	exp	lndiff
fdr	1.5359*	10.3073**	
	(0.8089)	(4.0050)	
ps*exp			0.3054***
			(0.0370)
urban	2.1473***	-14.3907***	2.3635***

	(0.3320)	(1.7989)	(0.3317)
lnconsume	0.4255	8.0352**	0.4578
	(0.5789)	(3.1523)	(0.5820)
lndensity	0.1133**	0.2651	0.0857*
	(0.0496)	(0.2696)	(0.0498)
lnpass	-0.2277*	0.1767	-0.2740**
	(0.1283)	(0.6955)	(0.1277)
ps	7.2061***		
	(0.8648)		
pertraffic	-0.0497***		
	(0.0143)		
constant	7.1858**	-24.3660	8.0726***
	(3.0204)	(16.4386)	(3.0431)
R-squared	0.553	0.696	0.543
N	630	630	630
Time fixed effect	Yes	Yes	Yes
Area fixed effect	Yes	Yes	Yes

Note. standard deviation in parentheses, * 0.1 significant * * 0.05 significant * * 0.01 significant.

In order to investigate the robustness of the models, for models 1 and 2, we replace the fiscal revenue decentralization (fdr) with the fiscal expenditure decentralization (fds) and replace the proportion of direct disaster economic loss with the proportion of the disaster-affected population, the other variables were left unchanged for regression. The results are shown in Table 2. From the table, we can see that the sign of the main variables in Model 1 and Model 2 is changed, and the significance level is enhanced, which shows that our empirical model is robust.

Table 2. Robustness Test

	Model 1	Model 2	
		(1)	(2)
	lndiff	exp	lndiff
fds	3.1711***	48.0050***	
	(0.7766)	(4.9711)	
szrk*exp			0.0252***
			(0.0059)
urban	0.4652*	-12.5055***	0.5864**
	(0.2658)	(1.6825)	(0.2895)

lnconsume	0.5925	4.0966	0.4879
	(0.4452)	(2.9703)	(0.4763)
lndensity	0.0778**	-0.0624	0.0724*
	(0.0379)	(0.2533)	(0.0409)
lnpass	-0.0702	-0.3019	-0.0720
	(0.0980)	(0.6484)	(0.1052)
ps	6.7932***		
	(0.6576)		
pertraffic	-0.0145		
	(0.0103)		
constant	3.6482	-30.4747**	6.4882***
	(2.3073)	(15.3487)	(2.4960)
R-squared	0.625	0.736	0.557
N	630	630	630
Time fixed effect	Yes	Yes	Yes
Area fixed effect	Yes	Yes	Yes

Note. standard deviation in parentheses, * 0.1 significant * * 0.05 significant * * 0.01 significant.

5. Conclusion

China's tax-sharing reform in 1994 made local governments responsible for most of the expenditures, including public goods for disaster prevention and relief. The theoretical and empirical evidence shows that there is a positive correlation between the share of fiscal revenue in China and the expenditure of local governments on natural disaster relief, local Governments' limited share of fiscal revenue and China's special incentives for political promotion have led to a bias towards economic public goods service, which has further led to a reduction in local government funding for disaster prevention and control, accordingly, local governments are urged to invest more money in natural disaster relief to help the economic recovery of the affected areas.

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29

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