

Emergency Fiscal Budgeting and Disaster Risk Reduction: The Moderating Role of Fiscal Autonomy

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Abstract: Emergency fiscal budgeting is a core component of disaster governance. It supports disaster response and recovery, but it also shapes prevention and preparedness before losses occur. This study examines whether emergency fiscal budgeting reduces disaster impacts and whether fiscal autonomy strengthens that effect. Using provincial panel data from China for 2005-2016, the analysis employs a two-way fixed-effects model. Disaster impact is measured by the population affected by natural disasters. Emergency fiscal budgeting is proxied by budgeted expenditure on natural disaster living assistance, and fiscal autonomy is measured by the ratio of local budgetary revenue to local budgetary expenditure. The results show a stable negative association between emergency fiscal budgeting and disaster impacts. Provinces with stronger emergency fiscal budgeting tend to have smaller affected populations. The interaction term between emergency fiscal budgeting and fiscal autonomy is also negative, indicating that fiscal autonomy strengthens the disaster risk reduction effect of emergency fiscal budgeting. Further analysis for the central and western regions yields a similar pattern, and robustness checks using alternative sample periods do not alter the main findings. These results suggest that disaster impacts are shaped not only by hazard exposure, but also by fiscal preparation and local fiscal conditions. The findings provide empirical support for strengthening ex ante disaster-related budgeting and for improving the institutional setting in which local governments use fiscal resources for disaster risk reduction.

1. Introduction

Natural hazards continue to impose heavy human and economic losses. China remains highly exposed to disaster risk. Official statistics show that natural disasters affected 10.09 million hectares of crops in 2024, including 1.24 million hectares with complete crop failure. Floods, waterlogging, and geological disasters alone caused direct economic losses of 263.0 billion yuan. These figures show the scale and persistence of disaster risk in China. They also explain why disaster risk reduction (DRR) remains a central task of public governance. In the UNDRR framework, DRR refers to the prevention of new risk, the reduction of existing risk, and the management of residual risk. It is not limited to post-disaster relief. It also requires sustained investment in prevention, preparedness, and resilience. This shift is difficult to achieve in practice. Preventive action often brings delayed and less visible returns. Emergency response is more immediate and more

observable. Local governments may therefore privilege response over prevention. Such incentives can push governments to underinvest in prevention even when preparedness yields larger social returns. This tension is especially relevant in disaster governance, where the value of prevention is often recognized only after losses occur ^[1]. In this setting, emergency public finance matters. It supports preparedness, response, recovery, and the broader capacity of governments to manage disaster risk. Yet whether emergency fiscal budgeting actually reduces disaster impacts remains unclear. Existing studies suggest that fiscal structure may shape disaster outcomes, but the evidence is mixed. Cross-national research links greater fiscal decentralization to lower disaster impacts ^[2]. Evidence from the United States also shows that decentralization can affect disaster mitigation through public spending choices ^[3]. These studies are informative, but they do not directly test whether emergency fiscal budgeting itself reduces disaster impacts, nor do they explain how local fiscal autonomy conditions that relationship in a subnational setting.

This article addresses that question in the Chinese context. This study investigates whether emergency fiscal budgeting reduces the population affected by natural disasters and whether fiscal autonomy strengthens that effect. Fiscal autonomy matters because it shapes local discretion in resource use. It also affects whether fiscal inputs can be translated into effective disaster governance outcomes. Using provincial panel data from China for 2005–2016, this study employs a two-way fixed-effects model to estimate the effect of emergency fiscal budgeting on disaster impacts and to test the moderating role of fiscal autonomy. By taking fiscal autonomy as an analytical entry point, this article provides direct evidence on the disaster risk reduction effect of emergency fiscal budgeting. It seeks to deepen understanding of local governments' incentives for disaster prevention and to offer policy implications for strengthening disaster governance capacity.

2. Literature Review

2.1 Disaster risk reduction

Recent scholarship no longer treats disasters as isolated shocks followed by short-term relief. The dominant view frames disaster governance as a continuous process of risk reduction, preparedness, response, and recovery. Tierney conceptualizes disaster governance as a social, political, and economic process embedded in broader systems of societal governance^[4]. Crisis management depends not only on formal authority, but also on governance capacity and institutional legitimacy ^[5]. This literature has moved the field away from a response-centered understanding of emergency management. It has also raised a harder question: why do governments still struggle to sustain preventive action when the value of ex ante investment is widely recognized? One answer lies in the politics of attention and incentives. Healy and Malhotra show that voters reward visible disaster relief but do not similarly reward preparedness spending ^[1]. Exposure to natural hazard events, by itself, is weakly associated with policy change for improved disaster risk reduction^[6,7]. Disasters therefore do not automatically generate preventive reform. Political incentives, institutional routines, and fiscal arrangements shape whether risk governance moves upstream or remains trapped in ex post response. It suggests that disaster impacts cannot be explained by hazard exposure alone. They must also be linked to the structure of public action before disasters occur.

2.2 Emergency Public Finance and Fiscal Autonomy

Disaster risk reduction needs fiscal support before losses occur. Recent mapping of DRR scholarship shows that governance and public finance remain underweighted relative to technical risk assessment and urban planning, even though implementation depends heavily on fiscal capacity

and institutional coordination ^[8]. Fiscal capacity serves as the foundation of state governance; from the perspective of public risk, its core lies in the prevention and mitigation of risks, and only through fiscal stability can certainty be infused into state governance.

Emergency fiscal budgeting should therefore be understood as part of risk governance, not simply as a post-disaster adjustment tool. A disaster-resilient fiscal system needs to connect budgeting, reserve design, and risk financing with ex ante risk reduction rather than rely only on ex post compensation ^[9]. Fiscal readiness matters because disasters generate contingent liabilities that can quickly turn into fiscal stress when governments lack prior preparation. Evidence from provincial data shows that government emergency budgeting is associated with lower disaster impact, which indicates that routine fiscal commitment can produce measurable disaster risk reduction effects rather than merely symbolic preparedness signals ^[10]. Emergency fiscal budgeting should be treated as a substantive policy input with observable governance consequences. In China, emergency management-related fiscal expenditure comes mainly from budgetary appropriations and can be grouped into fiscal funds and fiscal policy measures. Fiscal funds support the full disaster cycle. They cover pre-disaster prevention, emergency response, and post-disaster recovery and reconstruction. Pre-disaster spending includes contingency reserves, budgeted expenditure on disaster prevention and emergency management, and emergency supply stockpiles. Response spending finances emergency operations and the temporary accommodation of affected residents. Recovery and reconstruction spending supports debris clearance and the rebuilding of public facilities and housing.

The effect of emergency fiscal budgeting is unlikely to be constant across regions. Budgetary input does not automatically become governance output. Local governments need discretion to align spending with local risk exposure, timing, and operational needs. Local autonomy can improve adaptation to shocks, especially when crises vary across territories and require differentiated responses ^[11]. Recent studies of local DRR implementation show that weak coordination, limited fiscal autonomy, poor enforcement, and low community engagement can all constrain local risk governance ^[12]. Evidence from Central Vietnam points in the same direction. Local disaster management is facilitated by transparency and collaboration, but weakened by accountability gaps, staff shortages, and limited autonomy in implementation ^[13].

2.3 Research Gap

DRR research still gives more attention to technical assessment than to local governance and public finance ⁸. Research on disaster budgeting has begun to show that emergency budgets can reduce disaster impact in China, but that evidence remains limited and has not been fully connected to the institutional conditions under which budgeting works best ^[10]. Research on decentralisation and extreme events shows that local autonomy matters, yet it usually examines governance structure in general rather than emergency fiscal budgeting in particular ^[11,14].

This leaves two gaps. The first is a policy gap. The direct disaster risk reduction effect of emergency fiscal budgeting is still underexamined in subnational analysis. The second is a mechanism gap. Fiscal autonomy is rarely modelled as a condition that may strengthen or weaken the effectiveness of emergency fiscal budgeting. This article addresses both gaps by focusing on emergency fiscal budgeting, measuring disaster impacts through the population affected by natural disasters, and testing the moderating role of fiscal autonomy.

3. Research Design

3.1 Theoretical Hypotheses

3.1.1 Emergency Fiscal Budgeting and Disaster Impacts

Disaster governance spans prevention, preparedness, response, and recovery. Among these stages, prevention is the most effective way to reduce losses before hazards develop into actual damage. Early warning, monitoring, drills, stockpiling, and similar measures can lower vulnerability and limit disaster impacts. Whether local governments attach importance to these tasks is often reflected in their budgetary commitments.

In China, budgeted expenditure on natural disaster living assistance captures an important part of this commitment. It reflects regular fiscal preparation for disaster-related needs rather than temporary spending after a disaster has already occurred. A higher level of such budgeting usually means that local governments devote more attention and resources to prevention and preparedness. On this basis, stronger emergency fiscal budgeting is expected to reduce the population affected by natural disasters. Accordingly, this study proposes the following hypothesis:

H1: Higher emergency fiscal budgeting is associated with lower disaster impacts.

3.1.2 The Moderating Role of Fiscal Autonomy

The effect of emergency fiscal budgeting is unlikely to be the same across regions. Budgetary input alone does not guarantee better disaster outcomes. Its effect depends on how local governments use resources, organise priorities, and carry out preventive measures. Fiscal autonomy may shape this process.

When fiscal autonomy is low, local governments face tighter budget constraints and have less room to adjust expenditure to local risk conditions. In that setting, they are more likely to rely on support from higher-level governments, especially after large disasters. This weakens incentives for sustained investment in prevention and preparedness. Budgetary resources are then more likely to flow toward post-disaster response than pre-disaster risk reduction. When fiscal autonomy is higher, local governments have more discretion over revenue use and expenditure planning. This gives them greater room to match emergency fiscal budgeting with local hazard exposure and prevention needs. It also makes it easier to support early warning, preparedness, stockpiling, and other ex ante measures. Under these conditions, emergency fiscal budgeting is more likely to have a stronger disaster risk reduction effect. Accordingly, this study proposes the following hypothesis:

H2: Fiscal autonomy strengthens the negative association between emergency fiscal budgeting and disaster impacts.

3.2 Data Sources

This study uses a provincial panel dataset for 2005-2016. The sample covers provinces, autonomous regions, and municipalities in China. Data come from the China Statistical Yearbook, the China Civil Affairs Statistical Yearbook, provincial budget revenue and expenditure statements, and other official statistical releases. Observations related to the 2008 Wenchuan earthquake are excluded from the baseline analysis. The purpose is to reduce the influence of an extreme shock on the estimation.

Data on budgeted expenditure for natural disaster living assistance are taken from provincial civil affairs budget reports and the China Civil Affairs Statistical Yearbook. Data on the population affected by natural disasters are drawn from the same source. Information on fiscal revenue, fiscal expenditure, GDP per capita, population density, industrial structure, education, and infrastructure

is taken from the China Statistical Yearbook. The further analysis also uses data on specific disaster types, including droughts, floods, geological hazards, typhoons, and wind-hail disasters.

3.3 Variable Measurement

3.3.1 Dependent Variable

The dependent variable is disaster impact. This study measures disaster impact by the population affected by natural disasters. Direct economic losses are closely related to the level of regional economic development. Given their high correlation with GDP per capita, using economic losses as the dependent variable may produce spurious regression results ^[15]. A lower affected population indicates a lower level of disaster impact and, in turn, a stronger disaster risk reduction effect.

3.3.2 Independent and Moderating Variables

The core explanatory variable is emergency fiscal budgeting. In principle, preventive fiscal expenditure covers disaster prevention and emergency management spending, contingency reserves, and emergency supply stockpiles. These categories are not equally suitable for empirical measurement. Contingency reserves are often kept at the minimum level and may remain unused for long periods. Emergency supply stockpiles are also difficult to quantify in a comparable way across provinces. For this reason, the analysis uses budgeted expenditure on natural disaster living assistance as a proxy for emergency fiscal budgeting. This variable captures regular fiscal preparation for disaster-related needs and provides a practical indicator of how much attention local governments give to prevention and preparedness.

The moderating variable is fiscal autonomy. Here, fiscal autonomy refers to the degree of local discretion in fiscal planning and resource allocation. It indicates how far local governments can support their own expenditure and align budgetary decisions with local priorities. Following the measurement approach commonly used in the Chinese fiscal decentralization literature, fiscal autonomy is defined as the ratio of local budgetary revenue to local budgetary expenditure ^[16]:

$$FA_{it} = \frac{LocalBudgetaryRevenue}{LocalBudgetaryExpenditure} \quad (1)$$

A higher ratio indicates stronger fiscal self-reliance and greater room for local fiscal choice.

3.3.3 Control Variables

Several control variables are included in the empirical models.

Historical disaster exposure is measured by the lagged population affected by natural disasters. Disaster patterns often persist over time. Past exposure may therefore influence both current preparedness and current disaster outcomes.

GDP per capita controls for differences in economic development. Provinces with higher income levels may have stronger prevention capacity and lower vulnerability.

Population density captures the concentration of exposure. Once disasters occur, densely populated areas are more likely to report larger affected populations.

Industrial structure is measured by the share of primary industry in regional GDP. Provinces with a larger primary sector tend to be more exposed to natural hazards.

Education level is measured by the illiteracy rate. This variable is included because education affects risk awareness, access to information, and preparedness capacity.

Infrastructure level is proxied by per capita urban green space. In the present dataset, this variable is used to capture local infrastructure and urban resilience conditions.

3.4 Model Specification

The fixed-effects model is widely used in panel data analysis because it controls for unobserved heterogeneity across individual units. By accounting for individual-specific characteristics that do not vary over time, the FEM isolates the impact of key independent variables. Moreover, including time fixed effects helps address potential omitted variable bias that arises from time-specific factors. Therefore, this study adopts a two-way fixed effects model for the regression analysis. The baseline model is specified as follows:

$$DP_{it} = \beta_0 + \beta_1 BE_{it} + \varphi X_{it} + v_i + \mu_t + \varepsilon_{it} \quad (2)$$

To examine the relationship among emergency finance budgets, fiscal autonomy, and disaster impacts, this study further introduces an interaction term between emergency finance budgets and fiscal autonomy. The moderating model is specified as follows:

$$DP_{it} = \beta_0 + \beta_1 BE_{it} + \beta_2 FA_{it} + \beta_3 BE_{it} * FA_{it} + \varphi X_{it} + v_i + \mu_t + \varepsilon_{it} \quad (3)$$

Where **DP** denotes the population affected by natural disasters; **BE** denotes budgeted expenditure on natural disaster living assistance; **FA** denotes fiscal autonomy, measured by the ratio of local budgetary revenue to local budgetary expenditure; and **BE*FA** is the interaction term between emergency fiscal budgeting and fiscal autonomy. **X** represents the control variables. Subscript *i* denotes the province, autonomous region, or municipality, and subscript *t* denotes the year. v_i captures individual (province-level) fixed effects, μ_t captures year fixed effects, and ε_{it} is the error term.

4. Results and Discussion

4.1 Descriptive Statistics of Variables

Table 1 reports the descriptive statistics of the main variables. The sample shows substantial cross-provincial variation. From 2005 to 2016, the average population affected by natural disasters reached 11.8 million, with a large standard deviation and a maximum of 54.9 million. This indicates that disaster impacts differed markedly across provinces. The affected cropland area also shows considerable dispersion, which further reflects strong regional heterogeneity in disaster exposure and loss.

Emergency fiscal budgeting varies substantially across the sample. The mean budgeted expenditure on natural disaster living assistance is RMB 394.78 million, while the maximum reaches RMB 3.25 billion. This suggests substantial differences in local fiscal commitment to disaster-related spending. Fiscal autonomy also differs notably across provinces. Its mean is 0.498, with values ranging from 0.064 to 0.938. This variation provides an empirical basis for examining whether fiscal autonomy conditions the effect of emergency fiscal budgeting on disaster impacts.

The control variables also display meaningful heterogeneity. GDP per capita, population density, industrial structure, education, and infrastructure differ substantially across provinces. These differences indicate that provinces faced uneven social, economic, and structural conditions during the sample period. Taken together, the descriptive statistics suggest that the sample contains sufficient variation for identifying the relationship between emergency fiscal budgeting, fiscal autonomy, and disaster impacts.

Table 1: Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Min	Max
Disaster-Affected Population (person-times)	11800000	10700000	1000	54900000
Budget for Natural Disaster Living Assistance (10k RMB)	39478.43	39883.46	384.1	324809.8
Disaster-Affected Population in Previous Year (person-times)	12700000	11300000	1000	54900000
GDP per Capita (RMB/person)	33165.49	20725.14	5218	124516
Population Density (persons/km ²)	368.243	492.7723	2.327902	3891.167
Share of Primary Industry in GDP (%)	11.52436	5.582089	0.3884856	33.6
Illiteracy Rate (%)	7.076129	6.806053	1.16	45.65
Per Capita Urban Green Space (m ² /person)	10.76331	3.028915	0.42	19.77
Affected Cropland Area (1,000 hectares)	1136.701	991.3897	0	7393.7
Destroyed Cropland Area (1,000 hectares)	127.3226	150.7512	0	908.7
Affected by Floods, Typhoons, etc. (1,000 hectares)	351.4203	403.7171	0	2654
Affected by Wind and Hail Disasters (1,000 hectares)	112.1807	136.9765	0	1128.93
Fiscal Autonomy	0.4979052	0.2022157	0.0640036	0.9377479

4.2 Analysis of the Impact of Emergency Finance Budgets on Disaster Outcomes

Table 2 presents the baseline regression results for the relationship between emergency fiscal budgeting and disaster impacts. Across all specifications, the coefficient on emergency fiscal budgeting remains negative. The result also stays stable after the sequential inclusion of control variables. This pattern indicates a robust negative association between emergency fiscal budgeting and the population affected by natural disasters.

The baseline results support **H1**. Higher emergency fiscal budgeting is associated with lower disaster impacts. This finding suggests that budgeted expenditure on natural disaster living assistance is not merely a formal fiscal item. It reflects a tangible level of fiscal commitment to disaster-related needs. Once this commitment increases, local governments are in a better position to support preparedness, early intervention, and related protective measures before disaster losses expand.

The control variables also reveal several meaningful patterns. Population density is positively associated with disaster impacts. Provinces with denser populations tend to have larger affected populations once disasters occur. Industrial structure also shows a positive association with disaster impacts. Provinces with a larger share of primary industry appear to be more vulnerable to natural hazards. By contrast, the inclusion of historical disaster exposure, GDP per capita, education level, and infrastructure does not alter the main finding. The negative association between emergency fiscal budgeting and disaster impacts remains stable throughout.

Overall, the baseline regressions show that stronger emergency fiscal budgeting is linked to a smaller population affected by natural disasters. This result provides empirical support for the disaster risk reduction effect of emergency fiscal budgeting. It also lays the foundation for the next step of the analysis, which examines whether this effect varies with fiscal autonomy.

Table 2: Effect of Emergency Finance Budgets on Reducing Disaster Impact

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Emergency Finance Budget	-23.39** (11.03)	-24.83** (12.16)	-26.16** (12.28)	-24.49** (11.94)	-23.54** (10.76)	-23.60** (10.81)	-23.72** (10.87)
Historical		0.06	0.05	0.04	0.03	0.02	0.02

Disaster Exposure		(0.083)	(0.085)	(0.085)	(0.08)	(0.08)	(0.08)
GDP per Capita			-44.75 (82.55)	-142.05 (87.38)	-122.95 (83.48)	-122.69 (84.15)	-119.30 (83.53)
Population Density				22215.66*** (6870.452)	14063.28* (7446.25)	14262.42** (7295.33)	13688.1** (7206.39)
Industrial Structure					765971.8* (428375.2)	766468.6* (429830.8)	776033.8** (428391.7)
Education Level						-30971.42 (219937.7)	-41177.73 (227549.6)
Infrastructure							-146549 (289376.3)
Constant	13800000*** (1201540)	12900000*** (1933338)	13600000*** (2618890)	7537160*** (2283997)	-678143.8 (5642244)	-368839.6 (5322985)	869454.1 (6171749)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	360	360	360	360	360	360	360
Adjusted R ²	0.2617	0.2642	0.2651	0.2718	0.2890	0.2891	0.2898

Note: (1) Standard errors clustered at the province level are reported in parentheses. (2) *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

4.3 Moderating Effect of Fiscal Autonomy

Table 3 reports the results after the interaction term between emergency fiscal budgeting and fiscal autonomy is added to the baseline model. The coefficient on the interaction term is negative and statistically significant. This result indicates that fiscal autonomy strengthens the disaster risk reduction effect of emergency fiscal budgeting. In other words, the negative association between emergency fiscal budgeting and disaster impacts becomes stronger as fiscal autonomy increases.

This finding supports **H2**. Fiscal autonomy does not simply operate as an independent institutional characteristic. It conditions how effectively emergency fiscal budgeting is translated into disaster governance outcomes. Where local governments have greater fiscal discretion, budgetary input is more likely to produce a stronger reduction in the population affected by natural disasters. The result suggests that the effectiveness of emergency fiscal budgeting depends not only on the level of fiscal input, but also on the institutional setting in which that input is used.

The mechanism is consistent with the argument developed in the hypothesis section. When fiscal autonomy is low, local governments face tighter fiscal constraints and have less room to adjust expenditure to local risk conditions. In such cases, they are more likely to depend on upper-level government support after disasters occur. This weakens incentives for sustained investment in prevention and preparedness. Budgetary resources are then more likely to be used for post-disaster response than for ex ante risk reduction.

By contrast, when fiscal autonomy is higher, local governments have more room to allocate resources in line with local hazard exposure and local policy priorities. This gives them greater flexibility to support early warning, preparedness, stockpiling, and other preventive measures before disaster losses expand. Under these conditions, emergency fiscal budgeting is more likely to generate a stronger disaster risk reduction effect. The moderating result therefore suggests that local fiscal discretion is an important condition for improving the effectiveness of disaster-related public spending.

Taken together, the results in Table 3 show that fiscal autonomy reinforces the negative

relationship between emergency fiscal budgeting and disaster impacts. This finding adds an institutional dimension to the baseline analysis. Emergency fiscal budgeting matters, but its effect is not constant across provinces. It becomes stronger where local governments have greater fiscal room to act.

Table 3: Moderating Effect of Fiscal Autonomy on Finance Budget Effectiveness

Variable	(7)	(8)
Emergency Finance Budget	-23.71** (10.87)	-41.11** (13.52)
Fiscal Autonomy		-5358235 (13000000)
BE*FA		-234.32*** (89.13)
Control Variables	Yes	Yes
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Sample Size	360	360
Adjusted R ²	0.2898	0.2997

4.4 Further Analysis

The baseline results show a stable negative association between emergency fiscal budgeting and disaster impacts. This relationship, however, may vary across regions. China shows marked regional differences in disaster type, economic development, and fiscal conditions. The descriptive statistics also point to substantial heterogeneity in disaster impacts across provinces. For this reason, the analysis is extended to a more specific setting. The focus here is on the central and western regions, where wind and hail disasters are more common. This subsample provides a useful case for examining whether the baseline pattern still holds under a more regionally concentrated hazard context.

Table 4 reports the results for the central and western regions. The coefficient on emergency fiscal budgeting remains negative. More importantly, the interaction term between emergency fiscal budgeting and fiscal autonomy is also negative and statistically significant. The direction of the result is consistent with the main model. Fiscal autonomy continues to strengthen the disaster risk reduction effect of emergency fiscal budgeting. In other words, greater local fiscal discretion is associated with a stronger mitigating effect of disaster-related budgetary expenditure in regions where hailstorms are more salient.

This result matters for two reasons. First, it shows that the moderating role of fiscal autonomy is not limited to the full national sample. The same pattern appears in a subsample defined by a more specific disaster context. Second, it suggests that local fiscal room may be especially important where disaster risks are regionally concentrated and response needs are more uneven across places. Under these conditions, budgetary flexibility appears to improve the capacity of local governments to translate fiscal input into effective disaster risk reduction.

Table 4: Disaster Reduction Analysis in Central and Western Regions of China

Variable	Central & Western Hailstorms
Emergency Finance Budget	-0.0006686*** (0.0002245)

Fiscal Autonomy	-130.4132 (415.1057)
BE*FA	-0.002054*** (0.0009681)
Control Variables	Yes
Year Fixed Effects	Yes
Region Fixed Effects	Yes
Observations	225
Adjusted R ²	0.1412

Table 5 further shows that the central and western subsample is characterized by lower average fiscal autonomy and lower average GDP per capita than the national sample, while the scale of wind and hail exposure remains substantial. This pattern helps explain why fiscal autonomy matters in this setting. Where fiscal resources are more constrained and risk exposure remains high, the ability to finance expenditure with local budgetary revenue becomes more consequential for disaster governance outcomes. Taken together, the further analysis reinforces the main argument of this study. Emergency fiscal budgeting reduces disaster impacts, and this effect becomes stronger where local governments have greater fiscal autonomy.

Table 5: Summary Statistics of Key Variables in Central and Western Regions of China

Variable	Mean	Std. Dev.	Min	Max
Disaster Relief Budget (10,000 RMB)	48671.11	45860.47	4412.5	324809.8
Hailstorms Affected Area (1,000 ha)	137.1151	142.1869	0.5	1128.93
Fiscal Autonomy	0.384061	0.1174101	0.0640036	0.6371768
Public Budget Revenue (billion RMB)	984.3631	799.145	12.03	3388.85
Public Budget Expenditure (billion RMB)	2368.755	1694.684	160.25	8008.89
GDP per Capita (RMB/person)	25433.59	11859.11	5218	59433

4.5 Robustness Check

The baseline results are estimated with the panel covering 2005-2016. A remaining concern is that the findings may be sensitive to the sample period. To address this issue, the analysis re-estimates the model using two alternative time windows. One extends the sample to 2002-2016. The other narrows it to 2012-2016. This test examines whether the main results depend on a particular temporal setting.

Table 6 shows that the main findings remain stable across both alternative specifications. The coefficient on emergency fiscal budgeting stays negative in both regressions. The interaction term between emergency fiscal budgeting and fiscal autonomy also remains negative. The direction of the estimates is therefore unchanged when the sample period is expanded or shortened. This result is consistent with the baseline analysis. Emergency fiscal budgeting continues to be associated with lower disaster impacts, and fiscal autonomy continues to strengthen that relationship.

Table 6: Robustness Check

	(1) 2002-2016	(2) 2012-2016
Emergency Finance Budget	-39.56*** (12.80)	-45.71** 23.06289
Fiscal Autonomy	-4581450 (13100000)	15800000 (11600000)

BE*FA	-230.44*** (87.52)	-346.90** (149.9242)
Control Variables	Yes	Yes
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Observations	422	151
Adjusted R ²	0.2980	0.3453

These results strengthen the credibility of the empirical findings. The baseline conclusion is not driven by a particular choice of starting year or ending year. Nor does the moderating effect of fiscal autonomy disappear when the time coverage changes. The robustness check therefore supports the stability of both the main effect and the interaction effect.

Taken together, the evidence from Table 6 suggests that the core argument of this study is temporally robust. Stronger emergency fiscal budgeting is linked to lower disaster impacts, and this effect becomes stronger where local governments have greater fiscal autonomy.

5. Conclusion

Emergency fiscal budgeting is a basic component of disaster governance. It supports disaster response and recovery, but its role is not limited to ex post intervention. It also matters for prevention and preparedness. This study examines that role with provincial panel data from China. The results show a stable negative association between emergency fiscal budgeting and disaster impacts. A higher level of budgeted expenditure on natural disaster living assistance is associated with a smaller population affected by natural disasters. This finding suggests that disaster-related fiscal commitment has a measurable disaster risk reduction effect. It also indicates that natural disaster impacts are not shaped by hazard exposure alone. They are influenced by the way governments prepare fiscally before losses expand.

The analysis also shows that fiscal autonomy strengthens this effect. Where local governments have greater fiscal room, emergency fiscal budgeting is more likely to reduce disaster impacts. This result adds an institutional dimension to the baseline finding. Budgetary input matters, but its effect depends on the fiscal setting in which it is used. Local fiscal discretion affects whether budgetary resources can be aligned with local hazard conditions and translated into effective prevention and preparedness. In this sense, the disaster risk reduction effect of emergency fiscal budgeting is not constant across provinces. It becomes stronger where local governments are better able to support expenditure with their own budgetary revenues.

These findings carry several policy implications. The first is that emergency fiscal governance should place greater weight on ex ante risk reduction. A system that concentrates too heavily on post-disaster relief cannot fully support whole-process disaster governance. Budgetary arrangements need to provide more stable support for prevention, preparedness, early warning, and related pre-disaster measures. The second implication concerns the allocation of fiscal authority and expenditure responsibility. If local governments remain the primary actors in disaster management, they also need a clearer and more workable fiscal framework. This includes clearer responsibility-sharing rules between central and local governments and more stable institutional support for local preparedness. The third implication concerns local fiscal capacity. Improving the disaster risk reduction effect of public spending requires not only higher fiscal input, but also stronger local fiscal room and better alignment between risk exposure and budgetary decisions.

This study also has limitations. Fiscal autonomy is treated here as a moderating condition, but the concept is more complex than a single ratio can capture. The analysis focuses on local fiscal self-reliance measured by local budgetary revenue relative to local budgetary expenditure. This

measure is useful, but it does not fully reflect broader institutional arrangements such as intergovernmental transfers, earmarked funds, or differences in formal expenditure responsibility. In addition, the study uses the population affected by natural disasters as the main indicator of disaster impact. This choice avoids some of the comparability problems associated with direct economic losses, but it does not capture all dimensions of disaster consequences. Future research can extend the analysis by refining the measurement of fiscal institutions, incorporating additional outcome indicators, and examining whether the relationship identified here varies across different institutional and hazard contexts.

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