“Man-Made” Natural Disaster

Impact of National Flood Detention Policy on Social Development in China

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Background and Question

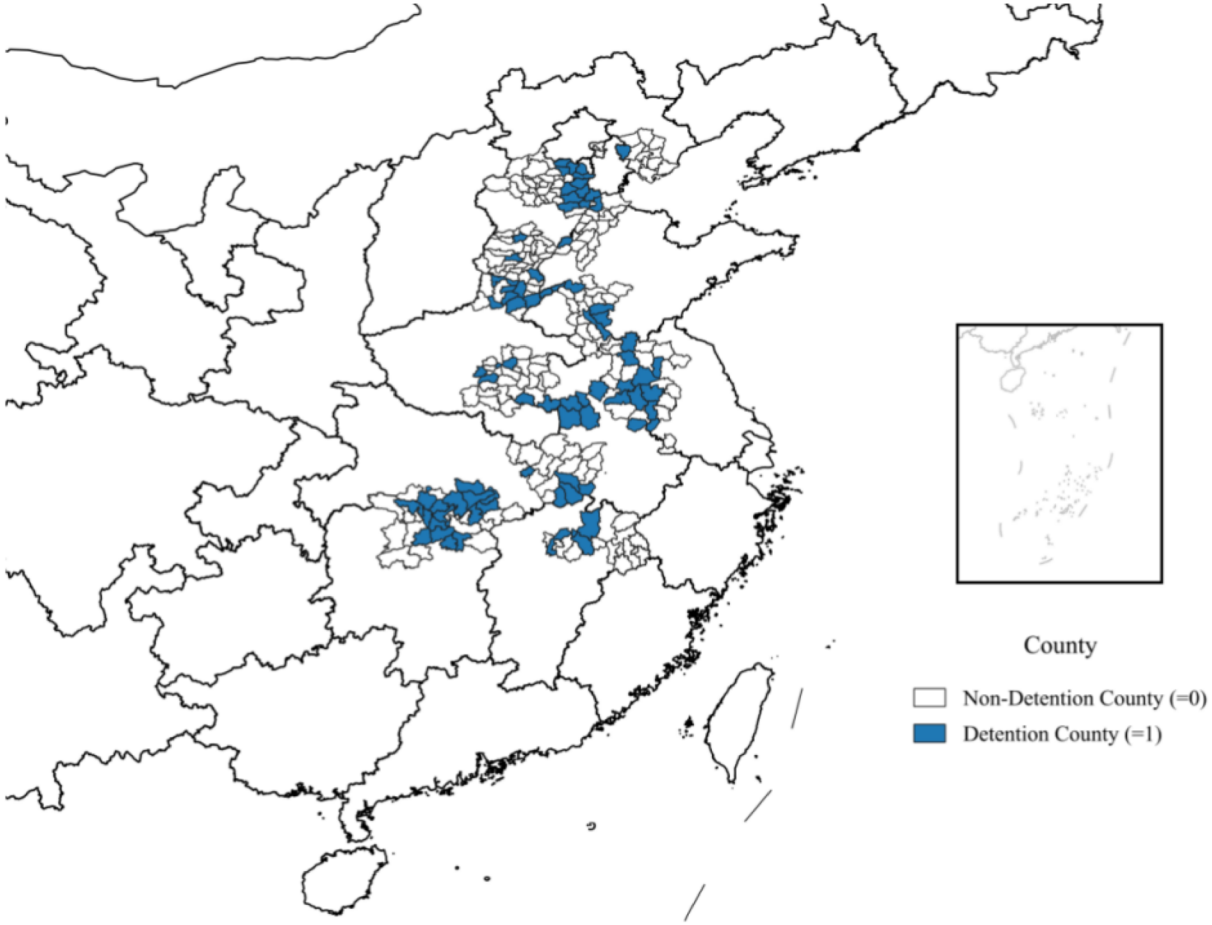
- **Introduction of "Flood Detention Policy":**
  - State Council, 2000: *Interim Measures for Compensation for Utilization of Flood Detention Areas*
  - **Flood Detention Area:** refers to low-lying areas and lakes designated by policy for the temporary storage of floodwaters outside embankments to ensure the safety of the key metropolises
  - **Local government** should: "organize relevant departments and sectors to facilitate the transfer and protection of personnel and property within the area,"
  - **key metropolises' government** (directly benefiting from detention and diversion) should: "establish support, compensation, and assistance systems for the detention area."
- **"Man-Made" Natural Disaster:**
  - refers to a series of human interventions – such as policies or infrastructure development – designed for natural disaster prevention, but which, result in the area **being subjected to ongoing higher potential disaster risks** compared to before these prevention measures were implemented
  - however, the occurrence of each disaster remains highly random, despite the continuous potential risks.
- **Question: What is the impact of "Flood Detention Policy" on the economic and social development of localities where detention area are located?**
- **Hypothesis:**
  - **H1:** After the introduction of flood detention policy, compared to "non-flood detention counties", the economic level of "flood detention counties" is likely to decrease
  - **H2:** After the introduction of flood detention policy, compared to "non-flood detention counties", the population size of "flood detention counties" is likely to decrease

Research Design

- **Model:**

$$Y_{it} = \beta_0 + \beta_1 DID + \gamma_k \sum_{k=1}^{n} X_{kit} + \lambda_i + \nu_t + \varepsilon_{it}$$

  - Y represents variables related to development
  - DID represents the interaction term between treatment variable and period variable
- **DID=DetentionArea × T:**
  - DetentionArea (treatment variable):
    - 1 refers to (75 detention counties)
    - 0 refers to (166 non-detention counties)
  - T (period variable):
    - 1 refers to year 2001 and after (detention policy introduced)
    - 0 refers to year before 2001
- **Dependent Variable:**
  - Economic: GDP
  - Social: average household size (number of people per household)



Sample: 241 counties within the jurisdiction of the prefecture-level cities which has flood detention zone

Baseline Results

- For economic:
  - GDP in counties within flood detention areas shows **a decrease** compared to those not within
  - Indicating that larger potential natural disasters can exert short-term or long-term negative effects on economic activities in locality
- For social:
  - Household size in counties within flood detention areas shows **a reduction** compared to those not within
  - Specifically, a decrease of approximately 5 individuals per 100 households in comparison to counties not designated as flood detention areas
  - Indicating that larger potential natural disasters can heighten residents' awareness of disaster risk, prompting some degree of population migration

- Robustness Checks:
  - Check1: placebo policy year (2000→1998)
    - Considering the Yangtze River Flood in 1998
  - Check2: PSM-DID
    - Self-selection bias: underdeveloped regions → flood detention areas?
    - Considering if treatment group and control group is comparable

	Regional GDP (ln_gdp)		Average Household Size (household_size)	
	(1)	(2)	(3)	(4)
	DID	DID_FE	DID	DID_FE
DID (DetentionArea×T)	-0.062	-0.069**	-0.049	-0.052*
	(0.05)	(0.03)	(0.04)	(0.03)
Constant	2.550***	3.643	4.251***	11.545***
	(0.25)	(2.32)	(0.20)	(2.65)
Control Variables	Yes	Yes	Yes	Yes
County Fixed Effects	No	Yes	No	Yes
Time Fixed Effects	No	Yes	No	Yes
Adjusted R-squared	0.510	0.720	0.144	0.456
Section	9	9	9	9
Observation	1,966	1,966	1,966	1,966

Note: Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.001.

Concluding Remarks

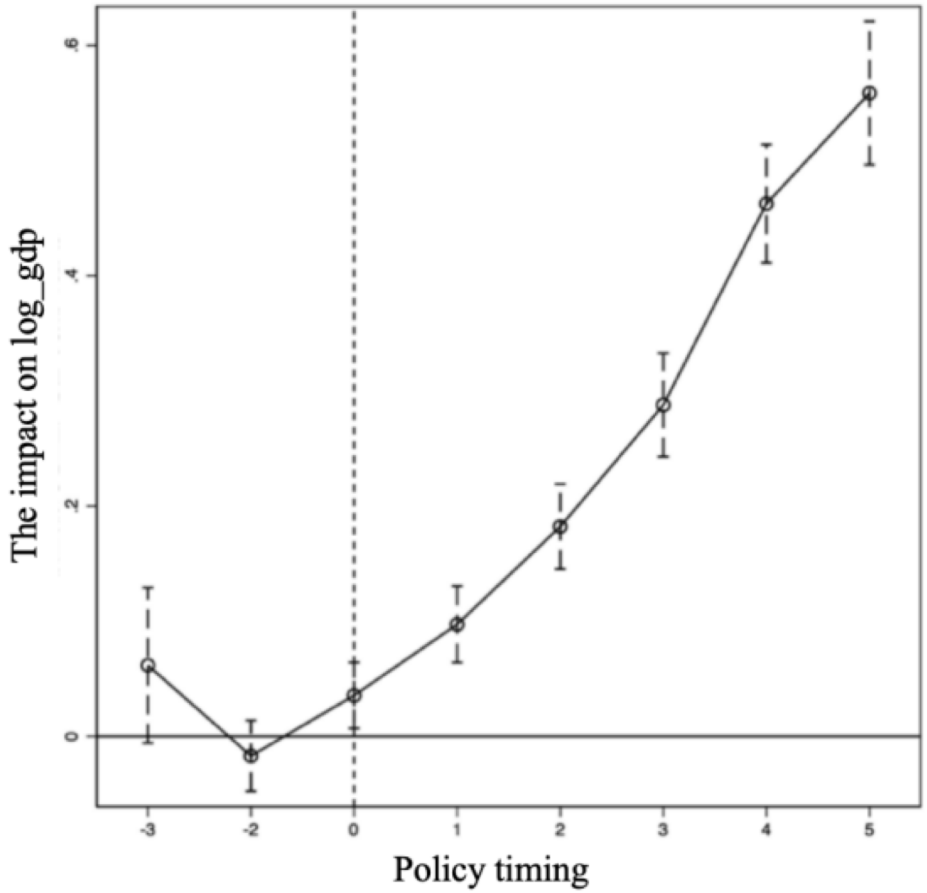
- Findings:
  - After the introduction of flood detention policy, compared to "non-flood detention counties", the economic level of "flood detention counties" is likely to decrease
  - After the introduction of flood detention policy, compared to "non-flood detention counties", the population size of "flood detention counties" is likely to decrease
  - Such negative effects are more likely the consequences of the flood detention policy itself, rather than the flood shocks or the use of flood detention areas (an alternative explanation is excluded)
- Problems:
  - Endogenous: (1) how flood detention areas / counties designated? (2) the impact of policy or the impact of flood shock?
  - Method: RDD as a better option? threshold cannot be set (standard of setting flood detention areas is unknown)
  - How to define "Man-made"? Use? Designation?
- For further research:
  - Compensation Effect: after the use of flood detention areas, what kinds of compensation the flood detention county will get? And, what is the impact of this compensation on economic and social development?
  - Mechanism: still unclear, case study (interview, archive materials…)

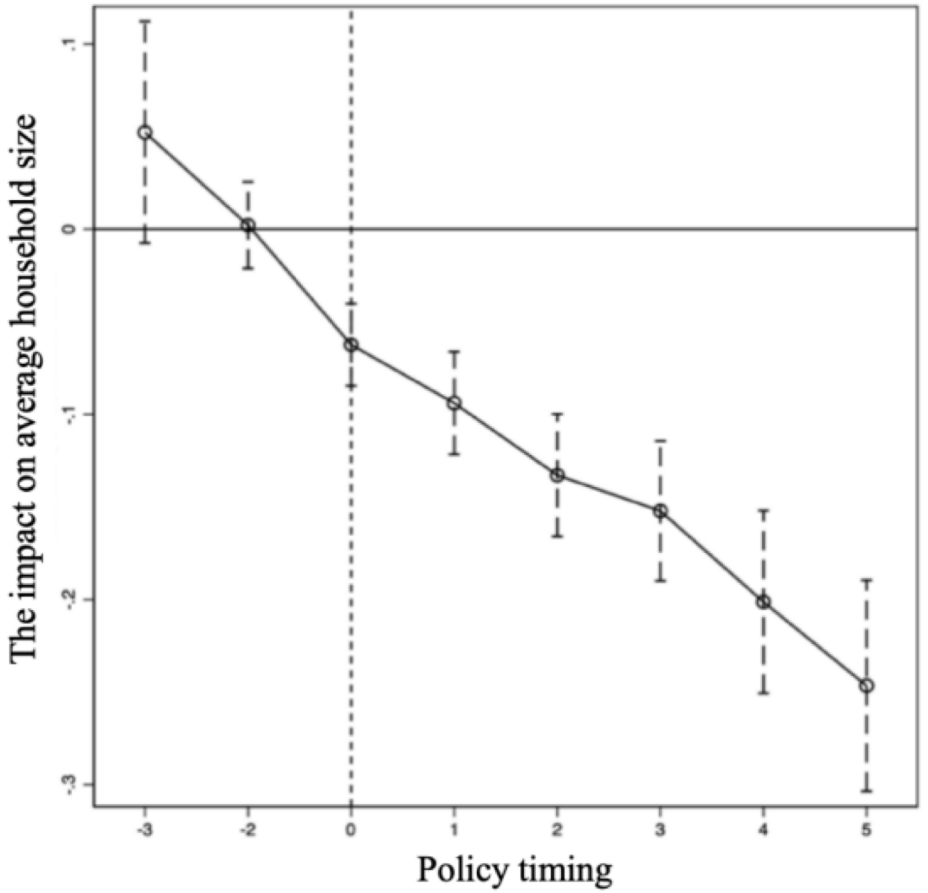
Appendix: Exclude Potential Alternative Explanation

- **Alternative explanations:**
  a. **The use of these flood detention areas** (i.e., the actual occurrence of natural disasters), rather than their designation as national flood detention areas by policies, has a substantial impact on local social development
  b. Counties designated as flood detention areas have **historically been frequently impacted by flood shocks** that both their designation and the decline in their socio-economic development levels are consequences of flood shocks.
- **Case:** historical archives from local flood detention areas in Henan Province
  a. before the policy, the local flood detention areas was informal
  b. after the policy, the "natural disaster risk" becomes the "man-made natural disaster"
  c. local comprehensive record of the use of flood detention areas before 1990, which allows to assess the impact of flood shocks and the use of detention areas on a more micro level (village)
- **Variables and Methods:**
  - Dependent variables: net income per capita, population size in 1990
  - Independent variables: number of times the flood detention area has been used
  - Method: intraclass correlation coefficient model (ICC), village-level, region-level
- **Findings:**
  - for villages located within the flood detention area, the historical impact of flood disasters and the use of flood detention area do not significantly reduce the economic development level and the population size of the village

Appendix: Parallel Trends Test

- An event study approach: pre-treatment (1997–1999), post-treatment (2001–2005)
  - $Y_{it} = \beta_0 + \sum_{j=-3}^{5} \delta_j DID_{i,t-j} + \gamma_k \sum_{k=1}^{n} X_{kit} + \lambda_i + \nu_t + \varepsilon_{it}$





Appendix: Robustness Check

- Robustness Check1: placebo policy year
- Robustness Check2: PSM-DID (propensity score matching)

	Regional GDP (ln_gdp)		Average Household Size (household_size)	
	(1)	(2)	(3)	(4)
	Placebo Policy Year (1998)	PSM-DID	Placebo Policy Year (1998)	PSM-DID
DID (DetentionArea×T)	-0.126	-0.061*	0.047	-0.056**
	(0.05)	(0.03)	(0.05)	(0.03)
Constant	3.677	12.512***	11.696***	3.943***
	(2.30)	(0.04)	(2.64)	(0.03)
Control Variables	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	No	Yes	No
Time Fixed Effects	Yes	No	Yes	No
Adjusted R-squared	0.718	0.671	0.452	0.374
Section	9	9	9	9
Observation	1,966	1,966	1,966	1,966

Note: Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.001.

Appendix: Exclude Alternative Explanations

	(1)	(2)	(3)	(4)
variable	perincome	perincome	pop1990	pop1990
area_hisapply	-2.230	-1.461	-3.029	7.035
	(3.18)	(2.98)	(5.78)	(8.23)
Level1: Village Level				
safepop_percent		1.773*		19.772
		(1.06)		(75.85)
perland		-3.279		-15.427***
		(2.01)		(3.60)
high		0.009*		-0.170
		(0.01)		(0.34)
Level 2: Region Level				
area_hisyear		-13.574		11.064
		(8.71)		(7.23)
area_villdiba		2.674**		0.124
		(1.20)		(3.31)
area_dam		74.302		-332.963**
		(62.74)		(153.88)
area_villagenum		0.926		4.372
		(0.75)		(3.48)
area_unexpected		227.064***		0.369
		(80.57)		(266.84)
Constant	550.068***	778.015**	1,223.398***	816.833**
	(52.68)	(346.74)	(103.94)	(380.98)
AIC	3711.501	3701.687	6283.767	6290.637
BIC	3727.208	3748.81	6299.622	6338.2
Observations	375	375	389	389
Number of groups	14	14	15	15

Note: Cluster robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.001.