

# Analysis of multi-region direct/indirect socio-economic effects of the Three Gorges Project

## 三峡工程的直接和间接社会经济与环境效益核算与分析

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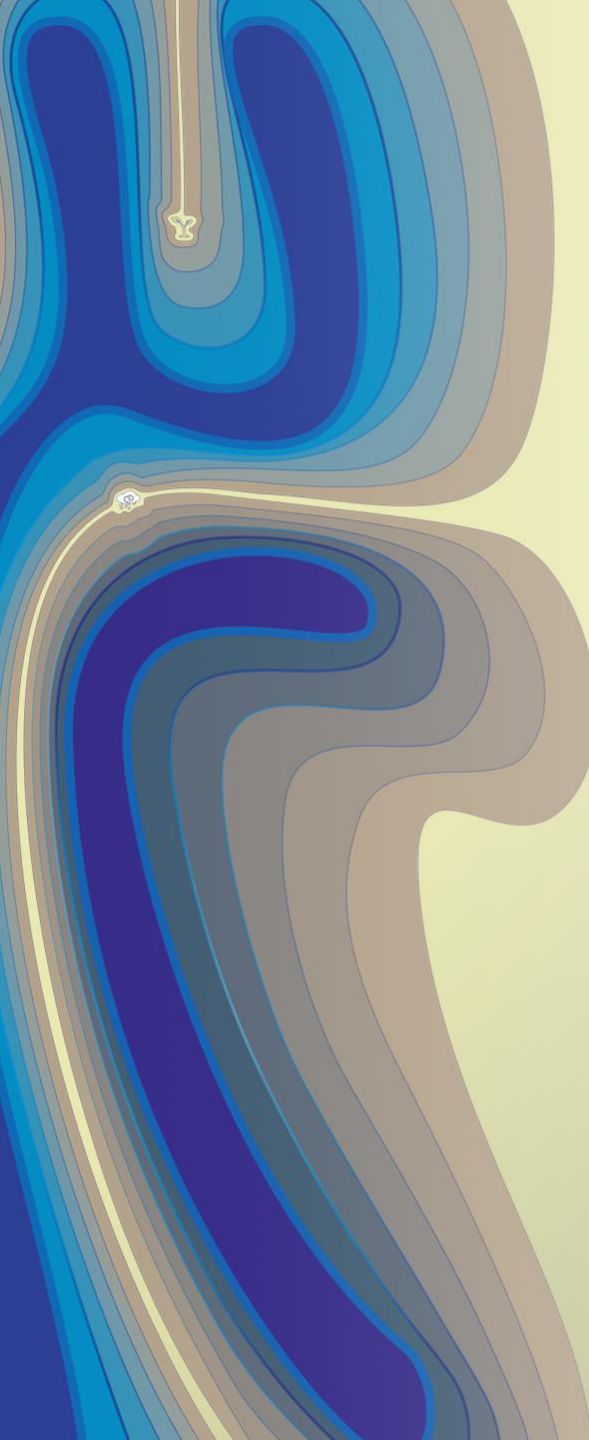
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## 三峡工程 The Three Gorges Project

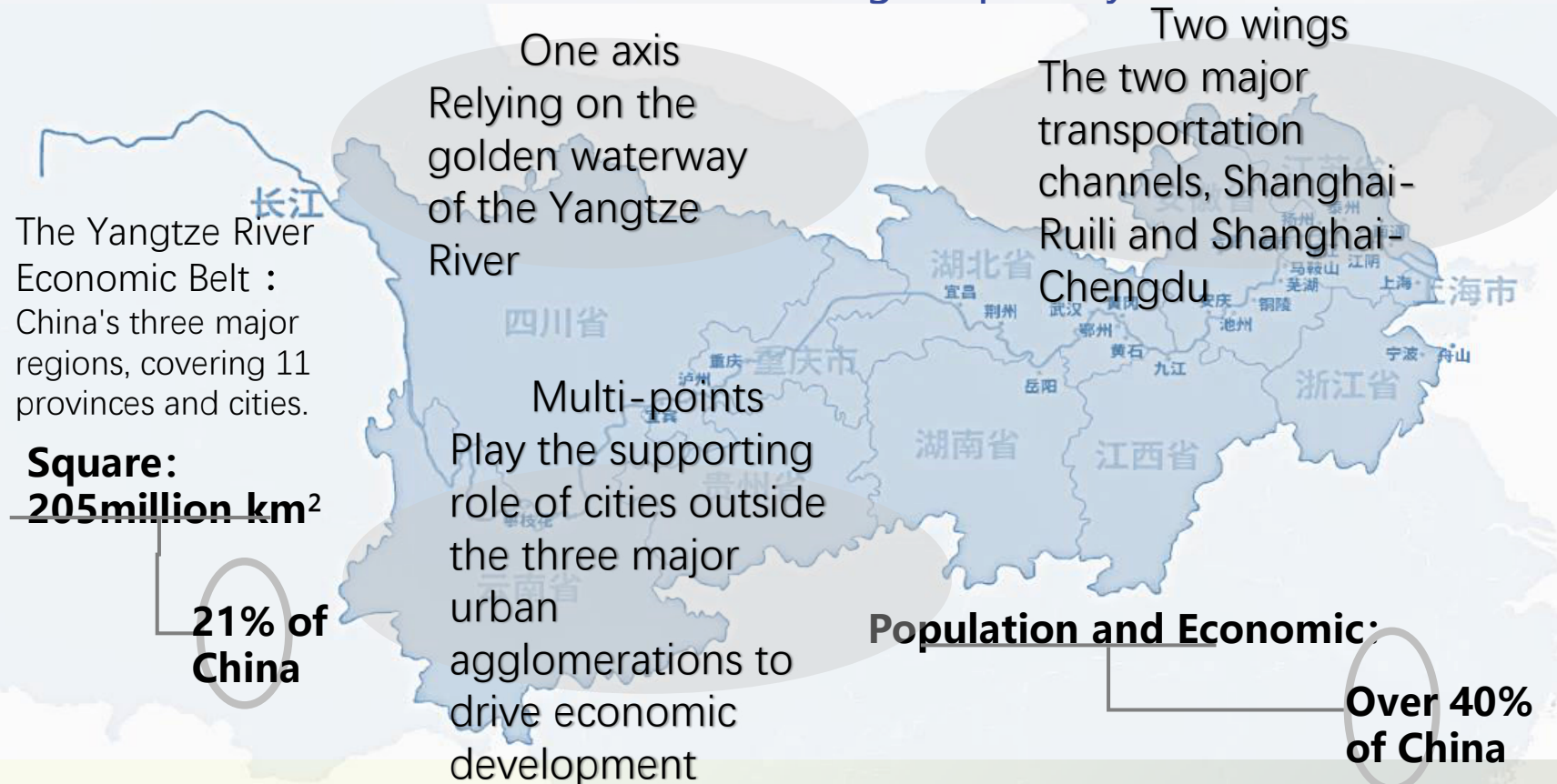
- The Three Gorges Project began construction in 1994 and began impounding water for power generation in 2003. It was not fully completed until 2009. It has been 90 years since Sun Yat-sen proposed the construction of the Three Gorges in 1919.
- Since its completion, the Three Gorges Dam has been the world's largest hydropower station and the largest engineering project ever built in China. It has become the world's largest hydropower station and clean energy production base, and is also the center of the Yangtze River Golden Waterway.



## “依托黄金水道，建设长江经济带”

### "Build the Yangtze River Economic Zone relying on the golden waterway"

The Outline of the Development Plan for the Yangtze River Economic Belt proposes a "One axis, Two wings, Three poles, and multi-points" pattern for the industrial layout and development direction of the Yangtze River Economic Belt, based on the idea of "ecological priority, basin interaction, and intensive development".



## 日益凸显的长江流域问题 The increasingly prominent problems in the Yangtze River Basin

The Yangtze River is the third largest river in the world and the largest river in China. The basin has gathered about 33 % of the country's population and created about 34 % of the gross national product. Frequent and severe floods also threaten vast areas within the basin, especially the economically developed middle and lower reaches of the plain, restricting economic and social development and seriously affecting the ecological environment.



The spatio-temporal differentiation of precipitation in the basin is significant



ecological environment problems



Water pollution



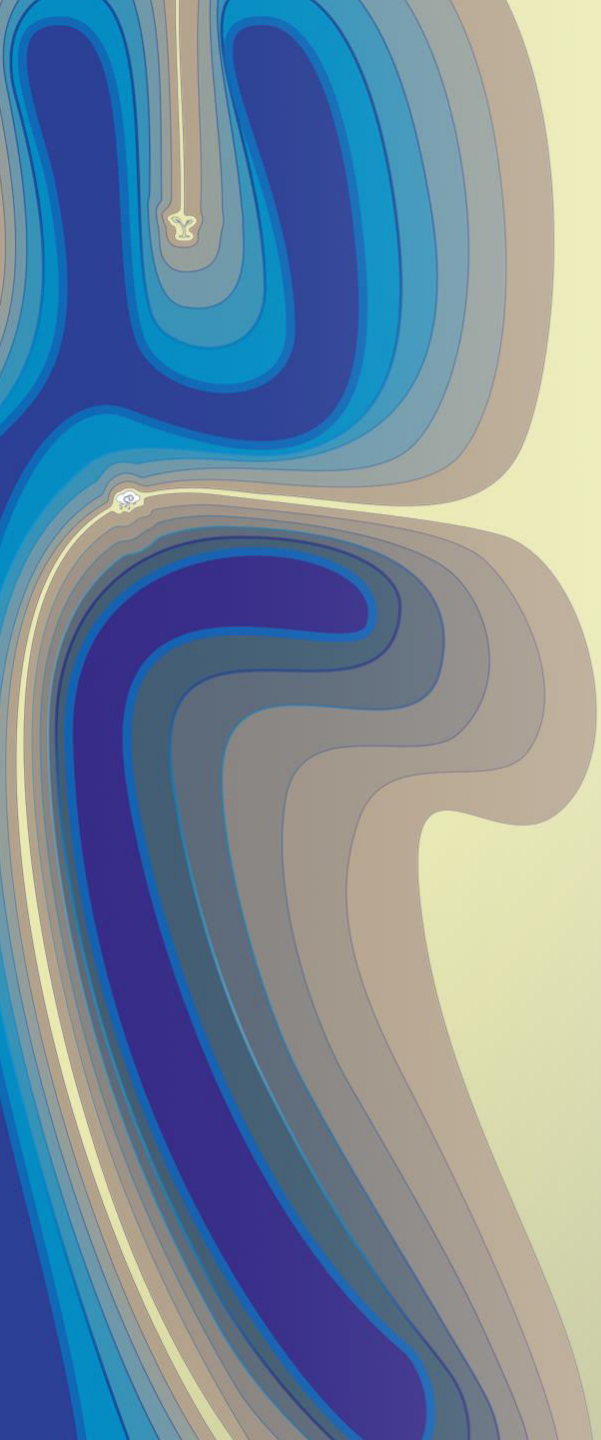
soil erosion and sediment accumulation



Local rainstorm and flood



High temperature and heat wave

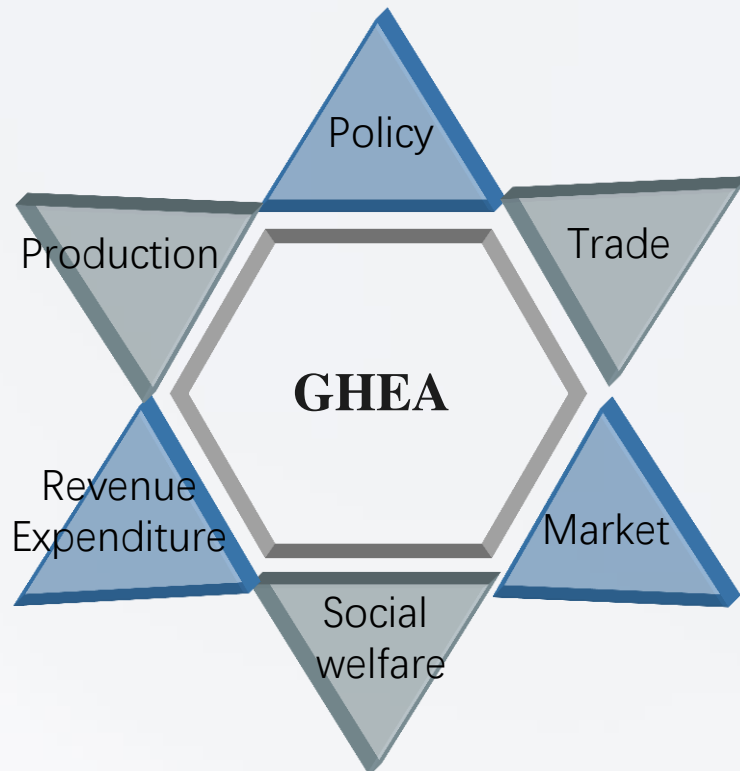
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# Research method: General Hydraulic Engineering Equilibrium Analysis Model

GHEA model (General Hydraulic Engineering Equilibrium Analysis Model) is a CGE model (computable general equilibrium model)



Simulate the impact of policy changes or external shocks on regional socio-economic and ecological environment.



GHEA includes 6 modules:

Production module

Trade module

Revenue and Expenditure Module

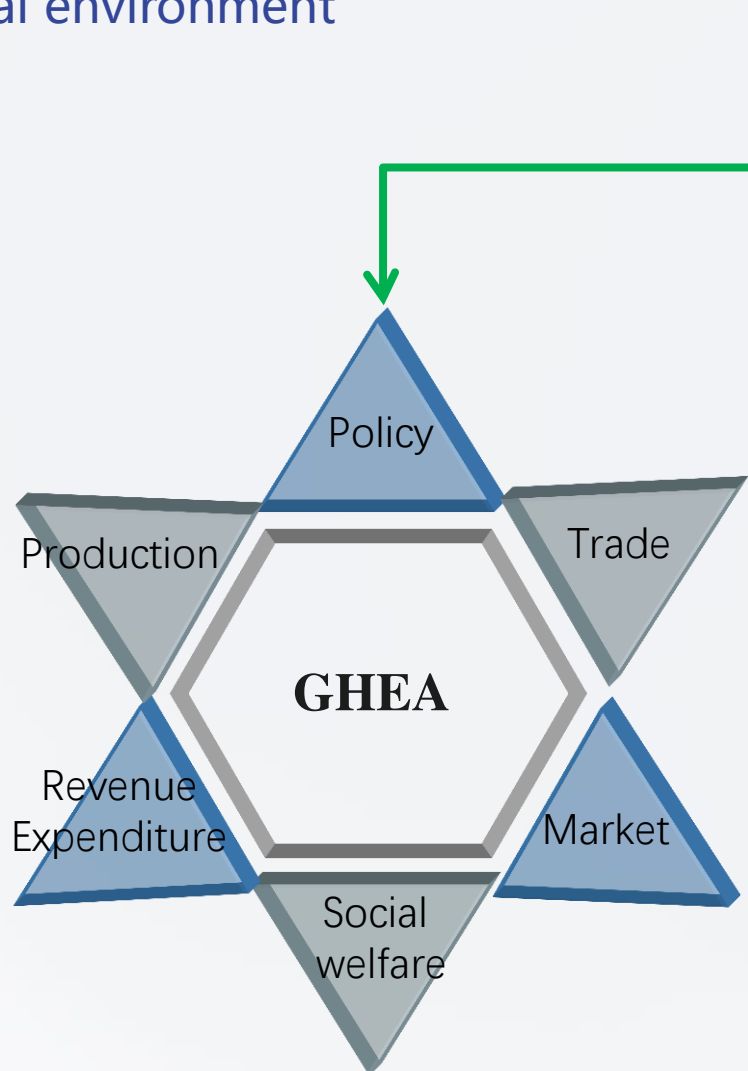
Policy module

Social welfare module

Market module



GHEA model: Analyze the effects of different water conservancy policies on social economy and ecological environment



**Impacts related to policies such as flood control / water conservancy projects**

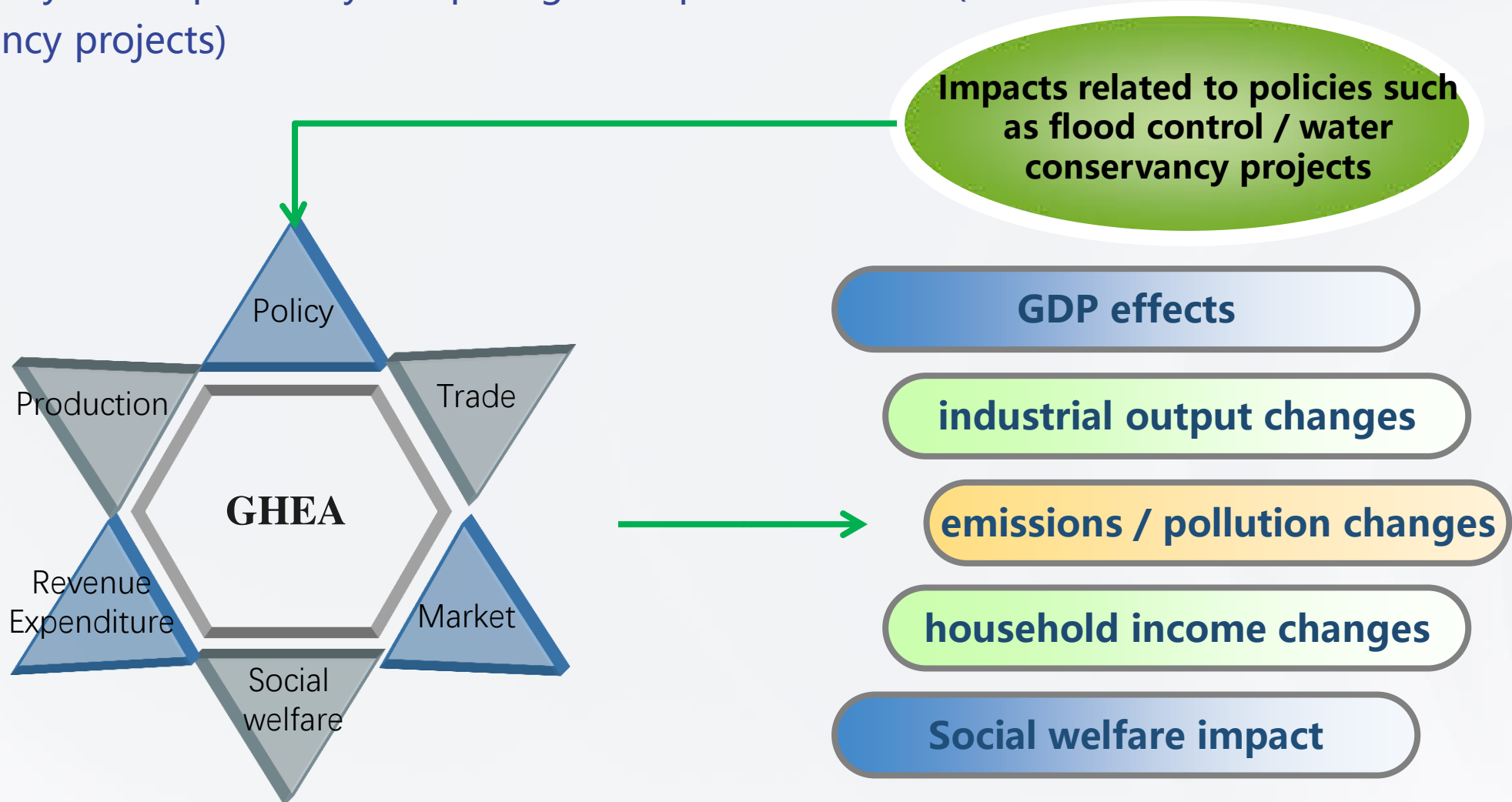
**Flood control / water conservancy project construction and other policies**

- can bring different socio-economic and ecological environment impacts
- lead to changes in related decisions

**These changes...**

- Considered as an "external shock"
- and break the original "balance" state of the system

The GHEA model evaluates the socio-economic and ecological environmental effects of water conservancy development by comparing the equilibrium state (such as with or without water conservancy projects)



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## Study on Indirect Flood Control Benefits of the Three Gorges Project:

- The flood losses reduced by the Three Gorges Project are its direct flood control benefits



Protect farmland from inundation loss



Protect the house from the loss of flooding



Protect industrial capital loss



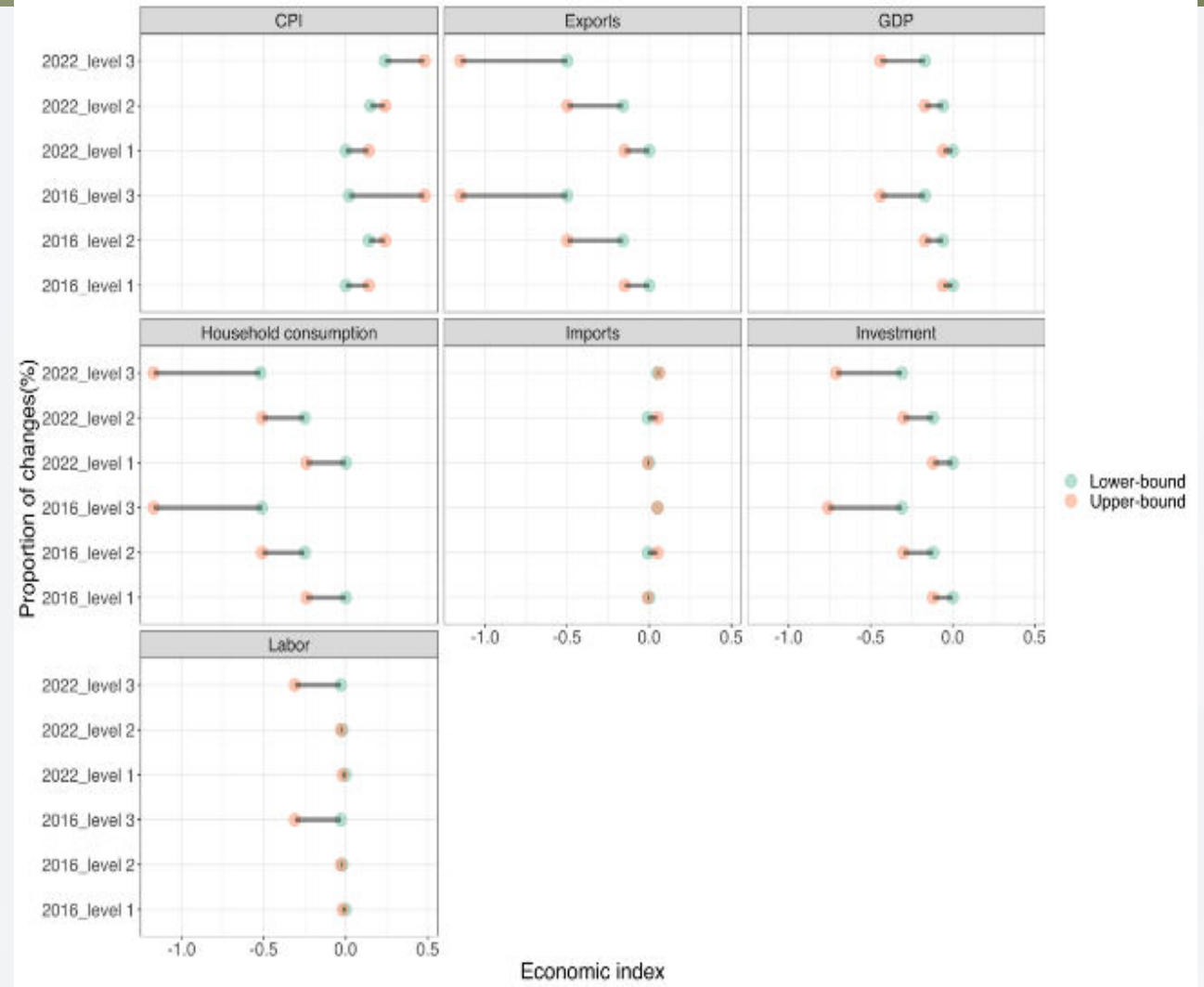
Protect the road from flooding

On this basis, the protection function of the Three Gorges Project can also be passed, gathered and amplified through the industrial chain, resulting in indirect effects on various industries such as household consumption, government investment, departmental output, and labor employment. These benefits are **indirect flood control benefits**

- Developed the equilibrium accounting model of indirect flood control benefits of the Three Gorges Project (WCGE)
- Quantified the indirect benefits of the Three Gorges Project in flood control, as well as the medium and long-term impacts of various post-disaster reconstruction policies
- The Three Gorges Project module was added to the traditional CGE model to reflect the "protection function" of the Three Gorges Project construction (that is, protecting areas that are not flooded)
  
- The indirect flood control benefits of the Three Gorges Project...
  
- Starting from the function of the Three Gorges Project, quantify its protective effect on production factors such as capital, land use, and labor
- Identify the indirect benefits brought by flood control function
- Using factor analysis to quantify the impact of multiple influencing factors and their interaction on the medium and long-term indirect flood control benefits of the Three Gorges Project

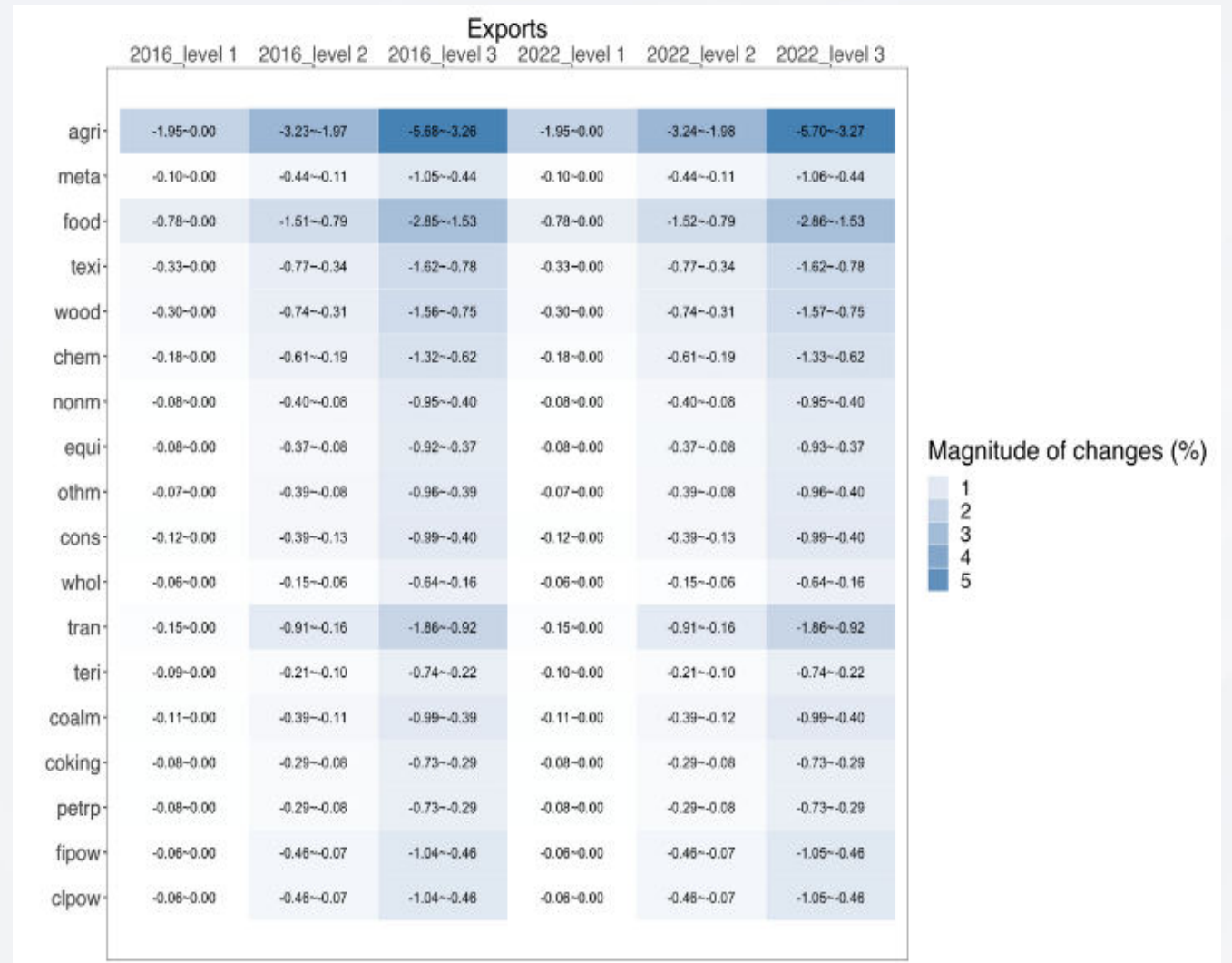
# Innovative achievements

- The results shows:
- When facing floods with a return period of 10-year, 100-year, and 1000-year, the indirect flood control benefits of the Three Gorges Project are 21.9 billion yuan, 187.1 billion yuan, and 429.7 billion yuan (accounting for 0.04%, 0.39%, and 0.86% of the GDP of the Yangtze River Economic Belt), and the direct flood control benefits are 16.604 billion yuan, 125.424 billion yuan, and 206.019 billion yuan, respectively.



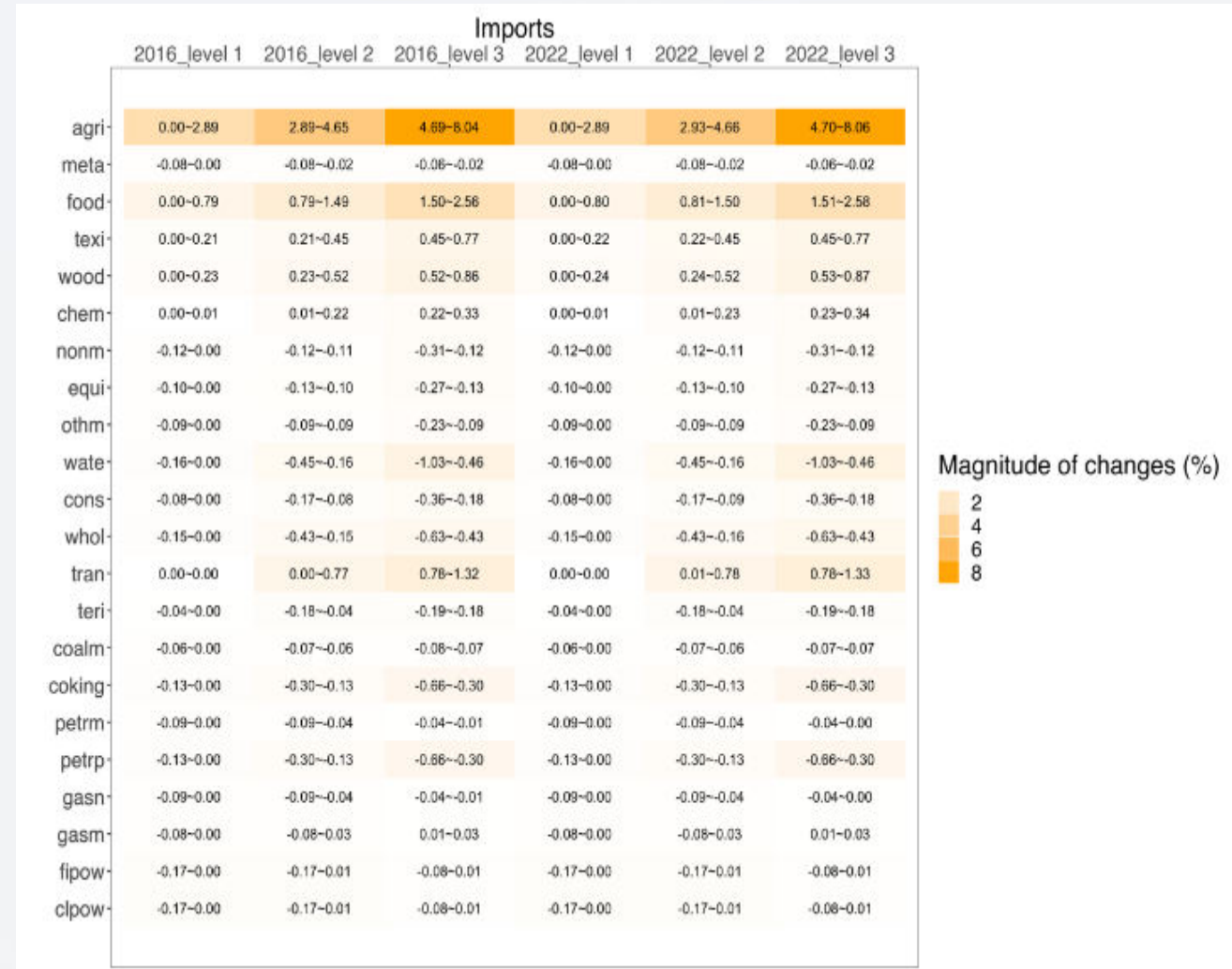
Protective effect on various economic indicators

- The results shows:
- The flood control capacity of the Three Gorges Project is mainly manifested in the ability to mitigate the rise in the consumer price index (CPI) of residents after the disaster, with the mitigation rates of 0.14 %, 0.24 %, and 0.48 % for the three scenarios, respectively.



The protective effect on exports of various sectors

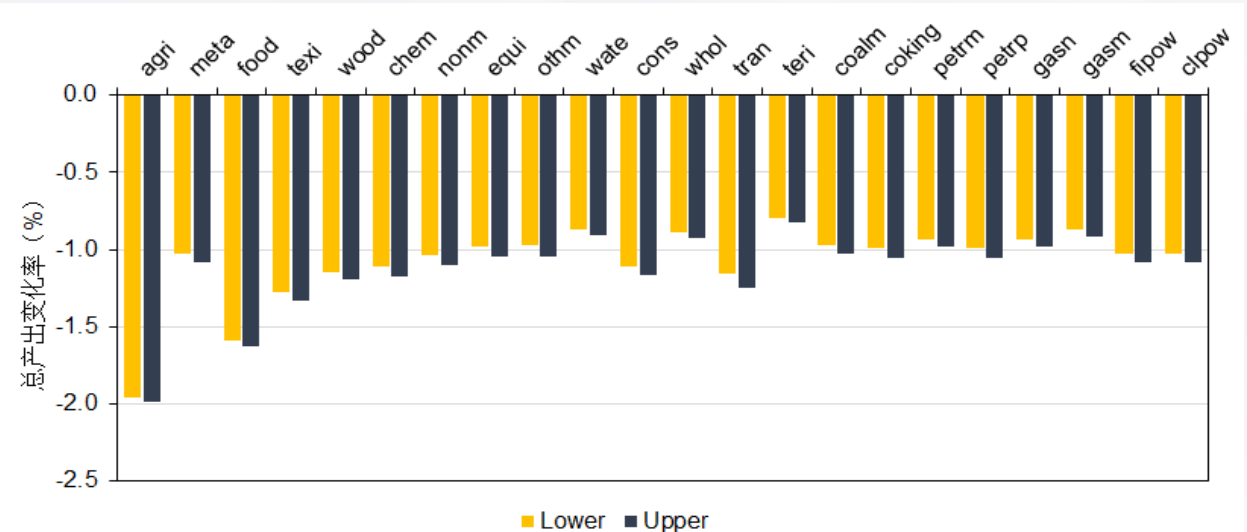
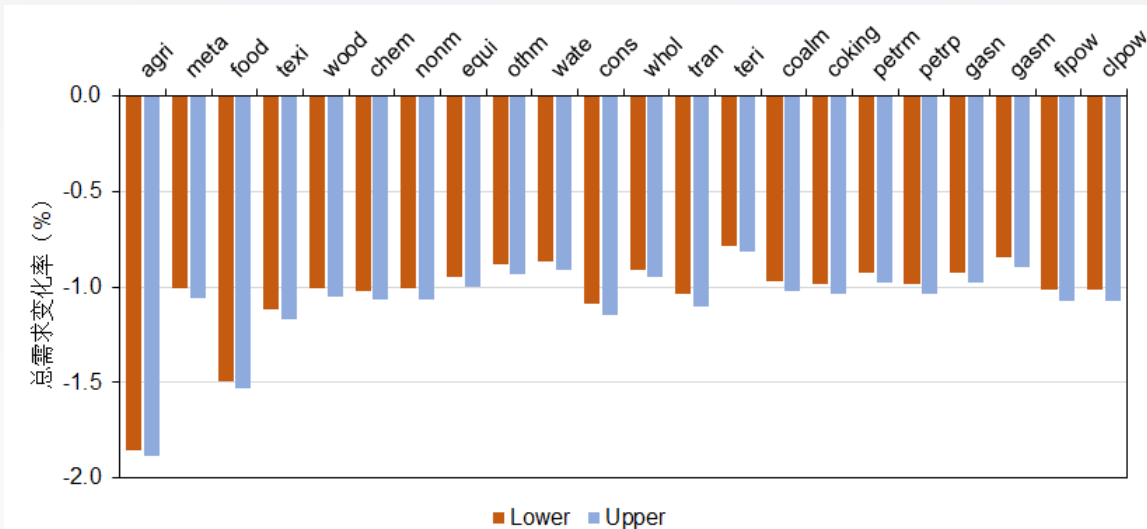
- The results shows:
- At the same time, it can alleviate the negative impact of floods on the import and export of goods in the Yangtze River Economic Belt, with the mitigation rates of 0.17 %, 0.53 %, and 1.20 % for the three scenarios, respectively.



Protective effect on imports in various sectors



- The results also shows:
- The study also found that the indirect flood control benefits of the Three Gorges Project include:
- Helping reduce the loss of total output of various departments, with the loss reduction amount exceeding 1 % of the total output,
- Among them, agriculture, food and tobacco processing, and textile industry have the largest losses.
- Overall, the indirect flood control benefits of the Three Gorges Project include:
  - Reduced the GDP loss of 0.18 ~ 0.26 % in the long economic belt
  - Avoid 0.31 ~ 0.42 % price increase



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- #3 main conclusions:
- **The Three Gorges Project will help reduce long-term GDP losses related to floods by approximately 50 %:** in the long run, the flood control capacity of the Three Gorges Project can protect [129. 99, 304. 78] [471. 48, 1706. 15], [1022. 57, 2380. 39] billion yuan of GDP from being damaged by floods each year.
- **The Three Gorges Project will help the construction and service industries seize the opportunity of post-disaster reconstruction and achieve further development.**
- At the same time, effective flood control is more effective than aggressive post-disaster fiscal stimulus in reducing long-term GDP losses caused by floods, **as "prevention" is far more important than "compensation"**.