Estimation of an equilibrium model with externalities: Post-disaster neighborhood rebuilding Fu, C. and Gregory, J., 2019

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Motivation

- **Key questions**: How to isolate the spillover effects of neighbors' choices to one's choice.
- Build a dynamic equilibrium model to capture these strategic interactions.
- Application: rebuilding of neighborhoods affected by Hurricane Katrina under the Louisiana Road Home program (RH).

Background: RH Program

- RH program provided financial assistance to homeowners affected by Hurricane Katrina. The program was announced in February 2006.
- Two types of assistance:
  (1) Rebuilding: up to 150,000
  (2) Relocation: up to 150,000 conditional on turning over the property to the state.

Data

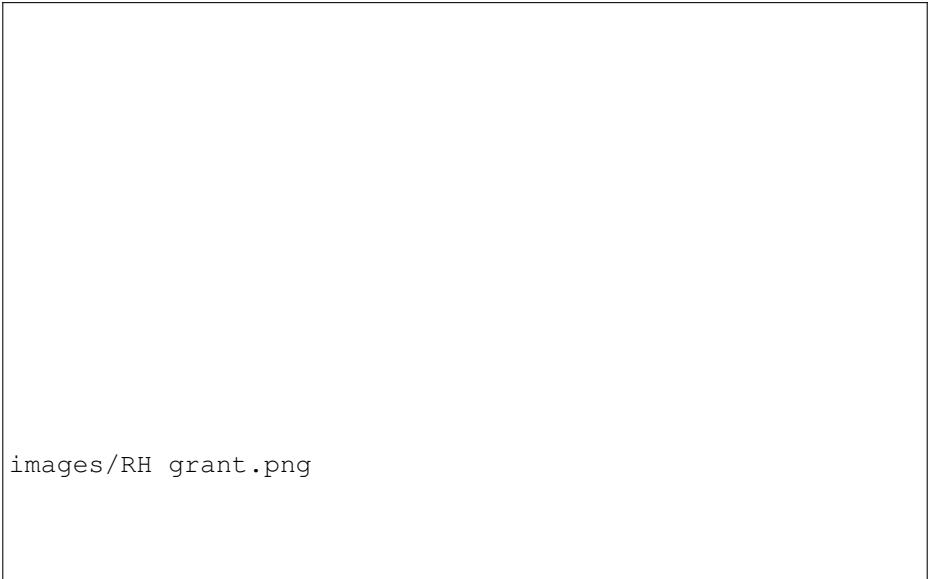
- Assessor's property data: time of home repairs & sales; transaction prices. 2004-2010
- Road Home program data: application dates, grant amounts, grant type, cost appraisal, and private insurance payments paid to households.
- FEMA data: damage assessments (depth of flooding).
- 2000 Census data: demographic characteristics of the neighborhood.
- DNORS, ACS: salary and employment data.
- Federal Reserve Bank of New York Consumer Credit Panel/Equifax: neighborhood-level credit scores.

Data are merged by street address: 60175 households living in 4795 blocks.

Summary Statistics

Table 1

RDD



Model Framework

- Agents (homeowners) decide whether to rebuild after a disaster.
- Payoff function incorporates direct costs and benefits from neighbors' decisions.
- Markov Perfect Equilibrium (MPE) used to model strategic interactions.

Utility Function

$$U_{i,t} = \beta_0 + \beta_1 R_i + \beta_2 X_i + \beta_3 \sum_{j \neq i} w_{ij} R_j + \epsilon_{i,t},$$

where:

- $R_i = 1$ if agent i rebuilds, 0 otherwise.
- X_i represents homeowner characteristics.
- w_{ij} is the weight capturing influence from neighbor j.
- $\epsilon_{i,t}$ is an idiosyncratic shock.

Dynamic Decision Making

$$V_i(s_t) = \max_{R_i \in \{0,1\}} \left[U_{i,t} + \delta \mathbb{E} V_i(s_{t+1}) \right]$$

- $V_i(s_t)$ is the value function given the state s_t.
- δ is the discount factor.
- Future payoffs depend on neighborhood rebuilding decisions.

Estimation Strategy

- Uses two-step estimation:
  (1) First, estimate structural parameters using observed decisions.
  (2) Second, simulate counterfactual policies to evaluate welfare effects.
- Incorporates a nested fixed-point algorithm for equilibrium computation.

Conclusion

- Externalities significantly impact rebuilding decisions.
- Strategic interactions must be accounted for in policy design.
- Future research: extending the model to different disaster settings.