

# Estimation of an Equilibrium Model with Externalities: Post-Disaster Neighborhood Rebuilding *Replication Code*

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## Replication

We are unable to post the main data sources used in this paper, but here we provide the code used to generate the paper's main results. These files can be used for replication if a researcher obtains the underlying data. Access to the confidential administrative data from the Road Home program requires entering into a data sharing agreement with the state of the Louisiana. The Assessor's data can be purchased from the Orleans Parish Assessor's office. The geographically identified version of the Displaced New Orleans Residents Survey can be obtained by following the application process on RAND's website.

## Code

1) ./1.Recodes and Reduced Form Estimates/

- 1.merge\_non\_RoadHome\_sources.do: This program merges data from the DNORS survey, FEMA block-level flood measures, and Census tract-level demographic measures to household-level property assessment data from the Orleans Parish Assessor's Office.
- 2.Import\_Road\_Home\_data.do: This program loads the administrative data from the Road Home program and merges them to the household-level Assessors merged dataset created in the previous step.
- 3.fully\_impute.do: This program performs imputations of missing values for key variables using the procedure described in Online Appendix II.

- 4.export\_exogenous\_model\_vars\_for\_estimation.do: This program saves the variables created with Stata as Matlab-readable .csv files. It also creates and saves a Stata dataset with one observation for each *pair* of homes, to be used when examining heterogeneity in spillover effects by distance to the rebuilding neighbor.
- 5.Spillovers\_analysis.do: This program performs some final recodes and then performs much of the papers reduced form analysis.

Output: Tables 1, 2, and 3; Figures 1, 2, and 4

- 6.Pairwise\_dataset\_spillover\_RDs.do: This program computes RD estimates of the strength of the spillover effect of a neighbor rebuilding as a function of distance from the rebuilding neighbor.

Output: Figure 3

## 2) ./2.Counterfactual Policy Simulations/

- A0a.import\_data.m: This program reads the analysis dataset into Matlab.
- A0b.ConsumptionPaths.m: For each household, this program computes the consumption utility associated with each possible rebuilding choice (period 1, 2, 3, 4, 5, or never) under each of the counterfactual policies that we consider. To do this, the program loops over households and rebuilding choices, calling programs B2a.find\_CStar.m (unconstrained households) and B2a.find\_CStar\_BC.m (borrowing-constrained households) each time through the loop.
- A1.cf.simulations.m: This program simulates households' equilibrium rebuilding choices under RH and under the various counterfactual policies using the subroutine B2b.SimulateChoices.m. Specifically, as in Sauer and Taber (2017), we first take draws of  $\epsilon_i$ ,  $b_j$ , and borrowing constrained status from a known distribution and compute equilibrium rebuilding choices on each block for each of 80 separate sets of these draws for each block. We then compute the likelihood of each combination of draws that would be necessary to generate identical incentives under our estimates of the equilibrium model's parameters and compute block-level importance weights, again following Sauer and Taber (2017), that reflect the likelihood of each simulation under the estimated model. When tabulating the simulation results, we weight the simulated outcomes by these importance weights.
- B2a.find\_CStar.m: This program computes the optimal consumption path associated with a particular set of financial incentives and a particular choice of when to rebuild for households who are free to borrow.

- `B2a.find_CStar_BC.m`: This program computes the optimal consumption path associated with a particular set of financial incentives and a particular choice of when to rebuild for households who are borrowing constrained.
- `B2b.SimulateChoices.m`: This program simulates equilibrium rebuilding choices for a given set of draws of the model’s stochastic variables and a given set of model parameters.
- `B3.ComputeImpWeights.m`: This program computes an importance weight for each simulated block, as in Sauer and Taber (2017), by comparing the likelihood of a particular simulated block under the known distribution used in the simulations and the likelihood of the draws needed to generate identical incentives under the estimated model parameters.
- Publicly available utility programs: `gendist.m`, `getindex.m`, `gridmake.m`, `parsave.m`

### 3) `./3.Goodness of Fit and Policy Simulations/`

- `0.import_simulation_output.do`: This program reads the results of the simulations done in Matlab into Stata.
- `1.goodness_of_fit.do`: This program creates tables and figures assessing the model’s fit to the data.

Output includes Table 5; Figures 7, 8, and 9

- `2.process_policy_simulations_and_welfare.do`: This paper performs welfare calculations for the policies considered in the paper and summarizes the “optimal” policy design calculations.

Output includes Tables; Figure 10

## Variable Definitions:

- **A0**: Household’s initial assets draw.
- **ClosingOption**: Road Home grant option chosen (0 = nonparticipant).
- **damage\_home\_imp**: Imputed damage categories using matching procedure with DNORS survey responses (1=Not damaged, 2=Damaged, but livable, 3=Damaged, not livable, 4=Destroyed).
- **damage\_home\_impflag**: Flag for type of imputation performed

- **floodcat1:** <2 feet of flooding.
- **floodcat2:** 2-3 feet of flooding.
- **floodcat3:** 3-4 feet of flooding.
- **floodcat4:** 4-5 feet of flooding.
- **floodcat5:** 5-6 feet of flooding.
- **floodcat6:** >6 feet of flooding.
- **flooding:** Flood depth (feet).
- **grant1:** Rebuilding grant offer.
- **grant1\_APPEAL:** Rebuilding grant offer including the results of any appeals.
- **grant2:** Relocation grant offer.
- **grant2\_APPEAL:** Relocation grant offer including the results of any appeals.
- **grantsmooth:** Grant offer for possible counterfactuals that remove the discontinuity from the RH formula by basing all grant offers on damage estimates.
- **i:** Within-block household index.
- **I:** Number of households on the block.
- **ins:** Private insurance received.
- **j:** Census block index.
- **k:** Cost of needed repairs.
- **LMI\_imp:** Low/moderate income indicator.
- **lnHHINC05:** Pre-Katrina household income.
- **lnHOMEVAL05:** Appraised home value before Katrina.
- **lnSALE\_PRICE:** Ln(price) at which home was first sold privately after Katrina (-999 if there was no sale).
- **majblack:** Block majority black indicator.
- **majcoll:** Block majority college educated indicator.
- **Mbal:** Mortgage balance when Katrina occurred.
- **Mpmt:** Annual mortgage payment.
- **NEVATRISK\_opt2:** Indicator that a household is sufficiently insured that RH options 2 and 3 are dominated options.

- **PaymentsLeft:** Monthly mortgage payments remaining when Katrina occurred.
- **pct\_pov\_tr:** Poverty rate in the household's Census tract.
- **pctblack:** Black share in the household's Census block.
- **pctcoll:** College share in the household's Census block.
- **P\_HAT\_BASE:** Predicted private sale offer price if no neighbors rebuild ( $\mu_j = 0$ ). Offers increase with  $\mu_j$  as described in the paper.
- **purchase\_year:** Year home was purchased.
- **QualGeocode:** Reliability of geocode (0-100).
- **RENT:** Imputed rental cost of comparable housing away from New Orleans.
- **RHapplicant:** Indicator that the household applied to the RH program.
- **RISKCAT1:** Average neighborhood Equifax riskscore <600.
- **RISKCAT2:** Average neighborhood Equifax riskscore 600-625.
- **RISKCAT3:** Average neighborhood Equifax riskscore 625-650.
- **RISKCAT4:** Average neighborhood Equifax riskscore 650-675.
- **RISKCAT5:** Average neighborhood Equifax riskscore 675-700.
- **RISKCAT6:** Average neighborhood Equifax riskscore 700-725.
- **RISKCAT7:** Average neighborhood Equifax riskscore >725.
- **riskscore:** Neighborhood mean Equifax riskscore.
- **running\_APP\_imp:** Ratio of RH Type 1 to Type 2 damage estimates including any appeals.
- **running\_imp:** Ratio of RH Type 1 to Type 2 damage/replacement cost estimates including any appeals.
- **type1\_imp:** RH estimate of the cost of repairing home damages (including imputed values for non-applicants).
- **type2\_imp:** RH estimate of the cost of replacing the home entirely (including imputed values for non-applicants).
- **type2\_impflag:** Flag describing which imputation method was used.
- **w0:** Annual household earnings offer away from New Orleans.
- **w1:** Annual household earnings offer in New Orleans.
- **x:** Longitude.

- **y:** Latitude.
- **Y0:** Home in a repaired state immediately after Katrina.
- **Y1:** Home in a repaired state 1 year after Katrina.
- **Y2:** Home in a repaired state 2 years after Katrina.
- **Y3:** Home in a repaired state 3 years after Katrina.
- **Y4:** Home in a repaired state 4 years after Katrina.
- **Y5:** Home in a repaired state 5 years after Katrina.