The Impact of Rebuilding Grants and Wage Subsidies on the Resettlement Choices of Hurricane Katrina Victims

Jesse Gregory
University of Wisconsin

January 24, 2013
Background

- August 29, 2005 – Katrina makes landfall
- August 31, 2005 – Flood waters cover 80% of New Orleans

Image: Time Magazine (2005)
Disaster Relief Programs

- Public service provision
  - Debris removal, infrastructure repair

- Subsidies/transfers to individuals
  - Subsidized flood insurance (NFIP)
  - Standing programs
  - *Ad hoc* supplemental relief
Disaster Relief: Standing Programs

- SBA Disaster Loan Program
  - Creditworthiness standards (marginally) more lenient than banks’
  - 276,000 Gulf Coast applicants by December 2005
  - 82% were rejected (New York Times, 2005)

- FEMA Disaster Assistance Grants
  - Intended to cover “critical expenses” not covered by insurance/loans
  - “…not intended to restore your damaged property to its condition before the disaster”
  - Average grant $\approx$ $5,000
Disaster Relief: *Ad hoc* disaster relief spending

- Supplemental appropriations after severe disasters becoming routine

- Typically in the form of block grants to state/local governments

- Prominent example: the **Louisiana Road Home** program
  - Funded by a federal block grant
  - Administered by the State of Louisiana
  - “Largest housing recovery program in United States history”
Option 1
- Pays a cash grant equal to the insurance shortfall
- Homeowner must rebuild and reside in home for three years

Option 2
- Pays a cash grant equal to the insurance shortfall
- Homeowner must turn home’s deed over to the state
Louisiana Road Home Program

- Announced February 2006
- Application Deadline: July 31, 2007
- Most grants paid > 2 years after Katrina
Research Questions

1. How were resettlement choices influenced by government rebuilding subsidies (particularly the Louisiana Road Home Program)?

2. To what extent does the expectation that similar bailouts will occur in the event of a future disaster generate moral hazard? What is the associated deadweight loss?
Research Design

- Estimate a structural model of location/rebuilding/financing choices
- Compare households’ simulated choices under alternative policies
  - Q1: With and without the Road Home Program
  - Q2: With and without long-run subsidy for disaster insurance
The Welfare Economics of Disaster Relief

The central trade-off:

- Subsidies/bailouts benefit disaster victims in a time of need
  - Provide an insurance/consumption-smoothing benefit
  - Solve credit-market failures

- Subsidies/bailouts distort location choices
  - Moral hazard leads to “too many” people living in disaster-prone areas
Econ 101 Illustration of this Trade-Off

![Graph showing the relationship between housing cost ($), housing supply, and housing demand with population in New Orleans. The graph includes axes labeled as follows:

- Y-axis: Housing Cost ($)
- X-axis: New Orleans Population

The graph also includes two lines:

- A red line indicating Housing Supply
- A blue line indicating Housing Demand with B.C.

The graph demonstrates the trade-off between housing cost and housing demand with population in New Orleans.]
Econ 101 Illustration of this Trade-Off

Housing Cost ($)

New Orleans Population

Housing Demand\(^{-1}\) (w/o B.C.)

Housing Supply\(^{-1}\)

Housing Demand\(^{-1}\) (w/ B.C.)

Housing Supply\(^{-1}\) (subsidized)
Econ 101 Illustration of this Trade-Off

- *Housing Cost ($)*
- *New Orleans Population*
- *Decreased DWL*
- *Increased DWL*

Diagram:
- Housing Demand\(^1\) (w/o B.C.)
- Decreased DWL
- Increased DWL
- Housing Supply\(^1\) (subsidized)

Post-Katrina Rebuilding

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Econ 101 Illustration of this Trade-Off

Graph showing the relationship between housing cost and housing supply-demand in New Orleans. The graph indicates a negative correlation between housing cost and housing supply, with a positive correlation between housing demand and population growth.
Econ 101 Illustration of this Trade-Off

**Housing Demand (w/o B.C.)**

**Housing Supply (subsidized)**

**Housing Demand (w/ B.C.)**

**New Orleans Population**

**Housing Cost ($)**

Post-Katrina Rebuilding

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Preview of Findings
Location preferences are highly heterogeneous, strong average preference for returning to New Orleans

Large subgroups face borrowing constraints

Road Home’s impact was concentrated among credit constrained households

Economic distortion from expected future relief is relatively small
Related Literature

- Distortions caused by place-based policies with/without preference heterogeneity; Moretti (2011), Albouy (2009), Busso, Gregory, and Kline (2011)


Paper’s Contributions

- Performs a program evaluation of a prominent, difficult-to-study policy
- Estimates a structural migration model using directly-observable sources of variation in location-specific financial incentives
- Estimates a structural migration model that includes assets and borrowing constraints
Outline

- Data and background information
- Model
- Variation in the financial incentive to return
  - The New Orleans labor market
  - The Louisiana Road Home Program
- Estimation and counterfactual policy experiments
Data

- Displaced New Orleans Residents Survey
  - Demographic traits
  - Storm damage and insurance
  - Labor market attachment
  - Migration history

- Orleans Parish Assessor’s Office Property Database
  - Home sales
  - Home repairs
Sample restrictions
- Owner-occupied single-family homes
- Retirement age or one or more H.H. heads worked between 08/2004 and 08/2005
- N=560

Retrospective panel – four-month intervals
- Background traits and “t=0” circumstances
- Choice/state variables at t=1, ..., 12
Note: Sample includes households that owned single-family homes in pre-Katrina New Orleans before Katrina.

Source: DNORS and Orleans Parish Assessor’s Office Property Database
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Background - Property Damage

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Source: DNORS and Orleans Parish Assessor’s Office Property Database
Note: Households with initially unlivable homes.

Source: DNORS and Orleans Parish Assessor’s Office Property Database
Background - Insurance

Note: Households with initially unlivable homes.

Source: DNORS and Orleans Parish Assessor’s Office Property Database
Note: Households with initially unlivable homes.

Source: DNORS and Orleans Parish Assessor’s Office Property Database
Background - Repair Costs and Available Resources

Note: Households with initially unlivable homes (median and IQR).

Source: DNORS and Orleans Parish Assessor’s Office Property Database (Repair Costs); PSID (Liquid Assets)
Note: Households with initially unlivable homes (median and IQR).

Source: DNORS and Orleans Parish Assessor’s Office Property Database (Repair Costs); PSID (Liquid Assets)
Note: Households with initially unlivable homes (median and IQR).

Source: DNORS and Orleans Parish Assessor’s Office Property Database (Repair Costs); PSID (Liquid Assets)
Note: Home sale/ownership status computed as of Katrina’s fourth anniversary.

Source: Participation data from the Road Home Corporation linked to DNORS and Orleans Parish Assessors Office property data
Relative New Orleans Log-Wages By Occupation (2007-08)

- Construction
- Food Preparation and Serving
- Building Cleaning and Maintenance
- Arts/Design/Entertainment/Sports
- Architecture and Engineering
- Production
- Installation, Maintenance, and Repair
- Sales
- Lawyers
- Transportation and Material Moving
- Business Operations
- Office and Administrative Support
- Financial Specialists
- Healthcare Support
- Protective Service
- Personal Care and Service
- Healthcare Pract. and Technical
- Education and Library
- Computer/Mathematical
- Management

Change in Relative New Orleans Log-Wage: Pre-Katrina to 2007/2008

-0.5 -0.25 0 0.25
R.H. Participation and Home Sales - By Relative Wages

Note: Home sale/ownership status computed as of Katrina's fourth anniversary.

Source: Participation data from the Road Home Corporation linked to DNORS and Orleans Parish Assessors Office property data.
Road Home’s Financial Incentive to Rebuild

\[
\frac{P(\text{land})}{P(\text{home})} = 1 + \frac{\text{Repair Cost} / \text{(undamaged) Structure Value}}{\text{Total Holding} / \text{Structure Value}}
\]
Note: Private sale proceeds assume low insurance coverage
Road Home’s Financial Incentive to Rebuild

Note: Private sale proceeds assume low insurance coverage
Road Home’s Financial Incentive to Rebuild

Note: Private sale proceeds assume about 50% insurance coverage
Note: Home sale/ownership status computed as of Katrina's fourth anniversary.

Source: Participation data from the Road Home Corporation linked to DNORS and Orleans Parish Assessors Office property data.
Note: Home sale/ownership status computed as of Katrina's fourth anniversary.

Source: Participation data from the Road Home Corporation linked to DNORS and Orleans Parish Assessors Office property data.
Timing of Home Repairs Relative to Road Home

Note: Sample includes pre-Katrina New Orleans homeowners with initially uninhabitable homes.

Source: DNORS and Orleans Parish Property Database.
### Location/Home State \( (X_t) \):

<table>
<thead>
<tr>
<th></th>
<th>Pre-Katrina Home</th>
<th>Other New Orleans</th>
<th>Other Metro South</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Repaired/Still Owned:</strong></td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>Damaged/Still Owned:</strong></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>Sold:</strong></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
</tbody>
</table>

### Asset Holding \( (A_t) \):

<table>
<thead>
<tr>
<th></th>
<th>Debt</th>
<th>$0</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Debt</strong></td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td><img src="image13.png" alt="Image" /></td>
<td><img src="image14.png" alt="Image" /></td>
<td><img src="image15.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Model: Timing

- Time is discrete
- Periods $t = 0, 1, 2, ...$ are each four months long
- Each $t$, household observes $(X_t, A_t, \epsilon_t)$ and chooses $(X_{t+1}, A_{t+1})$
- Continues until age 65
**Model: Katrina occurs at t=0**

### Location/Home State \((X_t)\):

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<tbody>
<tr>
<td>Repaired/Still Owned:</td>
<td><img src="image" alt="Repaired House" /></td>
<td><img src="image" alt="Repaired House" /></td>
<td><img src="image" alt="Repaired House" /></td>
</tr>
<tr>
<td>Damaged/Still Owned:</td>
<td><img src="image" alt="Damaged House" /></td>
<td><img src="image" alt="Damaged House" /></td>
<td><img src="image" alt="Damaged House" /></td>
</tr>
<tr>
<td>Sold:</td>
<td><img src="image" alt="SOLD" /></td>
<td><img src="image" alt="SOLD" /></td>
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</tr>
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</table>

**initial state: \((X_0,A_0)\)**

### Asset Holding \((A_t)\):

<table>
<thead>
<tr>
<th>Debt</th>
<th>$0</th>
<th>(A_0?)</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Debt" /></td>
<td><img src="image" alt="$0" /></td>
<td><img src="image" alt="(A_0?)" /></td>
<td><img src="image" alt="Savings" /></td>
</tr>
</tbody>
</table>
Model: Each period, h.h. has opportunity to change states

### Location/Home State ($X_t$):

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<tbody>
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<td>Repaired/Still Owned:</td>
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<td>Sold:</td>
<td>![Sold House]</td>
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### Asset Holding ($A_t$):

- **Debt**: $0
- **Savings**: $0

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Model: Moving is disruptive

Location/Home State ($X_t$):

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</tr>
<tr>
<td>Damaged/Still Owned:</td>
<td><img src="image" alt="House with ladder" /></td>
<td><img src="image" alt="House with water damage" /></td>
</tr>
<tr>
<td>Sold:</td>
<td>$$0$</td>
<td>$$0$</td>
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Asset Holding ($A_t$):

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utility cost to moving = $\chi$
**Model: Location choice affects labor market opportunities**

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<td><strong>Location</strong></td>
<td><strong>Home</strong></td>
<td><strong>State</strong></td>
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<tr>
<td></td>
<td><strong>(X Pre-Katrina</strong></td>
<td><strong>Home Other</strong></td>
<td><strong>New Orleans Other</strong></td>
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<td></td>
<td><strong>State</strong></td>
<td></td>
<td><strong>South</strong></td>
</tr>
<tr>
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<tr>
<td><strong>Sold</strong></td>
<td><img src="image" alt="Money" /></td>
<td><img src="image" alt="Money" /></td>
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**Asset Holding (A):**

- **Debt**: $0
- **Savings**: $0

**NOLA labor market**

**Other South labor market**
Model: Location choice affects labor market opportunities

\[
\ln \text{wage}_{jLt} = \ln(\text{mean wage in } j\text{'s occ.})_{Lt} + x'_j \delta + \mu_j
\]
Model: If not in the pre-K home, hh rents at local prices

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<td>![House with ladder]</td>
<td>![House with ladder]</td>
<td>![House with ladder]</td>
</tr>
<tr>
<td>Sold:</td>
<td>![House with dollar sign]</td>
<td>![House with dollar sign]</td>
<td>![House with dollar sign]</td>
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</table>

**Asset Holding (A_t):**

- Debt: $0
- Savings: $0

NOLA housing market

Other South labor market

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Model: Home sales provide income

**Location/Home State (X_t):**

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**Asset Holding (A_t):**

- Debt
- Savings
- $0
Model: Home repairs are costly

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<td>![House with ladder]</td>
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<tr>
<td>Sold:</td>
<td>$$0$</td>
<td>$$0$</td>
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utility cost to repairs = $\chi$

Asset Holding ($A_t$):

- Debt
- $\$0$
- Savings
Model: Road Home grants

- Option 1 paid to those who rebuild at:
  - Beginning of 3rd year following Katrina (early rebuilders)
  - Repair date (later rebuilders)

- Home sales between 2nd and 5th anniversaries of Katrina earn the larger among:
  - Road Home option 2 grant
  - Proceeds from private sale
Model: HH responsible for mortgage payments

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Asset Holding ($A_t$):  

<table>
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<tr>
<th>Debt</th>
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Model: Preferences

\[ u(t) = \alpha C_t^{1-\omega} / (1-\omega) + B(L_t, t) + \eta \times 1(L_t = 1, 2) + \epsilon_t(X_{t+1}) \]

- \( \eta \sim N(0, \sigma_\eta) \)
- \( \epsilon_t \sim \text{Type I extreme value} \)

Objective: \( V = E \max \left( \sum_{t=1}^T \beta^t u(t) \right) \)
Model: Budget Constraint

* Inter-temporal budget constraint

\[ C(t) = (Income) - (Expenses) - (Change in Asset Holding) \]

* Possible borrowing constraint (to be estimated)

\[ r = \begin{cases} 
  r_s & \text{if Asset Holding} \geq 0 \\
  r_b(Z) \geq r_s & \text{if Asset Holding} < 0 
\end{cases} \]

Note: \( Z = \) vector of demographic traits
Model: Parameters

- **Fixed Parameters**
  - $\beta = .95$ (Kennan and Walker, 2011)
  - $\omega = 4.17$ (Barsky, Juster, Kimball, Shapiro, 1997)
  - $B_{L=3} \equiv 0$ (normalization)

- **Parameters to be Estimated**
  - $\alpha$ – weight on consumption utility
  - $B_{L=1}(Z, t)$ – location utility, pre-K home
  - $B_{L=2}(Z, t)$ – location utility, other N.O.
  - $\sigma_\eta$ – std. dev. of location preference heterogeneity
  - $\chi^M$ – moving utility cost
  - $\chi^R$ – rebuilding utility cost
  - $\gamma_r$ – borrowing interest rate parameters
Separability of $u(.)$ and $\epsilon$, and $\epsilon$ i.i.d. allow D.P. expression

May be solved with backward induction

$$V(X(t), A(t), \eta) = \max_{X(t+1)A(t+1)} \left\{ u(X(t+1), A(t+1), \eta) \right\}$$

$$V(X(t), A(t), \eta) = E_{\epsilon} V(X(t), A(t), \eta)$$
Obstacle: $A_i(t)$ is not observed

However, for a given $\theta$, $\eta$, and $A_i(0)$:

$$\hat{A}_i(t \mid \{X_i(\tau)\}, A(0), \eta, \theta) = \begin{cases} A_i(0) & \text{if } t = 0 \\ A^* \left(X_i(t-1), X_i(t), A_i(t-1), t-1\right) & \text{if } t > 0 \end{cases}$$
Maximum Likelihood Estimation

- Compute likelihood function by “integrating” over \([A(0), \eta]\)-types

\[
l_i(\theta \mid \{X_i(t)\}_{t=1}^T, A(0), \eta) = \prod_{t=0}^{11} P\left(X_i(t+1) \mid X_i(t), \tilde{A}_i(t \mid A(0)), \eta, \theta\right)
\]

\[
l_i(\theta \mid \{X_i(t)\}_{t=1}^T) = \frac{1}{10} \sum_{p_a=5}^{95} \frac{1}{5} \sum_{p_\eta=10}^{90} l_i(\theta \mid \{X_i(t)\}_{t=1}^T, F_{A(0)}^{i-1}(p_a), G_{\eta}^{i-1}(p_\eta))
\]

\[
L(\theta \mid \{X(t)\}_{t=1}^T) = \ln \left(\prod_{i=1}^N l_i(\theta \mid \{X_i(t)\}_{t=1}^T)\right)
\]
Estimation

- Nested fixed point maximum likelihood
  - Inner loop - solve model and compute likelihood for a guess of $\theta$
  - Outer loop - search parameter space for likelihood maximizing $\hat{\theta}$
Sketch of Identification

- Preferences for locations
  - Variation in location-specific financial incentives
    - Differences in wage paths across occupations
    - Road Home Option 1 vs. Option 2 or private home sale

- Scale of persistent heterogeneity
  - Extent of path dependence in choices

- Borrowing interest rate
  - Cameron and Taber (2004)
    - Influence of direct vs. gradually-accruing benefits/costs
    - Change in “consumption” at the time of an anticipated income change
### Structural Parameters - Borrowing interest rate

**Specification:**

\[ \ln(1 + r_b) = \ln(1/\beta) + Z'\hat{\gamma}_r \]

---

<table>
<thead>
<tr>
<th>Parameter:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of Borrowing interest rate - ln(1+r&lt;sub&gt;B&lt;/sub&gt;)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>ln(1/β) [ normalized ]</td>
</tr>
<tr>
<td>Black</td>
<td>0.141 [0.003]***</td>
</tr>
<tr>
<td>No bachelor's degree</td>
<td>0.357 [0.011]***</td>
</tr>
<tr>
<td>Pre-K. Income &lt; $20,000</td>
<td>0.414 [0.015]***</td>
</tr>
<tr>
<td>Pre-K. Income $20,000-$40,000</td>
<td>-0.012 [0.003]***</td>
</tr>
</tbody>
</table>

| Observations - household-periods | 6,720 |
| Observations - households | 560 |
| Log-Likelihood | -2,629.3 |
### Location Preference Equation

<table>
<thead>
<tr>
<th>B(L=3):</th>
<th>0.000 [norm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>B(L=2):</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.068 [0.018]***</td>
</tr>
<tr>
<td>B(L=1) minus B(L=2):</td>
<td></td>
</tr>
<tr>
<td>Intercepts</td>
<td>Refer to Graph</td>
</tr>
<tr>
<td>Nonblack</td>
<td>--</td>
</tr>
<tr>
<td>Black</td>
<td>-0.203 [0.057]***</td>
</tr>
<tr>
<td>Block poverty rate (&lt; 10%)</td>
<td>--</td>
</tr>
<tr>
<td>Block poverty rate (10% - 25%)</td>
<td>-0.003 [0.093]</td>
</tr>
<tr>
<td>Block poverty rate (&gt; 25%)</td>
<td>0.050 [0.059]</td>
</tr>
<tr>
<td>Purchased home &lt; 10 years before Katrina</td>
<td>--</td>
</tr>
<tr>
<td>Purchased home 10-20 years before Katrina</td>
<td>-0.066 [0.048]</td>
</tr>
<tr>
<td>Purchased home &gt; 20 years before Katrina</td>
<td>-0.135 [0.055]*</td>
</tr>
<tr>
<td>Either head born in Louisiana</td>
<td>--</td>
</tr>
<tr>
<td>Neither head born in Louisiana</td>
<td>0.002 [0.029]</td>
</tr>
</tbody>
</table>
### Structural Parameters - Unobserved Heterogeneity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of consumption utility, $\alpha$</td>
<td>0.210</td>
<td>0.050</td>
</tr>
<tr>
<td>Scale of persistent unobserved heterogeneity, $\sigma$</td>
<td>0.647</td>
<td>0.045</td>
</tr>
</tbody>
</table>
Model Fit

![Graphs showing trends](image-url)

- **Living in New Orleans**
- **Living in pre-Katrina Home**
- **Purchased Repairs/Rebuilt**
- **Sold Home**

Data from Jesse Gregory, University of Wisconsin, on Post-Katrina Rebuilding.
Under a given policy regime:

- Compute 10,000 simulated panels for each household
- Use each \((\eta \times A(0))\)-type in 1/50\(^{th}\) of those simulations
- Weight simulated panels by households’ ex-post \(pr(A(0), \eta)\)

\[
wgt(a, \eta) = \frac{1}{50} \times \left( \frac{l\left(\theta \left| \left\{ X_i(t) \right\}_{t=1}^{T}, \eta, A(0) \right\} \right)}{l\left(\theta \left| \left\{ X_i(t) \right\}_{t=1}^{T} \right\} \right)} \right)
\]
Experiment 1 - Effects of the Road Home Program

Simulate choices under several scenarios:

- No grant program
- No grant program, all may borrow at $1/\beta$
- Enacted policy environment (Road Home)
Experiment 1 - Effects of the Road Home Program

Homes Repaired (Percentage)

- No Grants: 49%
- Road Home: 54%

Jesse Gregory  University of Wisconsin  Post-Katrina Rebuilding  January 24, 2013  55/63
Experiment 1 - Effects of the Road Home Program

- Homes Repaired (Percentage)
  - No Grants: 49%
  - All May Borrow: 53%
  - Road Home: 54%

Jesse Gregory
University of Wisconsin
Post-Katrina Rebuilding
January 24, 2013
Experiment 1 - Effects of the Road Home Program

Homes Repaired (Percentage)

- No Grants
- Road Home

- <$20k: 44% No Grants, 54% Road Home
- >$40k: 50% No Grants, 54% Road Home

Jesse Gregory
University of Wisconsin
Post-Katrina Rebuilding
January 24, 2013
Experiment 1 - Effects of the Road Home Program

Homes Repaired (Percentage)

- No Grants
- All May Borrow
- Road Home

- <$20k
  - No Grants: 44%
  - All May Borrow: 52%
  - Road Home: 54%

- >$40k
  - No Grants: 50%
  - All May Borrow: 52%
  - Road Home: 54%
Experiment 2 - DWL From Expected Future Relief

Jesse Gregory
University of Wisconsin

Post-Katrina Rebuilding

January 24, 2013
Experiment 2 - DWL From Expected Future Relief

Compare choices under two policies
- No disaster-related transfers (after Road Home)
- Each period, pay cash to current New Orleans residents equal to the fair price of disaster insurance
Experiment 2 - DWL From Expected Future Relief

Supply of Residents

(Labor Demand - Housing Supply)

Deadweight Loss

Residents

Labor Wages minus Housing Costs

Supply of Residents -- Subsidized

(Labor Demand - Housing Supply)
Experiment 2 - DWL From Expected Future Relief

Supply of Residents

(Labor Demand - Housing Supply)

Deadweight Loss

Residents

Labor Wages minus Housing Costs

Supply of Residents

Supply of Residents -- Subsidized

Deadweight Loss

(Labor Demand - Housing Supply)
\[ DWL = \left( \frac{1}{2} \right) P^H_{TOT} \psi \tau^2 \]

- Notation:
  - \( P^H_{TOT} = \) Value New Orleans housing stock
  - \( \psi = \frac{d \ln S}{d\tau} \) \( (S = \) Supply of residents to New Orleans\)
  - \( \tau = \) Subsidy as fraction of home value
### Experiment 2 - DWL From Expected Future Relief

#### Deadweight Loss Calculation

<table>
<thead>
<tr>
<th>Description</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline value of housing stock</td>
<td>$11 B</td>
<td>$11 B</td>
</tr>
<tr>
<td>Subsidy ($\tau$)</td>
<td>3.30%</td>
<td>3.30%</td>
</tr>
<tr>
<td>Elasticity: $\psi$ (Average across households)</td>
<td>0.450</td>
<td></td>
</tr>
<tr>
<td>Elasticity: $\psi$ (Households below 35 years old)</td>
<td></td>
<td>1.737</td>
</tr>
<tr>
<td>Flow cost of subsidy ($[\text{Value of Housing Stock}] \cdot \tau$)</td>
<td>$363$ M</td>
<td>$363$ M</td>
</tr>
<tr>
<td>Deadweight loss ($\approx \frac{1}{2} \cdot [\text{Value of Housing Stock}] \cdot \psi \cdot \tau^2$)</td>
<td>$2.7$ M</td>
<td>$10.4$ M</td>
</tr>
</tbody>
</table>
Conclusion

- Estimated a structural model of post-Katrina resettlement and asset accumulation
  - Strong attachment to place – most households “inframarginal”

- Road Home program:
  - Increased rebuilding rates
  - Impact concentrated among borrowing constrained

- Distortions from disaster related subsidies:
  - Small compared to costs
  - Other types of moral hazard possible

- Limitations/areas for future research
  - Partial equilibrium (actual policies affect prices/amenities)
  - Social spillovers could “multiply” P.E. results, could lead to much larger impacts through equilibrium selection (Fu, Gregory, work in progress)
Descriptive Statistics - Demographics

Note: Sample includes households that owned single-family homes in pre-Katrina New Orleans before Katrina.

Source: DNORS and Orleans Parish Assessor’s Office Property Database
Note: Sample includes households that owned single-family homes in pre-Katrina New Orleans before Katrina.

Source: DNORS, Orleans Parish Assessor’s Office Property Database, and American Community Survey