Reverse-Engineering Censorship in China

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(Talk at Harvard’s Graduate Commons Program 2/11/2015)

1Based on joint work with Jennifer Pan and Margaret Roberts
2GaryKing.org
Papers

- An Observational Study:
  

- Experimental and Participatory Studies:
  
  *Reverse Engineering Chinese Censorship* (Science, 2014)

- Methods:
  
  - *General Purpose Computer-Assisted Clustering and Conceptualization* (PNAS, 2011)
  - *A Method of Automated Nonparametric Content Analysis for Social Science* (AJPS, 2010)
  - *Computer-Assisted Keyword and Document Set Discovery from Unstructured Text*

Copies at GaryKing.org
Chinese Censorship

The largest selective suppression of human expression in history: implemented manually (within a few hours of posting), by \( \approx 200,000 \) workers, located in government and inside social media firms.

A huge censorship organization: (obviously) designed to suppress information (paradoxically) very revealing about the goals, intentions, and actions of the Chinese leadership.
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Chinese Social Media: Fractured over 1,400+ sites
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(Plus 59% from Sina Blog)
The Goals of Censorship make Social Media Actionable

What could be the goal?

1. Stop collective action

Implications: Social Media is Actionable!

Chinese leaders: measure criticism to judge local officials, censor to stop events with collective action potential.

Thus, we can use criticism & censorship to predict:
- Officials in trouble, likely to be replaced
- Policies that generate dissent (& interest of leaders)
- Government action outside the Internet
- Dissidents to be arrested; peace treaties to sign; emerging scandals
- Disagreements between central and local leaders

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Our Observational Research Design: 5 Steps

1. Monitor 85 content areas over 6 months
2. Download each social media post, the instant it appears
3. Revisit each later to check if it was censored (carefully, from computers all over the world)
4. Repeat 11,382,221 times
5. Analyze with new methods of computer-assisted text analysis
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Censorship is not Ambiguous: Example Error Page

Sorry, the host you were looking for does not exist, has been deleted, or is being investigated
Censorship is not Ambiguous: BBS Error Page

The page you requested is temporarily down. How about you go look at another page.

Jingjing, one of China's cartoon internet police
The Censors are Fast; Our Automated Methods are Faster
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Example: Shanghai Subway Crash
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![Bar Chart]

- Days Until Censorship, Shanghai Subway Analysis
- Days After Post Was Written
- Number Censored
- Days After Post Was Written

Days Until Censorship, Shanghai Subway Analysis
Days After Post Was Written
Number Censored
0 1 2 3 4 5 6 7
0 50 100 150 200 250
Post Volume & Censorship are “Bursty”
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- Found 87 volume bursts in our 85 topic areas
- Identified real world event associated with each burst

Our hypothesis: The government censors all posts in volume bursts associated with events with collective action potential (regardless of how critical or supportive of the state).
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Begin with our 87 volume bursts in 85 topic areas. For each burst, calculate change in % censorship inside to outside each volume burst within topic areas - censorship magnitude.

If the goal of censorship is to stop collective action, we expect:

1. On average, % censored should increase during volume bursts.
2. Some bursts (associated with politically relevant events) should have much higher censorship.

![Censorship Magnitude vs Density Chart]

12/28
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Classification of Events Generating the Bursts

Event classification (each category can be +,
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1. protest or organized crowd formation outside the Internet
individuals who have organized or incited collective action on the
ground in the past;
topics related to nationalism or nationalist sentiment that have incited
protest or collective action in the past.

(Inter-coder reliability: 98.9%)
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What Types of Events Are Censored?

![Graph showing the distribution of censorship magnitude and density across different categories: Collective Action, Criticism of Censors, and Pornography. The graph displays the density of events across a range of censorship magnitudes, with distinct colors for each category.]

- Policy
- News

- Collective Action
- Criticism of Censors
- Pornography
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Protests in Inner Mongolia
Pornography Disguised as News
Baidu Copyright Lawsuit
Zengcheng Protests
Pornography Mentioning Popular Book
Ai Weiwei Arrested
Collective Anger At Lead Poisoning in Jiangsu
Google is Hacked
Localized Advocacy for Environment Lottery
Fuzhou Bombing
Students Throw Shoes at Fang BinXing
Rush to Buy Salt After Earthquake
New Laws on Fifty Cent Party

U.S. Military Intervention in Libya
Food Prices Rise
Education Reform for Migrant Children
Popular Video Game Released
Indoor Smoking Ban Takes Effect
News About Iran Nuclear Program
Jon Hunstman Steps Down as Ambassador to China
Gov't Increases Power Prices
China Puts Nuclear Program on Hold
Chinese Solar Company Announces Earnings
EPA Issues New Rules on Lead
Disney Announced Theme Park
Popular Book Published in Audio Format

Censorship Magnitude

-0.2 0 0.1 0.3 0.5 0.7

Collective Action
Criticism of Censors
Pornography

Policies
News
Censoring Collective Action: Riots in Zencheng
Censoring Collective Action: Ai Weiwei’s Arrest

Ai Weiwei arrested

Count
Jan Feb Mar Apr May Jun Jul
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Count Published
Count Censored
Low Censorship on Policy: One Child

Speculation of Policy Reversal at NPC

- Count Published
- Count Censored

Jan Feb Mar Apr May Jun Jul
Low Censorship on News: Power Prices

Power shortages
Gov't raises power prices to curb demand
“ReadMe” Algorithm Validated in Chinese
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Example: Labor Strikes, 2010 (Training set: 100; Test set: 900)
“ReadMe” Algorithm Validated in Chinese

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Uncensored: Non-Collective Action Posts
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Regardless of whether Supportive or Critical
Uncensored: Non-Collective Action Posts
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<thead>
<tr>
<th>Percent Censored</th>
<th>Criticize</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Ai Weiwei</td>
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</tr>
<tr>
<td>0.2</td>
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Censored: Collective Action Posts

Regardless of whether Supportive or Critical
Censored: Collective Action Posts
Regardless of whether Supportive or Critical

![Graph showing percent censored for Ai Weiwei, Fuzhou Bombing, and Inner Mongolia]

- Ai Weiwei
- Fuzhou Bombing
- Inner Mongolia

Percent Censored
0.0 0.2 0.4 0.6 0.8 1.0
Criticize Support Criticize Support Criticize Support

21/28
Randomized Experiment (for causal inferences)

- Selected 100 top social media sites (∼87% of blogs, >500M Users, geographically diverse)
- Created 2 accounts on each (from inside China all over the country)
- Wrote 1,200 unique social media posts (CA/not CA, Pro/Anti)
- Submitted posts randomly assigned to type
- Checked on censorship (from computers in many countries)

Participatory Study (for descriptive inferences)

- Current method of learning how they censor: ask (carefully!)
- Our goal: change our sources' incentives
- Procedure: create our own social media website in China
  - Bought URL; contracted with firms for servers & software; posted and censored ourselves
  - To learn: we tried every software option, read the documentation, and called customer support(!)
Additional Research Designs

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Mechanisms of Censorship
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Submit text for posting

- Immediately held for review before publication

- Post reviewed after publication
  - Post is published
  - Post is removed (within 24 hours)
  - Post deleted during review

Publish immediately

- Post remains online

- Published

- Published

- Published

- Censored

- Censored

- Censored

The government goes on about anti-corruption everyday, but is it doing anything? Today, it's Guo Yongxiang from Sichuan... All officials are corrupt, it's only those who have offended someone that are investigated...

Sorry, the host you were looking for does not exist, has been deleted, or is being investigated.

By 2020 China will have 30 million bare branches (extra men), this is a critical situation. Behind it is the fact that every year more boys than girls are born, which is due to the one-child policy. Over the years, the one-child policy has created many social problems...

You have been silenced by the administrator, the type of silence is forever!
Mechanisms of Censorship

Submit text for posting

Immediately held for review before publication

Administrator has set up review for new topics, your post will be shown after it has passed review.

Post published after review

Post is removed (within 24 hours)

Sorry, the host you were looking for does not exist, has been deleted, or is being investigated

Post remains online

The government goes on about anti-corruption everyday, but is it doing anything? Today, it’s Guo Yongxiang from Sichuan… All officials are corrupt, it’s only those who have offended someone that are investigated...

Publish immediately

Obser-vational study

By 2020 China will have 30 million bare branches (extra men). This is a critical situation. Behind it is the fact that every year more boys than girls are born, which is due to the one-child policy. Over the years, the one-child policy has created many social problems...

Post deleted during review

(Post reviewed then deleted)

Account blocked

You have been silenced by the administrator, the type of silence is forever!
Mechanisms of Censorship

Post remains online

- Publish immediately

- Post is removed (within 24 hours)

Submit text for posting

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Post is published after review

- Post deleted during review

- Post reviewed then deleted

Account blocked

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64% of websites review some content

40% of all submissions reviewed

Obser-vational study

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Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

Panxu
Protest

Censorship Difference (Pro − Anti)
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu
Protest

Tibetan
Self-Immolations

Ai Weiwei
Album
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

Panxu Protest
Tibetan Self-Immolations
Ai Weiwei Album
Protests in Xinjiang

Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

Panxu Protest
Ai Weiwei Album
Corruption Policy

Tibetan Self-Immolations
Protests in Xinjiang
Posts For v. Against Government: Zero Causal Effect

![Graph showing the comparison of posts for and against the government, with zero causal effect. The graph includes topics such as Panxu Protest, Ai Weiwei Album, Tibetan Self-Immolations, Protests in Xinjiang, Corruption Policy, and Eliminate Golden Week.](image-url)
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu Protest
Ai Weiwei Album
Corruption Policy
Tibetan Self-Immolations
Protests in Xinjiang
Eliminate Golden Week
Rental Tax

24/28
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu Protest
Ai Weiwei Album
Corruption Policy
Tibetan Self-Immolations
Protests in Xinjiang
Eliminate Golden Week
Yellow Light Fines
Rental Tax

Protests in Xinjiang
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

- Panxu Protest
- Ai Weiwei Album
- Corruption Policy
- Tibetan Self-Immolations
- Protests in Xinjiang
- Eliminate Golden Week
- Rental Tax
- Yellow Light Fines
- Stock Market Crash
- Investigation of Sichuan Vice Governor
- Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

Panxu Protest
Ai Weiwei Album
Corruption Policy
Tibetan Self-Immolations
Protests in Xinjiang
Eliminate Golden Week
Yellow Light Fines
Stock Market Crash
Rental Tax
Investigation of Sichuan Vice Governor
Gender Imbalance

Censorship Difference (Pro − Anti)
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu Protest
Ai Weiwei Album
Corruption Policy
Eliminate Golden Week
Yellow Light Fines
Stock Market Crash
Gender Imbalance
Investigation of Sichuan Vice Governor
Li Tianyi Scandal
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect

Panxu Protest

Censorship Difference (CA Event − Non-CA Event)
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect

Censorship Difference (CA Event − Non-CA Event)

Panxu Protest
Tibetan Self-Immolations
Ai Weiwei Album

Censorship Difference (CA Event − Non-CA Event)
Collective Action Events: Large Causal Effect

Censorship Difference (CA Event − Non−CA Event)

Panxu Protest
Tibetan Self−Immolations
Ai Weiwei Album
Protests in Xinjiang
Evading Automated Review

Example Substitution 1:
- Homograph
  - 自
  - 由
  - "Freedom"
  - 目
  - 田
  - "Eye field" (nonsensical)

Example Substitution 2:
- Homophone (both sound like "hexie")
  - 和
  - 谐
  - "Harmonious [Society]" (official slogan)
  - 河
  - 蟹
  - "River crab" (irrelevant)

They can't follow the conversation; our new keyword methods can!

The same task:
1. the analyst's job,
2. language drift
   - #BostonBombings ⇝ #BostonStrong,
3. People hiding in plain sight,
4. Look-alike modeling,
5. Starting point for sophisticated automated text analysis
Evading Automated Review

Example Substitution 1:
Evading Automated Review

Example Substitution 1:

自由
Evading Automated Review

Example Substitution 1:

自由    “Freedom”
Example Substitution 1:

自由 “Freedom”
Evading Automated Review

Example Substitution 1:

自由
自由
“Freedom”

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自由 “Freedom”
目田 “Eye field”

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Example Substitution 1:

自由
自由
“Freedom” (nonsensical)

目田
目田
“Eye field” (nonsensical)
Evading Automated Review

Example Substitution 1: Homograph

自 由
“Freedom”
目 田
“Eye field” (nonsensical)
Evading Automated Review

Example Substitution 1: Homograph

自由
“Freedom”
目田
“Eye field” (nonsensical)
Evading Automated Review

Example Substitution 1: Homograph

自由 “Freedom”
目田 “Eye field” (nonsensical)

Example Substitution 2:
Evading Automated Review

Example Substitution 1: Homograph

自由
“Freedom” (censored)

目田
“Eye field” (nonsensical)

Example Substitution 2:

和谐
Evading Automated Review

Example Substitution 1: **Homograph**

自由 “Freedom”  
目田 “Eye field” (nonsensical)

Example Substitution 2:

和谐 “Harmonious [Society]” (official slogan)
Evading Automated Review

Example Substitution 1: Homograph

自由 自由
自由 “Freedom” (nonsensical)
目田 目田
目田 “Eye field” (nonsensical)

Example Substitution 2:

和谐 和谐
和谐 “Harmonious [Society]” (official slogan)
Evading Automated Review

Example Substitution 1: **Homograph**

自由
“Freedom”
目田
“Eye field” (nonsensical)

Example Substitution 2:

和諧
“Harmonious [Society]” (official slogan)
河蟹

Evading Automated Review

Example Substitution 1: Homograph

自由
目
“Freedom”
“Eye field” (nonsensical)

Example Substitution 2:

和谐
河蟹
“Harmonious [Society]” (official slogan)
“River crab”
Evading Automated Review

Example Substitution 1: Homograph

自由
“Freedom”
目
g“Eye field” (nonsensical)

Example Substitution 2:

和谐
“Harmonious [Society]” (official slogan)
河
“River crab” (irrelevant)
Evading Automated Review

Example Substitution 1: Homograph

自由
自由
“Freedom” (censored)

目田
目田
“Eye field” (nonsensical)

Example Substitution 2: Homophone (both sound like “hexie”)

和谐
和谐
“Harmonious [Society]” (official slogan) (censored)

河蟹
河蟹
“River crab” (irrelevant)
Evading Automated Review

Example Substitution 1: Homograph

自由
目田
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和谐
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Evading Automated Review

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Evading Automated Review

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Example Substitution 1: Homograph

自由  "Freedom"  [CENSORED]
目田 "Eye field" (nonsensical)

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河蟹 "River crab" (irrelevant)

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Conclusions

The Chinese people:
Individually free, Collectively in Chains

Social Media (analyzed the right way):
Enables detailed, continuous, predictive monitoring of every Chinese
government, leader, policy, dissident, scandal, company, etc.
Predicts state actions when other sources are silent
Applicable to other countries

New statistical methods widely applicable beyond China:
Following conversations when people try to evade authorities, use
language creatively, achieve political purposes, etc.
Predicting action on the ground
Understanding large volumes of text in any language
Applications to brand monitoring, government analysis, sentiment
analysis, investments, news, advertising, etc.
Conclusions

The Chinese people:
Conclusions

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  - Applications to brand monitoring, government analysis, sentiment analysis, investments, news, advertising, etc.
For more information

GaryKing.org
Appendix
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Mar. 29, 5 days prior
Apr. 3, Ai Weiwei Arrested

% of Posts Censored
Actual % censorship
Predicted % censorship trend based on 3/19–3/29 data

Mar 19 Mar 29 Apr 08 Apr 18
0.0 0.2 0.4 0.6 0.8 1.0
2011

Placebo Test:
Most extreme of all effects
30/28
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Mar. 29, 5 days prior
Apr. 3, Ai Weiwei Arrested

% of Posts Censored
Actual % censorship
Predicted % censorship trend based on 3/19–3/29 data

Placebo Test:
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Mar. 29, 5 days prior
Apr. 3, Ai Weiwei Arrested

Actual % censorship

Mar 19 Mar 29 Apr 08 Apr 18
0.0 0.2 0.4 0.6 0.8 1.0
2011
% of Posts Censored
Actual % censorship
Predicted % censorship trend based on 3/19–3/29 data

Placebo Test: Most extreme of all effects
Predicting the South China Sea Peace Agreement
Predicting the South China Sea Peace Agreement

Predicted % censor trend based on 6/10–6/20 data

Actual % censorship

Jun. 20, 5 days prior
Jun. 25, Peace Agreement

Placebo Test:
Most extreme of all effects

Jun 12 Jun 22 Jul 02
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
2011
% of Posts Censored
Predicting the South China Sea Peace Agreement

Jun. 20, 5 days prior
Jun. 25, Peace Agreement

Predicted % censor trend based on 6/10–6/20 data

Actual % censorship

Placebo Test:
Predicting the South China Sea Peace Agreement

Jun. 20, 5 days prior
Jun. 25, Peace Agreement

Predicted % censor trend based on 6/10–6/20 data

Actual % censorship

Placebo Test: Most extreme of all effects
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

Jan 23
Jan 30
Feb 06
Feb 13

−0.2
0.0
0.2
0.4
0.6
0.8
1.0
2012

% of Posts Censored

Jan. 28,
5 days prior
Feb. 2,
Wang Lijun
demoted

Actual % censorship

Predicted % censorship trend based on 1/18−1/28 data

Placebo Test:
Most extreme of all effects

32/28
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

Jan. 28, 5 days prior
Feb. 2, Wang Lijun demoted

Actual % censorship

Predicted % censorship trend based on 1/18–1/28 data
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

[Diagram showing the percentage of posts censored over time, with a sharp increase following Wang Lijun’s demotion on Feb 2, 2012.]

Placebo Test:
- Most extreme of all effects
- Actual % censorship
- Predicted % censorship trend based on 1/18–1/28 data

Jan. 28, 5 days prior
Feb. 2, Wang Lijun demoted

Jan 23 Jan 30 Feb 06 Feb 13
−0.2 0.0 0.2 0.4 0.6 0.8 1.0
2012
% of Posts Censored

32/28
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

Jan. 28, 5 days prior
Feb. 2, Wang Lijun demoted

Actual % censorship

Predicted % censorship trend based on 1/18–1/28 data

Placebo Test: Most extreme of all effects
Uncensored Posts (w/o Collective Action Potential)
Critical of the State
Uncensored Posts (w/o Collective Action Potential)
Critical of the State

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<td>CENSORED</td>
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<tr>
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This is a city government [Yulin City, Shaanxi] that treats life with contempt, this is government officials run amuck, a city government without justice, a city government that delights in that which is vulgar, a place where officials all have mistresses, a city government that is shameless with greed, a government that trades dignity for power, a government without humanity, a government that has no limits on immorality, a government that goes back on its word, a government that treats kindness with ingratitude, a government that cares nothing for posterity...
Censored Post (with Collective Action Potential)
Supporting the State
Censored Post (with Collective Action Potential)
Supporting the State

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The bombing led not only to the tragedy of his death but the death of many government workers. Even if we can verify what Qian Mingqi said on Weibo that the building demolition caused a great deal of personal damage, we should still condemn his extreme act of retribution. The government has continually put forth measures and laws to protect the interests of citizens in building demolition. And the media has called attention to the plight of those experiencing housing demolition. The rate at which compensation for housing demolition has increased exceeds inflation. In many places, this compensation can change the fate of an entire family.