

Experiments in Political Science

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Departamento de Economía (UdelaR)

2020 Joint Methods Seminar

Overview

The Rise of Experimentation in Political Science

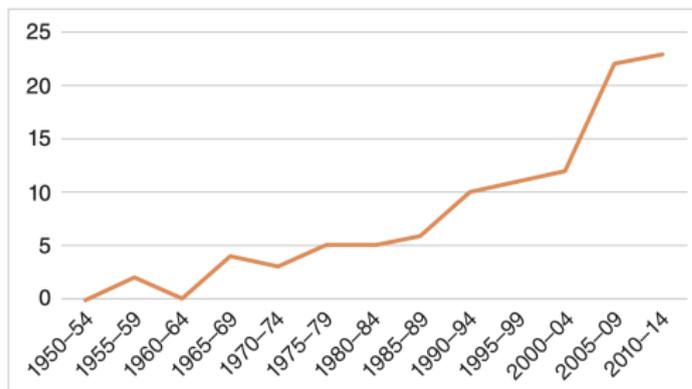
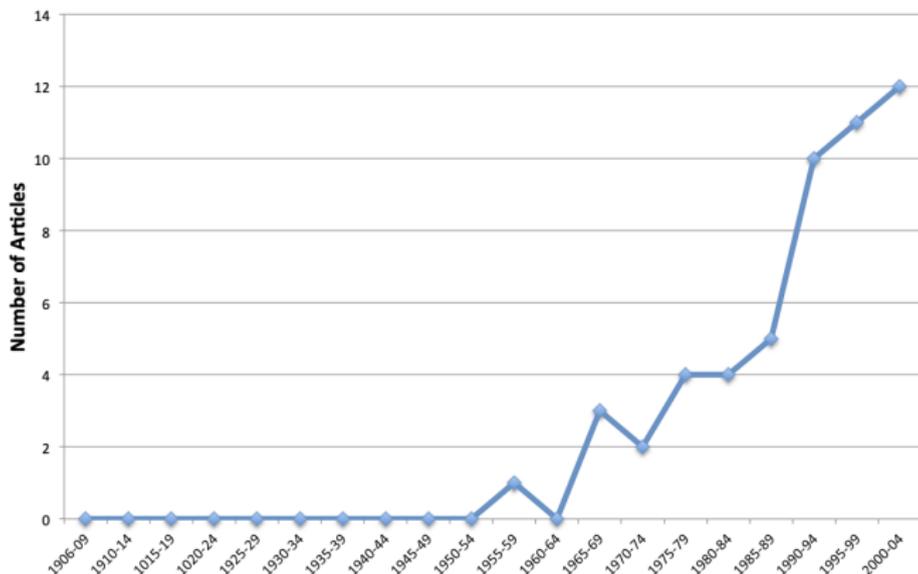


Figure 1 Experimental Articles in APSR, 1950–2014. (Note: Between 1906 and 1954, no experimental articles appeared.)

The Rise of Experimentation in Political Science

Randomized Controlled Experiments Published in the *American Political Science Review* (1906-2004)



Source: Jamie Druckman, Donald P. Green, James H. Kuklinski, and Arthur Lupia. 2006. "The Growth and Development of Experimental Research Political Science." *American Political Science Review* 100: 627-635.

The Rise of Experimentation in Political Science

Peer reviewers for major journals in political science, to judge by the experience of the *APSR* and other leading outlets, have begun, if not to reject other modes of inquiry, to credit far more the findings of experimental research. More specifically, the now-frequent criticism of endogeneity, that is, of possible reverse causation or of causation of two correlated variables from a third factor not considered, has felled many an otherwise convincing paper;⁵ and the by-now conventional answer of employing a clearly exogenous instrumental variable (IV) can never be as convincing as a randomized experiment—although, of course, such experimentation is hardly possible in the case of historical data.

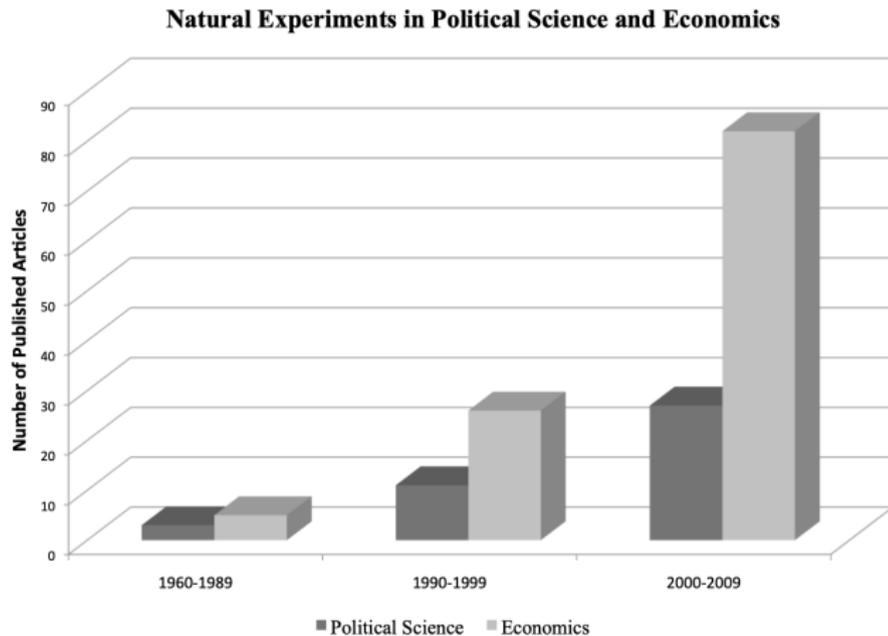
Rogowski, R. (2016). The Rise of Experimentation in Political Science. *Emerging Trends in the Social and Behavioral Sciences*, 1–11.

The Rise of Experimentation in Economics

The parallel shift in economics, albeit more recent, seems also to be more rapid, particularly in development economics, where the work of Abhijit Banerjee and Esther Duflo (2011) has proved revolutionary and is rapidly coming to dominate. The World Bank, the Inter-American Development Bank, and the governments of Indonesia and India, among many others, have tested policy innovations through randomized controlled trials (RCTs) (*Economist*, 2013, 2015).

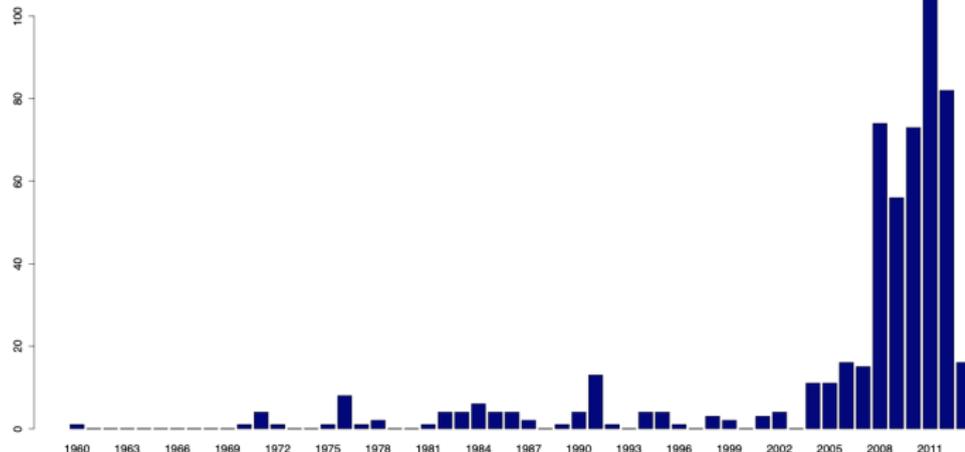
Rogowski, R. (2016). The Rise of Experimentation in Political Science. *Emerging Trends in the Social and Behavioral Sciences*, 1–11.

Two disciplines, one trend



Articles published in major political science and economics journals with “natural experiment” in the title or abstract (as tracked in the online archive JSTOR). From Dunning (2017)

Other design-based studies



The figure shows the number of peer-reviewed journal publications in economics and political science that refer to an RD design in the title or abstract. From Dunning (2017)

Causality

Causality

The *fundamental problem of causal inference*

To estimate an *ATE* or the *ATT* we need:

$$E[Y_{i1}|T = 0]$$

$$E[Y_{i0}|T = 1]$$

But we never observe the two conditions.

Assumption of independence

Potential outcomes are independent to treatment status

$$Y_{i1}, Y_{i0} \perp T_i$$

Assumption of independence

Potential outcomes are independent to treatment status

$$Y_{i1}, Y_{i0} \perp T_i$$

So that :

$$\begin{aligned}ATE &= E[Y_{i1} - Y_{i0}] \\ &= E[Y_{i1}] - E[Y_{i0}] \\ &= E[Y_i|T = 1] - E[Y_i|T = 0]\end{aligned}$$

The expectation of unobserved potential outcomes is equal to the expectation conditional on the treatment assignment.

Identification strategy

“To ask what is your identification strategy is to ask what research design (and assumptions) one intends to use for the identification of a causal effect.” (Keele, 2015)

Identification strategies

- ▶ Selection on observables
 - ▶ Conditional ignorability
 - ▶ No omitted variables

$$(Y_{i1}, Y_{i0} \perp T_i) | X_i$$

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Some challenges

- ▶ Untestable assumptions
- ▶ Model dependent results
- ▶ “p-hacking”

Types of experiments

- ▶ Field experiments - Randomized controlled trials (RCTs)
- ▶ Lab and Survey Experiments
- ▶ Natural Experiments

Identification strategies

Experiments and natural experiments

- ▶ Design-based rather than model-based methods
- ▶ Attempts to confront inferential problems (such as confounding) come at the research design stage, rather than through ex-post statistical adjustment
- ▶ Inferential leverage comes more from the research design and not from modeling (e.g., multivariate regression, matching)
- ▶ A simple comparison of means may suffice to establish a causal effect

Natural experiments

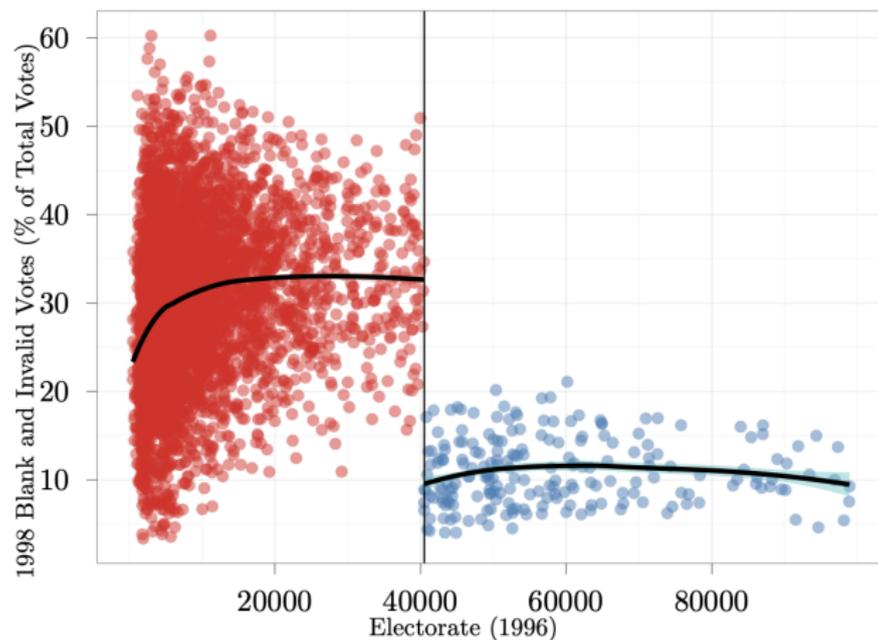
Natural experiments

- ▶ Natural experiments
 - ▶ Regression Discontinuity Designs (RDD)
 - ▶ Instrumental Variables (IV)

Assumption: "*as if random*" treatment assignment

Natural experiments

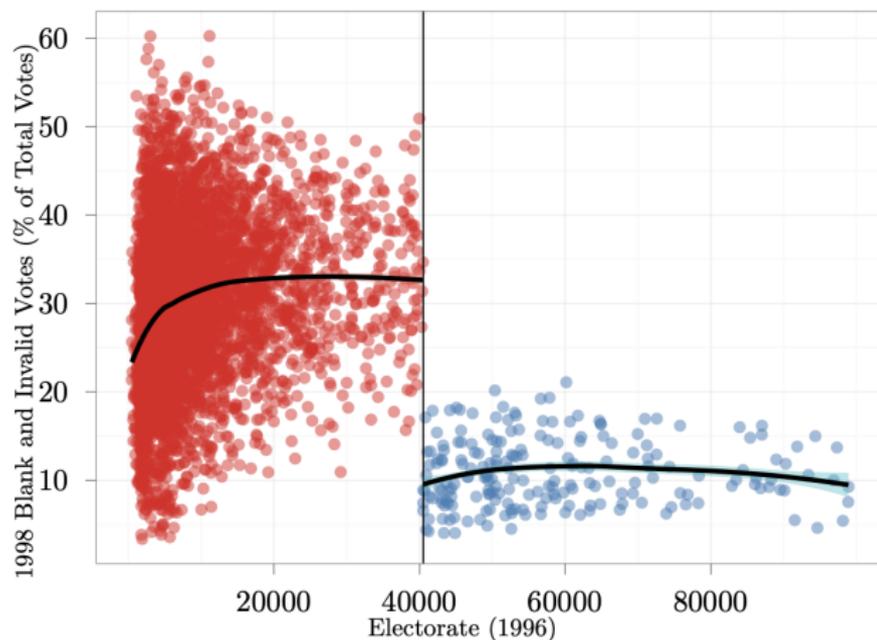
Effects of an intervention: electronic voting in 1998 in Brazil



Source: Hidalgo 2011

Natural experiments

Partial assessment of assumptions (i.e. balance)



Source: Hidalgo 2011

Is “as if random” plausible?

Yes, if it is actually random.

- ▶ For example, a lottery can be used to instrument the treatment.

Field experiments

Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment

By JOSHUA ANGRIST, ERIC BETTINGER, ERIK BLOOM, ELIZABETH KING,
AND MICHAEL KREMER*

Colombia used lotteries to distribute vouchers which partially covered the cost of private secondary school for students who maintained satisfactory academic progress. Three years after the lotteries, winners were about 10 percentage points more likely to have finished 8th grade, primarily because they were less likely to repeat grades, and scored 0.2 standard deviations higher on achievement tests. There is some evidence that winners worked less than losers and were less likely to marry or cohabit as teenagers. Benefits to participants likely exceeded the \$24 per winner additional cost to the government of supplying vouchers instead of public-school places. (JEL I22, J13, I28)

Angrist, Joshua, Eric Bettinger, Erik Bloom, Elizabeth King, and Michael Kremer. 2002. "Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment." *American Economic Review* 92 (5): 1535–58.

Is “as if random” plausible?

Sometimes we need to make an extra effort to convince colleagues:

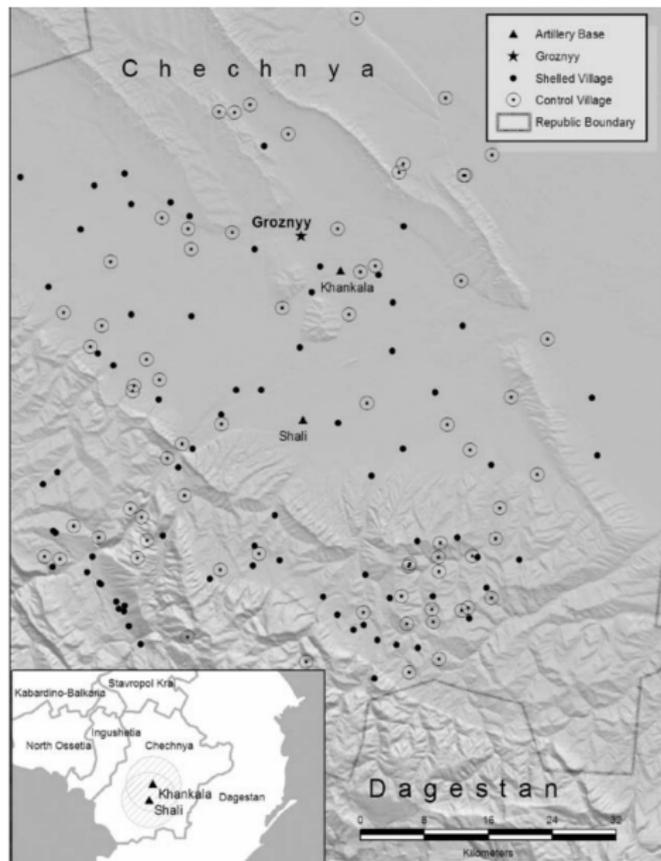
Does Indiscriminate Violence Incite Insurgent Attacks?

Evidence from Chechnya

Jason Lyall

*Department of Politics and the Woodrow Wilson School
Princeton University, New Jersey*

Does a state's use of indiscriminate violence incite insurgent attacks? To date, most existing theories and empirical studies have concluded that such violence is highly counterproductive because it creates new grievances while forcing victims to seek security, if not safety, in rebel arms. This proposition is tested using Russian artillery fire in Chechnya (2000 to 2005) to estimate indiscriminate violence's effect on subsequent patterns of insurgent attacks across matched pairs of similar shelled and nonshelled villages. The findings are counterintuitive. Shelled villages experience a 24 percent reduction in posttreatment mean insurgent attacks relative to control villages. In addition, commonly cited "triggers" for insurgent retaliation, including the lethality and destructiveness of indiscriminate violence, are either negatively correlated with insurgent attacks or statistically insignificant.



Note: One hundred forty-seven populated settlements (seventy-three treated, seventy-four control). The sample population is defined by the range of Russian artillery (see inset map).

Village Level “As-if” Randomization Tests and Postmatching Statistics

Covariates	Mean Treated	Mean Control	Mean Difference	Std. Bias	Rank Sum	K-S Test
“As if” randomization						
Population	7.364	7.020	0.344	0.209	0.248	0.133
Poverty	2.425	2.284	0.141	0.245	0.163	0.802
Tariqa	0.027	0.068	-0.041	-0.244	0.255	-
Elevation	5.933	5.756	0.177	0.225	0.202	0.169
Isolation	4.424	3.959	0.465	0.171	0.641	0.990
Neighbor	0.742	0.899	-0.157	-0.213	0.321	0.542
Garrison	0.178	0.122	0.056	0.145	0.339	-
Rebel	0.548	0.446	0.102	0.204	0.218	-

Limitations

Qualitative methods and contextual knowledge are often required for designing and validating natural experiments.

Randomized controlled trials

Randomized controlled experiments

So called “gold standard” in identification strategies

- ▶ Subjects are assigned to treatment, T_i based on some *random* process
- ▶ The researcher has the ability to impose independence between *treatment status* and *potential outcomes*

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- ▶ Subjects are assigned to treatment, T_i based on some *random* process
- ▶ The researcher has the ability to impose independence between *treatment status* and *potential outcomes*

As a result, treated and non-treated units are, *in expectation*, equal in:

- ▶ observables
- ▶ non-observables

Under ideal conditions of compliance, and no-spillovers,
 $ATE = ATT$

Randomized controlled experiments

There are still several potential limitations:

- ▶ limits to randomization
 - ▶ block randomization

Randomized controlled experiments

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- ▶ limits to randomization
 - ▶ block randomization
- ▶ Noncompliance
 - ▶ Local effects (LATE)

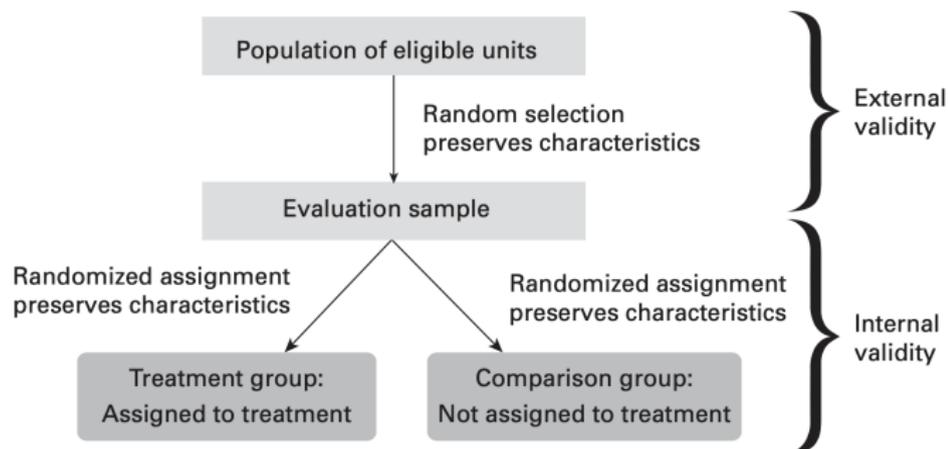
Randomized controlled experiments

There are still several potential limitations:

- ▶ limits to randomization
 - ▶ block randomization
- ▶ Noncompliance
 - ▶ Local effects (LATE)
- ▶ Attrition
- ▶ Spillovers

External validity

Can we infer to the population based on an *internally valid* experiment?



Gertler, et al. (2017).

Responses to the “crisis” of external validity

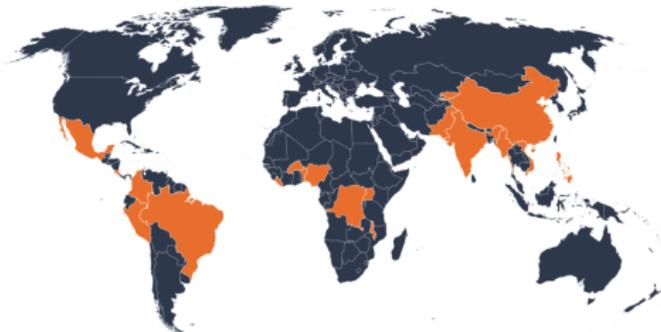
- ▶ Analyze heterogeneous treatment effects
 - ▶ Descriptive interactions between T_i and units characteristics X_i (sex, age, education, ideology, etc.)
 - ▶ This depends on observables in X .
 - ▶ Warning: It is not a test of causal mechanisms

Responses to the “crisis” of external validity

- ▶ Analyze heterogeneous treatment effects
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- ▶ Replication

Metaketa Initiative



Metaketa Initiative Project Locations

The **Metaketa Initiative** is a collaborative research model aimed at improving the accumulation of knowledge from field experiments on topics where academic researchers and policy practitioners share substantive interests. EGAP funds and coordinates studies across countries, clustered by theme, to improve and incentivize innovative research alongside integrated analysis and publication.

Context: EGAP sees an **on-going crisis of external validity** of development research and few systemic efforts to address it. The business-as-usual model for many academic researchers is to select topics they find interesting and seek funding to implement the research in an original way. In practice, this often means the **results may be difficult to integrate** with learning developed in **other contexts**. Other research is done in the context of policy evaluation. In these cases, the research is sometimes commissioned by development agencies and implemented by researchers. Often this research responds strongly to particular local needs but is not designed to answer questions that span variegated contexts. A consequence of this is that **major policy innovations often rest on fragile research foundations**.

For example, major lessons have been drawn on the effectiveness of community-based monitoring of health workers for health gains, or on the advantages of disseminating information on corruption about politicians—all from single studies. Yet there are well known reasons for caution, not least because of the presence of publication bias afflicting academic research. Positive results get published and read, negative or null results often disappear, and little is learned about the role that context plays in determining when a finding is relevant or not.

Solution: EGAP is trying to change this challenge of external validity; in part by **getting the incentives right** to attract the best researchers to contribute to a collective endeavor that **identifies critical areas** where **generalizable knowledge** can have a **large impact**. The key idea of this initiative is to take a major question of policy importance for governance outcomes, identify an intervention that is tried, but not tested, and implement a cluster of coordinated research studies that can provide a reliable answer to the question.

Metaketa Rounds

- I. Information and Accountability
- II. Taxation
- III. Natural Resource Governance
- IV. Community Policing
- V. Women's Action Committees and Local Services

Recent Press Publications

Eight Principles of the Metaketa Initiative

- Coordination across research teams
- Predefined themes and comparable interventions
- Comparable measures
- Integrated case selection
- Preregistration
- Third-party analysis
- Formal synthesis
- Integrated publication

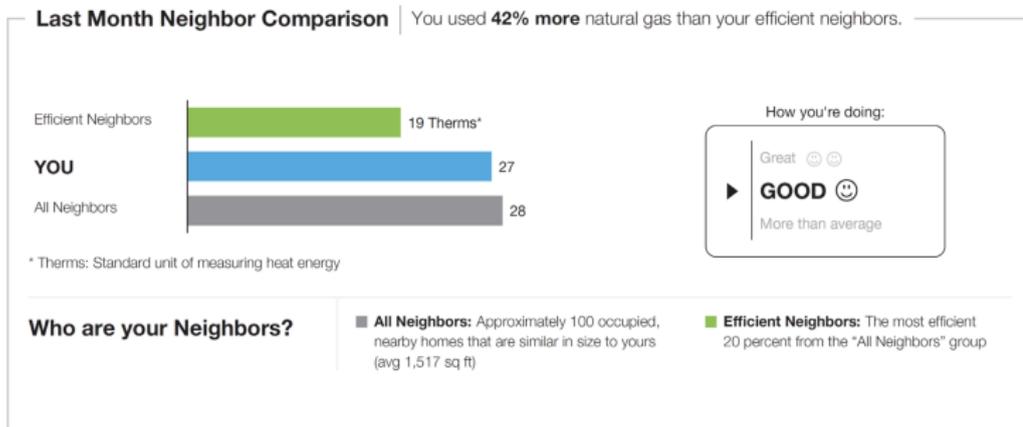
SITE SELECTION BIAS IN PROGRAM EVALUATION*

HUNT ALLCOTT

“Site selection bias” can occur when the probability that a program is adopted or evaluated is correlated with its impacts. I test for site selection bias in the context of the Opower energy conservation programs, using 111 randomized control trials involving 8.6 million households across the United States. Predictions based on rich microdata from the first 10 replications substantially overstate efficacy in the next 101 sites. Several mechanisms caused this positive selection. For example, utilities in more environmentalist areas are more likely to adopt the program, and their customers are more responsive to the treatment. Also, because utilities initially target treatment at higher-usage consumer subpopulations, efficacy drops as the program is later expanded. The results illustrate how program evaluations can still give systematically biased out-of-sample predictions, even after many replications. *JEL* Codes: C93, D12, L94, O12, Q41.

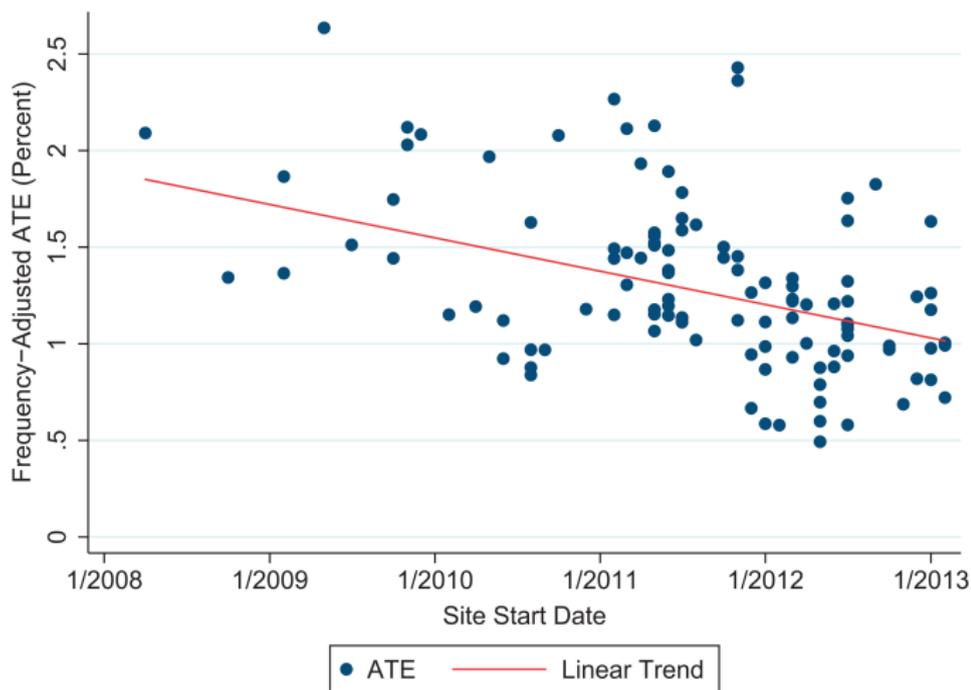
Allcott, H. (2015). Site Selection Bias in Program Evaluation. *The Quarterly Journal of Economics*, 130(3), 1117–1165. <https://doi.org/10.1093/qje/qjv015>

Replication



Schultz et al. (2007)

Selection bias in program evaluation



Allcott, H. (2015). Site Selection Bias in Program Evaluation. *The Quarterly Journal of Economics*, 130(3), 1117–1165. <https://doi.org/10.1093/qje/qjv015>

Survey Experiments

Definitions

- ▶ A survey experiment is just an experiment that occurs in a survey context
 - ▶ As opposed to in the field context
- ▶ Can be in any mode (face-to-face, CATI, online, etc.)
- ▶ May or may not involve a representative population
 - ▶ Mutz (2011): “population-based survey experiments”

The First Survey Experiment?

Hadley Cantril (1940) asks 3000 Americans either:

Do you think the U.S. should do more than it is now doing to help England and France?

- ▶ Yes
- ▶ No

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Do you think the U.S. should do more than it is now doing to help England and France **in their fight against Hitler?**

- ▶ Yes
- ▶ No

The First Survey Experiment?

Hadley Cantril (1940) asks 3000 Americans either:

Do you think the U.S. should do more than it is now doing to help England and France?

- ▶ Yes 13%
- ▶ No

.pull-right[Do you think the U.S. should do more than it is now doing to help England and France **in their fight against Hitler?**

- ▶ Yes 22%
- ▶ No

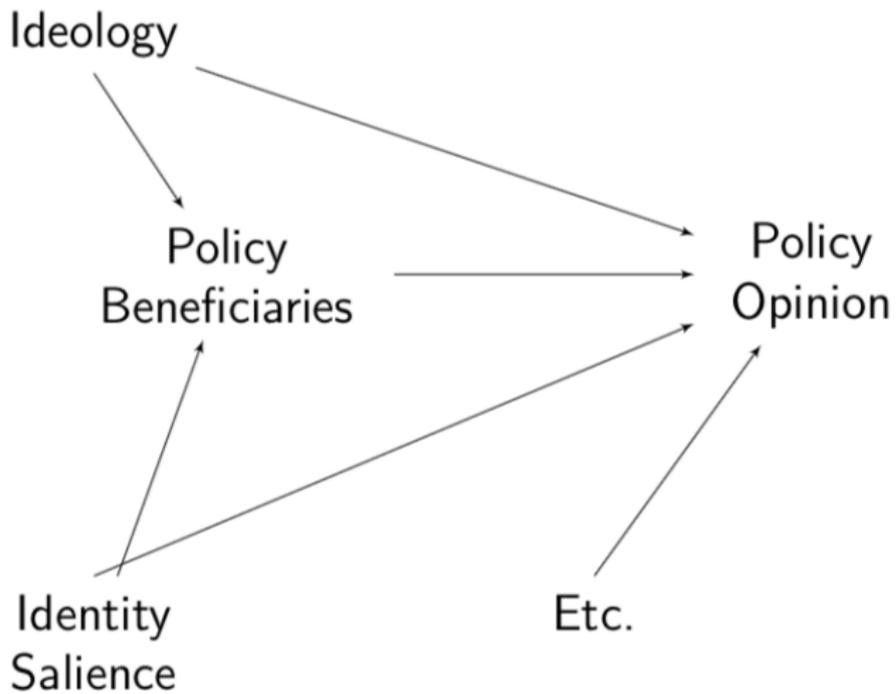
The “Hitler effect” was $22\% - 13\% = 9\%$

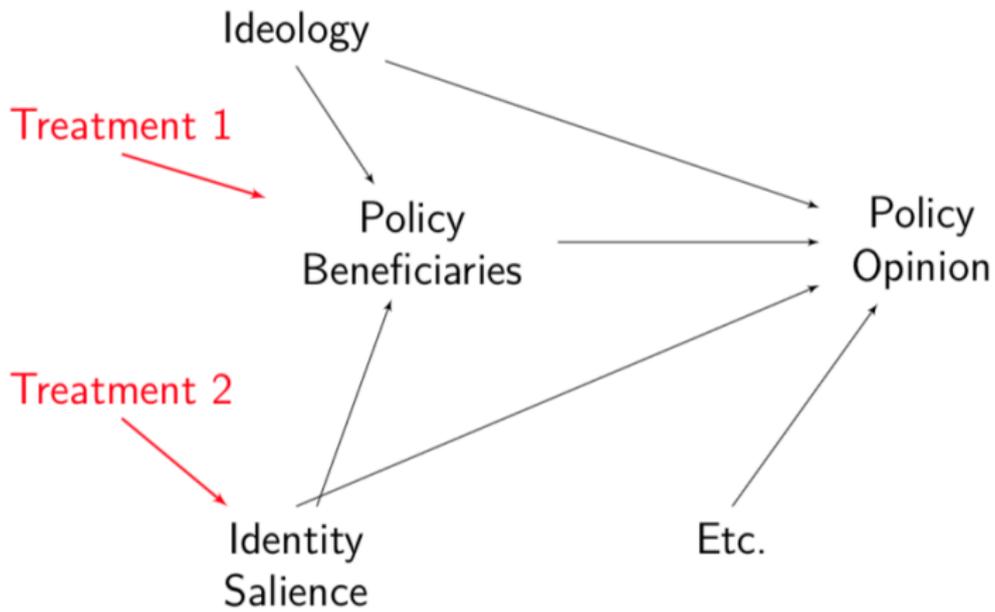
Different types of survey experiments

- ▶ Sensitive item designs
 - ▶ list experiments
 - ▶ Randomized response
- ▶ Vignettes
 - ▶ factorial or multiple arms
- ▶ Randomized conjoint analysis

Factorial Designs

- The two-condition experiment is a stylized ideal
 - ▶ An experiment can have any number of conditions
 - ▶ Up to the limits of sample size
 - ▶ More than 8–10 conditions is typically unwieldy
 - ▶ Three “flavors”:
 - ▶ Multiple conditions in a single factor
 - ▶ Multiple fully crossed factors
 - ▶ Partially crossed (“fractional factorial”) designs
 - ▶ Regression methods provide a generalizable tool for causal inference in such designs





Example¹

- ▶ How close do you feel to **your ethnic or racial group**?
- ▶ Some people have said that taxes need to be raised to take care of pressing national needs. How willing would you be to have your taxes raised to improve education **in public schools**?

¹Transue. 2007. "Identity Salience, Identity Acceptance, and Racial Policy Attitudes: American National Identity as a Uniting Force." *American Journal of Political Science* 51(1): 78–91.

Example²

- ▶ How close do you feel to **other Americans**?
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Example³

- ▶ How close do you feel to **your ethnic or racial group**?
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Example⁴

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2x2 Factorial Design

Condition	Americans	Own Race
Educ. for Minorities	$Y_{1,0}$	$Y_{1,1}$
Schools	$Y_{0,0}$	$Y_{0,1}$

Two ways to parameterize this

Dummy variable regression (i.e., treatment–control CATEs):

$$Y = \beta_0 + \beta_1 X_{0,1} + \beta_2 X_{1,0} + \beta_3 X_{1,1} + \epsilon$$

Interaction effects (i.e., treatment–treatment CATEs):

$$Y = \beta_0 + \beta_1 X_{1_1} + \beta_2 X_{2_1} + \beta_3 X_{1_1} \times X_{2_1} + \epsilon$$

Considerations

- ▶ Factorial designs can quickly become unwieldy and expensive
- ▶ Need to consider what CATEs are of theoretical interest
 - ▶ Treatment-control, pairwise
 - ▶ Treatment-treatment, pairwise
 - ▶ Marginal effects, averaging across other factors
 - ▶ Comparison of merged conditions

Sensitive Item Designs

- ▶ Randomization can be used to measure something
- ▶ List experiments
 - ▶ Randomly present lists of items of varying length
 - ▶ Difference in count of items supported is prevalence of sensitive attitude/behavior
- ▶ Randomized response
 - ▶ Present a sensitive question
 - ▶ Use a randomization device to dictate whether the respondent answers the sensitive question or something else

List Experiments⁵

Now I'm going to read you three things that sometimes make people angry or upset. After I read all three, just tell me *how many* of them upset you. I don't want to know which ones. just how many.

1. the federal government increasing the tax on gasoline
2. professional athletes getting million-dollar salaries
3. large corporations polluting the environment

⁵Kuklinski et al. 1997. "Racial Prejudice and Attitudes Toward Affirmative Action." *American Journal of Political Science* 41(2): 402–419.

List Experiments⁶

Now I'm going to read you three things that sometimes make people angry or upset. After I read all three, just tell me *how many* of them upset you. I don't want to know which ones. just how many.

1. the federal government increasing the tax on gasoline
2. professional athletes getting million-dollar salaries
3. large corporations polluting the environment
4. **a black family moving in next door**

⁶Kuklinski et al. 1997. "Racial Prejudice and Attitudes Toward Affirmative Action." *American Journal of Political Science* 41(2): 402–419.

Randomized Response⁷

Here is a bag; in it there are stones from the game 'Go,' some colored black and others white. Please take one stone out, and see by yourself what color it is, black or white. Don't let me know whether it is black or white, but be sure you know which it is.

If you take a black one, answer the question: "Have you ever had an induced abortion?"

If you take a white one, answer the question: "Were you born in the lunar year of the horse?"

Considerations:

- ▶ Can use any randomization device
- ▶ Can be cognitively complex

⁷Blair, Imai, and Zhou. 2015. "Design and Analysis of the Randomized Response Technique." *JASA* 110(511): 1304–19.

Conjoint Analysis

Conjoint experiments

- ▶ Surveys measure stated preferences
- ▶ Conjoint analysis involves measuring revealed preferences based upon a series of forced-choice decisions
 - ▶ Present respondents with pairs of “profiles” containing many features
 - ▶ Force respondents to choose which of the two they prefer
- ▶ Estimate relative importance of features of each profile
- ▶ Randomization of profile features gives differences in preferences across attributes a causal meaning

See: Hainmueller, Hopkins, and Yamamoto (2014)

Pros and Cons

- ▶ Pros
 - ▶ Reduces “cheap talk” results
 - ▶ Lower social desirability biases
 - ▶ Mimics real-world decisions
 - ▶ Revealed preferences are causally interpretable
- ▶ Cons
 - ▶ More cognitively complex for respondents than traditional polling
 - ▶ No straightforward “% support” statistics
 - ▶

The Hidden American Immigration Consensus: A Conjoint Analysis of Attitudes toward Immigrants

Jens Hainmueller
Daniel J. Hopkins

Stanford University
Georgetown University

Many studies have examined Americans' immigration attitudes. Yet prior research frequently confounds multiple questions, including which immigrants to admit and how many to admit. To isolate attitudes on the former question, we use a conjoint experiment that simultaneously tests the influence of nine immigrant attributes in generating support for admission. Drawing on a two-wave, population-based survey, we demonstrate that Americans view educated immigrants in high-status jobs favorably, whereas they view those who lack plans to work, entered without authorization, are Iraqi, or do not speak English unfavorably. Strikingly, Americans' preferences vary little with their own education, partisanship, labor market position, ethnocentrism, or other attributes. Beneath partisan divisions over immigration lies a broad consensus about who should be admitted to the country. The results are consistent with norms-based and sociotropic explanations of immigration attitudes. This consensus points to limits in both theories emphasizing economic and cultural threats, and sheds new light on an ongoing policy debate.

⁸Hainmueller, Jens, and Daniel J. Hopkins. 2015. "The Hidden American Immigration Consensus: A Conjoint Analysis of Attitudes toward Immigrants." *American Journal of Political Science* 59 (3): 529–48.

Immigration Example

Introduction to experimental tasks:

“This study considers immigration and who is permitted to come to the United States to live. For the next few minutes, we are going to ask you to act as if you were an immigration official. We will provide you with several pieces of information about people who might apply to move to the United States. For each pair of people, please indicate which of the two immigrants you would personally prefer to see admitted to the United States. This exercise is purely hypothetical. Please remember that the United States receives many more applications for admission than it can accept. Even if you aren't entirely sure, please indicate which of the two you prefer.”

Immigration Example

	Immigrant 1	Immigrant 2
Prior Trips to the U.S.	Entered the U.S. once before on a tourist visa	Entered the U.S. once before on a tourist visa
Reason for Application	Reunite with family members already in U.S.	Reunite with family members already in U.S.
Country of Origin	Mexico	Iraq
Language Skills	During admission interview, this applicant spoke fluent English	During admission interview, this applicant spoke fluent English
Profession	Child care provider	Teacher
Job Experience	One to two years of job training and experience	Three to five years of job training and experience
Employment Plans	Does not have a contract with a U.S. employer but has done job interviews	Will look for work after arriving in the U.S.
Education Level	Equivalent to completing two years of college in the U.S.	Equivalent to completing a college degree in the U.S.
Gender	Female	Male

Immigration Example

	Immigrant 1	Immigrant 2
If you had to choose between them, which of these two immigrants should be given priority to come to the United States to live?	<input type="radio"/>	<input type="radio"/>

On a scale from 1 to 7, where 1 indicates that the United States should absolutely not admit the immigrant and 7 indicates that the United States should definitely admit the immigrant, how would you rate Immigrant 1?

Absolutely Not Admit							Definitely Admit
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Using the same scale, how would you rate Immigrant 2?

Absolutely Not Admit							Definitely Admit
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Immigration Example

Attributes	Values
Education Level	No formal education Equivalent to completing fourth grade in the U.S. Equivalent to completing eighth grade in the U.S. Equivalent to completing high school in the U.S. Equivalent to completing two years at college in the U.S. Equivalent to completing a college degree in the U.S. Equivalent to completing a graduate degree in the U.S.
Gender	Female Male
Country of Origin	Germany France Mexico Philippines Poland India China Sudan Somalia Iraq
Language	During admission interview, this applicant spoke fluent English During admission interview, this applicant spoke broken English During admission interview, this applicant tried to speak English but was unable During admission interview, this applicant spoke through an interpreter
Reason for Application	Reunite with family members already in U.S. Seek better job in U.S. Escape political/religious persecution
Profession	Gardener Waiter Nurse Teacher Child care provider Janitor Construction worker Financial analyst Research scientist Doctor Computer programmer
Job Experience	No job training or prior experience One to two years Three to five years More than five years
Employment Plans	Has a contract with a U.S. employer Does not have a contract with a U.S. employer, but has done job interviews Will look for work after arriving in the U.S. Has no plans to look for work at this time
Prior Trips to the U.S.	Never been to the U.S. Entered the U.S. once before on a tourist visa Entered the U.S. once before without legal authorization

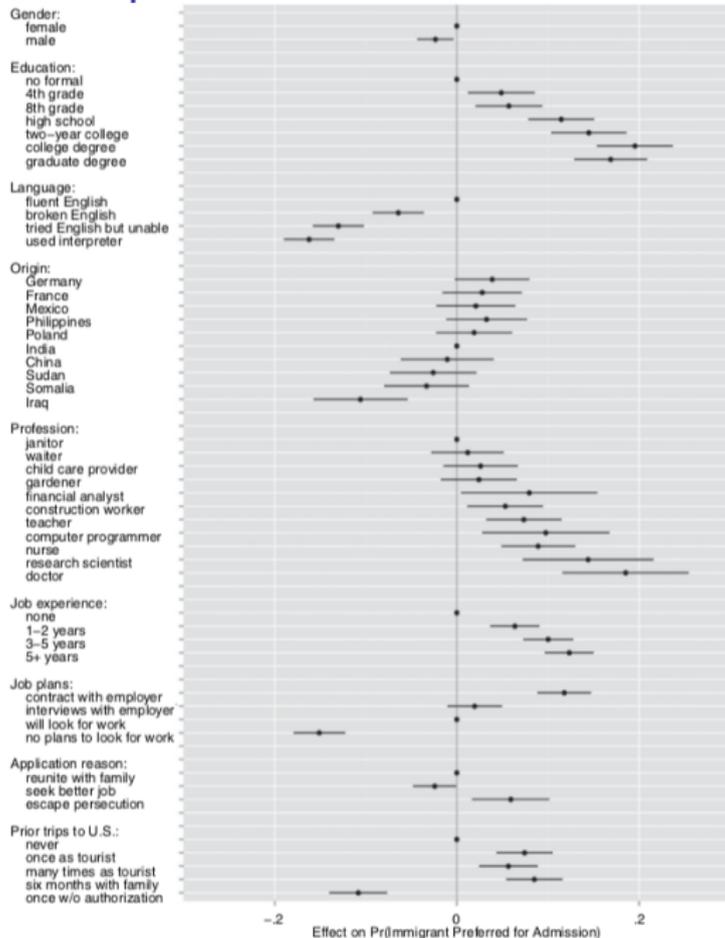
AMCEs

Statistic of interest is the *average marginal component effect* (AMCE), which is the causal effect of each level of each feature on support for an overall profile.

We can estimate this using (dummy variable) OLS, assuming:

- ▶ Full randomization of attributes and randomized pairing of profiles
- ▶ Even presentation of levels w/in features
- ▶ No profile ordering effects

Immigration Example : Results



Challenges

- ▶ Interpretation of AMCEs depend on choice of the base category
 - ▶ Report marginal means (Leeper et. al., 2020)
- ▶ Heterogeneity
 - ▶ Higher order interactions between treatment conditions
 - ▶ Respondents' characteristics

Example: Illegal electricity users

Profile attributes and their respective values:

sex	male; female
age	26, 37, 58
job status	formal employment, informal self-employed; long-term unemployed; short-term unemployed
income	“about half poverty line”, “about poverty line”, “about 1.5 times the poverty line”, “about 3 times the poverty line”
education	primary; incomplete secondary; complete secondary
childs	0, 2, 5 children under 18
place of residence	regular neighborhood, urban slum, rural area
energy provider	private; public; non-profit organization
social assistance benefits	beneficiary of cash-transfers program; no beneficiary

Example: Illegal electricity users

Escenario 1 de 6

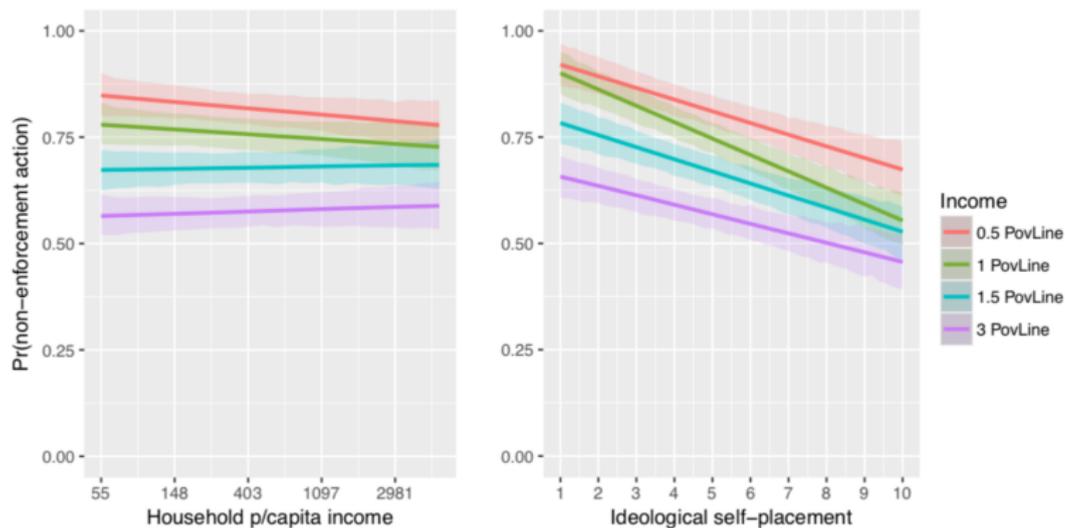
	Usuario irregular 1	Usuario irregular 2
Nivel educativo	Secundaria completa	Primaria
Situación laboral	Trabajo asalariado, sin derechos sociales (su patrón no aporta a la seguridad social)	En el desempleo hace 3 semanas
Sexo	Hombre	Hombre
Recibe ayuda de programas sociales del gobierno	No recibe	Sí, recibe transferencias de ingreso
Ingreso mensual (en pesos uruguayos)	\$ 12.540 (doce mil quinientos cuarenta)	\$ 25.100 (veinticinco mil cien)
Hijos menores a cargo	5 hijos	No tiene
La empresa de servicio eléctrico en la zona es una...	Empresa privada	Empresa pública o estatal
Lugar de residencia	Asentamiento informal o barrio marginal	Barrio urbano en zona residencial
Edad	58 años	58 años

Example: Illegal electricity users

“What actions would you take with each of these two irregular users of electricity?”

- ▶ Non-enforcement options are “no measure at all” and “sending a warning letter”.
- ▶ Enforcement options are “cut the irregular connection” and “cut the irregular connection together with applying an economic sanction”

Example: Describing heterogeneity across respondents



Recent advances

- ▶ Causal interactions and causal mechanisms
- ▶ Direct effects and controlled direct effects
- ▶ Finding higher order interactions with machine learning
- ▶ Adaptive treatment assignment

Thanks !