

# Survey Methodologies for Sensitive Questions

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Joint work with

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# Introduction

- ▶ Challenge of measuring sensitive attitudes and behaviors
  - ▶ social desirability bias
  - ▶ non-response bias
- ▶ Indirect methods becoming increasingly popular
  - ▶ list experiments
  - ▶ endorsement experiment
  - ▶ randomized response
- ▶ **Development of statistical methods**
  - ▶ multivariate regression for each survey technique (Bullock, Imai and Shapiro 2010; Imai 2011; Blair & Imai 2012; Blair, Imai & Zhou 2014)
  - ▶ using responses as predictors in outcome regression (Imai, Park & Greene In-press)
- ▶ **Empirical validation studies**
  - ▶ validation against ground truth (Rosenfeld, Imai & Shapiro In-press)
  - ▶ comparison of multiple measurements (Blair, Imai & Lyall 2014)
  - ▶ prediction of behavior (Hirose, Imai & Lyall 2014)

# The Mississippi Validation Study (Rosenfeld, Imai & Shapiro In-press)

- ▶ Estimate voting on anti-abortion referendum using:
  - ▶ direct question
  - ▶ list experiment (item/unmatched count technique)
  - ▶ endorsement experiment
  - ▶ randomized response
- ▶ Validate estimates against official election outcome:
  - ▶ sample from voter history file
  - ▶ county-level voting recap reports for validation
- ▶ Case selection:
  - ▶ a poll conducted 24 hours before the election predicts 44% no votes
  - ▶ the amendment was defeated 58% to 42%
- ▶ Findings:
  - ▶ direct question  $\rightsquigarrow$  significant under-estimation though efficient
  - ▶ indirect methods  $\rightsquigarrow$  much less biased though more variable
  - ▶ endorsement and randomized response  $\rightsquigarrow$  least bias

# Direct Question

Did you vote YES or NO on the Personhood Initiative, which appeared on the November 2011 Mississippi General Election ballot?

Voted Yes

Voted No

Did not vote

Don't know

Refused

# List Experiment

Here is a list of four things that some people have done and some people have not. Please listen to them and then tell me HOW MANY of them you have done in the past two years. Do not tell me which you have and have not done. Just tell me how many:

Discussed politics with family or friends

Cast a ballot for Governor Phil Bryant

Paid dues to a union

Given money to a Tea Party candidate or organization

(treatment) Voted 'YES' on the 'Personhood' Initiative

How many of these things have you done in the past two years?

# Endorsement Experiment

We'd like to get your overall opinion of some people in the news. As I read each name, please say if you have a very favorable, somewhat favorable, somewhat unfavorable, or very unfavorable opinion of each person.

(control) Phil Bryant, Governor of Mississippi?

(treatment) Phil Bryant, Governor of Mississippi, who campaigned in favor of the 'Personhood' Initiative on the 2011 Mississippi General Election ballot?

# Randomized Response

To answer this question, you will need a coin. Once you have found one, please toss the coin two times and note the results of those tosses (heads or tails) one after the other on a sheet of paper. Do not reveal to me whether your coin lands on heads or tails. After you have recorded the results of your two coin tosses, just tell me you are ready and we will begin.

Now, please answer 'yes' if either your second coin toss came up heads or you voted 'YES' on the Personhood Initiative, which appeared on the November 2011 Mississippi General Election ballot.

Yes

No

Don't know

Refused

# Method for List Experiment (Imai 2011; Blair & Imai 2012)

- ▶ Setup:
  - ▶  $Y_i$ : observed response
  - ▶  $X_i$ : observed covariates
  - ▶  $Z_i^*$ : latent response to the sensitive item
  - ▶  $Y_i^*$ : latent response to the control items
  - ▶  $T_i$ : treatment such that  $Y_i = Y_i^* + T_i Z_i^*$
- ▶ Assumptions: (1) no design effect, (2) no liar
- ▶ A total of  $(2 \times (J + 1))$  “types” ( $Y_i^*, Z_i^*$ )
- ▶ Example: three control items ( $J = 3$ )

$Y_i$	Treatment group	Control group
4	(3,1)	
3	(2,1) (3,0)	(3,1) (3,0)
2	(1,1) (2,0)	(2,1) (2,0)
1	(0,1) (1,0)	(1,1) (1,0)
0	(0,0)	(0,1) (0,0)

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1	<del>(0,1) (1,0)</del>	(1,1) <del>(1,0)</del>
0	<del>(0,0)</del>	<del>(0,1) (0,0)</del>

# Statistical Model for List Experiment

- ▶ Submodel for the response to the sensitive item  $Z_i^*$ :

$$\Pr(Z_i^* = 1 \mid X_i) = \text{logit}^{-1}(\alpha + \beta^\top X_i)$$

- ▶ Submodel for the responses to the control items  $Y_i^*$ :

$$\Pr(Y_i^* = y \mid X_i, Z_i^*) = \text{Binomial}(J, \text{logit}^{-1}(\gamma + \delta^\top X_i + \zeta Z_i^*))$$

- ▶ Combine them under the likelihood framework

# Model for Endorsement Experiment (Bullock, Imai & Shapiro 2011)

## ▶ Setup:

- ▶  $T_i$ : treatment
- ▶  $Y_i$ : observed (ordinal) response
- ▶  $Y_i^*$ : latent (continuous) response
- ▶  $X_i$ : observed covariates
- ▶  $V_i^*$ : latent ideological position
- ▶  $Z_i^*$ : latent additional support induced by the endorsement

## ▶ Latent measurement model:

$$Y_i^* \stackrel{\text{indep.}}{\sim} \mathcal{N}(\beta(V_i^* + T_i Z_i^*) - \alpha, 1)$$

with appropriate cut-points

## ▶ Hierarchical model $V_i^*$ and $Z_i^*$ :

$$V_i^* \stackrel{\text{indep.}}{\sim} \mathcal{N}(\delta^\top X_i, 1)$$
$$Z_i^* \stackrel{\text{indep.}}{\sim} \mathcal{N}(\lambda^\top X_i, \omega^2)$$

## ▶ Probability of positive support: $\Pr(Z_i^* > 0 \mid X_i)$

# Model for Randomized Response (Blair, Imai & Zhou 2014)

- ▶ Setup:

- ▶  $Y_i$ : observed response
- ▶  $Z_i^*$ : latent response to the sensitive item
- ▶  $X_i$ : covariates

- ▶ The model is,

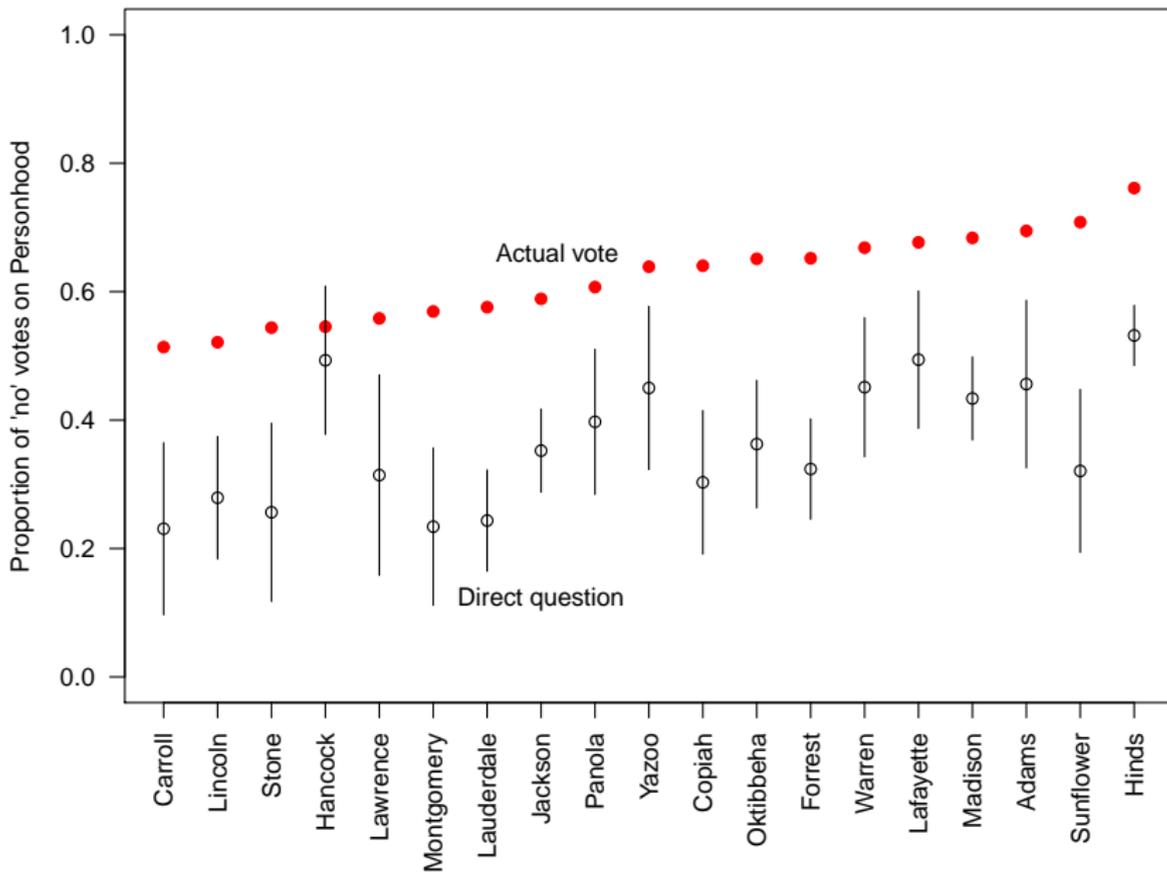
$$\Pr(Z_i^* = 1 \mid X_i) = \text{logit}^{-1}(\alpha + \beta^\top X_i)$$

- ▶ The likelihood function is given by,

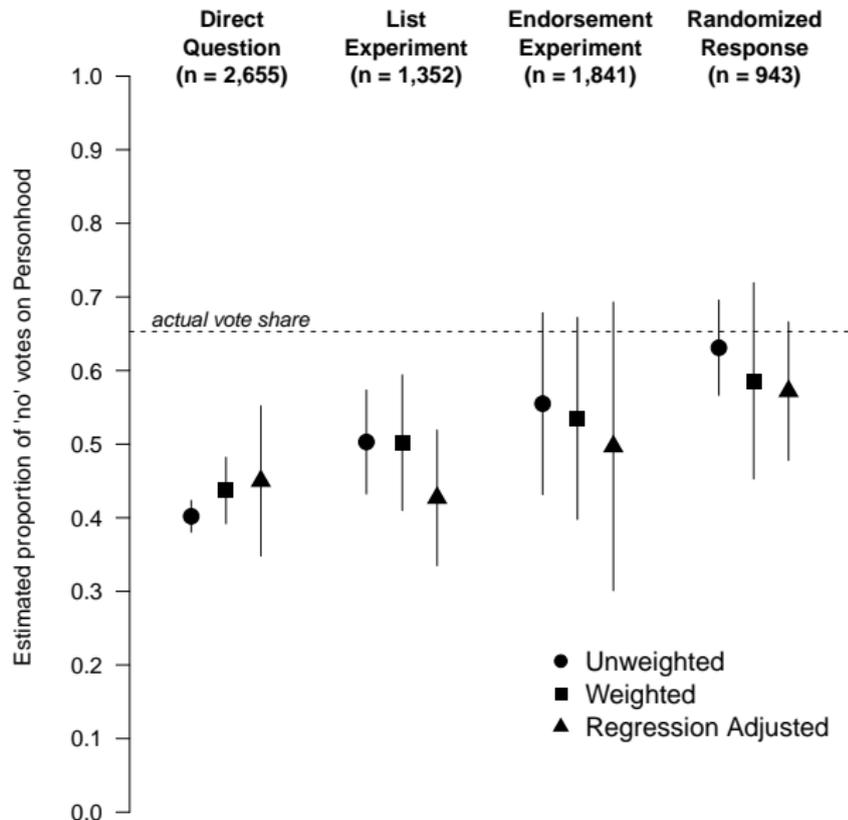
$$\prod_{i=1}^n \left\{ \frac{1}{2} \cdot \text{logit}^{-1}(\alpha + \beta^\top X_i) + \frac{1}{2} \right\}^{Y_i} \left\{ 1 - \frac{1}{2} \cdot \text{logit}^{-1}(\alpha + \beta^\top X_i) - \frac{1}{2} \right\}^{1-Y_i}$$

- ▶ Many other designs and accompanying methods are available

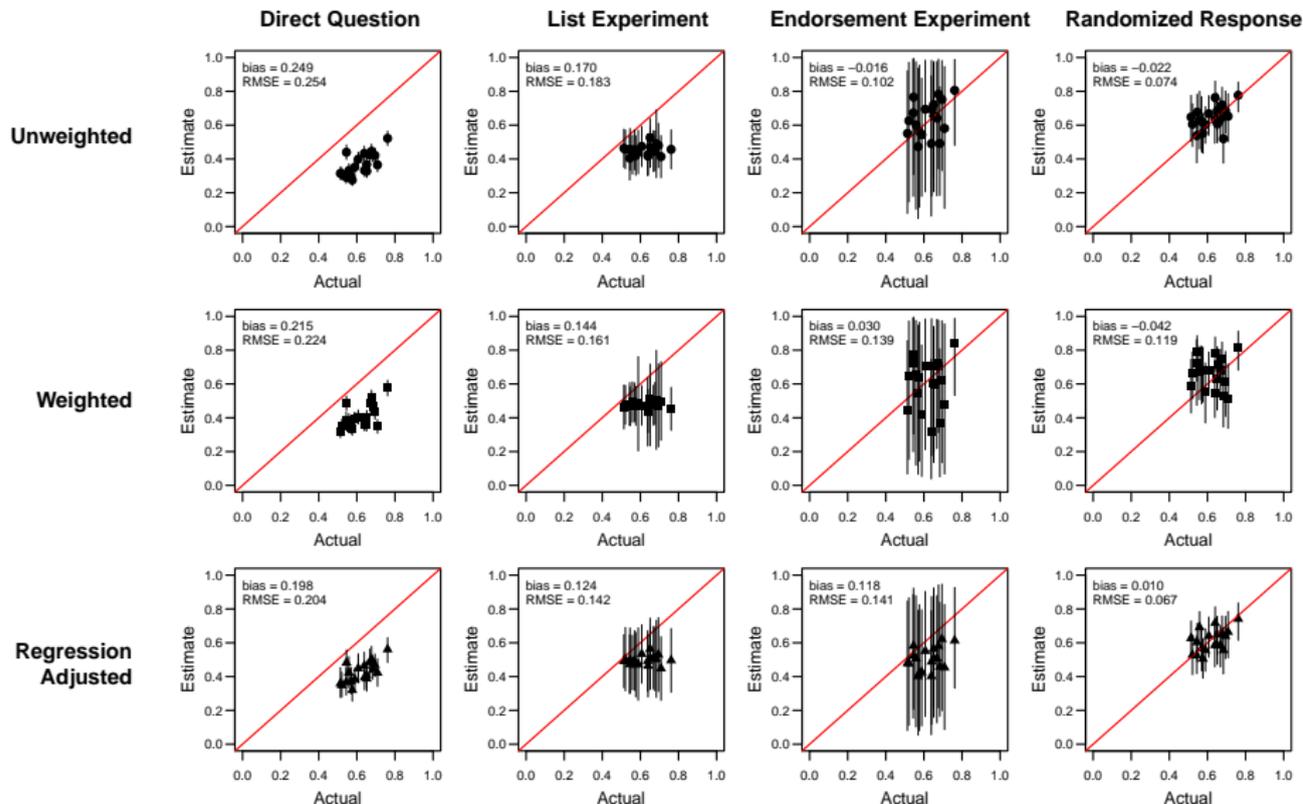
# Bias of the Direct Question



# Pooled Analysis



# County-level Analysis

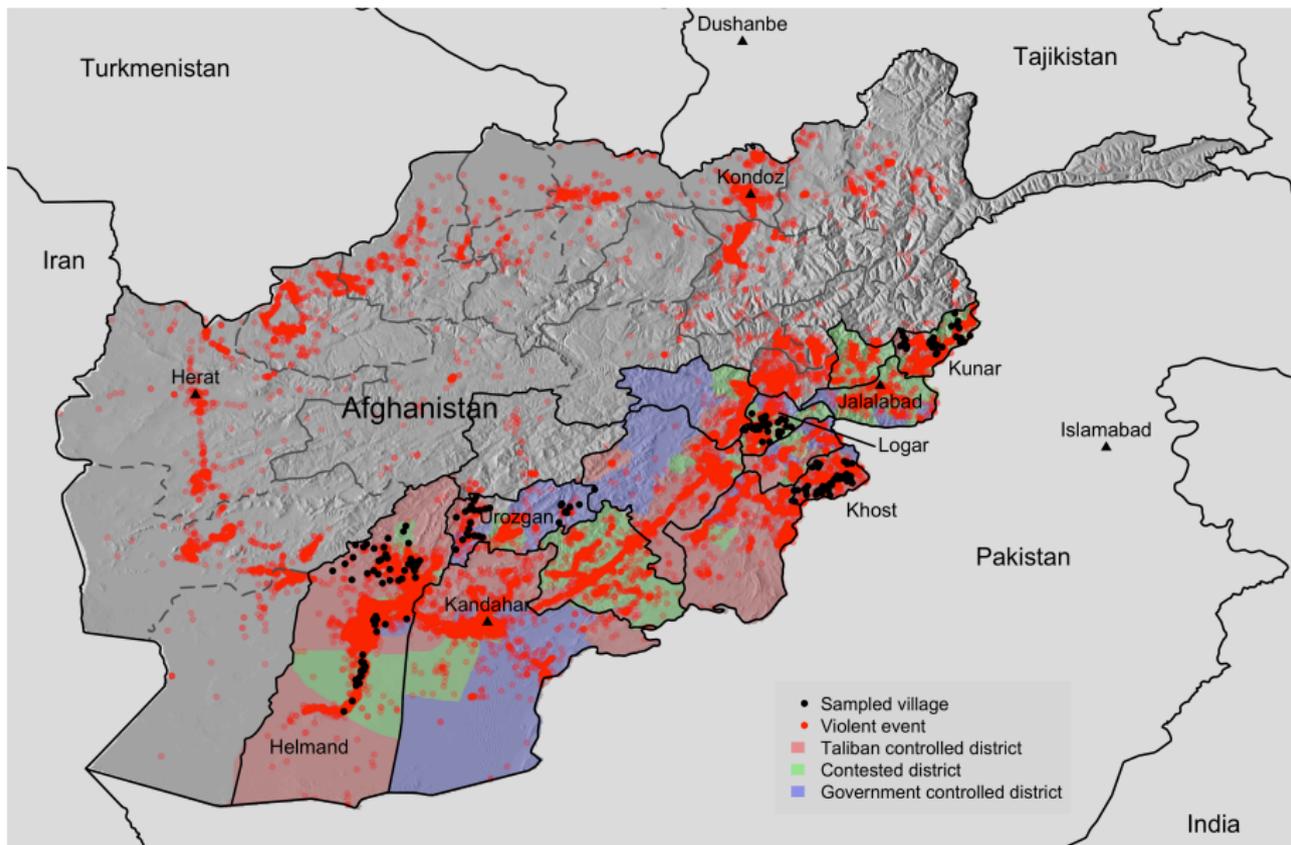


- ▶ How do we measure civilian attitudes in a conflict setting?
- ▶ Current efforts in Afghanistan rely on direct questions:
  1. USAID (TCAPF): “Who do you believe can solve your problems?”
  2. ISAF (ANQAR): “Over the past 6 months, do you think the Taliban have grown stronger, grown weaker, or remained the same?”
- ▶ Why are direct questions a bad idea?
  1. Threats to enumerators and respondents
  2. Nonresponse, social desirability bias
  3. Interviews are public
  4. Danger of selection bias in sampling locations (role of gatekeepers)
- ▶ ANQAR (November-December 2011): 50% refusal rate

# Public Nature of Interviews



# Surveying in the Heartland of Insurgency



# Endorsement Experiments

- ▶ Script for the **control group**:

A recent proposal calls for the sweeping reform of the Afghan prison system, including the construction of new prisons in every district to help alleviate overcrowding in existing facilities. Though expensive, new programs for inmates would also be offered, and new judges and prosecutors would be trained. How do you feel about this proposal?

Strongly agree; Agree; Indifferent; Disagree;  
Strongly disagree; Don't Know; Refuse to answer

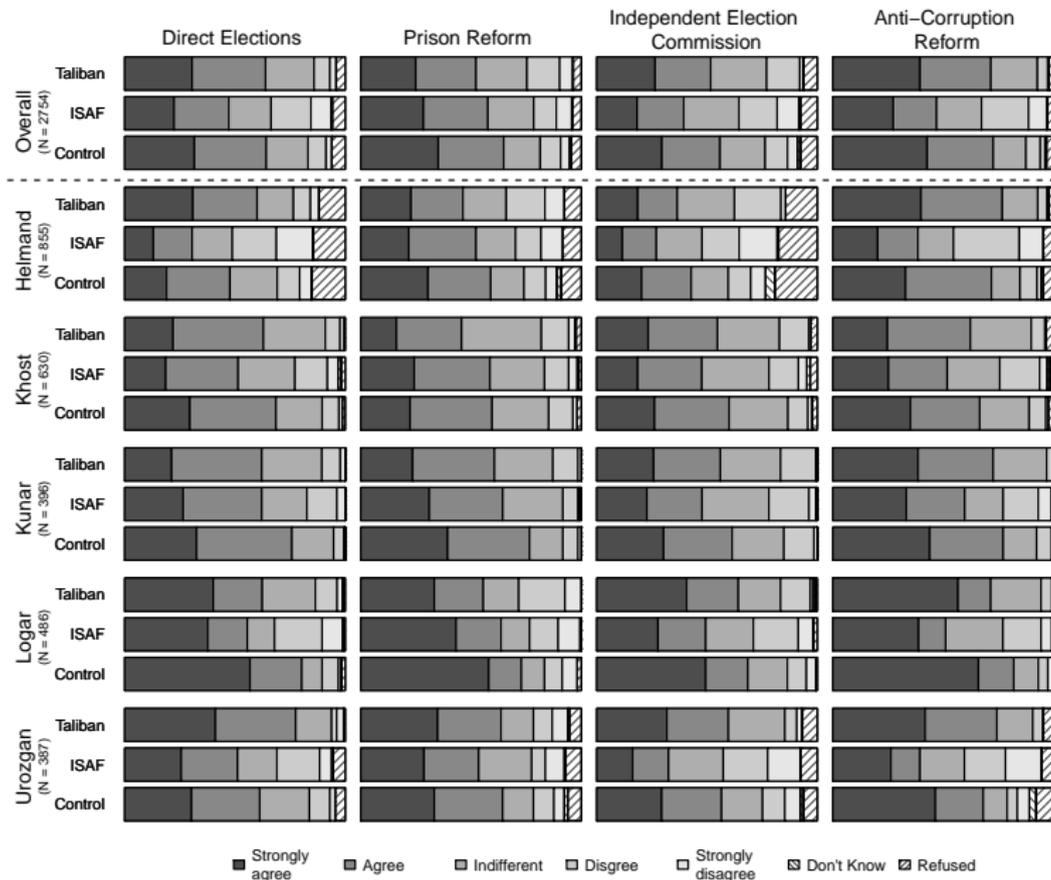
# Endorsement Experiments

- ▶ Script for the **treatment group**:

A recent proposal **by ISAF** calls for the sweeping reform of the Afghan prison system, including the construction of new prisons in every district to help alleviate overcrowding in existing facilities. Though expensive, new programs for inmates would also be offered, and new judges and prosecutors would be trained. How do you feel about this proposal?

Strongly agree;    Agree;    Indifferent;    Disagree;  
Strongly disagree;    Don't Know;    Refuse to answer

# Data from the Endorsement Experiments



# List Experiments

- ▶ Script for the **control group**:

I'm going to read you a list with the names of different groups and individuals on it. After I read the entire list, I'd like you to tell me how many of these groups and individuals you broadly support, meaning that you generally agree with the goals and policies of the group or individual. Please don't tell me which ones you generally agree with; only tell me how many groups or individuals you broadly support.

Karzai Government; National Solidarity Program; Local Farmers

# List Experiments

- ▶ Script for the **treatment group**:

I'm going to read you a list with the names of different groups and individuals on it. After I read the entire list, I'd like you to tell me how many of these groups and individuals you broadly support, meaning that you generally agree with the goals and policies of the group or individual. Please don't tell me which ones you generally agree with; only tell me how many groups or individuals you broadly support.

Karzai Government; National Solidarity Program; Local Farmers; **ISAF**

# Comparing and Combining List and Endorse Experiments

- ▶ Need for validation  $\implies$  **Multiple measurement strategy**
- ▶ Two measures should give similar results
- ▶ What is the probability of supporting ISAF?
  1. List: prob. of saying yes to the sensitive item
  2. Endorsement: prob. of endorsement having a positive effect on support for policy
- ▶ These probabilities should be similar!
- ▶ They can be estimated with a new multivariate regression method
- ▶ Endorsement and list experiments can even be combined for a joint analysis

# Statistical Analysis of Endorsement Experiments

- ▶ **Item response theory** to combine questions:

$$\Pr(Y_{ij} = 1 \mid T_i = k) = \Phi(\alpha_j + \beta_j(x_i + s_{ijk}))$$

- ▶  $\alpha_j$ : average popularity of policy  $j$
  - ▶  $\beta_j$ : how much policy  $j$  differentiates pro- and anti-reform respondents
  - ▶  $x_i$ : “ideal point” = how pro-reform respondent  $i$  is
  - ▶  $s_{ijk}$ : support level for combatant  $k$  in policy  $j$
- ▶ Multi-stage sampling  $\rightsquigarrow$  **Multi-level modeling**

$$s_{ijk} \stackrel{\text{indep.}}{\sim} \mathcal{N}(\lambda_{k,\text{village}[i]} + Z_i^\top \lambda_k^Z, \omega_{k,\text{village}}^2)$$

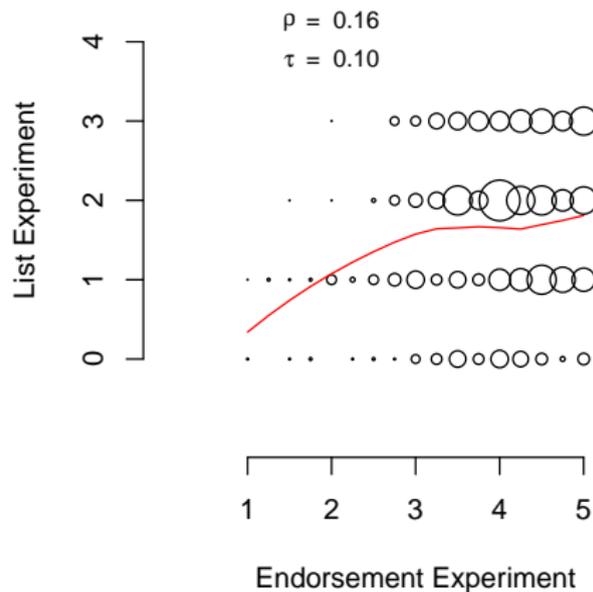
$$\lambda_{k,\text{village}[i]} \stackrel{\text{indep.}}{\sim} \mathcal{N}(\lambda_{k,\text{district}[i]} + V_{\text{village}[i]}^\top \lambda_k^V, \omega_{k,\text{district}}^2)$$

$$\lambda_{k,\text{district}[i]} \stackrel{\text{indep.}}{\sim} \mathcal{N}(\lambda_{k,\text{province}[i]} + W_{\text{district}[i]}^\top \lambda_k^W, \omega_{k,\text{province}}^2)$$

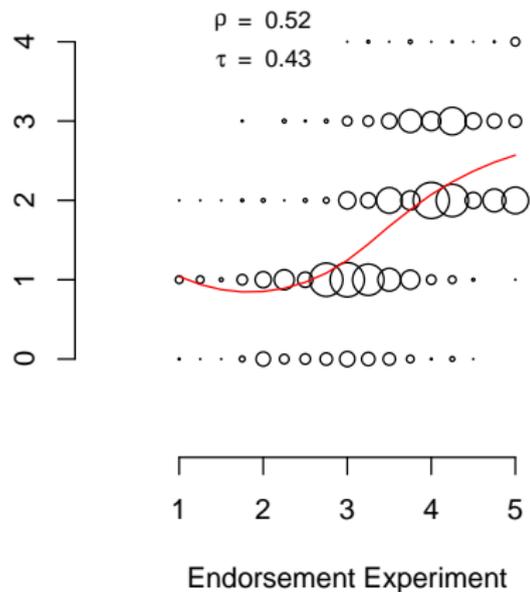
- ▶ Same multi-level structure for ideal points  $x_i$

# Descriptive Comparison: Overall

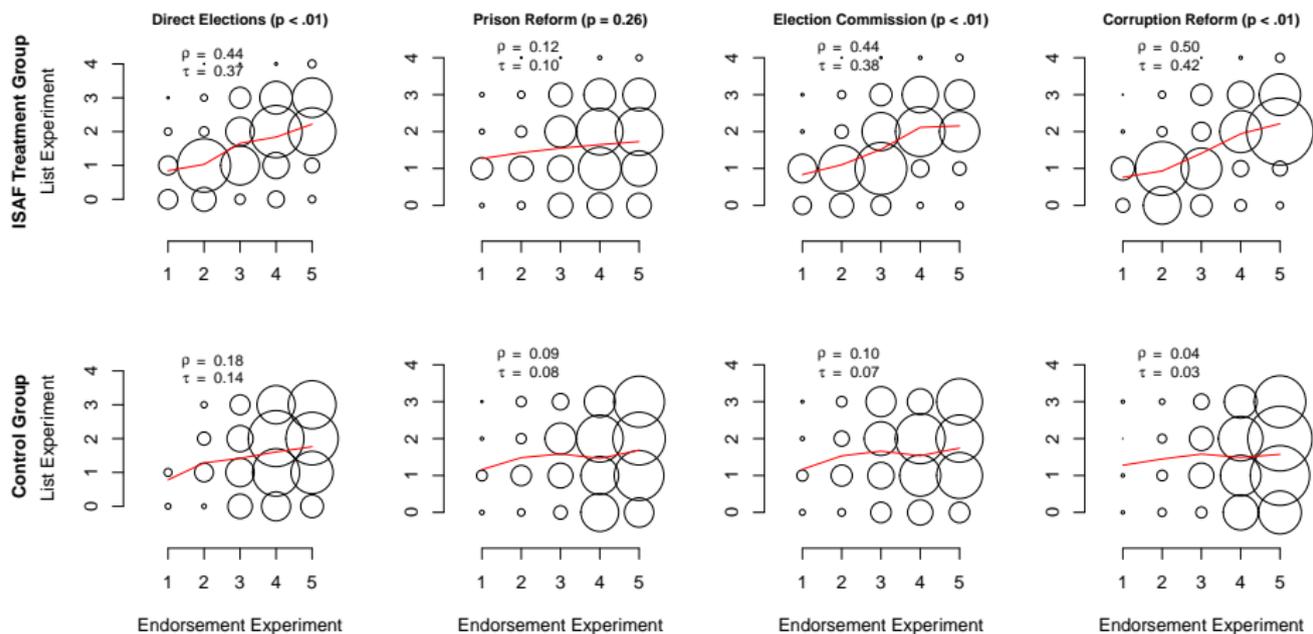
## Control Group



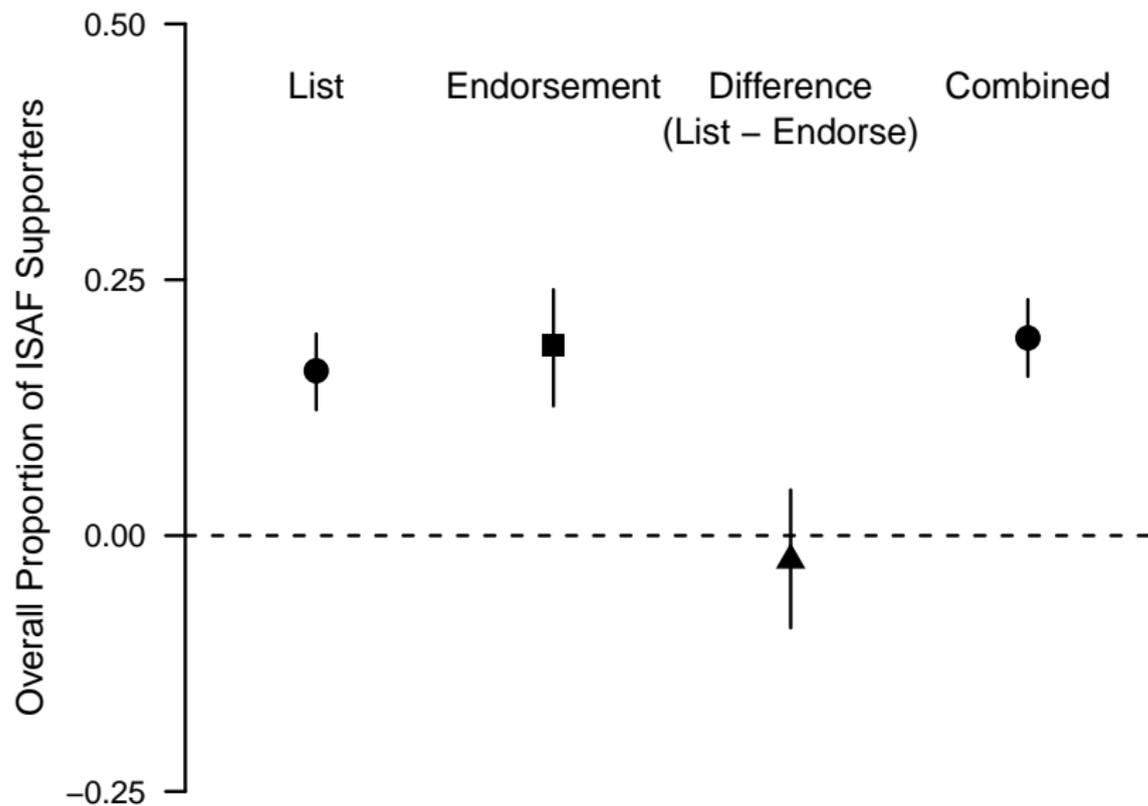
## ISAF Treatment Group



# Descriptive Comparison: Question by Question



# Overall Proportion of ISAF Supporters



# Concluding Remarks

- ▶ Direct question is severely biased
- ▶ All indirect methods reduce bias:
  - ▶ Endorsement and randomized response  $\rightsquigarrow$  least bias
  - ▶ List experiment  $\rightsquigarrow$  ceiling/floor effects, design effects
  - ▶ Ease of implementation: list  $>$  endorse  $>$  randomized response
- ▶ Use of multiple-measurement strategies when truth is not available
- ▶ Future research directions:
  - ▶ How to balance bias, precision, and cost
  - ▶ Use aggregate-level truth to improve individual-level estimates
- ▶ Open-source software:
  - ▶ **list** for list experiment (Blair, Imai & Park)
  - ▶ **endorse** for endorsement experiment (Shiraito & Imai)
  - ▶ **rr** for randomized response (Blair, Imai & Zhou)

- ▶ Development of new methods:
  - ▶ “Statistical Analysis of Endorsement Experiments: Measuring Support for Militant Groups in Pakistan.” *Political Analysis*
  - ▶ “Multivariate Regression Analysis for the Item Count Technique.” *Journal of the American Statistical Association*
  - ▶ “Statistical Analysis of List Experiments.” *Political Analysis*
  - ▶ “Comparing and Combining List and Endorsement Experiments: Evidence from Afghanistan.” *American Journal of Political Science*
  - ▶ “Using the Predicted Responses from List Experiments as Explanatory Variables in Regression Models.” *Political Analysis*
  - ▶ “Design and Analysis of the Randomized Response Technique.”
- ▶ Empirical applications and validations:
  - ▶ “Explaining Support for Combatants during Wartime: A Survey Experiment in Afghanistan.” *American Political Science Review*
  - ▶ “An Empirical Validation Study of Popular Survey Methodologies for Sensitive Questions.” *American Journal of Political Science*
  - ▶ “Can Civilian Attitudes Predict Civil War Violence?”