Do Selection Rules Affect Leader Responsiveness? Evidence from Rural Uganda

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Introduction

The appendix provides supplementary information for the analysis presented in the main text. Section 1 has additional information on the empirical setting and the data collection process, while Section 3 has additional tables and figures to support the study's arguments. Section 4 describes the analysis conducted for testing the sensitivity of results to possible violations of the IV assumptions.

1 Empirical Setting

1.1 Sampling Design

Focusing exclusively on farmer associations that were created as part of the Agriculture Productivity Enhancement Project (APEP), I used the following steps to conduct a stratified, random, multistage cluster design to select the study's sample.

Step 1: Define Target Population. To reduce crop-related variability, I limited the target population to only those associations that marketed the same crop. Coffee was selected since it was the most common cash crop marketed by the APEP groups. Limiting the sample to coffee producers reduced the universe of farmer associations from 204 to 113. In addition, I excluded (a) two farmer associations from Bugiri district because coffee was found to be very peripheral in that district; (b) five farmer associations from Busheni district because those groups were formed many years before APEP began operating in the area, and were not comparable in terms of their organizational capacity; and (c) one association from Kamwenge district because it was the single DC in that remote district and surveying it would have been logistically complicated and prohibitively expensive. The final universe of cases comprises of 105 coffee growing farmer associations.

Step 2: Define Strata. Though the universe of farmer associations is spread over 9 districts, I grouped the 105 farmer associations into 5 strata. Strata were defined by meaningful district-areas: neighboring districts that were historically part of the same district. The location of the sampled associations is presented in Figure 1.

Step 3: Sample Farmer Associations (DCs). Based on power calculations performed on simulated data, I sampled 50 farmer associations. I used unequal probability sampling without replacement to sample associations within strata (proportional to their size). The number of sampled associations from each stratum was proportional to the number of associations in each strata. Accordingly, each sampled association is representative of its strata without a need for further weighting.

Step 4: Sample Village-level Producer Organizations (POs). I used an independent random

sample to select six producer organizations (or POs) from each sampled farmer association, for a total of 287 POs. In some cases where a farmer association had fewer than seven POs, all of its village-level groups were included within the sample.

Step 5: Sample Group members. I sampled 6 'ordinary' members, on average, from each of the sampled POs, for a total of 36 sampled member per farmer association. The exact number of sampled members from each of the six sampled POs was proportional to the size of those farmer groups, assuring that the sample is self-weighted. The total sample size of DC members is, therefore, 50 DCs X 6 POs X 6 members per PO = 1,800, of which the survey team succeeded in surveying 1,781. I refer to this data source as the "members' survey".

Step 6: Board directors: A significant effort was made to survey each of the DC board members whether or not their PO was selected into the sample in stage 3 (i.e. complete enumeration). In each sampled DC I surveyed (i) the four executives, (ii) the chairmen of all POs, whether or not their group was sampled, and (iii) one or two representatives from each PO, irrespective of whether their PO was sampled, for a total of 1,316 interviews. A summary of the sampling scheme is provided in Table 1 below.

Table 1: **Sampling Design**

Step	Sampling Unit (SU)	Number of SUs	Sampling Method
1	Target Population	105 DCs	Coffee growers
2	District-area	5	Stratified – proportional to # of DCs in strata
3	Farmer Associations (DCs)	50	Unequal probability without replacement
4	Produce Organizations (POs)	6 per DC	Clustered – simple random sample.
5	Group members	36 per DC	Clustered – probab proportional to group size.
6	DC Board directors	$\sim$ 28 per DC	No sample: Complete Network.

1.2 Data Sources

I use four main data sources to construct the variables used in the empirical part of the paper: (1) Members' Survey; (2) Representatives' Survey; (3) PO questionnaire; and (4) DC questionnaire.

- **Members' Survey:** an individual-level survey with a random sample of group members who do not hold leadership positions in the association. Trained enumerators administered the members' surveys in a face-to-face interview, for a total of 1,781 surveys.
- **Representatives' Survey:** an individual level survey of POs leaders who serve as their group representatives on the DC council. Enumerators administered the representatives' surveys in a face-to-face interview, for a total of 1,316 surveys. The representatives' survey also included a network module designed to measure the network ties between council representatives.

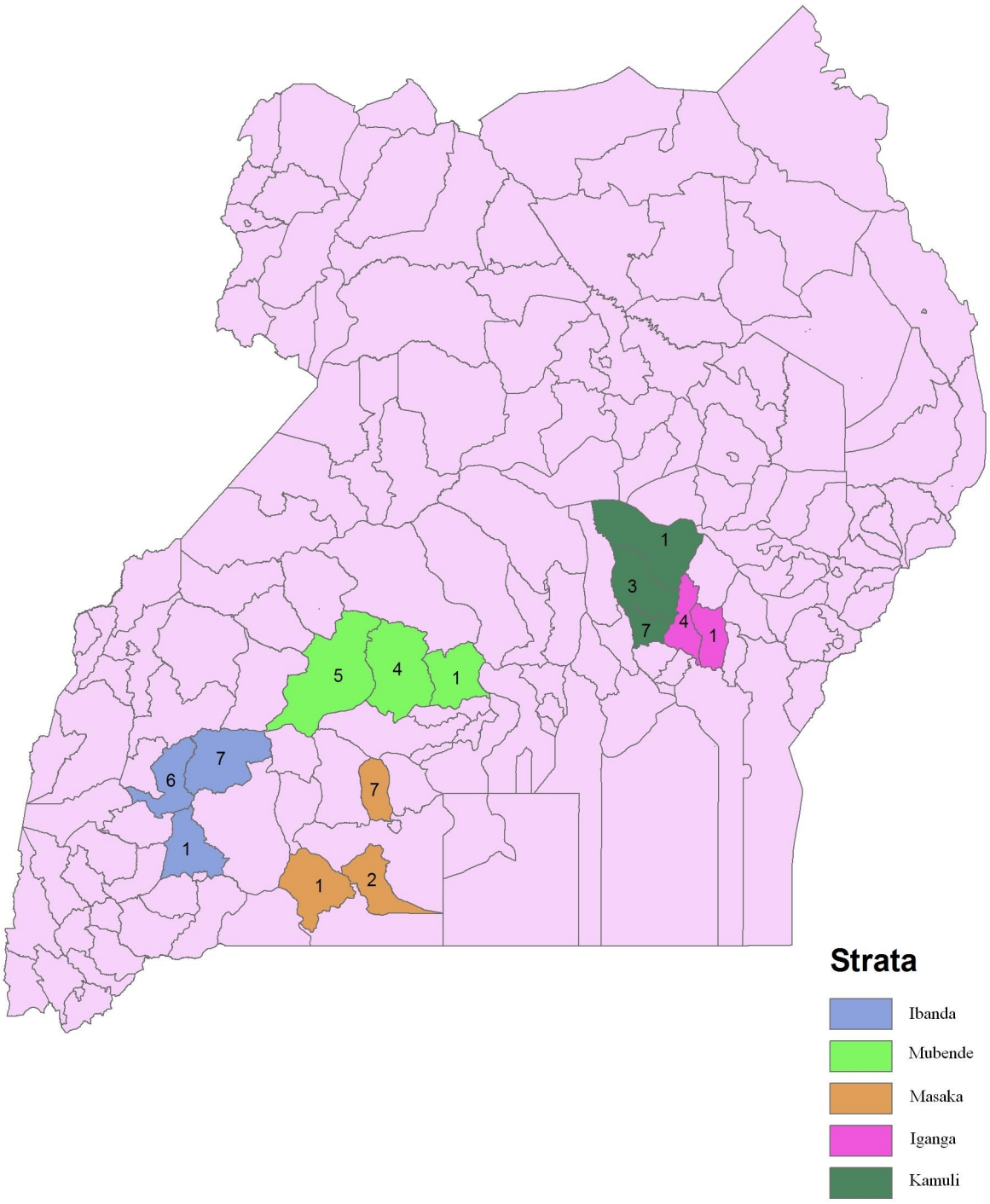

Figure 1: Location of Sampled Associations. Colors indicate strata, while numbers indicate the number of farmer associations sampled from within each district.

- **PO questionnaire:** a questionnaire that was administered to 3-4 leaders from each of the six sampled producer organizations, for a total of 287 questionnaires. In the first part of

the questionnaire, PO leaders were asked to provide group-level information (e.g., the group's year of foundation, its number of members, etc.) In the second part, group leaders were asked to provide information on the group members, such as the leader's assessment of the crop quality of each member, and whether members' cooperative behavior.

- **DC questionnaire:** this questionnaire was designed to capture information at the association-level (e.g. DC year of creation, number of POs, rules and procedures, etc.). The DC questionnaire was completed by DC manager together with the members of the executive committee (council chairperson, Treasurer, and Secretary). In addition, the executives provided information on the DC's marketing activities using the association's books and records.

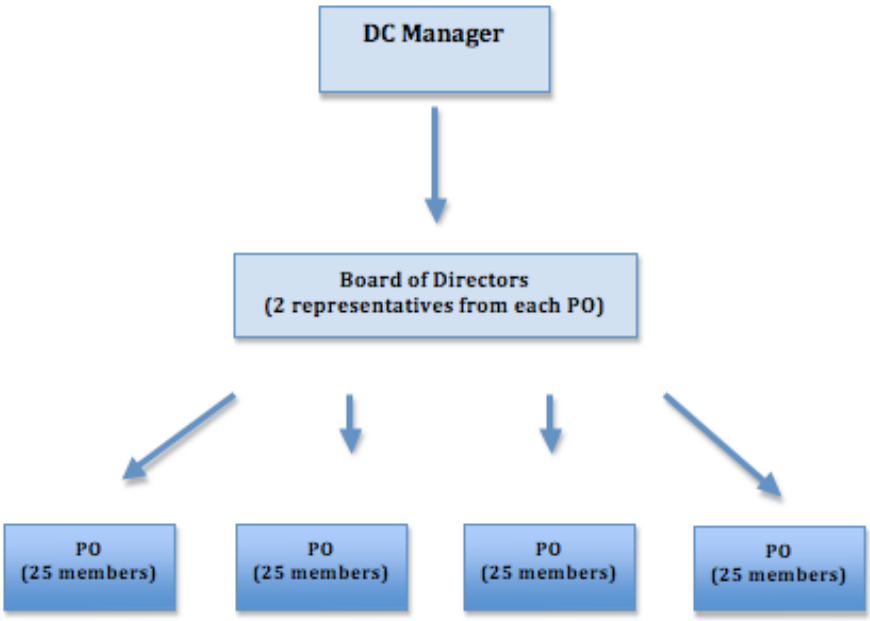

Figure 2: **APEP associations organizational structure.** This Figure presents the organizational structure of the APEP associations. Each farmer association (known as DC) is comprised of about 10 village-level producer organizations (POs), themselves comprised of about 20-25 members. Each of the POs that make up the association selects two representatives to serve on the DC council (also known as board of directors). The responsibilities of council representatives include, monitoring the work of the DC executives (including the manager), representing the opinions of PO members at the associational level, and transmitting information to and from their respective POs. The DC manager is the senior executive of the farmer association. His most important responsibilities include searching for buyers, negotiating input and output prices and organizing the collection of crops, including hiring and supervising employees. Additionally, DC managers help coordinate group activities, sanction 'defectors and facilitate the flow of information throughout the association.

1.3 Implementation

The survey instruments were piloted during the first two weeks in July 2009, and were translated to one of three local languages. Data was collected between late July 2009 and September 2009 by a group of 60 experienced local interviewers (enumerators), who administered all instruments in the respondents' native language. Hired directly by the PI, the enumerators were divided into three "language" teams. The eastern team covered 16 farmer associations in Iganga and Kamuli districts, where Basoga is the primary local language. The central team covered 20 DCs from Mubende, Mityana, Masaka and Rakai districts, where Luganda is the lingua franca. Finally, the western team covered 14 DC from Kiruhura, Mbarara and Ibanda districts, where Ranyankole is the lingua franca. Enumerators went through training in class (4 days) and in a field setting (4 days), which also included training on human subjects and survey techniques. Team leaders in a ratio of 1:5 supervised enumerators.

In each sampled association, data was collected in four rounds. First, an interviewer scheduled a meeting with the DC executives. In that meeting the interviewer introduced the study and asked for the association's cooperation. In addition, in that meeting s/he administered the DC-level questionnaire, and obtained a list of all DC board directors. In the second day of enumeration, the research team conducted interviews with board directors and with the chairmen of all village-level groups (POs), who were mobilized by the DC executives to a central location. In addition to individual-level interviews, leaders from each sampled village-group were asked to respond to a PO questionnaire, and to provide a complete list of all group members. Between the second and third round, the research team sampled 36 members from each sampled DC (including 8 replacements). Immediately after the sampling procedure, an interviewer travelled back to meet with the associations' leadership. In that meeting, the interviewer gave the DC leaders the list of sampled members and coordinated with them the next round of interviews. Once again, we relied on the DC leadership to mobilize the sampled members to a centralized location. In the third day of enumeration, individual-level interviews were conducted with the sampled members and with board directors who were not present in day 2. Finally, the survey team traveled to each association for an additional day to reach sampled members and board directors who, for any reason, were not present in the main enumeration days.

1.4 Missing data

Great care was taken to reduce missingness. The research team administered the DC questionnaires in all 50 sampled associations, PO questionnaires in 287 out of 289 producer organizations (POs), and 1,781 individual-level surveys out of a sample of 1,800 "ordinary" members. For data in surveys that were clearly missing at random (MAR), I used Patrick Royston's ICE multiple imputation

package in Stata 10, which applies a chained equations approach. I imputed missing data only for some asset variables and for basic demographic characteristics such as age and sex. I did not impute data for neither farmers' behavior nor attitudes and perceptions as group members.

2 Validity of the Instrument

Table 2: **Field Trainer Recommendation: In and Out of Sample**

			Treatment Assignment All DCs		**Treatment Assignment Sample DCs (Z_j)**		**Actual Treatment Sample DCs (d_j)**	
Trainer	Region	District	Appointment	Election	Appointment	Election	Appointment	Election
ET	West	Ibanda	17	0	6	0	5	1
JK	West	Mbarara	0	5	0	1	0	1
JK	West	Kiruhura	0	7	0	7	1	6
VO	Central	Masaka	13	0	7	0	5	2
DK	Central	Rakai	7	0	3	0	2	1
EK	Central	Mityana	0	5	0	1	0	1
EK	Central	Mubende	0	3	0	3	0	3
NK	Central	Mubende	0	14	0	6	0	6
WT	East	Iganga	11	0	5	0	4	1
DB	East	Kamuli	23	0	11	0	9	2
Total			71	34	32	18	26	24

Table 3: **Pre-treatment Balance Across Treatment Assignment**

	Treatment Assignment		**OLS**		
Covariate	**Appointment**	**Election**	**Δ**	**p-value**	**N**
Years since APEP	3.844	3.333	-0.510	0.122	50
	(0.196)	(0.256)	(0.324)		
Age of DC	3.000	2.556	-0.444	0.132	50
	(0.180)	(0.217)	(0.290)		
Original No. of POs	9.562	10.17	0.604	0.744	50
	(0.864)	(1.927)	(1.842)		
Original No. Members	161	178	16.307	0.727	38
	(23)	(45)	(46.264)		
Observations	**32**	**18**			

Note: P-values derived from Ordinary Least Square (OLS) regressions. Standard errors are in parenthesis.

Table 4: **Balance Test: *Other* Governance Institutions**

	Treatment Assignment		**OLS**		
	Appointments	Elections	Δ	unadj p-value	adj p-value
Governance summary index	-0.043	0.077	0.120	0.364	0.801
	(0.081)	(0.104)	(0.131)		
Have a signed constitution	0.750	0.889	0.139	0.208	0.690
	(0.078)	(0.076)	(0.109)		
Frequency council meetings (on-season)	1.733	2.438	0.704	0.165	0.690
	(0.230)	(0.447)	(0.499)		
Frequency council meetings (off-season)	1.419	1.938	0.518	0.251	0.690
	(0.235)	(0.382)	(0.446)		
Council meeting frequency codified in constitution	0.781	0.833	0.052	0.657	0.801
	(0.074)	(0.090)	(0.117)		
Frequency executives meetings (on-season)	2.929	3.222	0.294	0.461	0.801
	(0.235)	(0.319)	(0.395)		
Frequency executives meetings (off-season)	1.844	2.333	0.490	0.225	0.690
	(0.220)	(0.333)	(0.398)		
DC council chairperson term length	2.393	2.412	0.019	0.942	0.942
	(0.195)	(0.173)	(0.260)		
DC Manager term length	2.231	2.357	0.126	0.661	0.801
	(0.231)	(0.169)	(0.286)		
Manager attends executive meetings regularly	0.833	0.778	-0.056	0.651	0.801
	(0.069)	(0.101)	(0.122)		
Council representatives can hold other PO positions	0.615	0.667	0.051	0.748	0.823
	(0.097)	(0.126)	(0.159)		
Observations	32	18	50		

Note: Unadjusted two-tailed p-values derived from Ordinary Least Square (OLS) regressions. Adjusted p-values, which are calculated using the qqvalue package in Stata for multiple comparisons, represent the minimum uncorrected P-value threshold for which that P-value would be in the discovery set (false discovery rates). Standard errors are in parenthesis.

3 Robustness check

This section describes a non-parametric robustness check to the estimation strategy described in the main text. This analysis—that follows closely Rosenbaum (2010, Ch.5)—differs from the parametric analysis in the main text in two notables ways. First, it is non-paramtric and hence relies on fewer assumptions. Secondly, it employs matching to reduce possible discrepancies between associations that were advised to use elections ('treatment' groups) and those advised to use appointments ('control'). Farmer associations encouraged to adopt direct elections are matched with farmer association encouraged to use appointments, using Jasjeet Sekhon's genetic matching algorithm (one-to-one matching without replacement). The algorithm identifies optimal multivariate balance using three pre-treatment covariates (a) the time since APEP began operating in the area, (b) the age of the farmer association, and (c) the number of village-level groups (POs) that made up the association in the moment of its foundation. The outcome is $i = 1, \ldots, 36$ matched pairs, where $j = 1, 2$ subscripts the community organizations within a pair. Using other matching algorithms produces very similar results, which are not reported here.

Using Rosenbaum's notation, Z_{ij} is the assignment to treatment for farmer group j within pair i, D_{ij} is the actual leader selection rule an association adopts, and R_{ijk} is the observed outcome k. Note that while some outcomes are originally measured at the individual level (e.g., cooperation and attitudes towards leaders), I conduct the empirical analysis at the farmer association level, taking group averages as necessary. Using the matched pairs for each dependent variable, I perform an intention-to-treat (ITT) analysis followed by an instrumental variable (IV) analysis. ITT compares the community organization encouraged to use direct elections, $Z_{ij} = 1$, to the matched community organization that is encouraged to use appointments, $Z_{ij} = 0$, ignoring compliance behavior. The advantage of such analysis is that farmer associations are comparable, assuming the plausibility of the random assignment of encouragement is accepted. Note that for each outcome k, I observe $R_{ij} = Z_{ij} r_{Tij} + (1 - Z_{ij}) r_{Cij}$, such that the null hypothesis of no ITT effect is $H_0 : r_{Tij} = r_{Cij}$ for $i = 1, \ldots, I$, $j = 1, 2$.

To calculate exact p-values, I use Wilcoxons signed rank statistic and the Hodges-Lehman estimator for point estimates. One key advantage of ranks is that they are resistant to outliers and as such the test is more robust than the commonly used 'mean difference' alternative. I assume a constant additive treatment effect to calculate 95% confidence intervals. If the treatment has an additive effect $r_{Tij} = r_{Cij} + \tau$ for $i = 1, \ldots, 36$, $j = 1, 2$, then a 95% confidence set for the additive treatment effect, τ, is formed by testing each hypothesis $H_0 : \tau = \tau_0$ and retaining for the confidence set the values of τ_0 not rejected at the 5% level. Results are presented in Table 6.

Covariate Balance: Before/After Pair-Matching

	Before Matching:			p-value	
	X_T	X_C	$X_T - X_C$	T-test	KS (BS)
Age DC	2.556	3.000	-0.444	0.123	0.081
Years APEP	3.333	3.844	-0.511	0.122	0.009
N. producer organizations	10.167	9.563	0.605	0.777	0.769

	After Matching:			p-value	
	$\bar{X_T}$	$\bar{X_C}$	$\bar{X_T} - \bar{X_C}$	T-test	KS (BS)
Age DC	2.556	2.611	-0.055	0.742	0.838
Years APEP	3.333	3.333	0.000	1.000	0.922
N. producer organizations	10.167	9.944	0.334	0.778	0.820

Table 5: Table provides information on balance of the covariates used for pair-matching. *Age DC* is a continuous variable measuring the years since the foundation of the DC; *Years APEP* is continuous measures the years since APEP began operating in the area, and *N. producer organizations* refers to the number of producer organizations that made up the DC in its year of foundation. $\bar{X_T}$ is the mean value of the DCs assigned to treatment (direct elections) and $\bar{X_C}$ is the mean of DCs assigned to control (appointments). KS (BS) is univariate bootstrap Kolmogorov-Smirnov test.

Robustness Check: Main Outcome Measures

	(Intent-To-Treat (ITT))			
	p-value	estimate	lower 95	upper 95
Responsiveness summary index	0.000	0.975	0.620	1.297
Members obtain receipts (M)	0.000	0.959	0.520	1.486
Receipts are given to members (R)	0.001	1.501	0.995	2.044
Members warned: side selling (M)	0.000	1.951	1.252	2.544
Members warned: bad agri practices (M)	0.012	0.870	0.240	1.439
Manager is very transparent (M)	0.246	0.582	-0.325	1.378
Cooperation summary index	0.000	0.686	0.378	0.964
Members agree to increase commission	0.001	1.273	0.419	1.848
Members paid joining fees	0.000	1.651	1.108	2.193
Members paid annual dues	0.000	1.407	0.824	2.135
Contribution in commitment experiment	0.609	0.127	-0.336	1.369
Members' share of coffee bulked	0.966	0.024	–0.676	0.693
Planted sidling in past 12 months	0.012	1.069	0.306	1.946
Members dries coffee on tarps	0.080	0.555	-0.140	1.198

Table 6: **Paired Matched Randomization Inference.** Exact p-values are calculated using Wilcoxons signed rank statistic and point estimates are calculated using the Hodges-Lehman estimator.

4 Sensitivity Analysis

The identification strategy in this paper assumes that two farmer groups k and l with the same observed covariates x ($x_k = x_l$) have the same probability of treatment given the groups' potential outcomes (r_T and r_C), observed covariates x and unobserved covariates u. In other words, for pairs of farmer associations (DCs) that are matched using observed covariates, encouragement by field facilitators to use either direct elections (treatment) or appointments (control) is as good as random. It is possible, however, to argue that there may be some unobserved covariate u that the investigators did not measure (and hence did not match on) that was somehow observed or known to facilitators and that was used by facilitators to inform their recommendation of voting method. If this is the case, our assumption that treated and control farmer groups are comparable would not be valid. Put differently, the exogeneity assumption according to which treatment assignment is independent of potential outcomes and observed and unobserved covariates simply does not hold.

The idea of a sensitivity analysis is quite straightforward. The exogeneity assumption may be false, but to an extent controlled by a parameter, $\gamma > 1$. Specifically, two farmer groups k and l with the same observed covariates x have different *odds of treatment* that differ by at most a multiplier of γ. When $\gamma = 1$ then groups k and l are balanced also on unobservables. If $\gamma = 2$ then the treatment group might be twice as likely as the control group – with the same observed covariates – to be encouraged to adopt the treatment (i.e. direct elections), because they differ in ways that have not been measured. Sensitivity analysis allows to calculate point estimates, p-values and confidence intervals for different values of *gamma*. Results of a sensitivity analysis for four key dependent variables — leader responsiveness index, cooperation index, monitoring index and member-stranger contribution in the dictator game — are reported below in Figure 3.

For two outcome variables, leader responsiveness and members' cooperation indices, positive and significant treatment effects remain even if control groups are somehow four times more likely to be encouraged to adopt direct elections than farmer groups with similar observed covariates. For two other outcome variables, treatment significance disappears at about $\gamma = 2$; i.e. if if control groups are somehow two times more likely to be encouraged to adopt direct elections than farmer groups with similar observed covariates.

References

Rosenbaum, Paul R. 2010. *Design of observational studies.* Springer series in statistics New York: Springer.

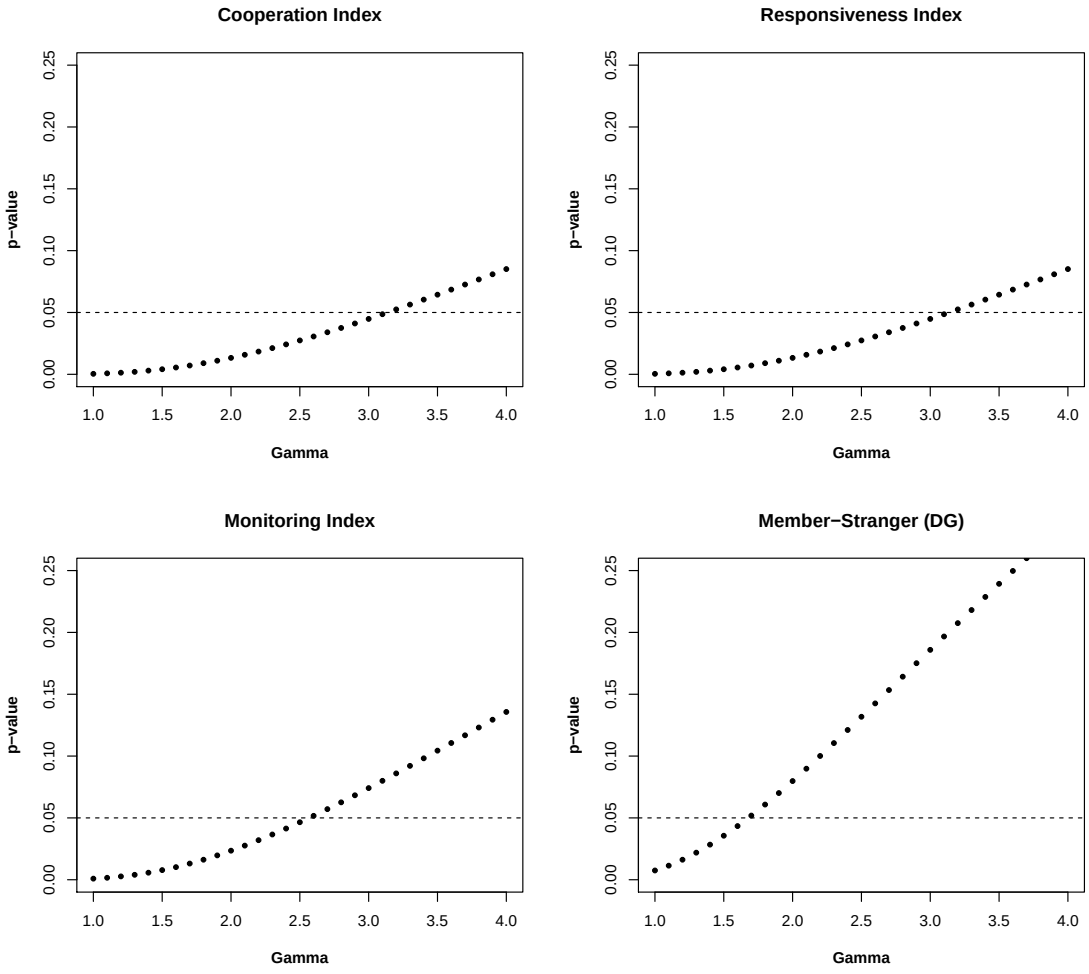

Figure 3: **Rosenbaum Sensitivity Test for Wilcoxon Signed Rank P-Value**