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## IAPRI-MSU Technical Training

# Intro to Economic Experiments with a Focus on Framed Field Experiments

Facilitated by Hambulo Ngoma & Nicole Mason  
Training materials developed by Hambulo Ngoma (IAPRI),  
Nicole Mason (MSU), and Stephen Morgan (MSU)

22 June 2018

Indaba Agricultural Policy Research Institute  
Lusaka, Zambia



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## Why this training?

- **Economic experiments** of different types are becoming **increasingly popular** and are **increasingly used** in **agricultural economics** and **development economics** research, incl. **policy analysis**
  - *Nobel Prize in Economics (experimental and behavioral economist winners)*
    - 2002: **Vernon Smith** - "for the use of laboratory experiments as a tool in empirical economic analysis, in particular, for the study of different market mechanisms". **Daniel Kahneman** - "for the introduction of insights from psychological research into economics, in particular with regard to judgements and decisions under uncertainty"
    - 2017: **Richard Thaler** - "for his contributions to behavioral economics"
- To **broaden your research methods toolkit**
- To enable you to **better understand other studies** that use economic experiments

### Can Field Experiments Return Agricultural Economics to the Glory Days?

David H. Herberich, Steven D. Levitt, John A. List

*American Journal of Agricultural Economics*, Volume 91, Issue 5, 1 December 2009, Pages 1259–1265, <https://doi.org/10.1111/j.1467-8276.2009.01294.x>





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## Road map

- 1. Brief intro to economic experiments - Nicky [10-11 AM]**
  - What are they, why do them, different types, examples from Stephen & Nicky's work
- 2. Framed field experiments (FFE) – Hambulo [11:15-12:00]**
  - What are, and why framed field experiments?
- 3. FFE applications on common pool resources [12-1 PM]**
  - Examples from Colombia and Tanzania
  - Hands-on practice from recent FFEs in Zambia





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## Brief intro to economic experiments – Learning goals

**By the end of this portion of the training, you should be able to:**

1. Explain what an economic experiment is and give some examples of things they can be used to study
2. Describe some pros/cons of economic experiments
3. Distinguish between different types of economic experiments (e.g., lab experiments, artefactual field experiments, framed field experiments, and natural field experiments)





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## What is experimental economics?

An empirical tool that economists and interdisciplinary teams can use to understand the extent to which an individual's (or group's) decisions or behavior are affected by various (testable) factors in a **controlled environment**.



Example: A lab experiment being conducted at the Loyola Marymount University Experimental Economics Lab (Source: <http://econlab.net/>)



Example: A framed field experiment being conducted in Ethiopia by researchers from the University of Frankfurt (Source: <https://www.wiwi.uni-frankfurt.de/abteilungen/mm/flex/flex.html>)





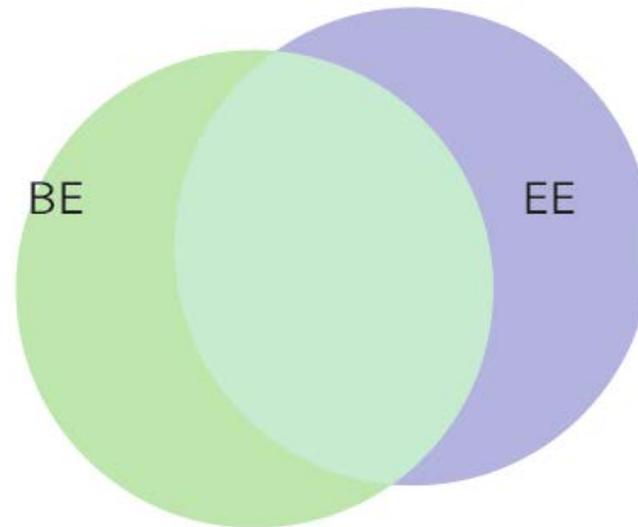
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## Behavioral and experimental economics



Source: Amere Teklay Hailu.  
2018. NMBU  
Ph.D. trial lecture



- Many behavioral economics studies use experiments
- Differ in orientation (EE: method vs. BE: approach)
- BE challenges neoclassical economic theory
  - ▶ *Homo economicus* vs. *Homo sapiens*





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## A key advantage of economic experiments

- Gives the researcher (more) control over “treatment status” of study participants
- Recall the impact evaluation (IE) trainings we have done over the last year. *What is the major challenge in IE, particularly when we are using observational data?*
- In an economic experiment, the researcher **randomly** assigns participants to treatment and control groups
  - *Why is this helpful?*
  - Enables cleaner identification of the treatment effect
  - Makes analysis easier (e.g., can often use simple OLS regression of outcome variable on treatment indicator)





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## Economic experiments can be used to:

- Test theories
- Establish empirical regularities as a basis for new theories
- Test institutions/rules of the game/markets
- Study preferences and decision-making
  - E.g., Risk and time preferences, preferences for goods and services, cooperation (public goods), etc.
- Estimate parameters
- Replicate previous work
- Teach economics
- ... among others!





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## A taxonomy of economic experiments (Harrison & List 2004 - p. 1014)

Experiment type	Key features (emphasis added)
<u>Conventional lab</u> experiment	"employs a <b>standard subject pool</b> of students, an <b>abstract framing</b> , and an <b>imposed set of rules</b> "
<u>Artefactual field</u> experiment	" <b>same as a conventional lab</b> experiment <u>but</u> with a <b>nonstandard subject pool</b> " (i.e., not students)
<u>Framed field</u> experiment	" <b>same as an artefactual field experiment</b> <u>but with field context</u> in either the commodity, task, or information set that the subjects can use"
<u>Natural field</u> experiment	" <b>same as a framed field experiment</b> <u>but</u> where the environment is one where the <b>subjects naturally undertake these tasks</b> and where the subjects <b>do not know that they are in an experiment</b> "

*What about things like experimental auctions & RCTs?*

Source: Harrison, G. W., & List, J. A. (2004). Field experiments. *Journal of Economic literature*, 42(4), 1009-1055.





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## Have any of you been involved in an economic experiment?

- *If so, what kind was it?*
  - Lab experiment
  - Artefactual field experiment
  - Framed field experiment
  - Natural field experiment
  - RCT





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## Example #1: A lab experiment

**Morgan, Mason, and Shupp (2018). “Comments, contributions and compliance: Evidence from a public goods experiment.” Manuscript under review.**

- **Research question:** are economic agents more likely to comply with a rule or regulation that is ultimately chosen if they are given the opportunity to provide input on what that rule or regulation should look like before it is chosen?
  - Also, any interaction with enforcement?
- **Lab experiment** so the experiment itself was **not framed** (very abstract) but **the policy-relevance/context that motivated** us to think about this question was agri-environmental policies and open comment periods in the US. (Explain.)
  - [Zambia Constitution Amendment Bill & stakeholder comments](#)



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## Example #1: A lab experiment (cont'd)

4 treatment groups:

<b>Control</b>	<b>Enforcement only</b>
<b>Comments only</b>	<b>Comments + enforcement</b>

- **4 "players" + 1 "policymaker"** per group
- **Players** given an **endowment of 25 points** that they must decide how to **allocate to their private account vs. to the group's account**
  - Points allocated to the **private account return 1 point to the individual player**
  - Points allocated to the **group account return 0.4 points to ALL players in the group (=1.6 total)**
- **Policymaker** decides on a **minimum contribution rule (MCR, how many points players should allocate to the group account)**
- Players in the **comment-related treatment groups** have the opportunity to provide an anonymous suggestion to the policymaker on what the MCR should be
- Players in the **enforcement-related treatment groups** have a 50% chance of being "caught" if they contribute less than the MCR to the group account. If caught, lose their entire endowment.
- **Repeat** many times. Look at **contributions** to the group account (public good), **compliance** with the MCR. **Test for stat. sig. differences** among treatment and control groups.



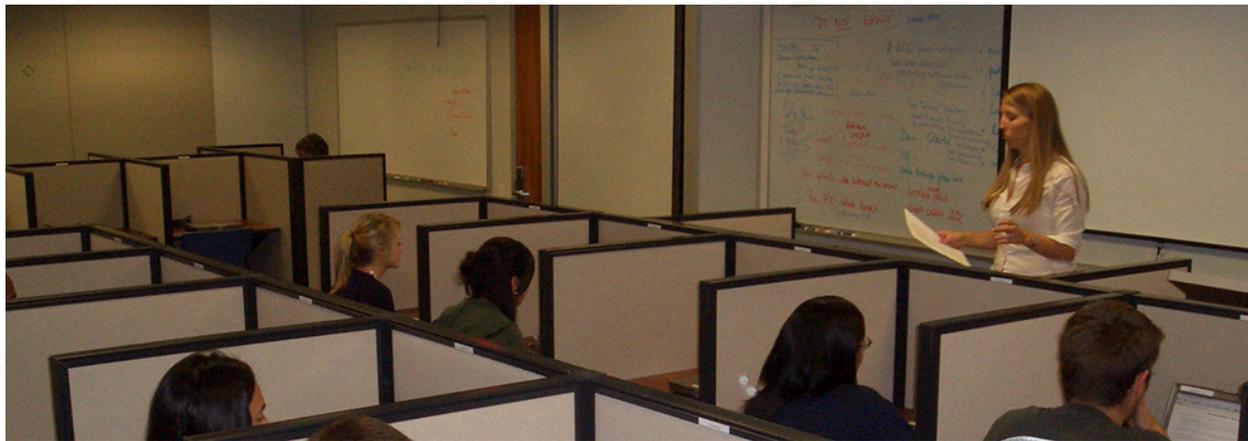


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## Example #1: A lab experiment (cont'd)

- Played in a computer lab at MSU with undergraduate students (oTree software)



Example: A lab experiment being conducted at the Loyola Marymount University Experimental Economics Lab (Source: <http://econlab.net/>)





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## Example #2: A lab experiment & a related artefactual field experiment

**Morgan, Mason, Shupp, and Myers. “Agricultural innovation and sustainable technology adoption: Strategic delay reconsidered.” Work in progress.**

- **Research question:** are economic agents more likely to put off adopting a new technology if the rate of innovation is high compared to when it is low?
  - EX) Think about iPhones or other mobile phones
  - This type of issue has been explored in other contexts but not in agric.
- **Two experiments:**
  - Lab experiment underway (online w/ MSU students)
  - Artefactual field experiment upcoming (online w/ MI wheat producers)



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## Example #2: A lab experiment & a related artefactual field experiment (cont'd)

### 2 treatment groups:

#### Low rate of innovation

(20% probability of a new technology becoming available in a given period)

#### High rate of innovation

(80% probability of a new technology becoming available in a given period)

- **Individual play** (not group play)
- Given 100 point **endowment**
- **Start out with a given technology.** If a new technology becomes available, player has to **decide if s/he wants to stay with their current technology or switch to the new technology**
  - If switch to a new technology, pay 50 points to switch
- **As new technologies are added, old ones are still available** (can switch back if want to – no cost if switching back to a technology they've already used)
- **For each technology that is available**, participant is told the **min and max returns possible** with that technology, and then after they choose which technology to use, **returns are randomly chosen** from within that range. Points added to their account.
- **Repeat** many times (26 rounds)
- Played online





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## Example #2: A lab experiment & a related artefactual field experiment (cont'd)

### Round 3: Technology Decision Form

In the last period you made the following selection:

**Baseline Technology: Average return of 80 points with range between 0 and 160 points per period. Returns have a 160 point spread.**

You currently have a total of **343 points** from previous rounds.

A new technology was **added** to your choice list this round.

Please select which technology you would like to use from the options below.

Decision:

- Baseline Technology: Average return of 80 points with range between 0 and 160 points per period. Returns have a 160 point spread.
- Technology A: Average return of 91 points with range between 9 and 174 points per period. Returns have a 165 point spread.
- Technology B: Average return of 103 points with range between 28 and 178 points per period. Returns have a 150 point spread.

Next

**LAB EXPERIMENT VERSION  
(played by MSU  
undergraduate students)**





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## Example #2: A lab experiment & a related artefactual field experiment (cont'd)

### Round 3: Agricultural Technology Decision Form

In the last period you made the following selection:

**Baseline Technology: Average return of 80 points with range between 0 and 160 points per period. Returns have a 160 point spread.**

You currently have a total of **297 points** from previous rounds.

A new technology was **added** to your choice list this round.

Please select which technology you would like to use from the options below.

Decision:

- Baseline Technology: Average return of 80 points with range between 0 and 160 points per period. Returns have a 160 point spread.
- Technology A: Average return of 91 points with range between 9 and 174 points per period. Returns have a 165 point spread.
- Technology B: Average return of 103 points with range between 28 and 178 points per period. Returns have a 150 point spread.

**ARTEFACTUAL FIELD  
EXPERIMENT VERSION  
(to be played by  
Michigan wheat farmers)**





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## Another key benefit of economic experiments (esp. lab, artefactual field, and framed field):

- Can often obtain data more quickly and inexpensively than RCTs and panel surveys
- EX) Two of Stephen's Ph.D. dissertation essays:
  - Able to do with small grants (US\$10,000 & US\$12,000).
  - In person lab experiment completed in 12 one-hour sessions (N=215)
  - Planned artefactual field experiment being done on-line (participants emailed a link to the experiment and survey) – anticipate data within roughly 2 weeks (N=100-160)
- Contrast to RALS costs and time (but note that RALS is much larger N and is useful for MANY studies, whereas above experiments are small N and on a very narrow set of research questions)





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Economic experiments: Internal validity is higher than studies based on observational data but external validity can be a concern (depending on the type of experiment)

- *Why?*
- *What do we mean by internal validity and external validity?*





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	Relative Internal Validity	Relative External Validity
Lab Experiments	High	Low
Field Experiments	Medium to High	Medium to High
Natural Experiments	Medium to High	High
Field/market Data	Low	High

Source: Roe, B. E., & Just, D. R. (2009). Internal and external validity in economics research: Tradeoffs between experiments, field experiments, natural experiments, and field data. *American Journal of Agricultural Economics*, 91(5), 1266-1271.





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## Small group discussions

- *Bounce around ideas with each other for lab or artefactual field experiments you could potentially run as part of your research program*
  - *What hypothesis(es) do you want to test?*
  - *How might you structure a lab or artefactual field experiment to test it?*





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# Framed Field Experiments: What, Why and How





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## Road map

1. Framed field experiments (FFE) [**11:15 AM-12 pm**]
  - what are, and why framed field experiments?
2. FFE applications on common pool resources [**12-1 pm**]
  - examples from Colombia and Tanzania
  - hands-on practice from recent FFEs in Zambia





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## Learning objectives

By the end of this session, participants should be able to;

1. define framed field experiments (FFEs)
2. differentiate FFEs from other field experiments in economics & highlight some merits and cons of FFEs
3. set up a basic FFE game, and
4. find relevant literature on FFEs





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## What are framed field experiments?

FFEs are **field experiments** conducted with a sample of **real subjects** in the **actual settings** where they make real-life decisions related to the study and using a **commodity** as **real** as is possible



Framed Field Experiment in Zambia: setting, commodity and task.

Source: IAPRI





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## Three key features distinguish FFEs

- **Subject pool:** field subjects recruited from population of interest for real world experiences
- **Commodity and tasks:** framed to be as real as possible, e.g., **tree branches** and **cutting trees** and subjects play for **real stakes**
- **Environment:** FFEs conducted in actual places where subjects make economic decisions in everyday lives





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## FFEs versus other controlled experiments

	Controlled experiment		
	Lab	Artefactual	Framed Field
Subject pool	Students	Relevant sample	Relevant sample
Commodity/task	Abstract	Abstract	As real as possible
Environment	Laboratory	Relevant location	Relevant location
Internal validity	High	Medium to high	Medium to high
External validity	Low	Medium	Medium to high

Sources: Harrison, G. W., & List, J. A. (2004). Field experiments. *Journal of Economic literature*, 42(4), 1009-1055  
 Roe, B. E., & Just, D. R. (2009). Internal and external validity in economics research: Tradeoffs between experiments, field experiments, natural experiments, and field data. *American Journal of Agricultural Economics*, 91(5), 1266-1271.





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## Thinking about conducting FFEs?

- **Research question/hypothesis:** what are you curious about? What do you want to find out or test?
- **Treatments:** what are the relevant instruments to change in the experiment?
- **Experimental design:** how are subjects allocated to experiment groups?
  - Randomization design, randomization block design etc
- **Sampling:** how are subjects recruited?
- **Framing:** what is the framing for commodity and task?
- **Stakes:** what are the stakes and payoff functions?
- **Take time in designing the experiment!**





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# Framed Field Experiments:

Applications to the management of common pool resources





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## What are common pool resources?

		SUBTRACTABILITY	
		<i>Low</i>	<i>High</i>
EXCLUSION	<i>Difficulty</i>	<b>Public Goods</b> Sunset Common Knowledge	<b>Common-Pool Resources</b> Irrigation Systems Libraries
	<i>Easy</i>	<b>Toll or Club Goods</b> Day-Care Centers Country Clubs	<b>Private Goods</b> Doughnuts Personal Computers

Source: Ostrom, E., Gardner, R., & Walker, J. M. (1994). *Rules, Games, and Common-pool Resources*. Ann Arbor: University of Michigan Press.





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## Cardenas, J. C., Stranlund, J., & Willis, C. (2000). Local Environmental Control and Institutional Crowding-Out

- **Research question (s):** how do external regulations affect time spent harvesting firewood in Colombia?
  - Collecting firewood affected water quality due to soil erosion
- **Treatments:**
  - command and control (government imposed quota)
  - community forest management (communication, cheap talk)
- **Experimental design:** 14 groups (of 8 subjects) played 8
  - 11 initial rounds and an additional 9 – 12 rounds with treatment
  - each chose  $x_i \in [0,8]$





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## Cardenas, J. C., Stranlund, J., & Willis, C. (2000). Local Environmental Control and Institutional Crowding-Out. World Development

- **Main findings:**
- Regulation crowded out other – regarding
  - weakly enforced regulation led subjects to be self-centered
- Communication fostered cooperation and had better conservation outcomes

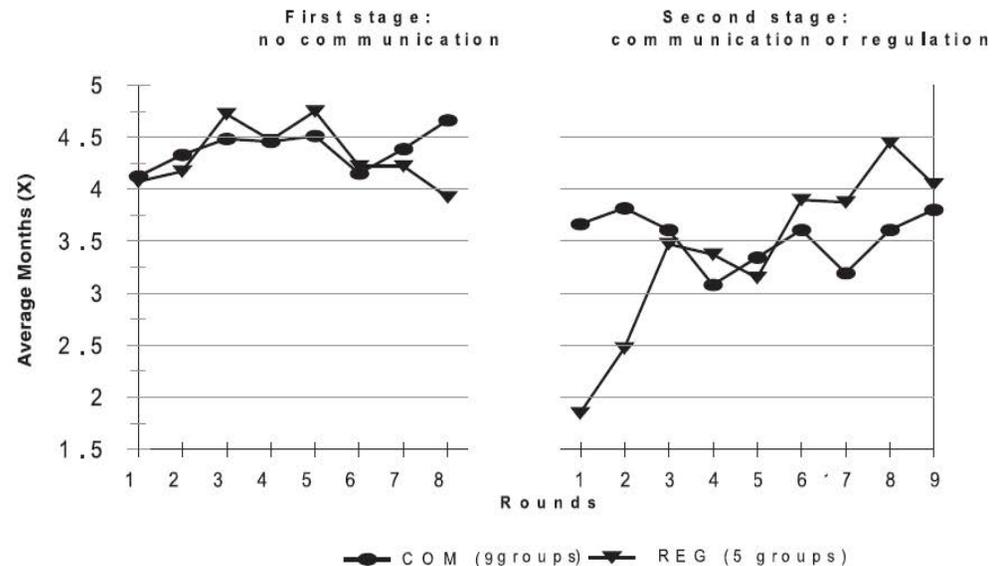


Figure 3. Average individual decisions.





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## Handberg, Ø. N., & Angelsen, A. (2015). Experimental tests of tropical forest conservation measures. JEBO

- **Research question(s):** what are the impacts of CAC, CFM and PES on forest stock in Tanzania?
  - at issue is deforestation, leading to climate change
  - REDD+ tries to address deforestation using PES
- **Treatments:**
  - command and control (CAC)
  - community forest management (CFM)
  - payment for environmental services (PES)



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## Handberg, Ø. N., & Angelsen, A. (2015). Experimental tests of tropical forest conservation measures. JEBO

- **Experimental design:** 36 groups (of 8 subjects) played 6 pre – and post – treatment rounds
  - payoffs based on harvest and standing trees from a stock of 80 tokens (paper trees) managed by a community of 8
  - participants privately decided on harvest (within limit) in each round, aggregate harvest announced and removed, but replaced before the next round. Games played for 12 rounds



Fig. 1. Paper trees used as tokens.



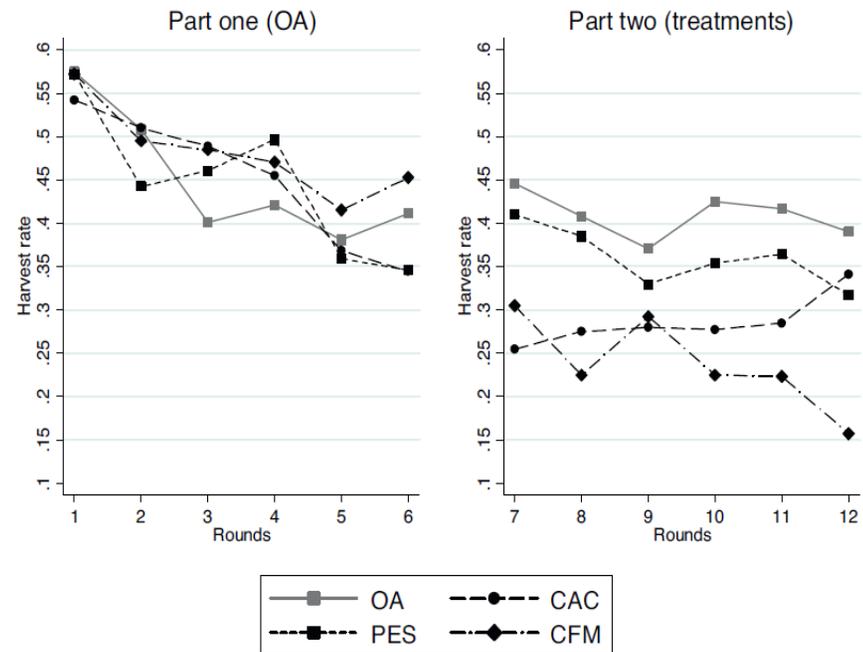


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## Handberg, Ø. N., & Angelsen, A. (2015). Experimental tests of tropical forest conservation measures. JEBO

- **Main findings:**
- CFM is as effective as CAC in increasing prosocial forest use
- PES was not effective in promoting conservation
- Moral, non – pecuniary motives important for conservation





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## Now, let's conduct a framed field experiment

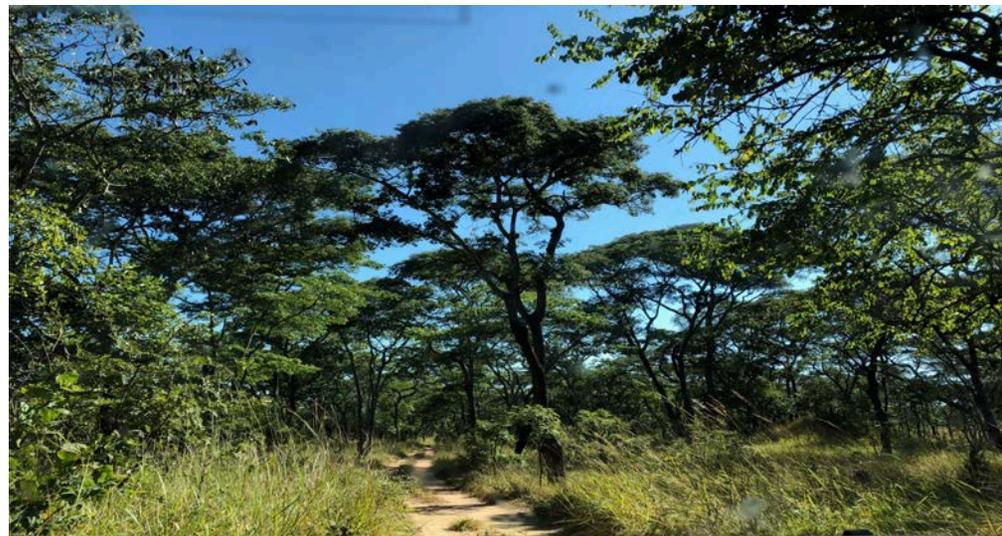




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**Whither forest in Zambia? Testing policy instruments for community forest management using framed field experiments**  
(Based on Ngoma et al., forthcoming)





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## Motivation

- Zambia has necessary policy framework in support of sustainable forest management (SFM)
  - Forest Act of 2015, National Forestry Policy, National Climate Change Policy, REDD+ strategy, 2018 CFM regulations etc.
  - SFM instruments around CFM, PES and to some extent CAC are proposed and some trialed
  - Deforestation remains a challenge
  - Some known **questions** remain unanswered:
    - what are the impacts of CFM, CAC, PES and OA on forest conservation?
    - can CFM outperform others (CAC & PES)?
    - within PES, is paying individuals better than paying groups?





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## Motivation

- It is difficult to address these questions for Zambia:
  - some of regulations are yet to be implemented
  - often, policy instruments are implemented singly, making cross comparison difficult, and
  - there is a missing data problem: forest use decisions are only observed under one policy instrument at a time
- Yet, we need to answer these questions ex-ante to inform policy
- We used framed field experiments (FfEs) played with real forest users in the actual locations where they make everyday forest use decisions, and using actual tree braches





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## Field work and sampling

- Field work conducted in Mpika and Serenje districts
  - 2 villages selected in each district based on having a forest in vicinity and with > 48 households
    - Included one village is forest reserve
  - 48 households randomly sampled in each village and either husband or wife invited to participate in the 'study'
  - Each participant was randomly assigned to a pre-determined group of 8 with a specific treatment to avoid kin – altruism
  - In total 24 groups participated for a sample of 191 and 1,910 observations\*





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## Experimental design and basic game structure

- Each group of 8 sat in a circle with 60 tree branches and played the experiment over 10 rounds after initial practice
  - Stage 1: pre – treatment (1-5 rounds)
  - Stage 2: treated (6-10 rounds)
  - no commination was allowed during the sessions
- This a one-shot game repeated 10 times
- Detailed instructions given in local language at the start of every session
  - individual harvests indicated on decision sheets in every round
  - total per round announced and removed before next round
  - stock replenished before next round
  - payoff function:  $\pi_{it} = px_{it} + (q/N)[X_s - x_{it} - \sum x_{-it}], x_{it} < x^{\max}$





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## Treatments

- **Open Access**: 4 groups played the based game for 10 rounds
- **CFM**: 5 groups played the second stage with a 3 min communication allowed between rounds
- **CAC**: 5 groups played second stage with sanctions imposed for  $x_i > 3$
- **PES, individual pay**: 5 groups played the second stage with an additional incentive of 80% of  $p$  as if  $x_i < x^{RL}$
- **PES, individual pay**: 5 groups played the second stage with an additional incentive of 80% of  $p$  as if  $Sum(x_i) < x^{RL}$





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## Let's get working folks...



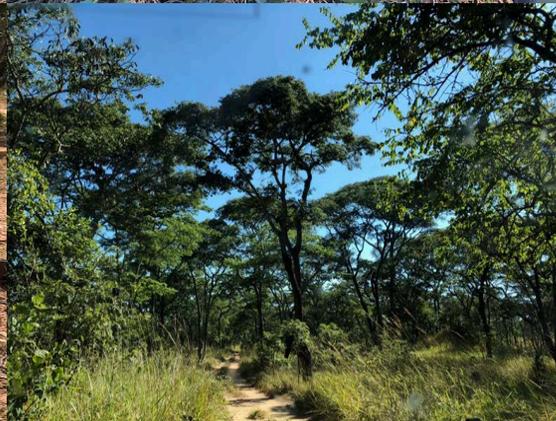
Commodity



Task



Task





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## Instructions

### For participants

Good morning! *[Introduce oneself and the research assistant(s)].*

We are from the Indaba Agricultural Policy Research Institute (IAPRI) in Lusaka. IAPRI is an indigenous Zambian organization with more than 10 years of experience in conducting applied policy research in agriculture, food security, nutrition and natural resource management. We work very closely with the Ministries of Agriculture, and Fisheries and Livestock, and the Central Statistical Office (CSO).

*[Do you have any questions?]*

First of all, thank you for taking time off your busy schedules to participate in this study. This is harvest time!

This is a study about the use and management of forest resources in your community. We will have an entertaining time, and we kindly request your attention and participation. But, first we need your consent.

### Informed Consent Statement

This study is an effort by the Indaba Agricultural Policy Research Institute (IAPRI) aimed at studying how local forest users make decisions about forest use and harvest. Your help in participating this experiment and in answering the post-experiment questions is very much appreciated. Your responses will be kept **COMPLETELY CONFIDENTIAL** and will be summed together with those of roughly 180 other households, and general averages from analysis will be reported for scientific research purposes only. You indicate your voluntary consent by participating in this study. *may we begin? If you have questions about this study, you may*

Harvest decision form

Participant ID \_\_\_\_\_

District \_\_\_\_\_ Village \_\_\_\_\_ Camp \_\_\_\_\_

Session \_\_\_\_\_ Round \_\_\_\_\_ Name of Participant \_\_\_\_\_

No. of trees	Decision
5 	
4 	
3 	
2 	



Indaba Agricultural Policy Research Institute  
Post-experiment questionnaire

Basic information	Response
E1 Participant ID.	
E2 Age	
E3 Gender	(1=female, 0=male)
E4 Highest education completed (1=None, 2=Primary/sub-standard education, 3=Secondary education, 4=College certificate (diploma), 5=Bachelor's degree (or Masters and above))	
E5 Are you a member of a forest users group?	(1 = yes, 0=no)
E6 Are you a member of a farmers' cooperative	(1 = yes, 0=no)
<b>Environmental awareness</b>	
E1 Have you heard about climate change?	(1=yes, 0=no)
E2 Do you think forests can help reduce the effects of climate change? If your answer is 'yes', how?	(1=yes, 0=no)
E3 Which one is more valuable for you? For the community? (1=standing trees, 0=cut trees)	You: _____ Community: _____
E4 Would you rather get direct benefit from trees you cut today than wait for shared benefits in the future? (1=yes, 0=no)	
E5 Do you use irrigation to cultivate in the dry season? (1=yes, 0=no)	
E6 Are you aware that forests regulate how much rain and water you could get? (1=yes, 0=no)	
E7 How do you see yourself: are you generally a person who is willing to take risks, or do you try to avoid taking risks? Please choose on a scale from 0 to 3: (0 = not at all willing to take risks, 1 = somewhat not willing to take risks, 2 = somewhat willing to take risks, 3 = very willing to take risks, 4= I don't know)	
E8 How do you see yourself: are you generally a person who is impatient and want to have 'things' now, or can you wait to get them later? Please choose on a scale from 0 to 3: (0 = always prefer to have things now, 1 = can somewhat not wait to have the things, 2 = can somewhat wait to have the things, 3 = willing to wait to have things, 4= I don't know)	

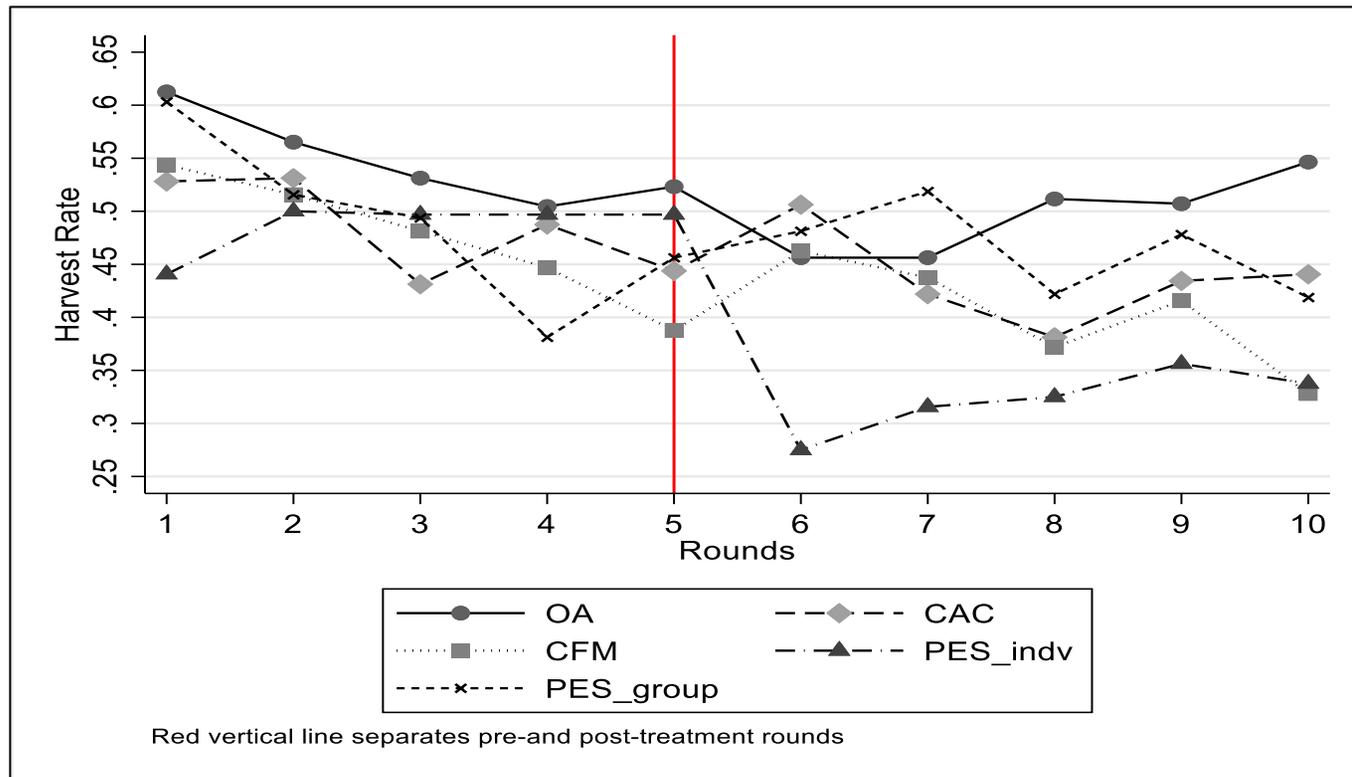




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## Trends in harvest rates by treatment

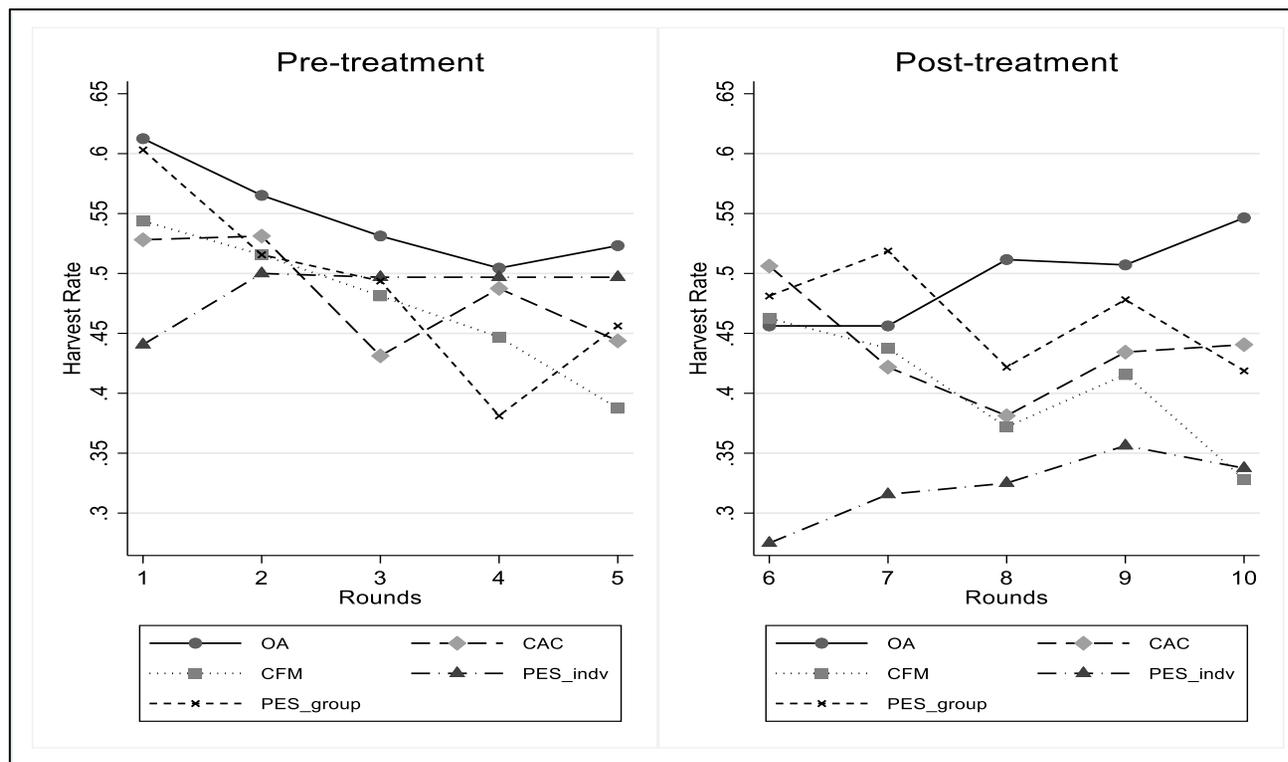




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## Harvest rates pre – and post – treatment

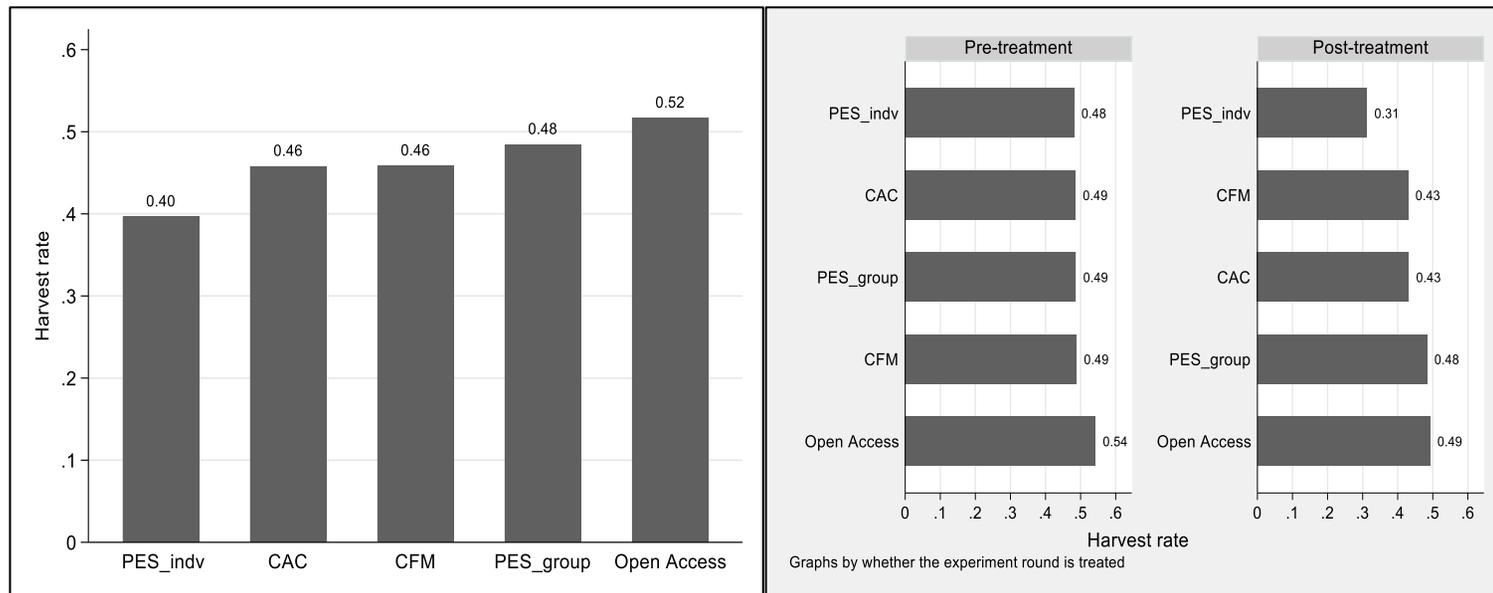




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## Harvest by treatment, pre – and post – treatment

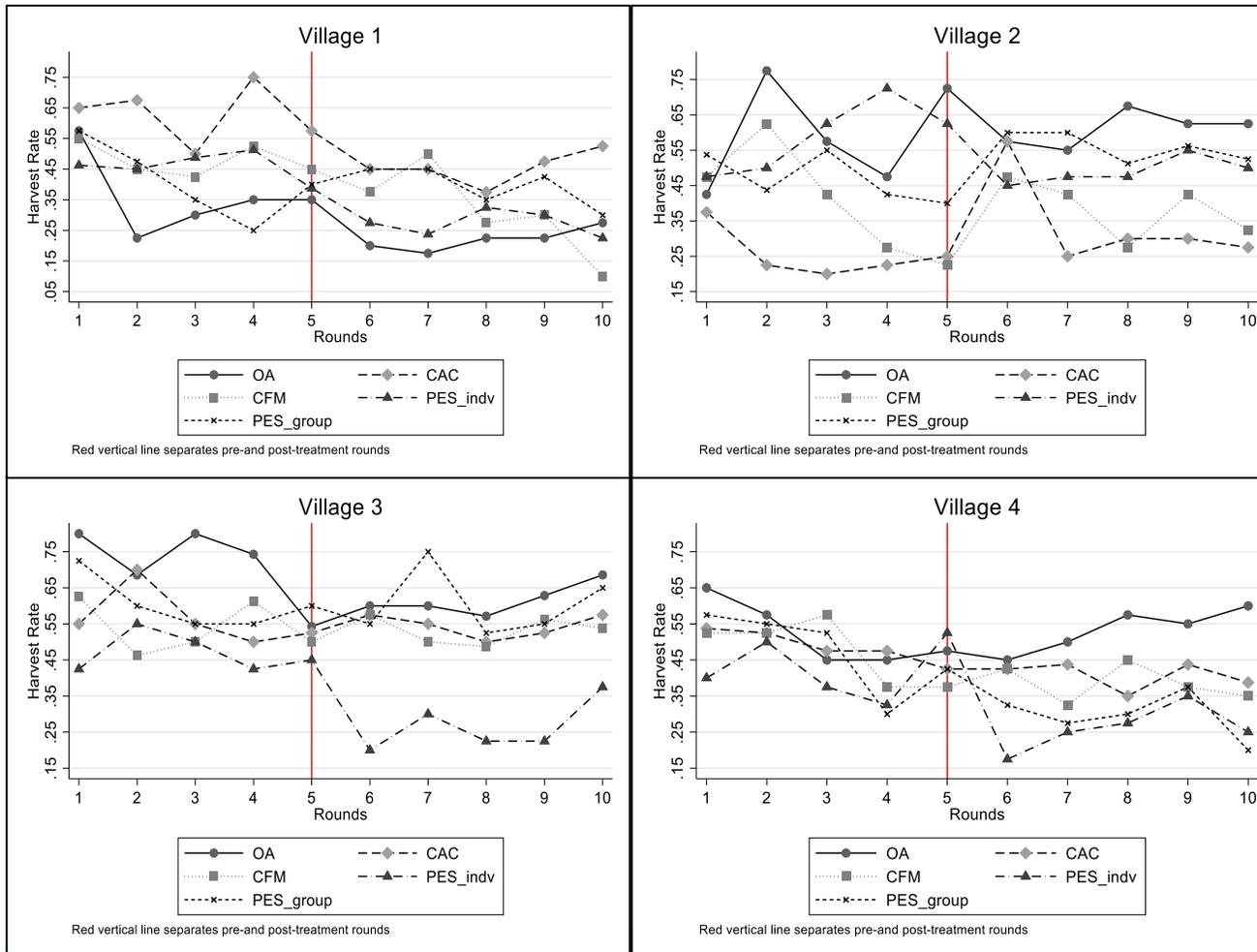




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## Harvest rates by village





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## Within treatment mean harvest rates

	Harvest rate (pre-treatment (1))	Harvest rate (post-treatment (2))	T-test (1)-(2)	N
<b>OA</b>	0.542 (0.024)	0.492(0.027)	0.050	310
<b>CAC</b>	0.485(0.021)	0.431(0.019)	0.054*	400
<b>CFM</b>	0.488(0.023)	0.429(0.022)	0.059*	400
<b>PES, individual pay</b>	0.481(0.021)	0.312(0.017)	0.169***	400
<b>PES, group pay</b>	0.486(0.023)	0.483(0.024)	0.003	400
<b>Overall effects</b>	0.494(0.010)	0.426(0.010)	0.068***	1,910

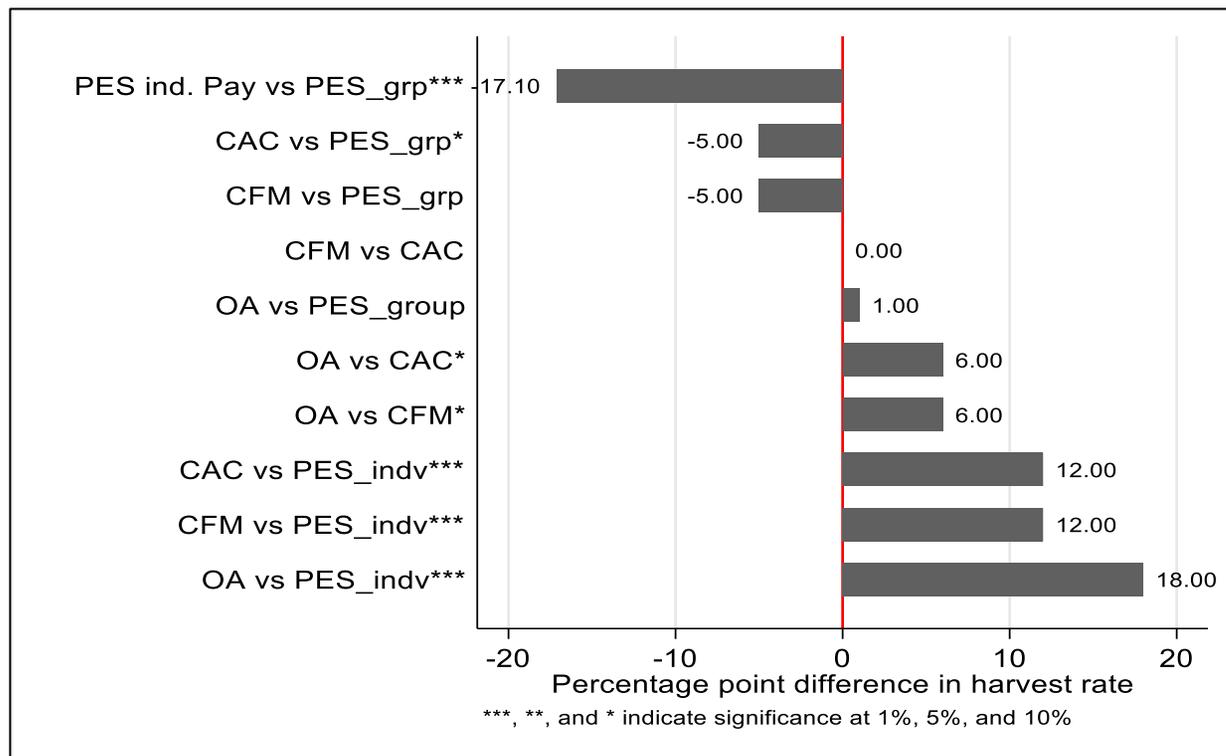




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## Between treatment mean harvest rates





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## Econometric results

	(1)		(2)		(3)	
			Panel data fractional response model			
	POLS	SE	Treatments	SE	Full	SE
CFM (yes = 1)	<b>-0.084***</b>	<b>0.026</b>	<b>-0.051</b>	<b>0.051</b>	<b>-0.083*</b>	<b>0.048</b>
CAC (yes = 1)	<b>-0.025</b>	<b>0.027</b>	<b>-0.056</b>	<b>0.048</b>	<b>-0.021</b>	<b>0.052</b>
PES, individual pay (yes = 1)	<b>-0.151***</b>	<b>0.023</b>	<b>-0.123***</b>	<b>0.046</b>	<b>-0.152***</b>	<b>0.042</b>
PES, group pay (yes = 1)	<b>-0.021</b>	<b>0.026</b>	<b>-0.031</b>	<b>0.053</b>	<b>-0.021</b>	<b>0.048</b>
Number of trips to the forest	-0.010	0.007			-0.009	0.014
Sold forest product last month (yes =1)	0.046**	0.019			0.050	0.039





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## Conclusion

- Individual pay is better than group pay for conservation
- The impacts of community forest management are small
  - could be combined with market-based incentives to improve forest conservation
  - Thus, clarifying benefit sharing mechanisms in community forest management and taking into account individuals' non-pecuniary motives will be important to for conservation





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## Thank you for your attention & participation!

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