Randomized control trials
and other methods of "pseudo-randomization"

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RANDOMIZED CONTROL TRIALS

- Objective: to measure the impact of adoption on adopters (and spillover on non-adopters): ATT

- Econometric technique: Needs many units of observation (farmers), many units of randomization (not necessary the same, often villages).

- Based on an "intervention" that actively induces some to adopt and not others.

- But adoption is a choice. And some may adopt despite not having been "treated", some may not adopt despite being "treated".

→ Measures the impact on those <u>induced to adopt</u> by the intervention.

Does not measure the impact on adopters that would adopt anyway, on adopters that adopted very early, etc.

Not to do list:

- Cannot randomize "adoption" itself, at the plot or the farmer level: it would give ATE over arbitrary set of farmers and plots, not over adopters in a normal setting. Adoption has to remain a choice.

- Randomization over "encouraging" adoption. But cannot be done through a demand side intervention, such as voucher, subsidies, offering credit, etc.

  This recovers the LATE (local average treatment effect) on the most marginal adopters induced to adopt by the encouragement. Not necessarily those with lowest or highest return to adoption (could be the most cash constraint). Hence does not even give a bound to the impact.

- Not at the household level within a village, as there is likely too much contamination or spillovers

Basic randomization

1. RCT at the village or "community" level

   - Can incorporate spillovers (on non-adopters) or local GE effect.

   - Can use household level observations but need clustering of errors → in fact need large number of villages if within village observations are highly correlated.

   - Can measure ITE, i.e., the average effect over the whole village, including the spillovers. Dividing ITE by (increase in) the number of adopters gives the effect of adoption per adopter (ATT + spillover).

2. Use supply-side interventions where the new technology is introduced to the whole village

   - Need to simulate the introduction of the new technology under conditions as close as possible to market conditions (at market price, without incentives to the sellers that would induce distortion in adoption, etc.) to measure meaningful impacts

   - Randomized an information / extension program (normal, sustainable)

   - Use local existing institutions (private agro dealers) to implement the supply side intervention, so that the technology comes within the normal context.

Beyond the simple randomization

1. Stratified randomization (to improve the quality of the randomization, or study heterogeneity)

   - Constitute strata based on observable characteristics that matters for adoption (agroecological context) or using matching technique (match villages on their propensity to have adopted another innovation, or to have an agrodealer, etc.)

   - Then randomize within stata

2. Combine panel and randomization: Randomized rollout.

   - Panel very powerful to control unobserved time invariant or unit invariant unobservables (Hoddinott)

   - Randomized rollout insures exogeneity of the timing of adoption.

   - Critical is to start observations on future sites of intervention

   - Very natural whenever the expansion of the intervention cannot be done everywhere at the same time

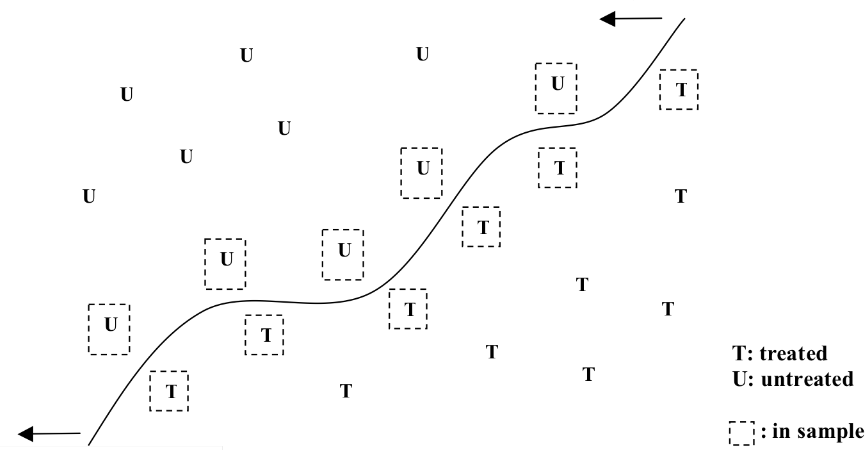
Beyond RCT … look for natural quasi-randomization

- Rollout without any explicit randomization (need to verify that the order of entry was not correlated with benefit of adoption). Issues is existence of panel data in areas of rollout.

- Geographical discontinuity (e.g., boundary in the spreading of a disease), and dif-in-dif method to estimate the impact of a technology that controls for the disease.

LATE, OK if there is no reason to be different from the producer on the other side of the boundary

Figure 2



boundary of

- Using (random) weather shocks to evaluate the impact of drought resistant (of flood resistant) varieties?

How to find natural experiments?

How to design a RCT?

Brainstorming and creativity …

There is no such thing as a simple straightforward RCT, since you cannot impose adoption (as opposed to the simpler health intervention)

EXAMPLES (suggestive ideas, not proposals, for three CGIAR technologies in need of impact evaluation)

Example: Genetically improved farmed tilapia (GIFT) by WorldFish Center (a village-level RCT using technology availability)

- Supply-side constraints in Bangladesh → RCT may be appropriate
- Identify a subset of villages engaged in Tilapia farming, not reached by supply, randomize into T and C
- Organize supply:

  through local aqua-dealer near the T villages (by giving them GIFT seeds, and incentive to sell the new variety).

  or through NGO/government agencies requesting them to sell in T villages
- Data requirement: Baseline and follow-up surveys of households

- Regress change in outcome (yield, income, profit, consumption, etc.) on whether village was offered GIFT or not (reduced form)→ ITE

- Regress change in outcome (yield, income, profit, consumption, etc.) on adoption.

  Adoption instrumented by whether village was offered GIFT or not (in interaction with individual z) → ATT (for those induced to adopt because of intervention, which is essentially all adopters if almost no independent adoption in control villages) = scaling of ITE to the adopters

If no spillover within villages, measure of ATT

If spillover, measure of ATT + average spillover

Example: Goat parasite treatment by ILRI and ACIAR (a village level RCT using training offerings)

- "Farmer livestock schools" teaching package of livestock management techniques
- Same scheme as before, with RCT on class offerings at the village level. No involvement of the private sector, but direct intervention
- Spillover very likely, as well as individual adoption of good practices in control villages
- Need to define "adoption", as any adoption. "Partial" adoption is endogenous. Need to measure the impact of adoption as it occurred, not of full adoption
- Direct comparison of average outcomes between T and C villages gives ATE of class offerings, which maybe of interest in itself.
- Regressing change in outcomes at the individual level on adoption, instrumented by the treatment status of the village, gives LATE, i.e., ATT plus the induced average spillover effect on non-adopters in the same village, for the farmers induced to adopt by the presence of the school.
- Data requirement: Baseline and follow-up surveys of households

Example: Drought tolerant maize varieties by CIMMYT (a natural experiment using weather shocks)

- Drought tolerance (DT) is a risk-reducing technology that carries benefits only if drought actually occurs. And drought occurrence, conditional on drought risk, is random.

The idea is to then compare DT adopters that happened to experience drought to DT adopters that happened not to experience drought (measures ATT in a year of drought)

- Data requirement: A large panel data set, with observations before and after the introduction of the DT variety.

- Use only those that will have adopted in the follow-up survey and had experienced a drought in the base year. [If the survey is designed with the evaluation strategy in mind, one could design the baseline focusing on an area of expected large adoption and having experienced a drought].

- Data requirement: Compile fine-grained rainfall data and estimate a drought risk indicator for each farmer in the sample.

- Match farmers on drought risk. Conditional on drought risk, drought occurrence is random. Hence the double difference identifies the avoided loss due to DT for adopters

	Before	After
Treatment	Drought w/o DT	Drought w DT
Control	Drought w/o DT	No drought w DT

Can measure the effect of DT in the drought year, conditional on drought risk. This does not include the other effects of DT, if any (lower yield in normal years, etc.)

Summary

Technological innovation	**Type of experimental design**	**Unit of analysis**	**Adoption analysis**	**Impact analysis**
Tilapia seeds	RCT Supply-side availability	Village level	Average adopter	ITE, ATT, ATT+spillover
Treatment for goat parasites	RCT Class offerings (info)	Village level	Marginal induced adopter	LATE of adoption ATE of FLS
Drought resistant seeds	Natural experiment Random weather shocks	Farmer level	Adopters	ATT (heterogeneity)