

# Introduction to impact evaluation in international development

Erick Gong

UC Berkeley & CEGA

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# Name cards

- Write Name on front (First and Last)
- Write Year (i.e. 3rd year undergrad, MPP) and department
- Credit / Auditing

# Agenda

- Administrative
- Why should we do impact evaluation?
- How should we do impact evaluation?
- Who should do impact evaluation?
- Statistics Review

# Format of Lectures

- August 14, why is this date important?



# Credit / Auditing

- Encourage those taking the course to do so for credit (please email me for a CEC)
- Auditors are welcome, please make seats available for those taking course for credit
- Why is their stickk.com? “Put a contract on yourself”

# Grading

- Attendance (place-cards)
- Participation
- Problem Sets (4) (STATA) [first PS will be handed out sept 22nd]
- Group Presentation

# Impact Evaluation

- Why do we do it?
- How should we do it?
- Who should do it?

# Why do Impact Evaluation?

- Interventions / Policies seem obvious
- We already have evidence, don't we?
- Trade offs between
  - Scaling vs. Evaluation
  - Time vs. Evaluation



# Financing Gap Theory

- Giving is Good (isn't it obvious?)
- The More Money the Better (the more good you can do)
- Conclusion: We don't really need to think about how money is spent.

# Is it obvious?

- Investment in Education leads to better educational outcomes, right?

# Textbooks

- This sounds like a great policy!
- Why would increasing access to textbooks improve test scores?
- Why wouldn't they work?
- Observational evidence.
- Randomized Impact Evaluation (Glewwe, Kremer, & Moulin 2009)

# Flip-charts

- Visual aids are the answer!
- Why would they work?
- Why wouldn't it work?
- Observational analysis
- Randomized Impact Evaluation (Glewwe et. al. 2006)

# Student/Teacher Ratio

- More teachers is the answer
- Why would it work?
- Why wouldn't it work?
- Observational studies
- Random Impact Evaluation (Banerjee et al 2005)

# Not so Obvious

- Programs, policies, and interventions may be promoted  
Intuition: isn't it obvious that they work?  
Evidence: evaluations relying on observational studies
- Thus the need for impact evaluation

# Trade offs

- Need to act now
- No time for Evaluation

# Marginal Approach

- Impact Evaluation necessitates a marginal approach to development
- Transformational Approach

$$growth = f(education, health, credit, democracy, rule of law, FDI, roads)$$

- Marginal Approach  
Specific Outcome and specific intervention



# Marginal Approach

- We can learn from what we do
- **Accountability**

# Learning is important

Table 5: The Similarity of Old and New Recommendations for Technical Interventions in Africa

<i>African problem to be addressed</i>	<i>Committee of the African Research Survey, 1938 (headed by Lord Hailey)</i>	<i>UN Millennium Project, 2005 (headed by Jeffrey Sachs)</i>
Malaria	{Steps to control malaria in European homes include} mosquito screening, mosquito bed-nets, and the use of insecticidal sprays...in certain native areas...malaria control by the spraying of native huts with a preparation of pyrethrum (p. 1126)	the public good will best be served by the free provision of insecticide-treated nets, application of residual insecticides, and provision of effective antimalarial medicines and diagnostics.... insecticides for indoor residual spraying (mainly DDT and pyrethroids) (p. xii, p. 6, Malaria task force report)
Hunger and nutrition	Whether the African eats enough food and, if he does whether it is of the right kind, and whether the attack on poor nutrition may not be the most important factor in reducing disease...the African suffers from deficiency of Vitamin A (pp. 1122-1123)	Chronic undernourishment is caused by a ... lack of access to food of sufficient quality and quantity.... It results in ... high child mortality brought about by associated diseases...Malnutrition {is also} caused by inadequate intake of ... {micronutrients such as} vitamin A (p.3 Hunger Task Force summary report.p. 128, Hunger Task Force full report)
Soil fertility	"methods of improving soil fertility {such as} green manuring" (p. 962)	"using green manure to improve soil fertility" (p. 107 Hunger Task force main report)

# Lazy Thinking

- Giving is Good (or at least it's not bad . . . ) & the more Money the Better =>  
We don't really need to think about how money is spent.
- Credibility (Donor Fatigue)
- Opportunity Cost

# Why Impact Evaluation

- Interventions / Policies seem obvious? **Not always.**
- We already have evidence, don't we? **Not rigorous evidence.**
- Trade offs between  
Scaling vs. Evaluation  
Time vs. Evaluation  
**A false trade off.**
- Method necessitates a marginal approach to development  
**Allows for learning and creates accountability.**

# How do we do Impact Evaluation?

- Why do we do it?
- **How should we do it?**
- Who should do it?

# How should we do it?

- Guidelines for research design
- Pilots
- Replications
- Other Methods
- Theory

# Framework for Research Design

- Specific Outcome
- Specific Program / Policy / Intervention
- Population of Interest
- Credible Counterfactual

# World Bank

Empowerment is the expansion of assets and capabilities of poor people to participate in, negotiate with, influence, control, and hold accountable institutions that affect their lives.

- How would you measure empowerment?
- What policies would you enact if this were your goal?



# Specific Outcomes / Interventions

- Outcomes
  - Education: test scores, student attendance, teacher attendance
  - Health: height, weight, biomarkers
  - Others: Income, Crop yields
- Interventions
  - Assignment of medications, scholarships, school uniforms, income.

# Counterfactual

- What would have happened in the absence of a program / policy / intervention?
- In experimental language: control group.
- Randomization helps a lot in generating a counterfactual.

# Randomization

- Gold-standard in impact evaluation
- Provides method to identify counterfactual  
What would have happened in absence of program?
- It is a fair and transparent method to allocate scarce resources

# Pilots

- Randomized Impact Evaluation
- PROGRESA

# Replications

- External Validity
- Deworming (Miguel & Kremer 2004), (Bobonis, Miguel, & Sharma 2002)
- Treatment for STD to prevent HIV transmission (Grosskurth et. al. 2000)

# Natural Experiments

- What if you can't do a randomized impact evaluation?
- Regression Discontinuity
- Propensity Score Matching
- Diff-in-Diff

# Theory

- A little theory helps
- Helps identify the channel
- Helps with external validity
- “The Illusion of Sustainability” (Miguel & Kremer 2007)

# How should we do it?

- Guidelines for design
- Pilots
- Replications
- Other Methods
- Theory



# Who Should Do It?

- Why do we do it?
- How should we do it?
- Who should do it?

# Who should do it?

- International Organizations
- Governments
- NGOs

# Public Good

Knowledge of what works and what doesn't work is a public good.

- Cost is borne by organization
- Benefit is for everyone

# International Organizations

- Lots of cooks in the kitchen. Everyone wants to provide services, few want to do impact evaluations
- International Organizations (i.e. World Bank, WHO) maybe best suited to coordinated impact evaluations

# Impact Evaluation

- Why do we do it?
- How should we do it?
- Who should do it?

# Impact Evaluation

- Why do we do it?
  - Impact of policies not always obvious
  - Existing evidence may not be rigorous
  - Allows for learning and accountability
- How should we do it?
  - Specific outcomes & interventions
  - Counterfactual (randomization)
  - Replications
- Who should do it?
  - International Organizations

# Goals

- Conditional Expectations  $\mathbb{E}[Y|X]$
- Linear Regression  $Y_i = \alpha + \beta X_i + \delta Z_i + \varepsilon_i$
- Stay Calm, don't panic

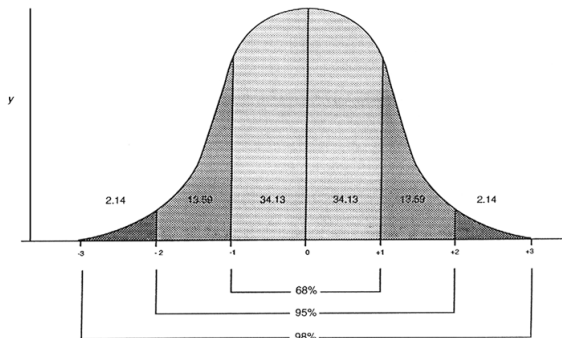
# Random Variable

- A variable that takes on numerical values
- Values represent an outcome when the outcome is unknown
- $Y$   $X$  (random variable)  $Y = y$  ,  $X = x$  (specific value)
- Examples
  - A coin flip (# of heads after coin tossed 10 times)
  - Age of UC Berkeley Student
  - Income of CA state resident



# Distributions

- Random Variable have distributions



- Mean ( $\mu$ )
- Variance ( $\sigma^2$ )

# Expectation

- Expectation Function  $\mathbb{E}[X] = \mu$   
Intuition: What is the average value? If drawn from distribution, what is your best guess on the value of the R.V.?
- Examples  
 $X =$  Age of UC Berkeley Student  
 $\mathbb{E}[X] = 20$

# Conditional Expectation

- Conditional Expectation Function  $\mathbb{E}[X|D]$   
Intuition: What is the average value of  $X$  given another value  $D$ ?
- Example  
 $X$  = Age of UC Berkeley Student  
 $D$  = Year at UC Berkeley  
 $\mathbb{E}[X|D = 1] = 18$  OR “Avg age of student given student is a 1st year”  
 $\mathbb{E}[X|D = 4] = 22$  OR “Avg age of student given student is a 4th year”

# Income Example

- $Y = \text{income}$  ,  $X = \text{Years of Education}$

$$\mathbb{E}[Y|X = 12]$$

$$\mathbb{E}[Y|X = 18]$$

- Chalkboard [x-axis = education, y-axis = income]

# Properties

- Constants

let  $a$  be a constant (i.e. 5,  $\pi$ , etc . .) and  $Y$  and  $X$  are random variables

$$\mathbb{E}[aY] = a\mathbb{E}[Y]$$

$$\mathbb{E}[aY|X] = a\mathbb{E}[Y|X]$$

- Addition

let  $b$  also be a constant

$$\mathbb{E}[a + bY] = \mathbb{E}[a] + \mathbb{E}[bY] = a + b\mathbb{E}[Y]$$

$$\mathbb{E}[a + bY|X] = \mathbb{E}[a|X] + \mathbb{E}[bY|X] = a + b\mathbb{E}[Y|X]$$

# Why do we care?

- Think of conditional expectations as good predictors
- Statement, “Given  $X$  this is what I predict  $Y$  will be”
- We haven’t sorted out causality vs. correlation ... yet
- Example (Income and Education)
- Regression Analysis estimates conditional expectation functions

# Linear Regression

- Intuition: A line that best fits the data
- Chalkboard (Best Fit Line)
- Slope is of interest

# Linear Regression

- Suppose  $Y$  can be described by a linear equation

$$Y = \alpha + \beta X + \varepsilon$$

- Example  $Y =$  income ,  $X =$  education
- Interested in  $\beta$  or the slope
- What's  $\varepsilon$ ?



# What is regression?

- OLS estimation (magic!)
- Intuition: Finds a line that best fits the data
- Technically it's this

$$\beta = \mathbb{E}(X'X)^{-1}\mathbb{E}(X'Y)$$

- Use Stata to estimate  $\beta$  (more magic!)

# Estimates of $\beta$

- Regression estimates  $\beta$  ( $\hat{\beta}$ )
- We then can test the null hypothesis ( $\beta = 0$ )

$$t = \frac{\hat{\beta} - \beta}{SE}$$

where under the null  $\beta = 0$

- Intuition: Tells you with what confidence you can reject the null.
- Example: Income and Education

# Linear Regression

- We can take the conditional expectation of  $Y$

$$Y = \alpha + \beta X + \varepsilon$$

$$\begin{aligned}\mathbb{E}[Y|X] &= \mathbb{E}[\alpha + \beta X + \varepsilon|X] \\ &= \mathbb{E}[\alpha|X] + \mathbb{E}[\beta X|X] + \mathbb{E}[\varepsilon|X] \\ &= \alpha + \beta \mathbb{E}[X|X] + \mathbb{E}[\varepsilon|X] \\ &= \alpha + \beta X + \mathbb{E}[\varepsilon|X]\end{aligned}$$

- Assume  $\mathbb{E}[\varepsilon|X] = 0$  then

$$\mathbb{E}[Y|X] = \alpha + \beta X$$

- What happens when  $X$  changes?

$$\frac{\partial \mathbb{E}[Y|X]}{\partial X} = \beta$$

- $\beta$  is the effect of an increase in  $X$
- Example of Income and Education,  $\beta$  is the effect on of an increase in education

# Practically Speaking . . .

- Conditional Expectations provide an intuitive way to think about regression analysis
- Regressions are done in STATA  
Estimates  $\hat{\beta}$  and t-statistics appear (like magic)
- Helpful to know the intuition of what regression is doing
- Helpful to be able to interpret your results

# Conclusions

- Don't panic!
- We'll be going over these concepts repeatedly
- Intuition is most important.