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lecture 4: Education–What works?

14.771, Fall 02

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Some facts and questions about education

There are enormous disparities in educational outcomes:

- ➜ Around the world
- ➜ Across regions in the same country
- ➜ By gender within countries
- ➜ By income levels
- ➜ By urban/rural residence

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Descriptive Evidence from India

Probe report: survey of schools and households in 234 villages in Bihar, Madhya Pradesh, rajasthan, UP, Himachal Pradesh: Northern Indian states.

Some striking facts from this report:

- ➜ Very poor education performance
- ➜ Fairly high motivation by parents
- ➜ Child labor does not seem to be a big constraint
- ➜ Direct cost are small but not negligible
- ➜ School availability is not a constraint at the primary school level, may matter more at the post primary school
- ➜ School quality is dismal

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Possible interventions

- ➜ Affecting the direct costs: scholarship programs, vouchers, school construction.
- ➜ Affecting the opportunity costs: child labor ban, mandatory schooling.
- ➜ Affecting the returns by changing school quality: textbooks, teacher training, incentives, class size, one teacher school.
- ➜ Improving income levels: unconditional transfers.
- ➜ No intervention specifically in education: foster economic growth to improve the returns to education.

Potential problems with experiments

Education is a field where experiment are relatively easy to run (often, one seeks to estimate a "production function"). But when planning an experiment, need to take into accounts several factors.

Threat to internal validity

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- Non response bias:
  - ➜ People may move off during the experiment. Moving may be related to the treatment.
  - ➜ Example: Remedial education program in Baroda. We are interested in the effect of the program on test scores. Drop out significantly diminished by the program. Bias if we test only the children who stayed in school?
  - ➜ Need to track down all children initially enrolled in the program.

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- Mix up of Treatment and Controls:
  - ➜ Example: treatment status in worm paper. Transfers from control class to treatment class in Tenessee Star class size experiment (Krueger).
  - ➜ The actual treatment status is therefore not random even though the initial assignment was random.
  - ➜ It is then important to use the *initial assignment* (or the "intention to treat") as an instrument for actual treatment.

Threats to external validity

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① Limited duration:

Experiments are in general temporary. People may react differently to a temporary program than to a permanent program.

② Experiment Specificity:

Specific geographic area, specific group.

③ Hawthrone and John Henry effects:

Treatment and control may behave differently because they know they are being observed. Therefore the effects may not be generalized to a context where subjects are not observed.

④ General Equilibrium effects:

Small scale experiments do not generate general equilibrium effects that might emerge when policy is applied to everybody in the population (e.g. INPRES experiment showed general equilibrium effect of improving access to education).

Threats to power

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① Experiment design and power of the experiment:

When the unit of randomization is a group (e.g. a school, or a class), need to take into account correlation of outcomes within groups. Can be large effects (see Kremer textbook experiments).

② Small samples:

Need to perform power calculation when starting an experiment. What is the sample size required to be able to discriminate from 0 an effect of a given size, with a given power?

Need to know variance, mean, intra-cluster correlation and expected effect size.

Mandatory Schooling: Taiwan

Analysis of a policy change

Spohr (1999): Compulsory schooling reform in Taiwan: Before the reform, school was compulsory for 6 years, then it became compulsory (and free) for 9 years.

Slide 9 The most obvious way to do that is to do a simple difference method using data before ($t = 0$) and after the change ($t = 1$):
$Y_{it} = \alpha + \beta \cdot 1(t = 1) + \epsilon_{it}$

The OLS estimate of β is the difference in means $\bar{Y}_1 - \bar{Y}_0$ before and after the change.

Problem: how to distinguish the policy effect from a secular change?
With 2 periods only, this is impossible. The estimate is unbiased only under the very strong assumption that, absent the policy change, there would have been no change in average Y.
Suppose that years 0,..,T are available and change took place in year t^*. Put all the year dummies in the regression:

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$$Y_{it} = \alpha + \sum_{\tau=1}^{T} \beta_\tau \cdot 1(t = \tau) + \epsilon_{it}$$

Then $\hat{\beta}_\tau = \bar{Y}_\tau - \bar{Y}_0$
Question: is there a rupture in the pattern of $\hat{\beta}_\tau$ around the reform date $\bar{t}$?

The reform takes place in 1968, and therefore affected cohort born in 1955 or later. Is there a break in the trend of education across cohorts:

See figure. Rupture in the trend. Detrend the data (remove the pre-reform trend): effect of the reform. Check that it happened only at the Junior high school level.

Slide 11 This is a nice application, but the design requires very special circumstances.

- ➜ Need to argue that nothing else happened at the same time to these cohorts
- ➜ If the reform is gradual, it is not possible to distinguish "secular" increase from the effect of the plicy
- ➜ The policy could endogeneously respond to an increase in the trend

School Construction: Indonesia: set up

The INPRES school construction program

Second five year plan (1974-79)-Oil shock.

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- ➜ A large program:
  - ➜ 61,807 primary schools constructed from to 1973/74 to 1978/79.
    Number of schools multiplied by 2. 1 schools for every 500 children.
  - ➜ A *change* in policy: Before 1973, no construction, ban on recruiting for public service positions.
- ➜ A program meant to favor low-enrollment regions.

Allocation rule: number of schools constructed in a district proportional to the number of children (ages 7 to 12) not enrolled in primary school.

Data and sources of variation

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SUPAS 95: A survey done in 1995: after the children educated in these schools have completed their schooling, and have started working.

- 150,000 men born 1950-1972
- Variables: education, year and region of birth, wages.

Sources of variation

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Two factors affect the intensity of the program.

- ➜ Year of birth : Examples
  - ➜ Born in 1962 or earlier: 12 or older in 1974. Not exposed to the program.
  - ➜ Born in 1967: 7 in 1974, 12 in 1979. Some exposure to the program.
  - ➜ What would we find if we compare the education of those born before and after 1962? Would this be a good measure of the impact of the program? Why?
- ➜ Region of birth

  The government was targeting low enrollment regions ⇒ substantial variation in program intensity across districts.

  What would we find if we compare regions with high and low construction?

The "Difference in differences" methodology

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- **Basic idea**

Suppose that there are two regions in the data: a "high program" region, and a "low program" region.

Suppose that we have the age group of the individuals: "young people", born after 1967 and who could fully benefit from the schools, and "old people" born before 1962, and who could not benefit at all from the schools.

So in total, we have four groups: YOUNG and High program, OLD and high program,.... See the DD in the table.

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- ➜ Calculate, D_{11}, the difference between the "HIGH" and "LOW" average among the young: what do we find and why?
- ➜ Calculate D_{21} the difference between the YOUNG and the OLD in the high program region: what do we find and why?
- ➜ Calculate, D_{12} the difference between the "HIGH" and "LOW" average among the old: how does it compare to D_{11}? why?
- ➜ Calculate the difference $DD_a = D_{11} - D_{12}$. How do you interpret it?
- ➜ Calculate the difference $DD_b = D_{21} - D_{22}$. How does it compare to DD_a? How do you interpret it?
- ➜ Could DD_a or DD_b be a good measure of the program?
  - ➜ Under what assumption?
  - ➜ Is assumption likely to be satisfied?

Control experiment

We have a possibility to check that the assumption is not rejected in the available data.

Slide 17 Suppose we fill the same boxes, but we now compare the "OLD" to the "VERY OLD". Neither of them benefited from the program: what do we expect to see if the assumption is satisfied? What do we expect to see if the assumption is not satisfied?

Table:what do we see?

Extending difference in differences

(1) Using all the regional variation

There are 280 districts in Indonesia, and we know how many schools each district has received: grouping the region into two groups is throwing away some information!

Slide 18 Before, we had 2 regional group, and 2 age group, we formed 4 age-region group. Now we have 280 regional group, 2 age group, how many groups can we form? What are these groups?

First, we form the average for each group. We will note S_{Yj} the average education of the young in any region j, and S_{Oj} the average education of the young in any region j.

Slide 19 What can we do next?
-Take the difference between young and old in all the regions
-Plot the differences against the number of school constructed per 1000 child during the INPRES program (see graph)
- What do we wee? What does this suggest?
- Suppose we run the regression:

$$S_{Yj} - S_{Oj} = \alpha P_j + v_j \tag{1}$$

Where can you see the slope of this regression?
- See table 4: what is the result of running this regression?
What can we conclude?
Under what assumption is this conclusion valid?
Any suggestion to test this assumption?

(2) Using regional and age variation

The last generalization is that we don't have only 3 age groups (young, old, and very old): we have 23 age group (everybody born between 1950 and 1972).

Slide 20 Note S_{j2}, S_{j3},....,S_{jk},... S_{j24} the average education of people born in region j, and who were of age 2, 3, ... k,...24, when the program started.

Suppose we run the regression:

$$S_{j2} - S_{j24} = \alpha_2 P_j + v_{j2}$$

What is α_2?

What is α_{23}? What should α_{23} be equal to?

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In general, suppose that for all ages k we run the regression:

$$S_{jk} - S_{j24} = \alpha_k P_j + \upsilon_{jk}$$

For what values of k should we see a positive α_k? (remember that children attend primary school until age 12). Should we see the coefficient be larger for younger children or older children?

Run the regressions in one operation:

$$S_{ijk} = c_1 + \alpha_{1j} + \beta_{1k} + \sum_{l=2}^{23} (P_j * d_{il}) \gamma_{1l} + \sum_{l=2}^{23} (\mathbf{C_j} * d_{il}) \delta_{\mathbf{11}} + \epsilon_{ijk}, \quad (2)$$

Figure 2: Do the dots have the expected pattern?