Comparing results: cost-benefit and cost effectiveness analysis

EE473

- How is a decision maker to decide which program or policy to implement in schools?

- How can we compare the results from multiple EPFs in order to determine which program or policy is best suited to help a school meet its production goal?

Cost-effectiveness analysis

- Compares how much each intervention costs in order to produce the same benefit

- To identify which can produce a given benefit for the least cost

Cost-benefit analysis

- Compare how much each intervention costs to the monetary value of the benefits each yields

- To find which yields the highest benefit for each dollar spent

Assume a school is looking for ways to increase student academic performance

A review of the EPF literature uncovers several studies that find reductions in class size and increases in teacher professional development both lead to higher test scores

Facing a tight budgets, the school principal must decide which intervention to implement

He is aware that each program requires him to purchase a specific set of additional inputs

Smaller class sizes at the very least require more teachers and more classrooms

The list for expanded professional development opportunities includes more substitute teachers, fees to bring outside educational consultants to the school, and travel expenses to send teachers elsewhere

The principal turns to the local economist to help him select one program

Cost-effectiveness analysis

- Requires data on the effects of the intervention and figures on how much the program costs
- The data on each intervention's effect on student achievement comes from the EPF analyses
- The magnitude of this effect comes from the parameter estimates on the dummy variables indicating whether or not a school has the intervention
- Cost data could come from schools that have implemented the interventions or from cost projections from the school itself

- The economist compares costs of the required inputs to the quantity of the output generated by calculating the cost-effectiveness ratio (CER)
- The CER is the cost of a particular program (C) divided by its effectiveness (E = the EPF parameter estimate)

$$CER = \frac{C}{E}$$

A CER is interpreted as how much each unit of effectiveness costs

E.g. assume the CER for the class size reduction program was 150

This means that to increase test scores by 1 point schools must spend $150

The program with the lowest CER is the most cost-effective program

Cost-benefit Analysis

- Compares the financial costs of each intervention to the financial benefits generated
- How are test scores converted to dollar figures?
- Economists do so by considering the long-term consequences of test scores
- High achieving students are more productive workers, less likely to commit crimes, and more likely to live healthy lifestyles

- Cost-benefit analysis attaches dollar figures to each of these long term outcomes
  - Increased productivity helps grow the economy
  - Lower crime rates reduce the costs to the legal system and the costs to the victim
  - Healthier people require less emergency medical care and fewer days off work
- A major source of controversy focuses on the ability of cost-benefit analysis to accurately capture social costs and benefits

Cost-benefit ratio

- The CBR is the cost of a particular program (C) divided by its benefits (B)

$$CBR = \frac{C}{B}$$

- Programs with the lowest CBR are said to be the best investment

Net Present Value Calculation

- Based on the premise that a dollar today is more valuable than a dollar tomorrow
- Future benefits are therefore discounted to their present value using a discount rate
- A program's net present value is the present value of the benefits minus the present value of the costs
- The program with the highest net present value is deemed to best investment

Advantages and Disadvantages

Advantages of CER

- it focuses on immediate educational output – test scores or graduate rates
- Easier to measure than their long-term benefits

Disadvantage of CER

- Measure must be in the same units – e.g. CER cannot be used to compare a program's effectiveness of increasing test scores to another program's effectiveness at increasing graduation rates

Advantages of CBR

- All costs and benefits are measured in dollars, any two interventions can be compared
- These do not need to be restricted to educational interventions, but rather include any social intervention – E.g. the costs and benefits of an educational intervention can be compared to the costs and benefits of a community health initiative

Disadvantages of CBR

- The difficulty in measuring an intervention's long-term benefits and the controversy that generates
- The benefits of one intervention may be more easily measurable than the benefits for another intervention

Exercise

1. How are cost-effectiveness and cost-benefit analyzes useful to decision-makers?
2. Explain the ways in which cost-effectiveness and cost-benefit analyzes differ?

3. A local schools has hired you go conduct a cost-effectiveness evaluation of three educational interventions they have implemented in their fourth grade classrooms. Each intervention was intended to improve student performance in mathematics. Consider the following fictitious cost and effectiveness data for three interventions. All fourth grade students were randomly assigned to one of three classes. There should be no selection bias within the school as to which type of student received which intervention.

Intervention	Cost per student	Average gain on math test- All students	Average gain on math test- Males	Average gain on math test- Females
Peer tutors	40	10	7	12
Teacher aide	360	22	18	24
Computer–assisted instruction	120	18	21	15

a. The school principal tells you that she is under a lot of pressure from parents to increase test score. Her primary concern is to implement the intervention that produces the increases test scores the most. **Which intervention would you recommend she implement in all the school's fourth grade classroom? Would your recommendation change if she told you that she was willing to have separate math instruction for male and female students if that helped increase test scores? Explain your answer.**

b. Now assume that the principal tells you, although she feels pressure to increase student test scores, her budget is extremely tight. She says she will need to justify the costs of the intervention to be implemented in all fourth grade classrooms. **From a cost-effectiveness standpoint, which intervention would you recommend? What would you recommend if students were to be separated by gender for math intervention? Explain your answer. Are your recommendations different from those in part a.**