

Cost-Benefit / Cost-Effectiveness Analysis in the Context of Impact Evaluations

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**IMPACT EVALUATION WORKSHOP FOR HEALTH SECTOR REFORM
Evaluating the Impact of Development Programs:
Turning Promises into Evidence**

**Cape Town, South Africa
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Impact Evaluation and Efficiency Analysis

Topics

- **Adding a cost component to our impact evaluation**
- **Defining and measuring efficiency**
- **Cost-effectiveness, cost-benefit and Technical Efficiency**

Impact Evaluation and Efficiency Analysis

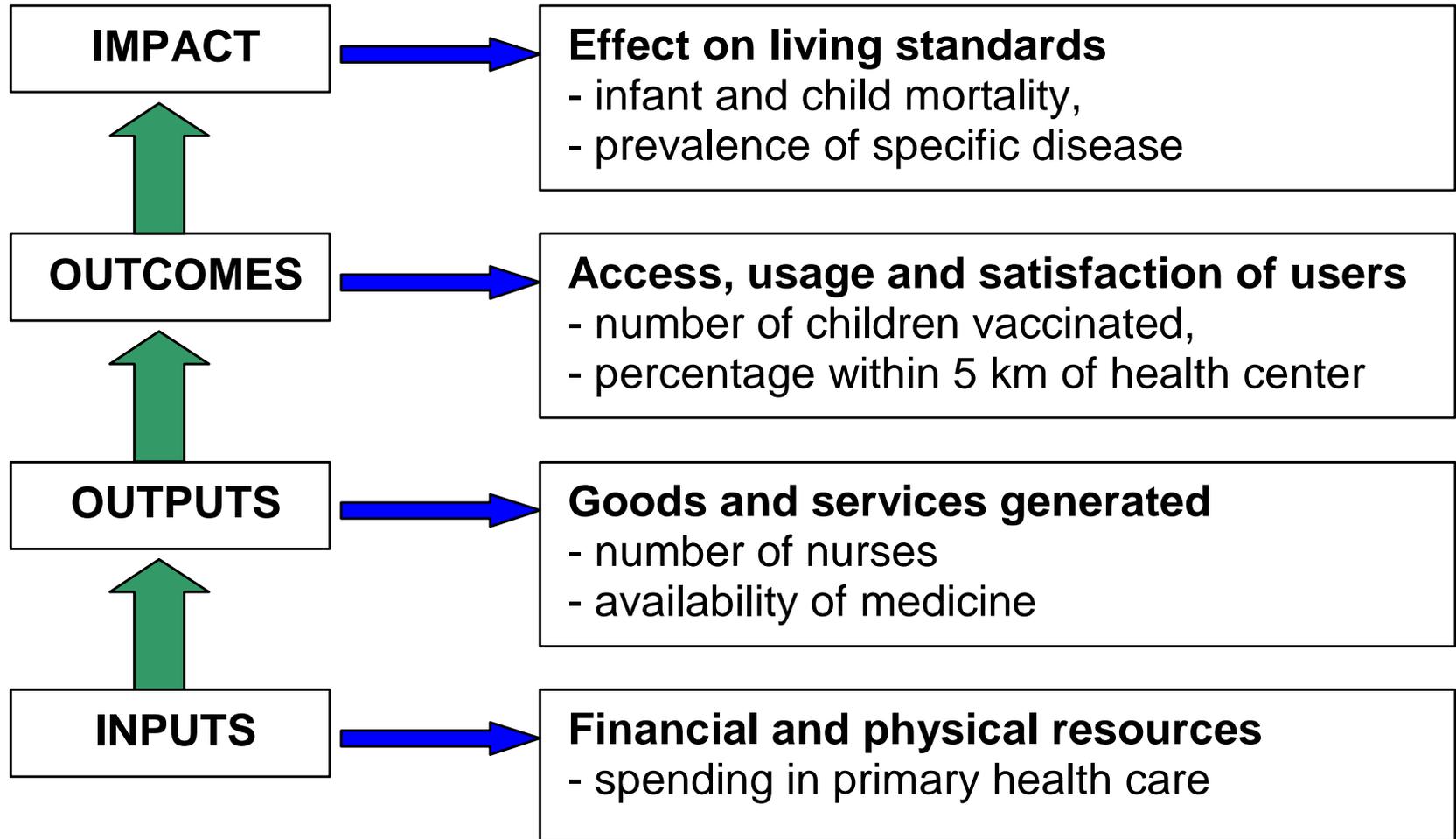
Topics

- **Adding a cost component to our impact evaluation**
- Defining and measuring efficiency
- Cost-effectiveness, cost-benefit and Technical Efficiency

Why evaluate?

- **Are we doing the right thing?**
 - ❑ **Are the results we see due to our intervention?**
 - ❑ **What would have happened in the absence of our intervention?**
- **Are we doing it right?**
 - ❑ **Can we do things more effectively and efficiently?**
 - ❑ **What are the constraints to efficient production?**

Monitoring and evaluation



Focus on outcomes and impact

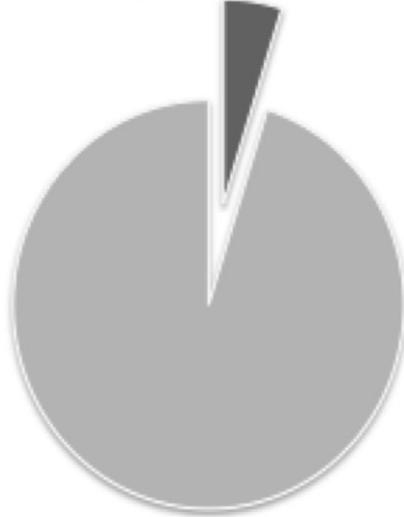
- **What is effect of a *specific* program on *specific* outcomes?**
- **How much better off are beneficiaries because of the intervention?**
- **How would outcomes differ under alternative program designs?**
- **Does the program affect different people differently?**

Efficiency?

- **What are the costs associated with the program / alternative program designs?**
- **Is this “technology” the best alternative we have to achieve the desire results?**

Why evaluate?

positive impact and cost-effective

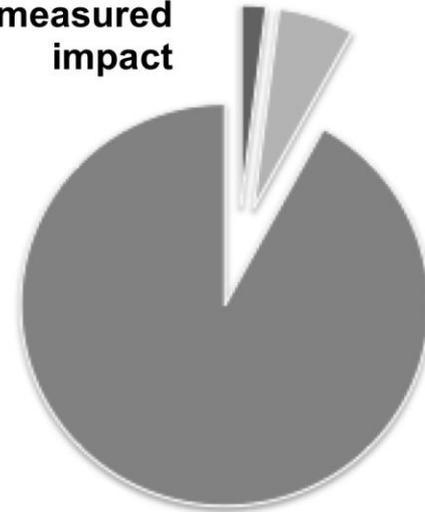


**From Betcherman's
youth labour review**

(14 of 289)

positive,
objectively-
measured
impact

positive impact



**From WDR review of
youth HIV evaluations**

(6 of 300+)

Basic ingredients

- **To start:**
 - ❑ **a clear goal,**
 - ❑ **a diagnosis of the problem, and**
 - ❑ **a solid theory of change.**
- **Then use whatever tools necessary to solve the fundamental evaluation problem:**

How can we know that differences in outcome are due to our intervention?

Choosing the right method

- **Methodological issues**
 - ❑ Can you identify control group?
 - ❑ What are your outcome/impact indicators?
 - ❑ Can you get the necessary data?
 - ❑ Can you get a large enough sample?
- **Choose the most robust strategy that fits the operational context**
 - ❑ Make sure that you have budget to support evaluation.
 - ❑ Do not deny anyone benefits merely to suit the evaluation.

Measuring costs appropriately

- Adding a cost component to the evaluation does not represent a significant additional burden
 - Most of the information already exists
 - Additional information needed can be collected through the instruments used for the impact evaluation (community, facility, household)
- Adding a cost component allows to discuss efficiency issues, in addition to effectiveness issues

Impact Evaluation and Efficiency Analysis

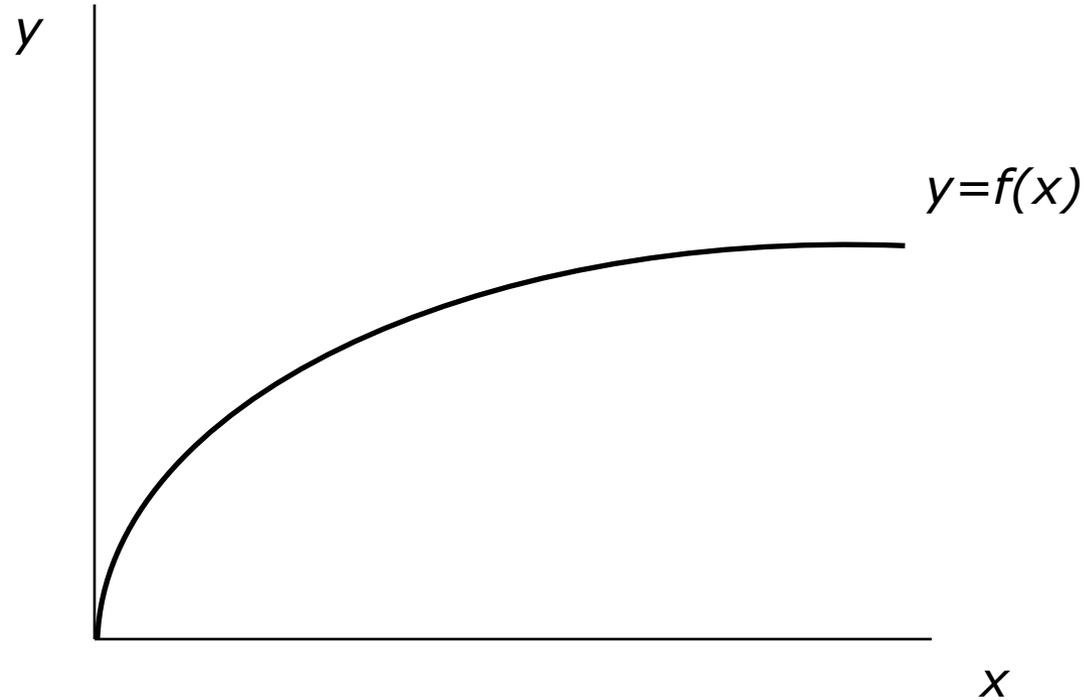
Topics

- Adding a cost component to our impact evaluation
- **Defining and measuring efficiency**
- Cost-effectiveness, cost-benefit and Technical Efficiency

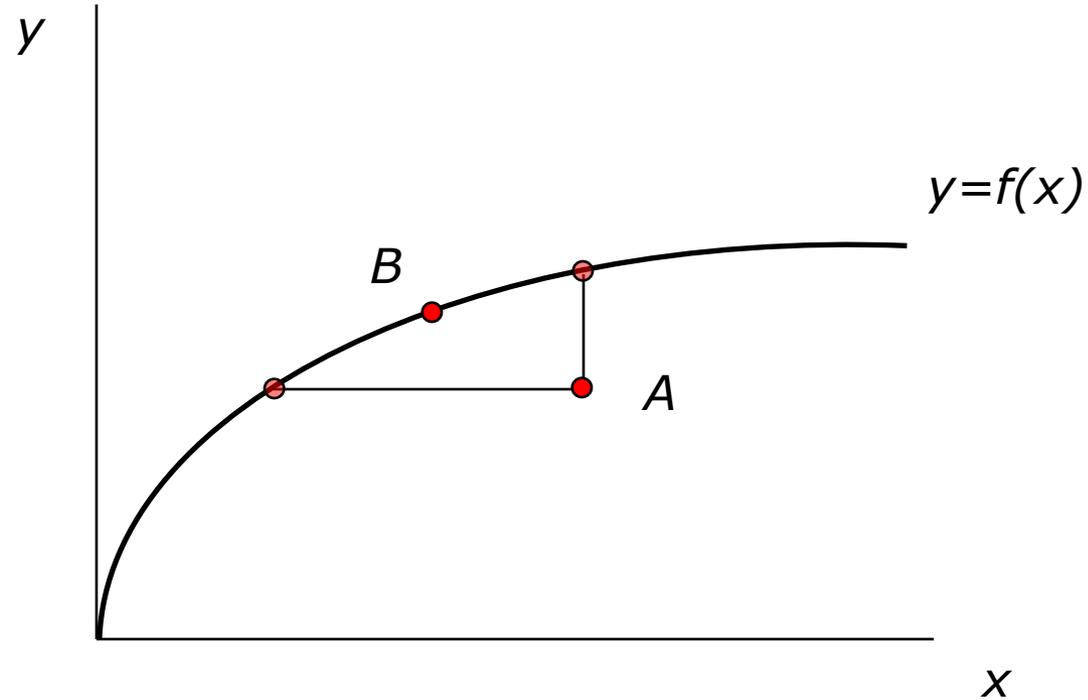
Production efficiency

- If an economy (public sector) is not efficient in producing a given service (outcome), it can produce more without reducing the production of other services
- It's about producing using available resources the best way possible
- In the context of public services, it means reaching more people

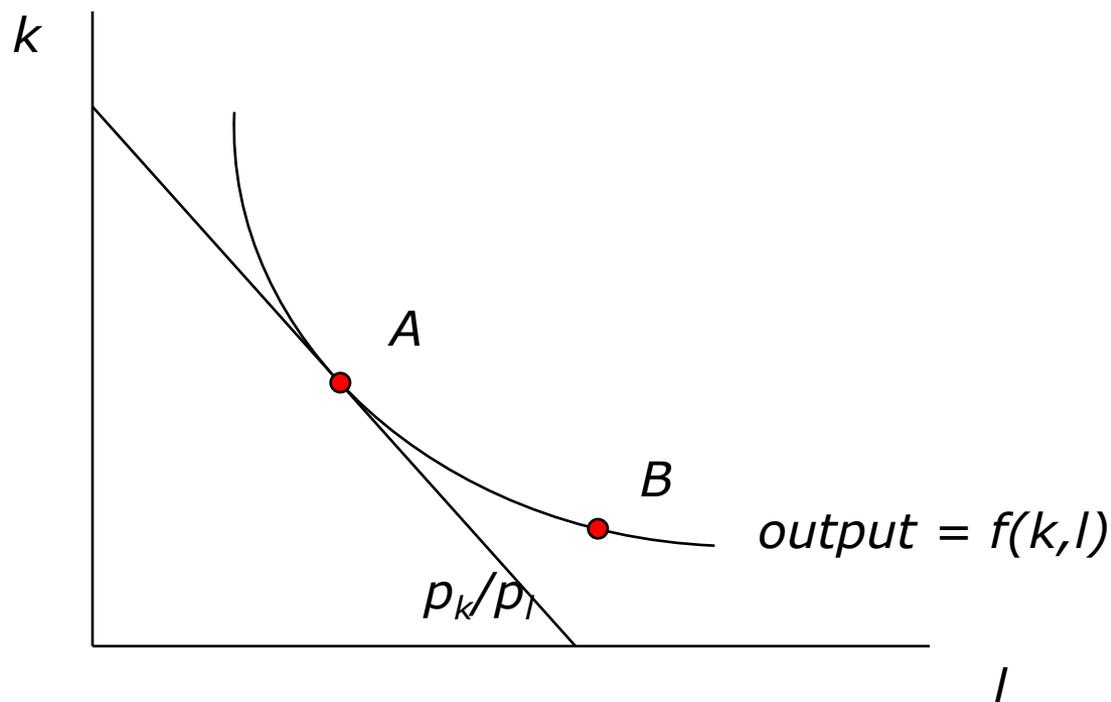
Production frontier



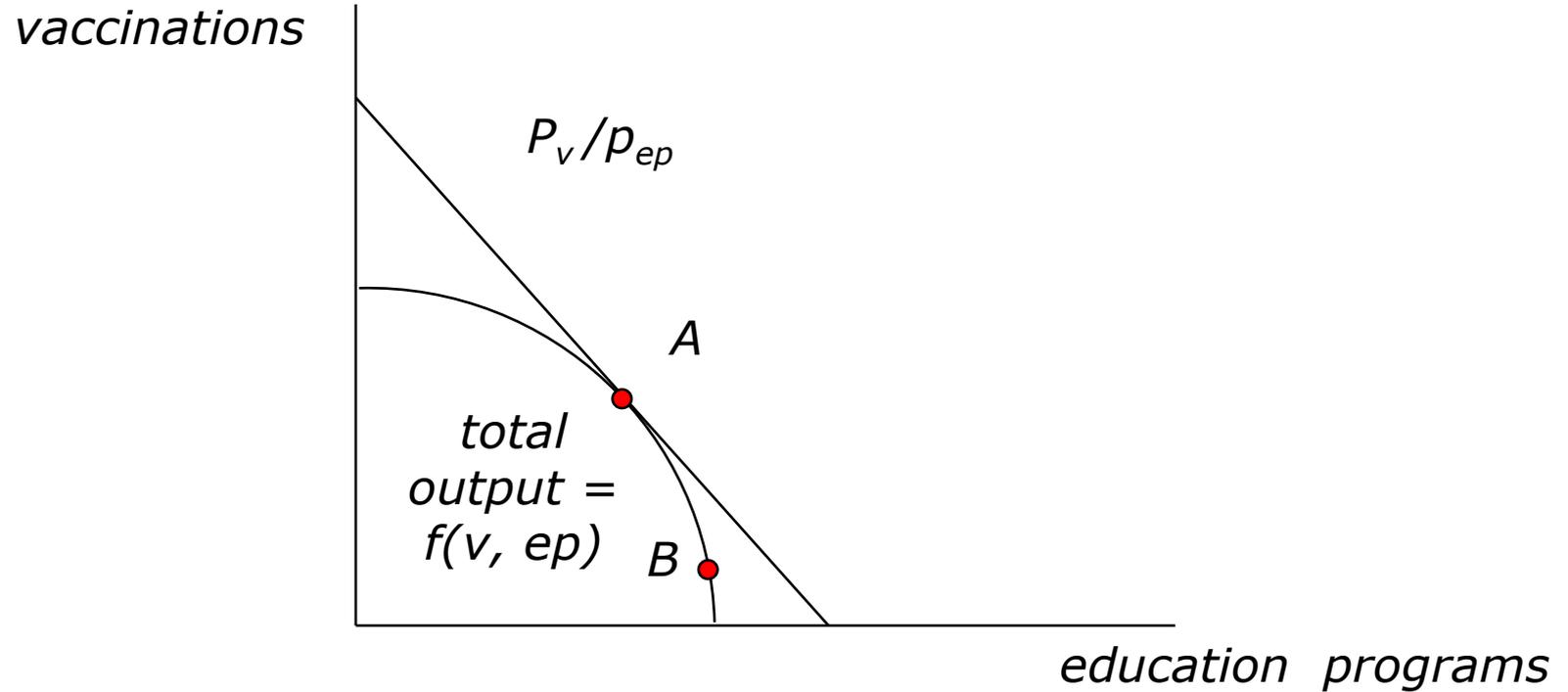
Technical efficiency



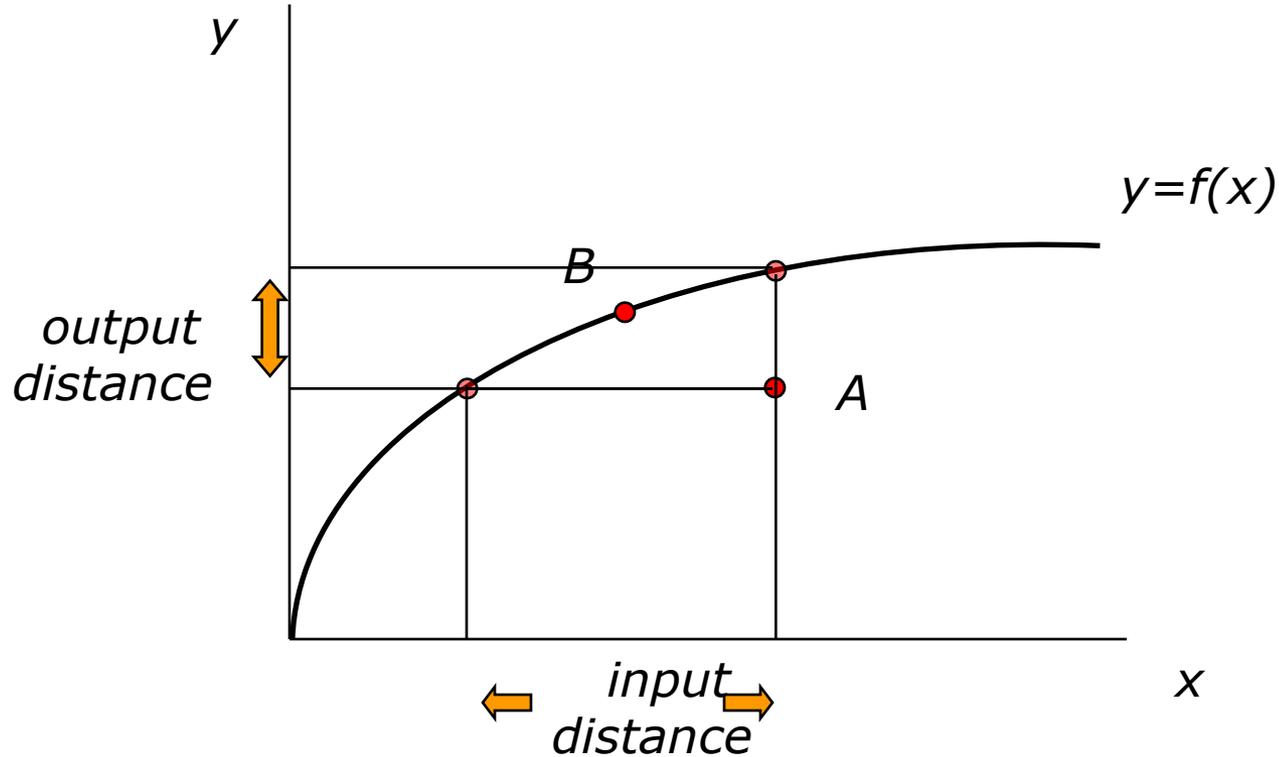
Input allocative efficiency



Output allocative efficiency



Distance from perfect efficiency



What do we need to do efficiency analysis? Measuring efficiency

- We have a few options:
 - ▣ CEA
 - ▣ CBA
 - ▣ Technical Efficiency Analysis (production/cost functions)
- All of them imply different approaches to deal with the question of efficiency
- All of them need basically the same type of information:
 - ▣ Production of outputs / outcomes
 - ▣ Costs

Why should we measure efficiency?

- Resources are limited:
- How do we know it is worthwhile to spend scarce tax resources on a particular strategy or program?
- How can we choose among alternatives?
- Is any intervention always better than none?
- Strong equity and ethical implications...

Impact Evaluation and Efficiency Analysis

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What is the difference between them?

- CBA: What is the next social benefit achieved with intervention/program A?
- CEA: What is the cost per unit of output/impact that can be bought by intervention A?
 - Cost per youth trained
 - Cost per life saved
 - Cost per children without nutrition problems

How?

- CBA:
 - Measure impact
 - Value impact in monetary terms
 - Measure costs
 - Take difference
- CEA:
 - Measure incremental impact(s)
 - Measure incremental costs
 - Take CE ratio: costs/impacts



Costs

- **Which costs should you measure?**
 - **Everything the program purchases**
 - **Any other resources the program uses, even things the program gets for free:**
 - **Volunteer labour**
 - **Donated equipment and supplies**
- **Why measure the cost of free stuff? Isn't it free?**

NO. FREE INPUTS ARE NOT FREE.

Costs

- **Why are free things not really free?**
- **Because they have an *opportunity cost*:**
 - **Each free thing can be used for a different purpose**
 - **Free things make resources available that would otherwise have been used to obtain them**
 - **free labour means lower wage payments;**
 - **free medicines means lower expenditure on medicines**

Costs

- **So how can you measure the cost of free things?**
 - ▢ **The *financial* or *accounting cost* method:**
Get estimates of similar inputs.
 - **What does input X cost, on average, in this place?**
 - **What does someone with these skills and experience usually earn?**

Costs

- **So how can you measure the cost of free things?**
 - **The *economic* or *shadow cost* method:**
Estimate a production function

$$Y = \alpha + X'\beta + Z'\gamma + \varepsilon$$

- where Y = output, and β and γ are the returns to paid and unpaid inputs (X and Z), respectively, in terms of physical output.
- These estimates can be denominated in value terms.

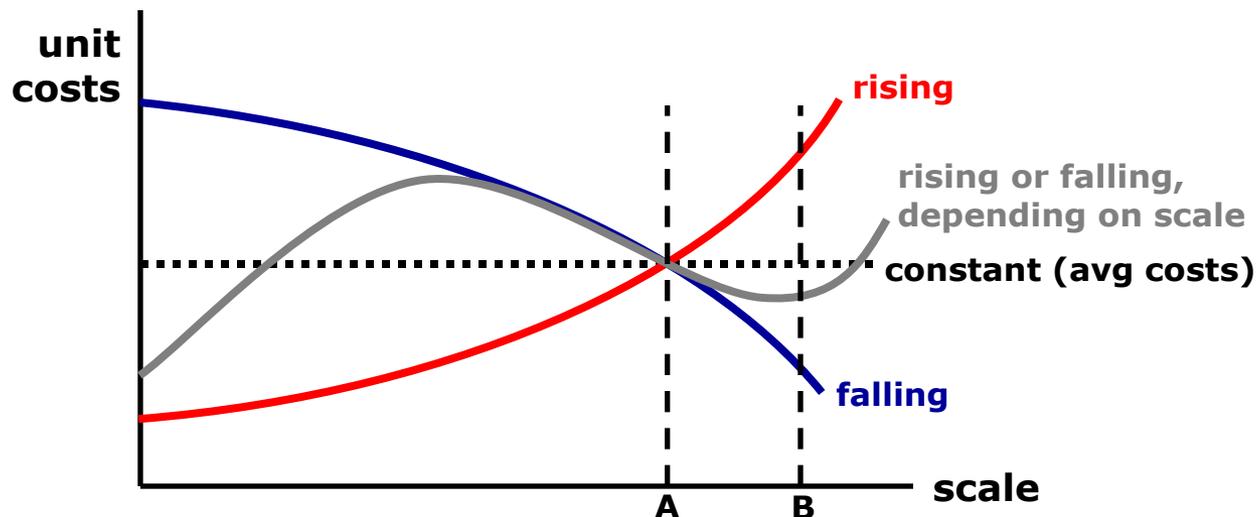
Costs

- **What difference does it make which method I use?**
 - **The accounting method gives estimates of the *average cost*.**
 - **The economic method gives estimates of the *marginal cost*.**
- **Marginal cost estimates are preferred for programming.**

Costs

- **Marginal costs vs Average costs:**

- What is the average cost of the input, or what does an average amount of expenditure (dollar, euro) buy?
- What will be the cost of the *next* unit of input, or how much of the input can I get for the *next* amount I spend?



- How much will it cost to scale up from A to B?

Estimating the value of benefits

- **First, why would you even want to?**
 - ❑ To understand whether the value of the benefits exceeds the cost of producing them.
 - ❑ A program can be cost-effective but not cost-beneficial.
 - ❑ Denominating outcomes and impact in similar terms allows us to compare across diverse interventions, not just different ways to produce one outcome.
- **Surely not everything can be expressed in monetary terms....**
- **So how can you translate physical outcomes or impacts into monetary terms?**

Outcomes and impact

- **Which outcomes? What impact?**

- ❑ **Must be agreed prior to program.** (Increase young women's **well-being**, by enhancing their **employability**.)
- ❑ **Choose indicators that accurately measure the desired goals.** (Participants are more likely to get employed, and they have higher incomes.)
- ❑ **Allow for multiple goals across sectors.** (An education project will affect employment, health, etc.)
- ❑ **But don't change goals in the middle of the project.** (I'm afraid my project won't do what I thought it would do. I'll conveniently forget my original objectives and focus on some others.)
- ❑ **And be open to unintended consequences.** (Although my program didn't affect X, it did have an impact on Y and Z.)

Estimating the value of benefits

- **Some benefits are relatively easy to value**
 - **If the benefit has a fair market price, then $B = V * N$ (benefit = market price times the number of people who get it).**
 - **For example, greater health leads to greater productivity and higher wages.**
- **Some benefits are harder to value**
 - **There's no market for social exclusion or self-esteem.**
 - **The benefit has externalities, so the price is not a good measure of the true social value.**
 - **For example, crime reduction in my neighborhood, and good-quality education for my children, also benefit others.**

Estimating the value of benefits

- **Where market prices don't exist or are poor indicators of value**
 - ***Hedonic pricing*** infers values for attributes that make up a composite good or service.
 - Crime reduction changes property values, so you can compare the prices of properties that are similar in every way, but differ in crime rates.
 - ***Contingent valuation*** asks people what they would be willing to pay to achieve or avoid a certain outcome, or what compensation they would require to put up with it.
 - Common in environmental economics, but are tricky to implement; answers obtained can change depending on the wording or order of questions.
 - "How much would you pay to save the whales?"
 - "How much would I have to pay you so that you wouldn't object to having all the whales killed?"

Discounting in principle

- **Why discount?**

- Acknowledge that resources have a cost (in real terms of borrowing and in terms of alternative investments)

- **Which discount rate should you use?**

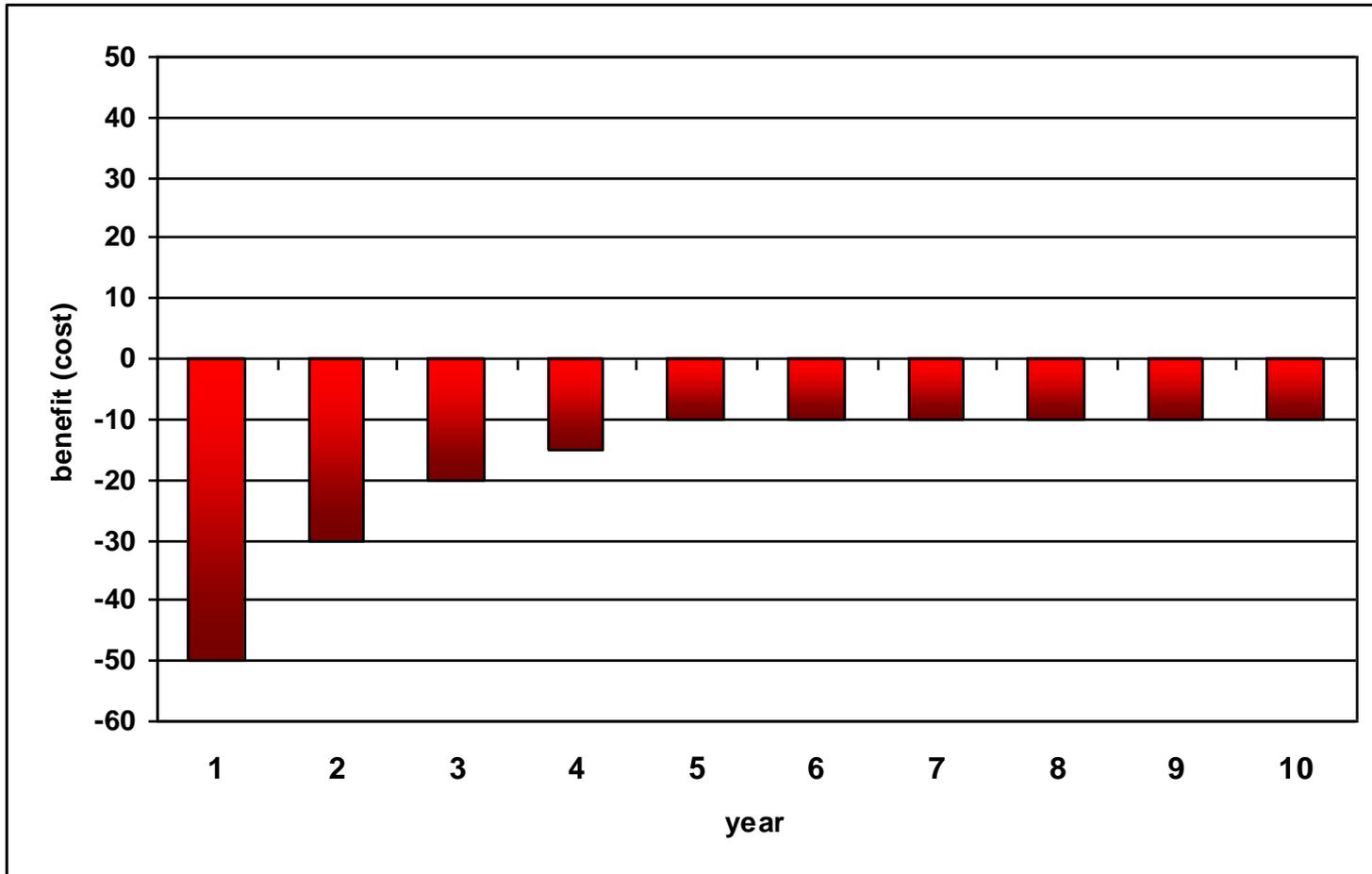
- Whichever accurately reflects the cost of capital. What would it cost if you had to borrow money to finance your project?

- **In general:**

- Higher discount rates give greater value to costs and benefits that occur more quickly.
- Projects that have delayed benefits relative to costs will have lower net returns.
- Consider both long-term and short-term costs and benefits. Programs that appear effective in the short term may have long-term negative consequences.

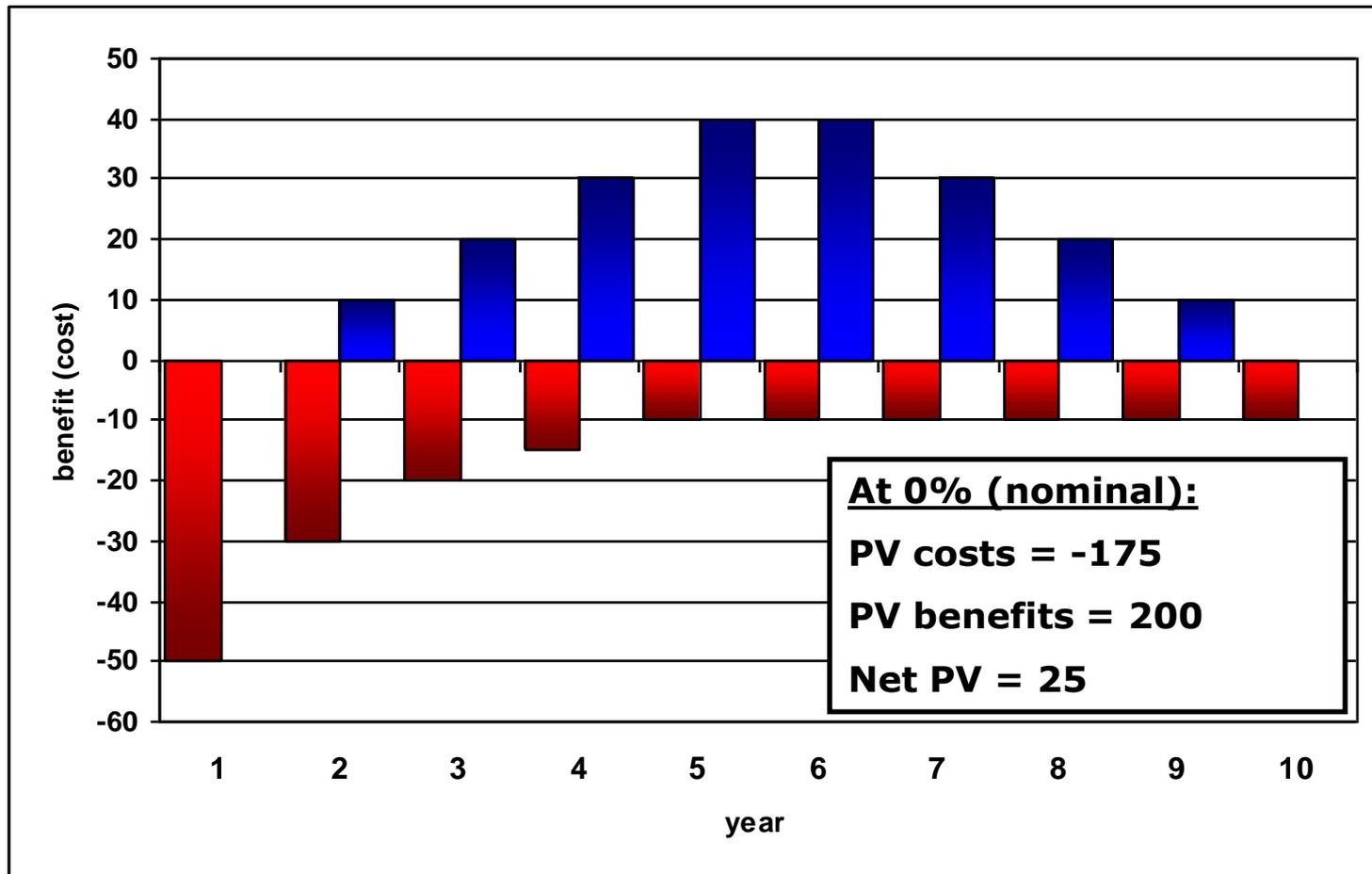
Discounting example

Project costs over time



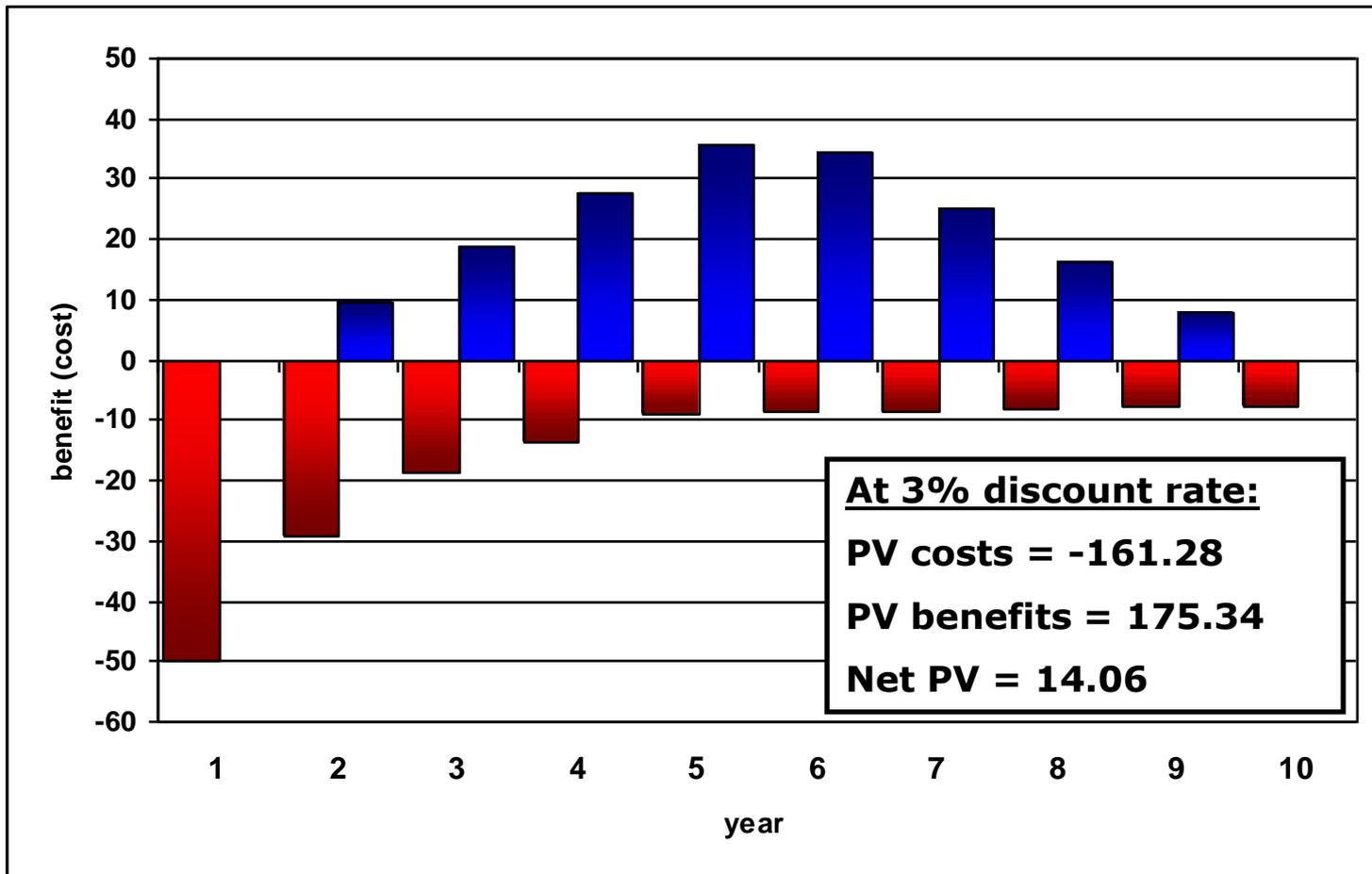
Discounting example

Project costs and benefits over time



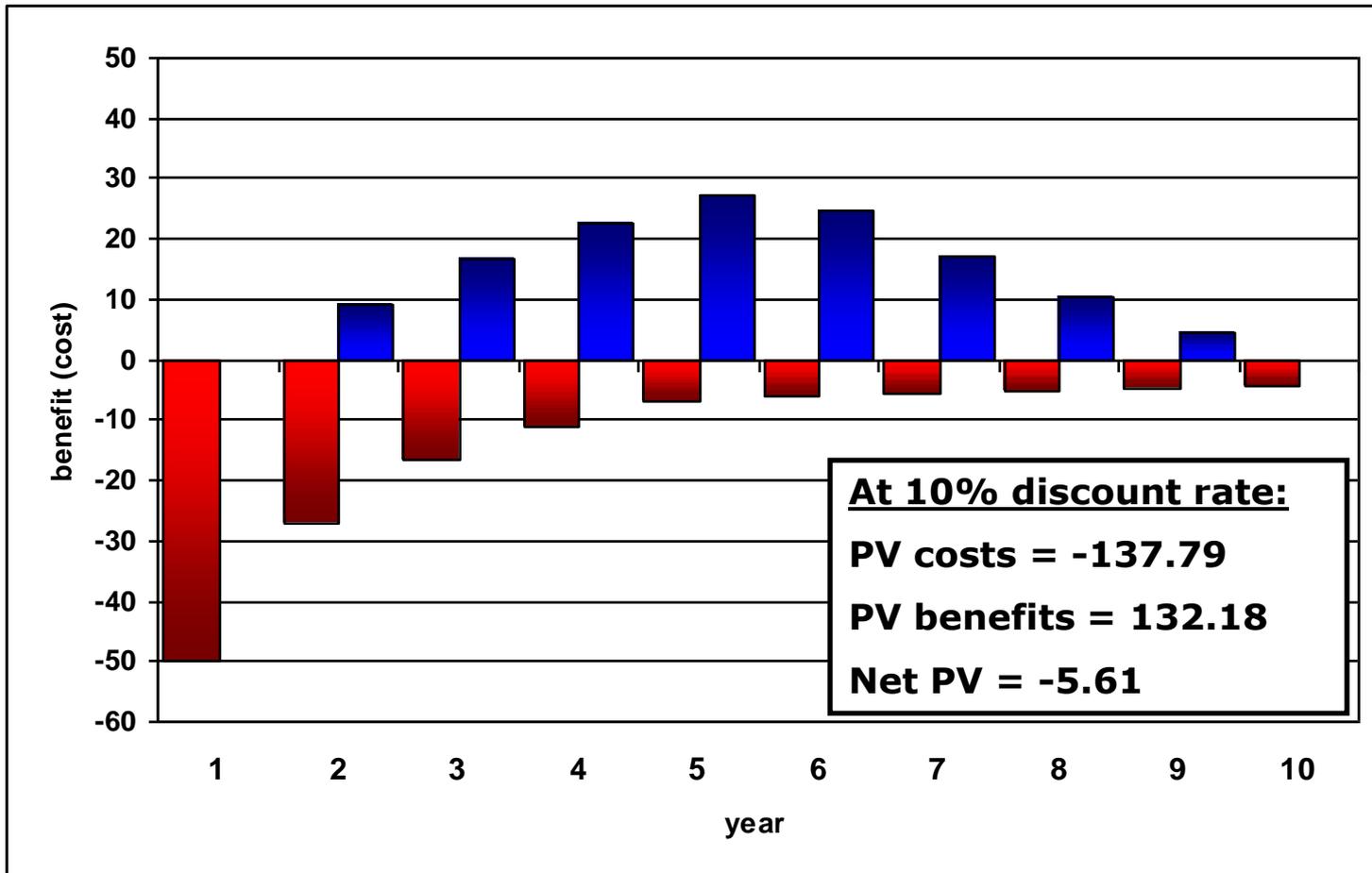
Discounting example

Project costs and benefits over time



Discounting example

Project costs and benefits over time



Cost-effectiveness analysis

- **What outcomes or impact do you get for each dollar's worth of program expenditure?**
 - ❑ **The number of HIV cases averted.**
 - ❑ **The number of young people employed.**
 - ❑ **The number of disability-adjusted life-years (DALYs) saved.**

(Remember -- these are relative to the number there would have been had the program not been implemented.)

- **Can be used to compare alternative methods of achieving a specific objective**

Cost-effectiveness analysis

- Natural units of output/impact
 - Lives saved
 - Vaccinated children
 - Trained teenagers
- Composite units of impact
 - QALYs and DALYs
 - Useful to compare with other interventions
 - Useful to aggregate different outcomes

Cost-effectiveness examples

Table 11: Estimated returns to various nutrition investments

	Cost per life saved (\$)	Returns to program cost (wages only)	Cost per discounted health life year gained (\$)
Under-nutrition Interventions			
Food Supplements	18,337	1.4	234
Nutrition Education	797	32.3	10.2
Integrated PHC-N	9,966	2.6	127
Food Subsidies	42,552	0.9	375
School Feeding	--	2.8	534
Iron Deficiency			
Supplementation of pregnant women only	800	24.7	12.8
Fortification	2,000	84.1	4.4
Iodine Deficiency			
Supplementation of reproductive-age women only	1,250	13.8	18.9
Supplementation (all persons under 60)	4,650	6	37
Fortification	1,000	28	7.5
Vitamin A Deficiency			
Supplementation (under 5 only)	130	50	4
Fortification	400	16	12.3

(Knowles and Behrman 2005, Table 11)

Cost effectiveness examples

- **Improving learning outcomes in India**
 - **Test of two alternative interventions:**
 - **Monetary incentives to groups of teachers and individual teachers conditional on student performance.**
 - **More inputs to schools (extra teacher, block grant for school supply needs).**
 - **Outcomes:**
 - **Incentives increased test scores by 0.15 SD.**
 - **Inputs increased test scores by 0.09 SD.**

Cost benefit examples

- **Vitamin A deficiency in the Philippines**
 - ❑ **Three different interventions in four areas over two years:** twice yearly distribution of a mass dosage of vitamin A; vitamin A fortification; and public health intervention using paraprofessionals for an educational, sanitation, immunization and horticulture program
 - ❑ **Measured benefits include reduced mortality, blindness, morbidity and treatment costs.**
 - ❑ **Costs included private household costs (including the opportunity cost of time).**
 - ❑ **MSG fortification and mass capsule distribution yielded discounted benefits much greater than discounted costs.**
 - ❑ **Interventions yielded higher returns among youth age 7-16 than among children age 1-6 (largely due to the effect of discounting future benefits over a longer period in the case of children).**

Cost benefit examples

- **De-worming in rural primary schools in Kenya.**
 - ❑ **Randomized the timing of the introduction of de-worming treatment across 75 schools.**
 - ❑ **The treatment significantly reduced disease prevalence, and increased school attendance by about seven percent.**
 - ❑ **The study estimated discounted lifetime benefits over US\$30 per treated child, primarily from gains in lifetime income.**
 - ❑ **Benefits are more than 60 times greater than costs, based on an estimated cost of US\$0.49 per treated pupil.**

Cost benefit examples

- **Scholarships for poor secondary school students in urban Colombia.**
 - ❑ **Randomly-assigned (by lottery) vouchers for children from poor families to attend private secondary schools.**
 - ❑ **After three years, lottery winners had completed more schooling (due to reduced repetition rates), and scored higher on standardized tests than students who had not received the vouchers.**
 - ❑ **Depending on the discount rate used, the benefits of the program are 1.4 to 3.8 times program costs.**

Cost benefit examples

- **Girls' schooling in Pakistan**

Rates of return to investment, in terms of wages

enable a primary graduate to complete secondary school	2.8%
improving primary school quality	13.0%
increasing access to current low-quality primary school	18.2%

(Behrman, Ross, Sabot 2004)

Returns in terms of other outcomes

Effects	Number	Unit value	Total benefits
Births averted	495	65	32,175
Child deaths averted	60	800	48,000
Maternal deaths averted	3	2,500	7,500
Total undiscounted benefits			87,675
Present value of total benefits ^a			42,600
Costs	1,000	30	30,000
Benefit-cost ratio			1.42

(Knowles and Behrman 2004, Table 10)

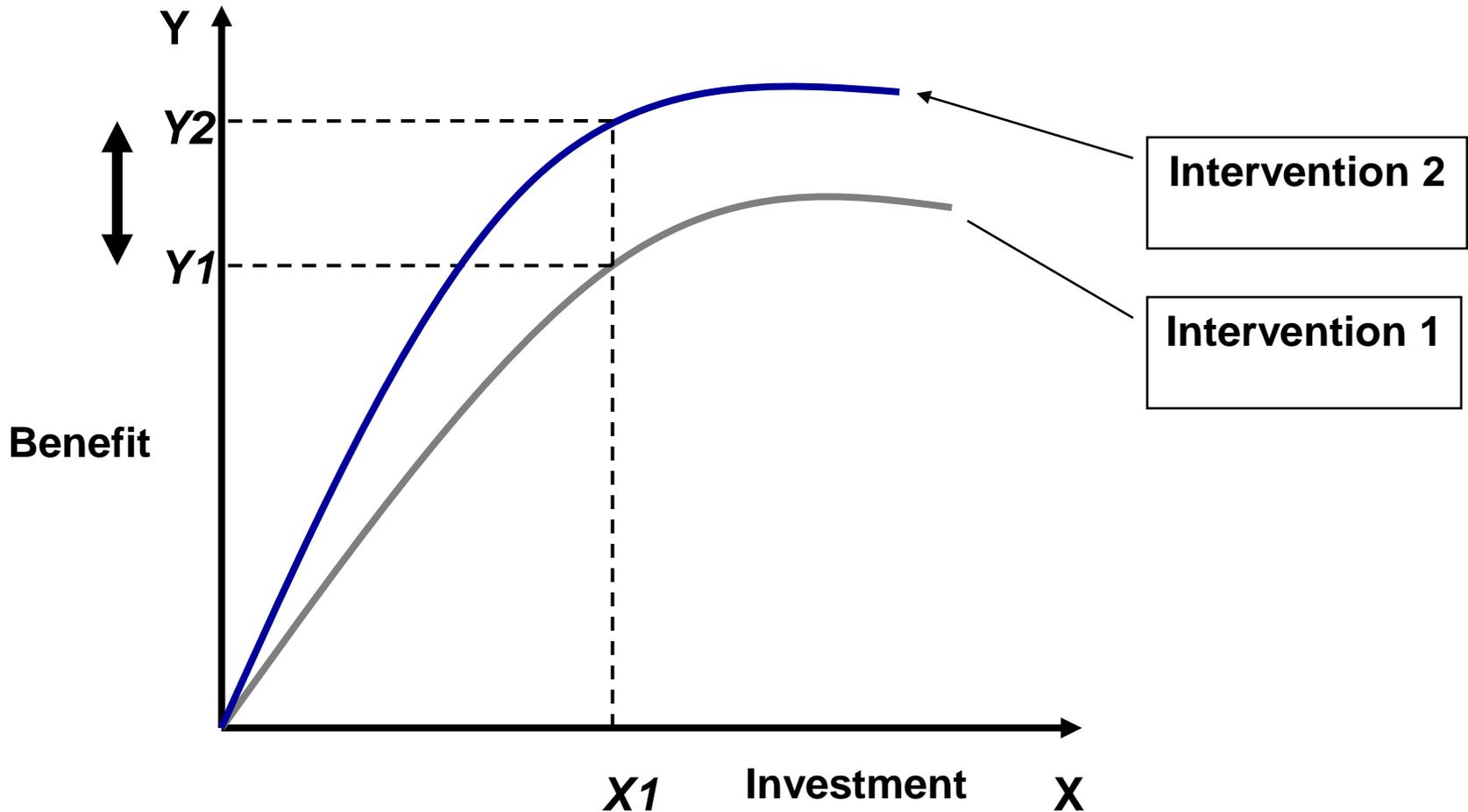
Efficiency within a program: technical efficiency analysis

The Public Sector...

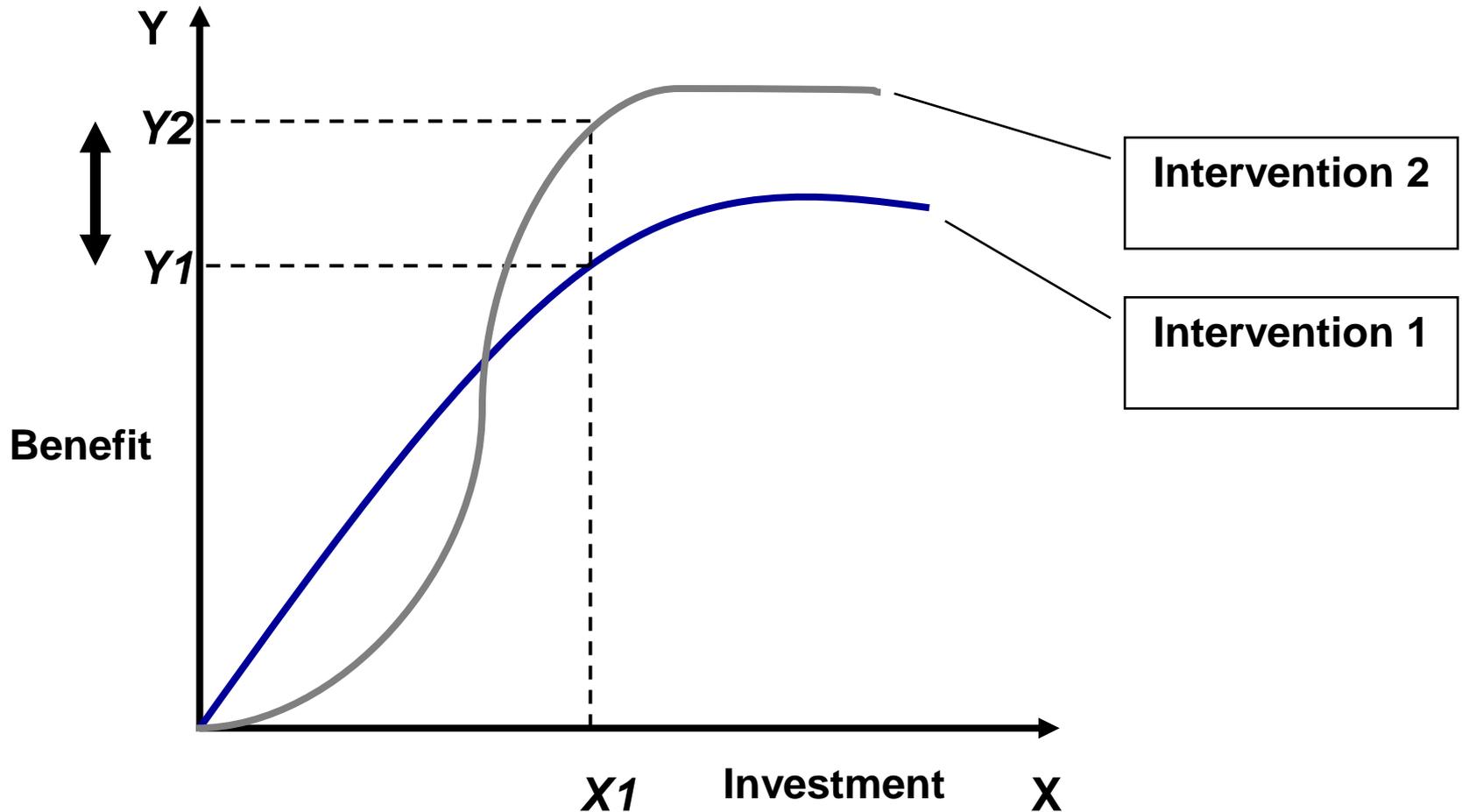
- Firms are not profit-maximizing
- Firms may not be cost-minimizing
- Firms produce more than one output
 - ▣ Aggregation, valuing outputs
 - ▣ Jointness in production, economies of scope
- Firms may not know how much demand there is for their services



Production Function and Allocative Efficiency



Production Function and Allocative Efficiency

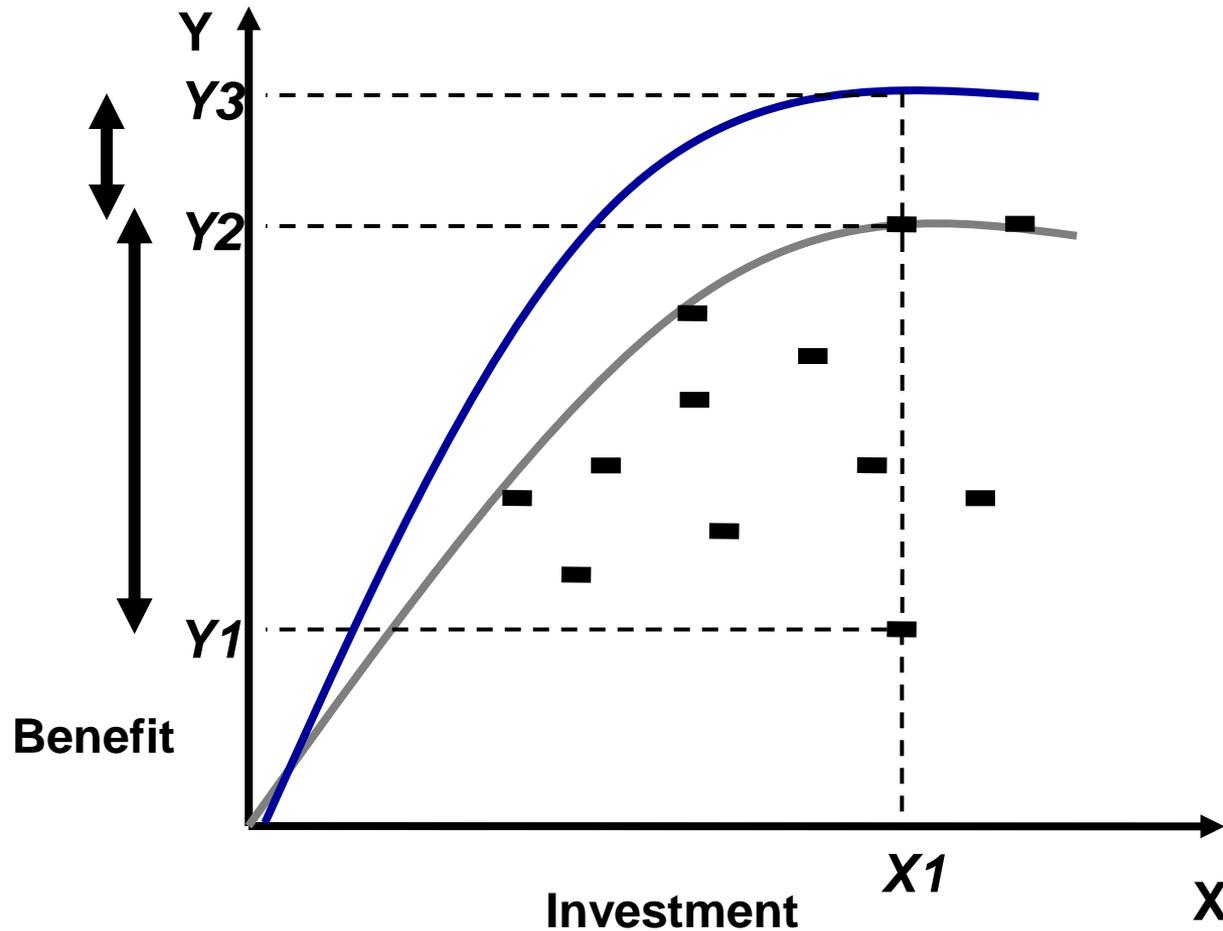


Allocative Efficiency

- Cost-effectiveness analyses typically assume:
 - Results are reproducible in different contexts and scales
 - Interventions are implemented at their efficiency frontier
- A “cost-effective” intervention can become very “cost-ineffective” if implemented inefficiently

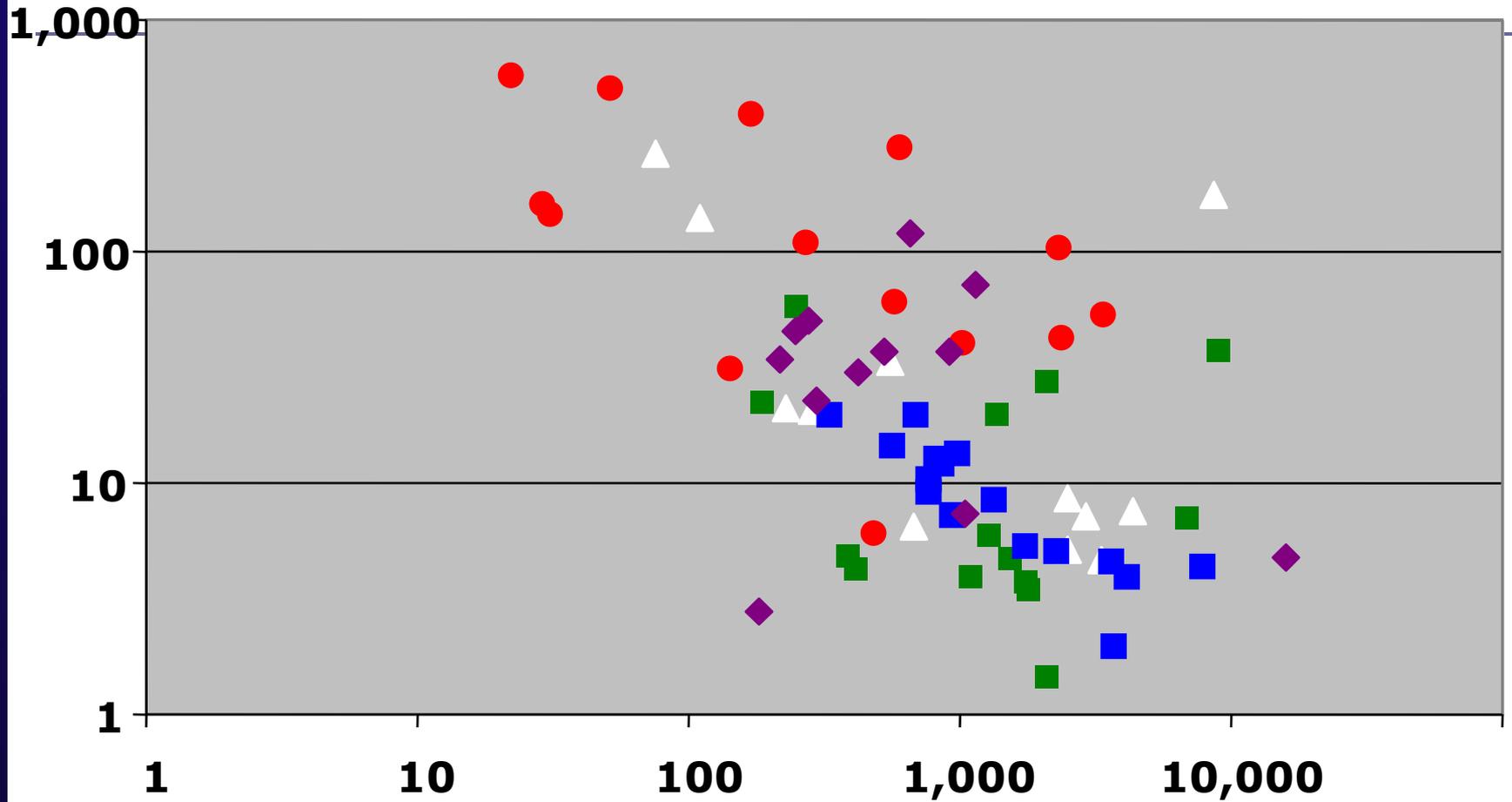


Production Function and Technical Efficiency



Scale and Average Unit Cost of VCT programs in 5 countries

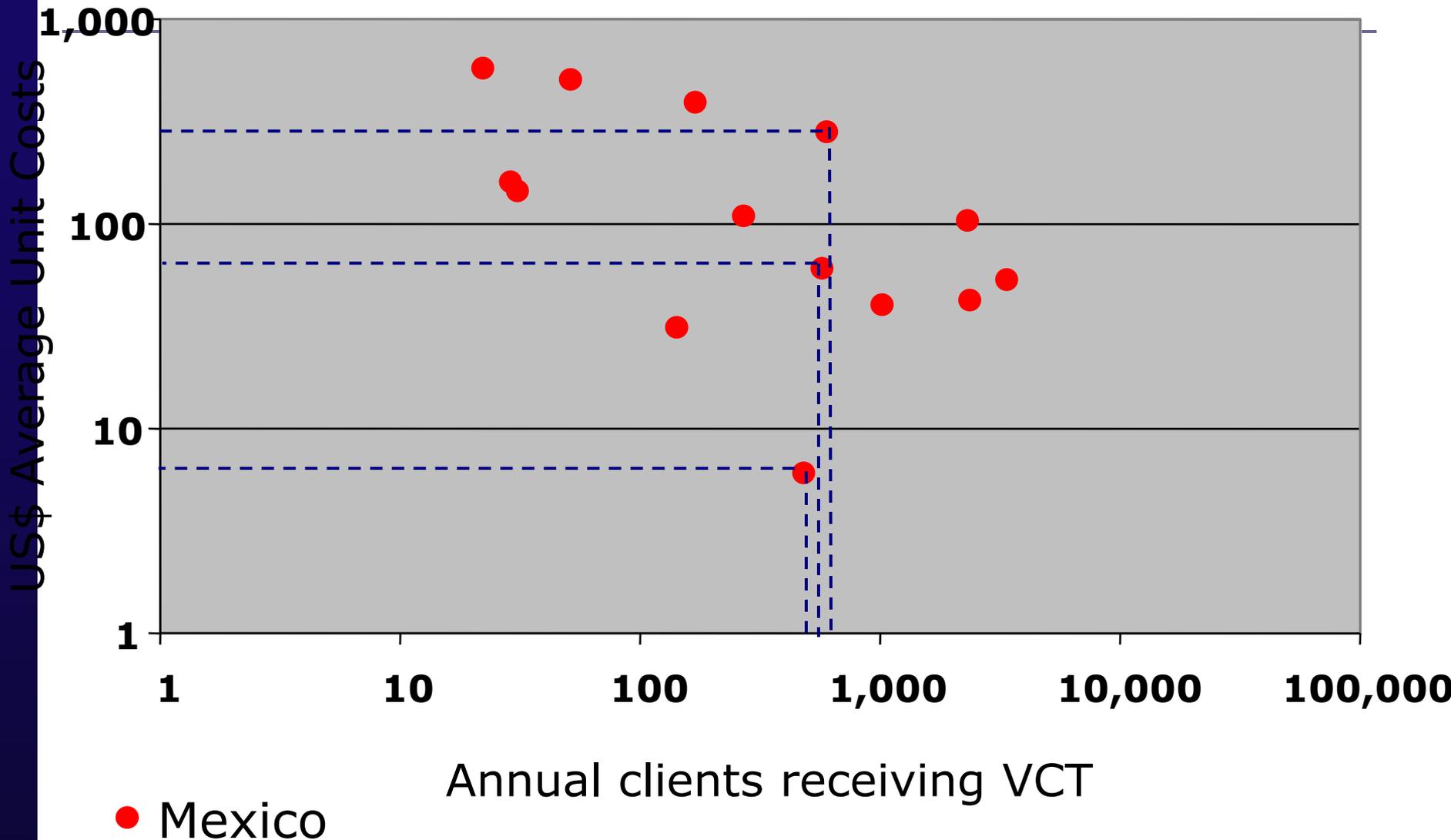
US\$ Average Unit Costs



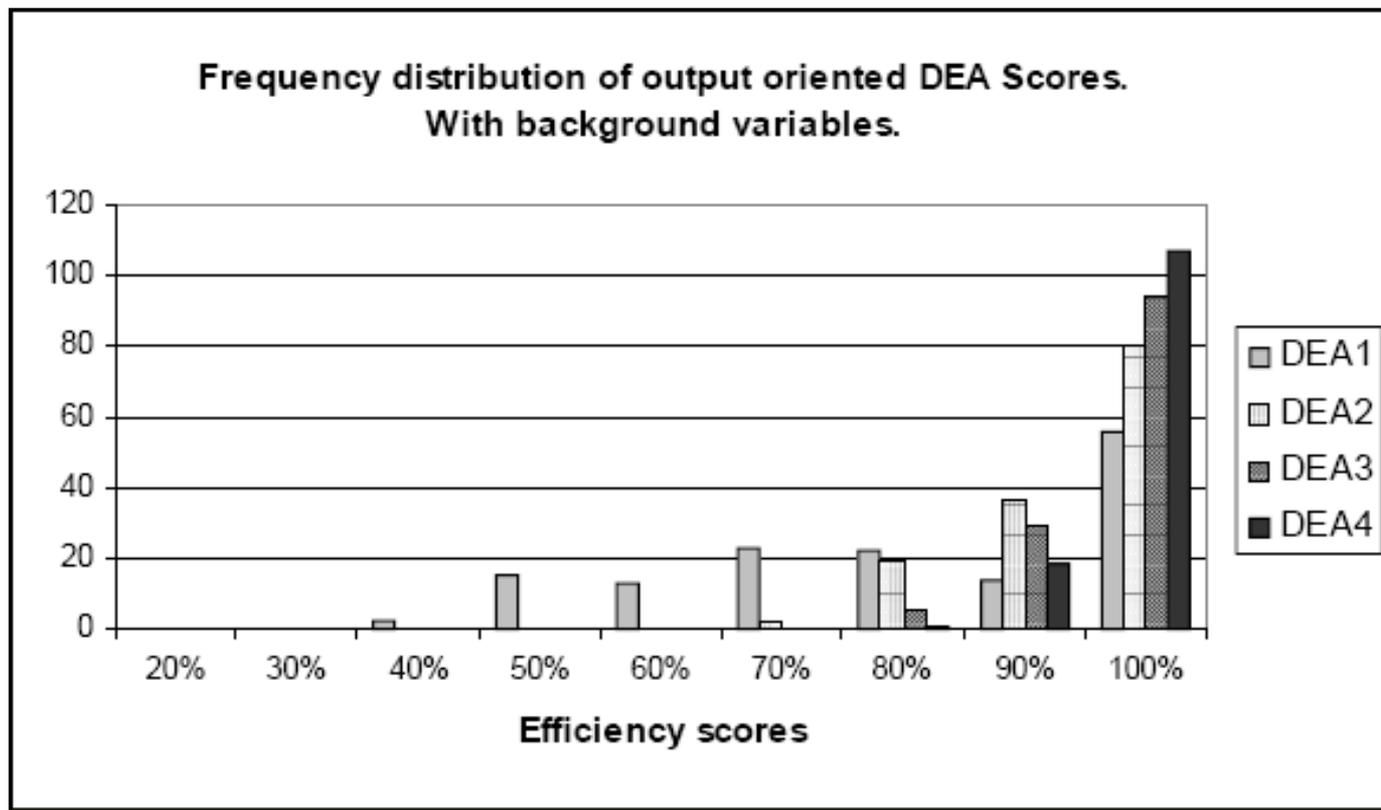
Annual clients receiving VCT

- Mexico
- Uganda
- △ Russia
- India
- ◆ South Africa

Scale and Average Unit Cost of VCT programs in 5 countries



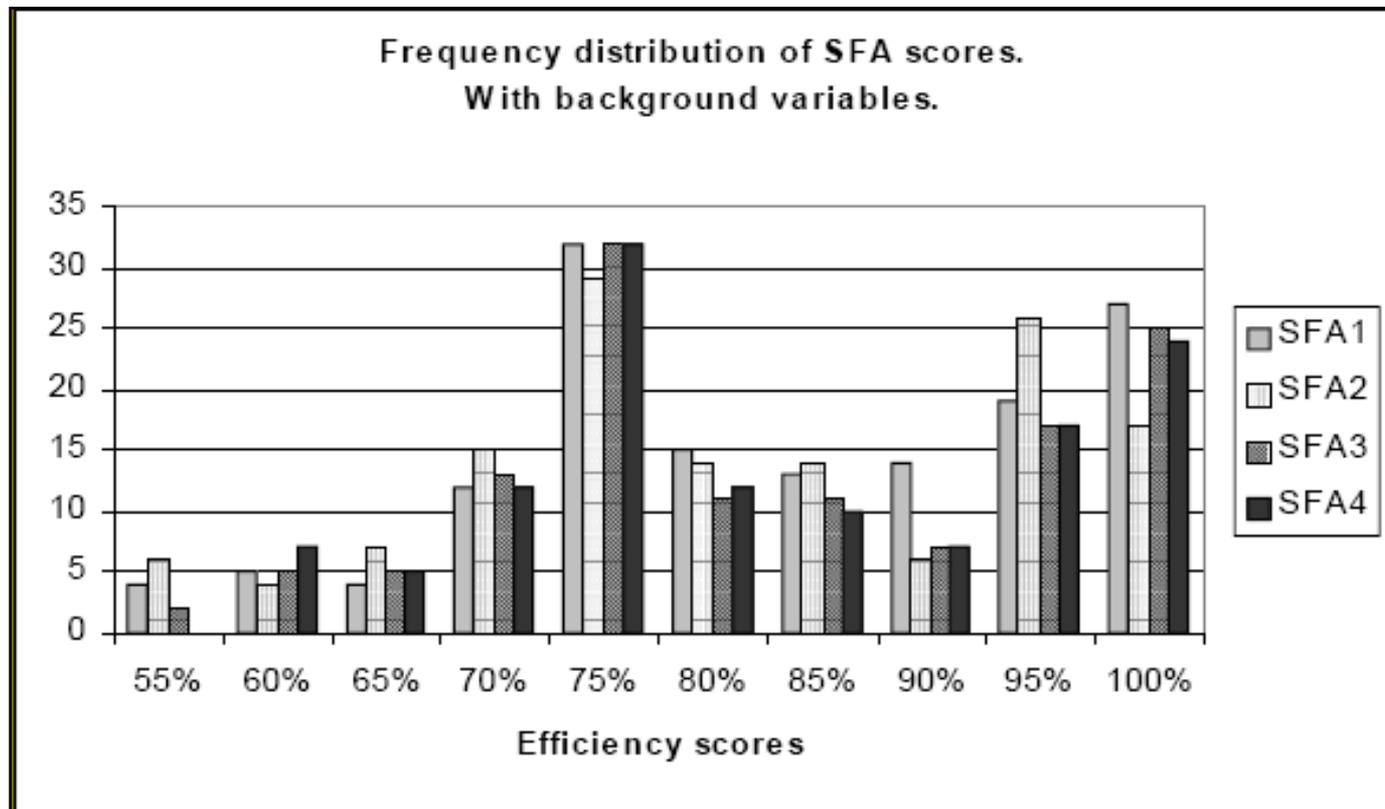
Local government services in Britain



Source: Stevens, O'Mahoney, Vecchi 2004



Local government services in Britain



Source: Stevens, O'Mahoney, Vecchi 2004

To conclude –

- Why measure efficiency?
 - Budget allocation decisions
 - Fiscal responsibility
 - Facility performance monitoring and management
- How can you measure it?
 - Add a costing component to your IE study
 - Choose an appropriate method – depends on the question you want to answer
- Evaluate technical efficiency
 - Public sector / NGOs are not like for-profit firms
 - Robust methods preferable – DEA or SFA
 - Try to understand *why* facilities differ

