

**National  
Institute  
of Public  
Health**

**Cuernavaca  
Mexico**



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*Costs and Costing*  
*Cost Benefit Analysis*  
*Cost Effectiveness Analysis*



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# *Costs and Costing*



# Costs perspectives: Accountants vs. Economists

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- Value of fixed assets vs. **Fixed Cost**

- *Total Cost (TC) = Cost of producing a specific amount of product/service*
- *Fixed Cost (FC) = Cost that does not vary with the quantity produced in the short run (one year)*
- *Variable Cost (VC) = Cost that varies with the quantity produced*

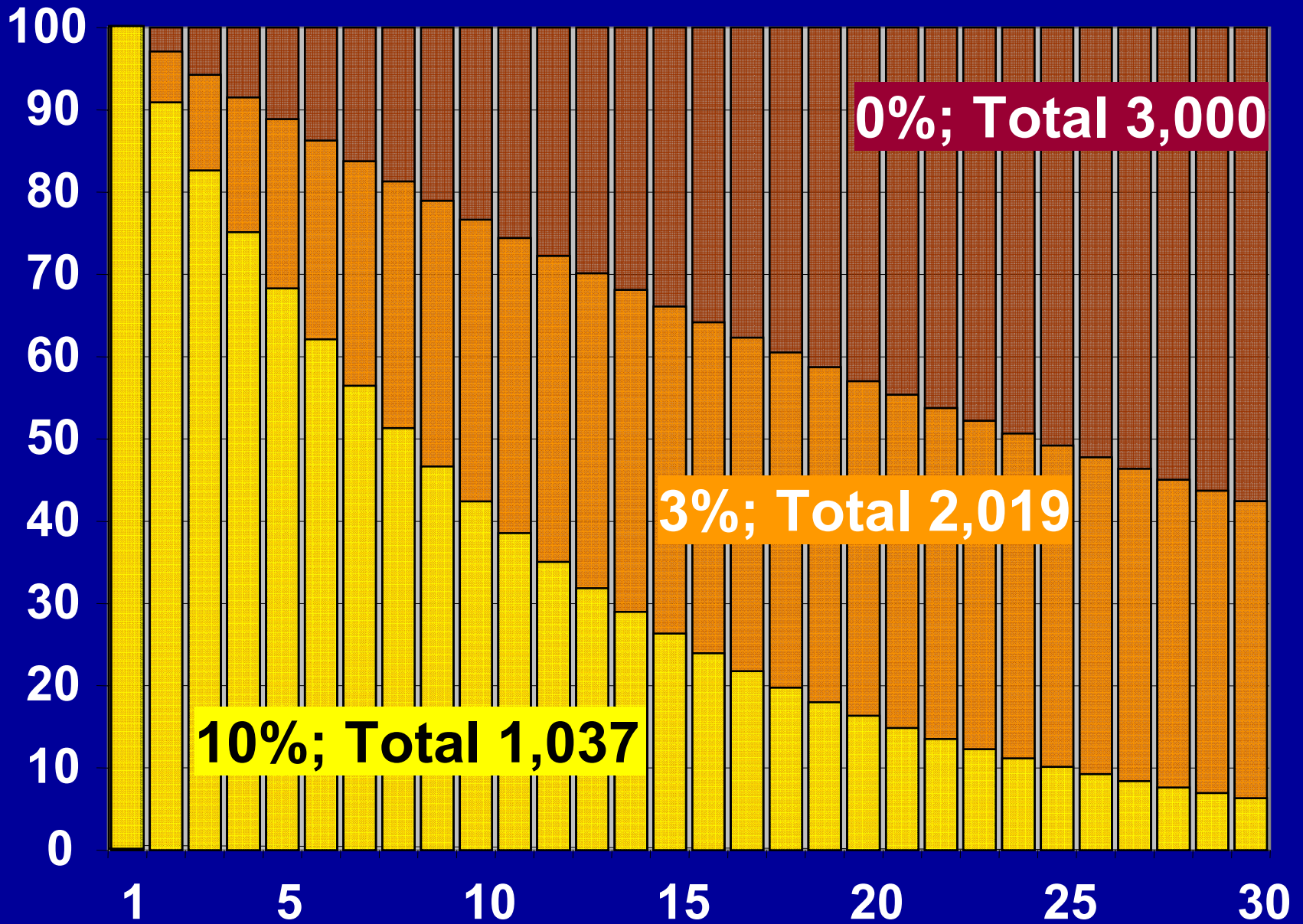


# Costs perspectives: Accountants vs. Economists

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- Value of assets vs. Fixed Cost
- Depreciation vs. Discounting





# Costs perspectives: Accountants vs. Economists

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- Value of assets vs. Fixed Cost
- Depreciation vs. Discounting
- Financial Cost vs. Opportunity Cost

*The cost of any activity  
measured in terms of the  
benefit forgone from the  
next best alternative*

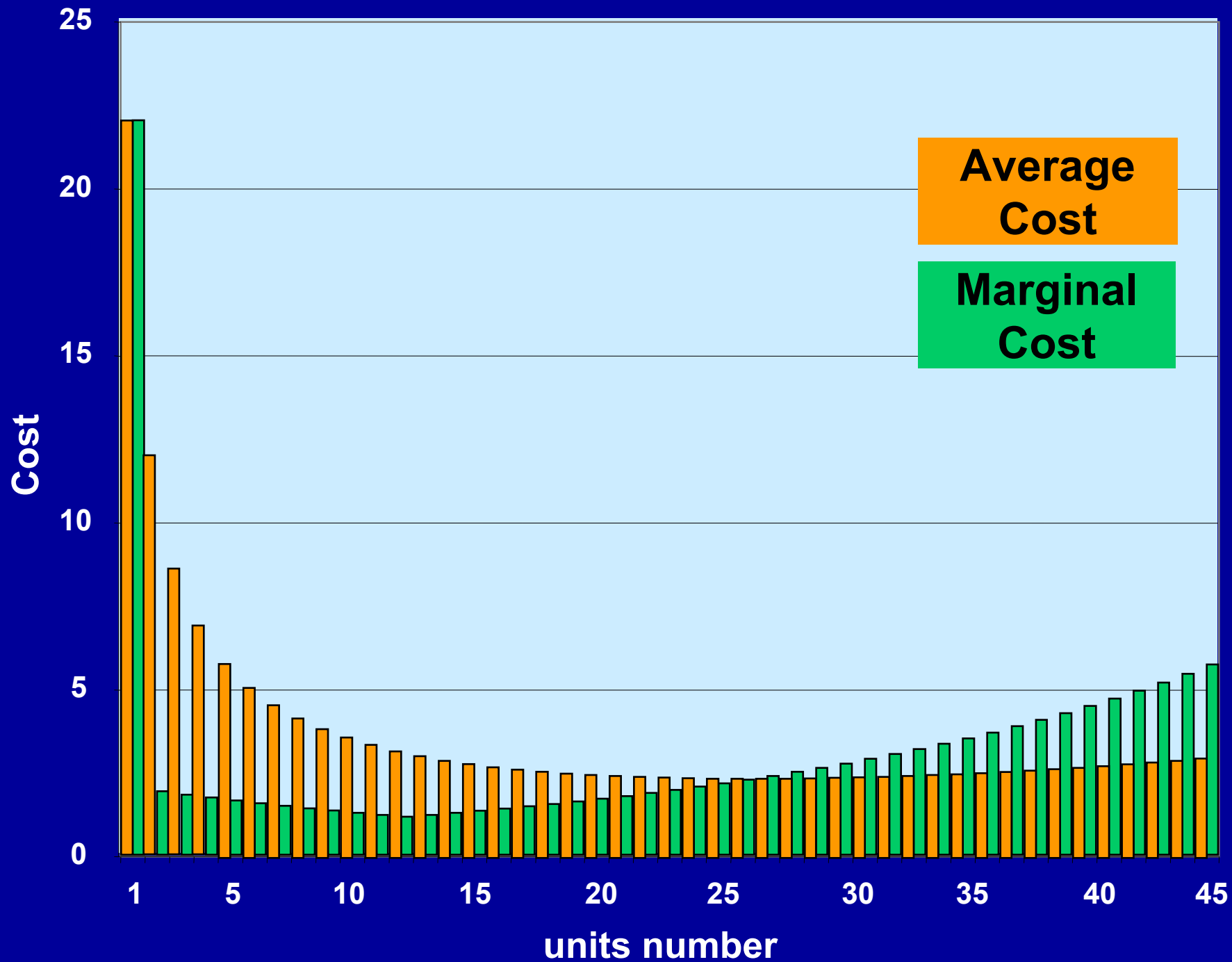


# Costs perspectives: Accountants vs. Economists

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- Value of assets vs. **Fixed Cost**
  - Depreciation vs. **Discounting**
  - Financial Cost vs. **Opportunity Cost**
  - Minimize leaks and auditing problems vs. Maximize efficiency
  - Average Cost vs. **Marginal Cost**
- *Average Cost: total cost / n*
  - *Marginal Cost: total cost [n] - total cost [n-1]*





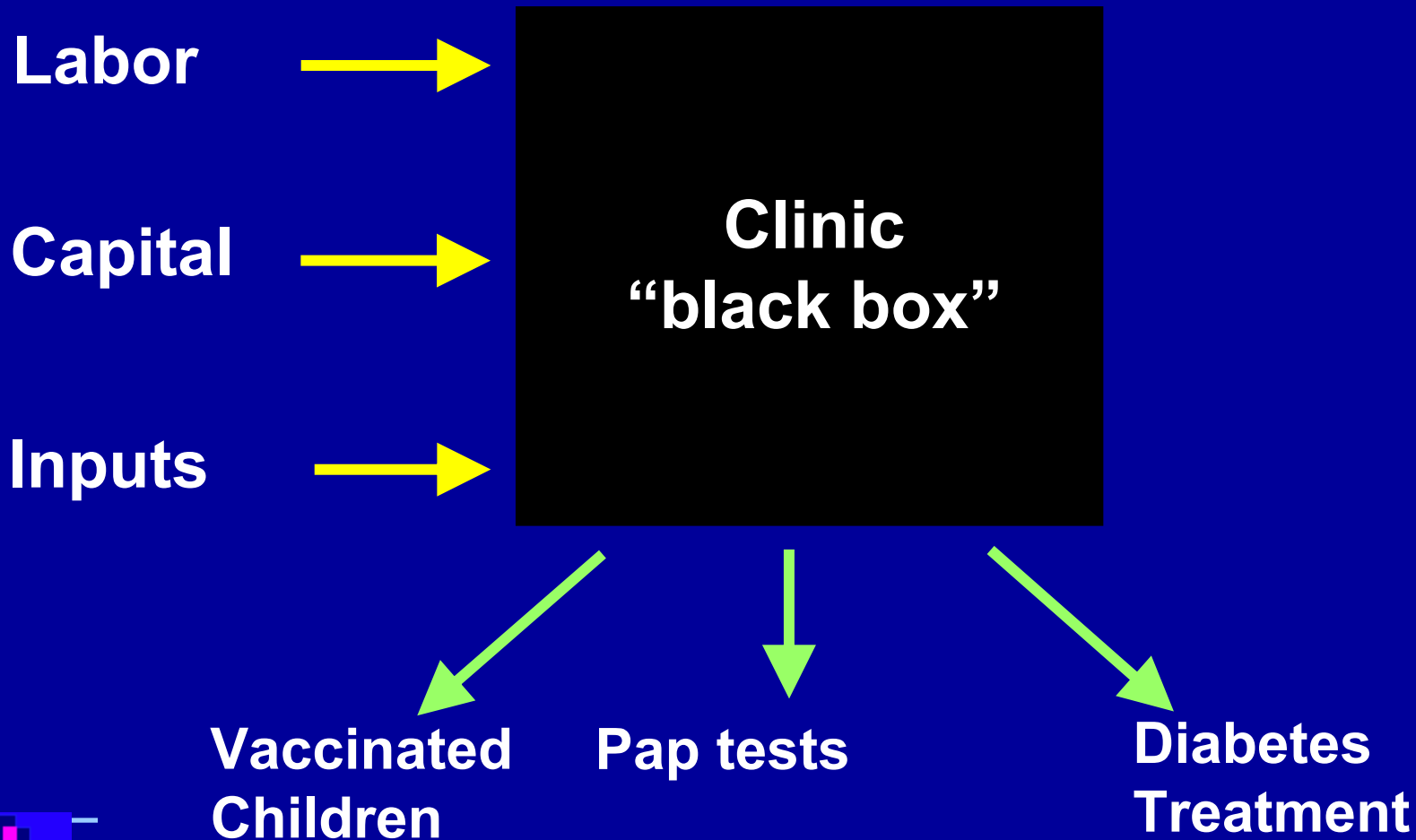
# Costers vs. Microeconomists

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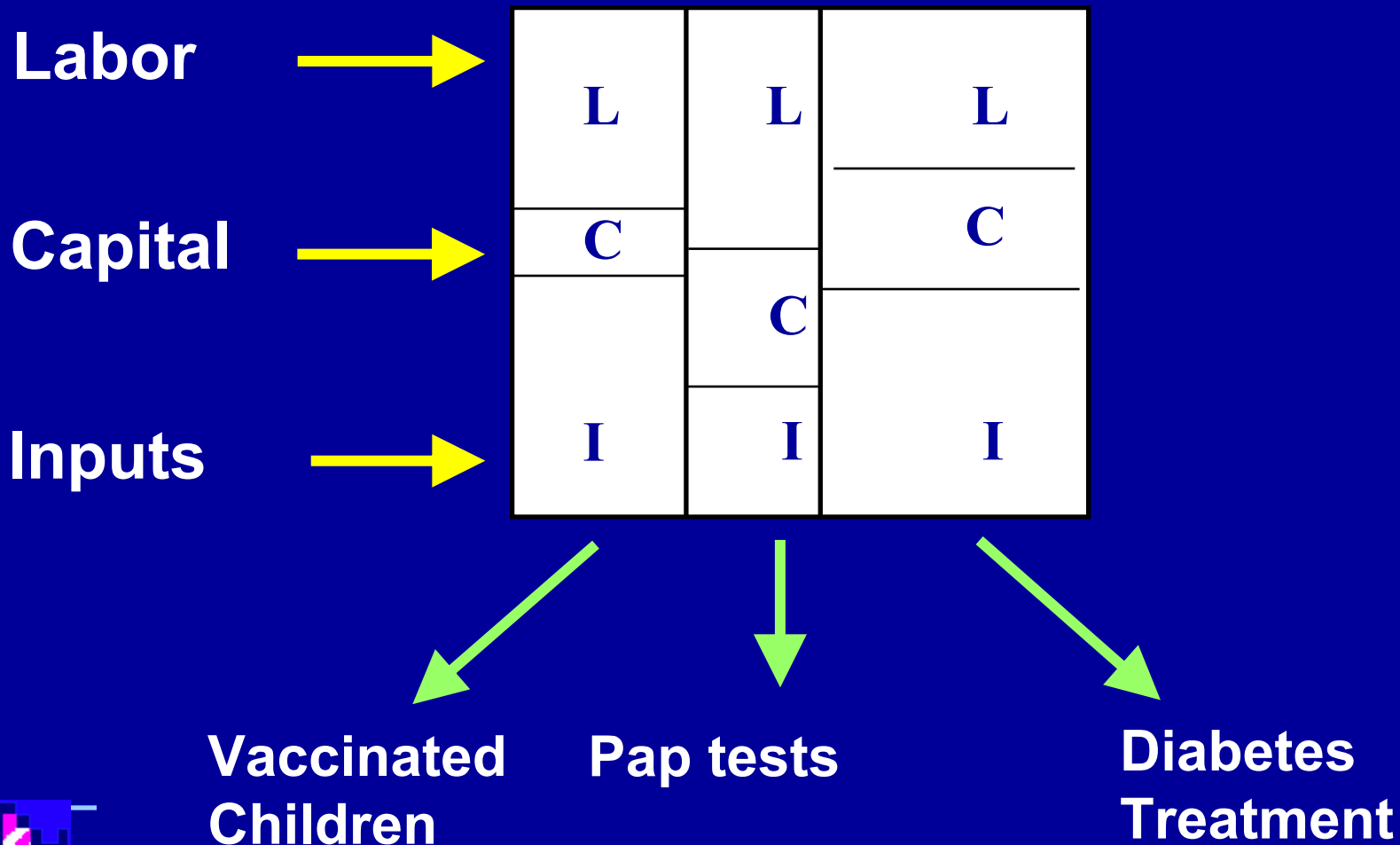
- *Costs allocation to products vs. Joint production function*



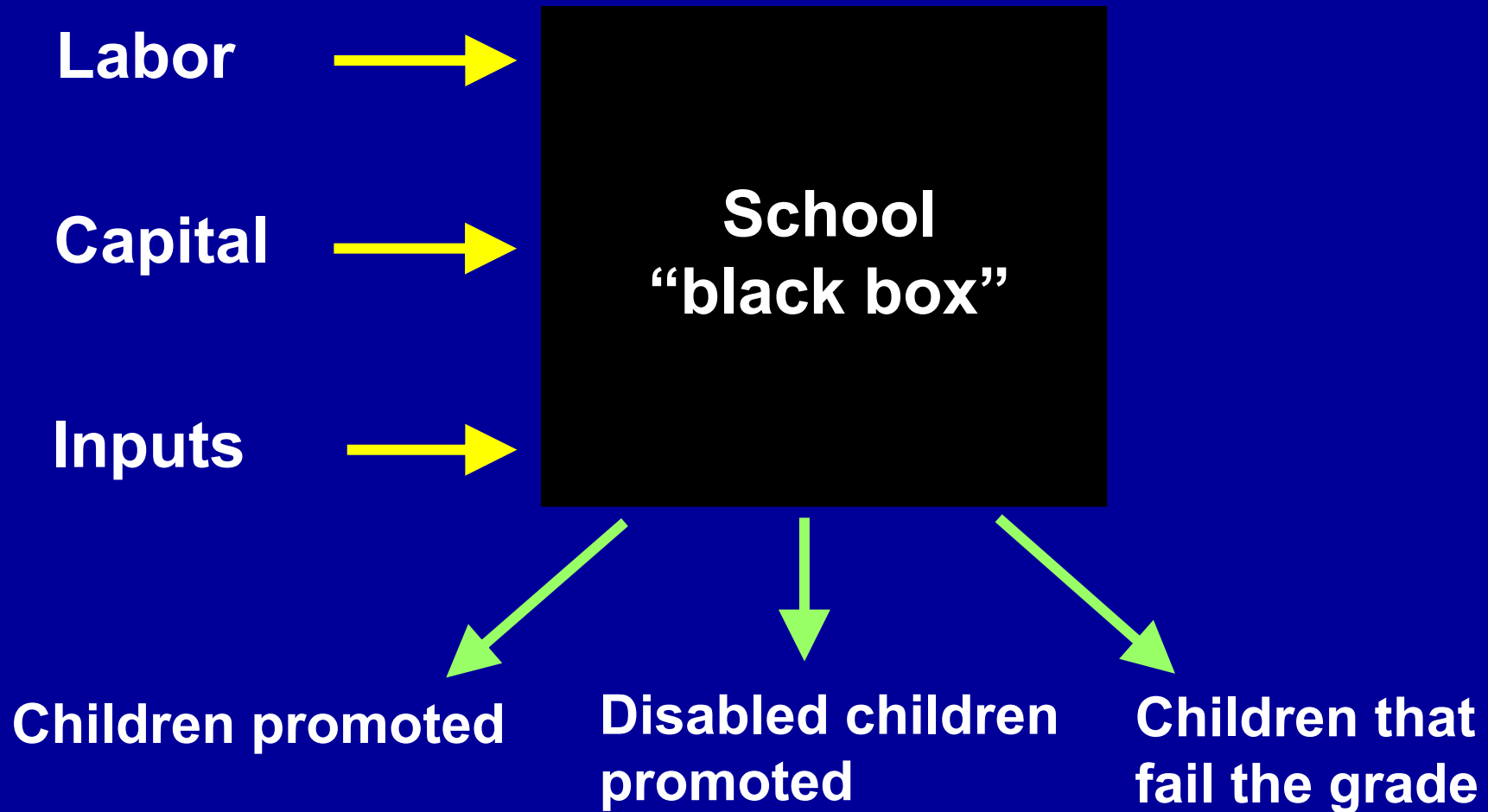
# Costs allocation to products vs. Joint production function



# Costs allocation to products vs. Joint production function



# Costs allocation to products vs. Joint production function



# ¿ Why cost?

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- *Evaluate efficiency in two equivalent programs*
  - Which one provides greater benefits, given a fixed amount of resources
- *Identify principal cost categories, to guide managers towards potential savings*
- *Forecast costs*
- *Set user fees*
- *Perform cost-benefit or cost-effectiveness analyses*



# ¿What is cost?

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*It is the value of the resources used to produce something (not necessarily the amount paid for the same resources)*



# Key costing aspects

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- A) Perspective*
- B) Time Frame*
- C) Analytic horizon*
- D) Data availability*



# A) Perspective

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- **User/beneficiary:** costs incurred by the user (e.g. transport costs, user fees, opportunity cost for the family, etc.)
- **Provider:** costs incurred by the service provider (e.g. treatment and hospitalization costs; costs of running a school)
- **Financial agent:** costs incurred by the funder (e.g. government, a public fund, insurance company, firm, bilateral agency...)
- **Social:** all costs, regardless of who pays, including positive and negative externalities (non-compensated work, changes in productivity, in the savings rate, etc.)



## B) Time Frame

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- *Period of study for data collection*
- *Need to capture temporal variation and start-up costs (typically one year)*



# C) Analytic Horizon

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- *Period of time in which costs and effects are modeled*
- *All potential costs and benefits must be considered*
  - Chronic illnesses
  - Academic performance
  - Environmental and infrastructure impact



# Cost estimation can be divided into three parts:

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- *Identification of the relevant costs*
- *Quantity of resources used (Qs)*
- *Value of resources used ( $C=P*Q$ )*

***P= price***

***Q= quantity***



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# Definitions and Costs Categorization



# Costs & Money

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- *Not all costs are expenses*
  - Caring/nursing time
  - Time spent helping children with their homework
  - Time of volunteers
  - Donations
- *Costs included depend on the perspective*



# Net Costs

- The net costs of one intervention are:  
(Total Costs of the intervention) –  
(Value of savings generated)*

<i>e.g. INTERVENTION: ROTAVIRUS VACCINE</i>	
<b>Costs</b>	<b>Savings</b>
<ul style="list-style-type: none"><li>▶ <i>Vaccine</i></li><li>▶ <i>Syringe, cotton, alcohol, etc.</i></li><li>▶ <i>Nurse time</i></li><li>▶ <i>Logistics: per diems expenses, transport, gasoline...</i></li></ul>	<ul style="list-style-type: none"><li><i>Averted hospitalizations</i></li><li><i>Averted productivity losses (home nursing, averted deaths)</i></li></ul>



# Two types of inputs to classify

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- **recurrent inputs**: *inputs that are used in less than one year*
- **capital inputs** : *inputs that last more than one year*



# Complications

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- *How to value the elements that have no representation in the market?*
- *How to manage shared costs?*



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# *Cost - Benefit Analysis*



# What is CBA?

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- *Values the consequences of an intervention in monetary terms*
- *Enables comparison of interventions in different sectors (e.g. health vs. education vs. infrastructure)*
- *If a project as a whole produces more benefits than costs, it is worth doing it. Otherwise, no.*



# ¿What is CBA?

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The results are reported in Net Present Value

NPV: enables the comparison of cash flows that differ over time

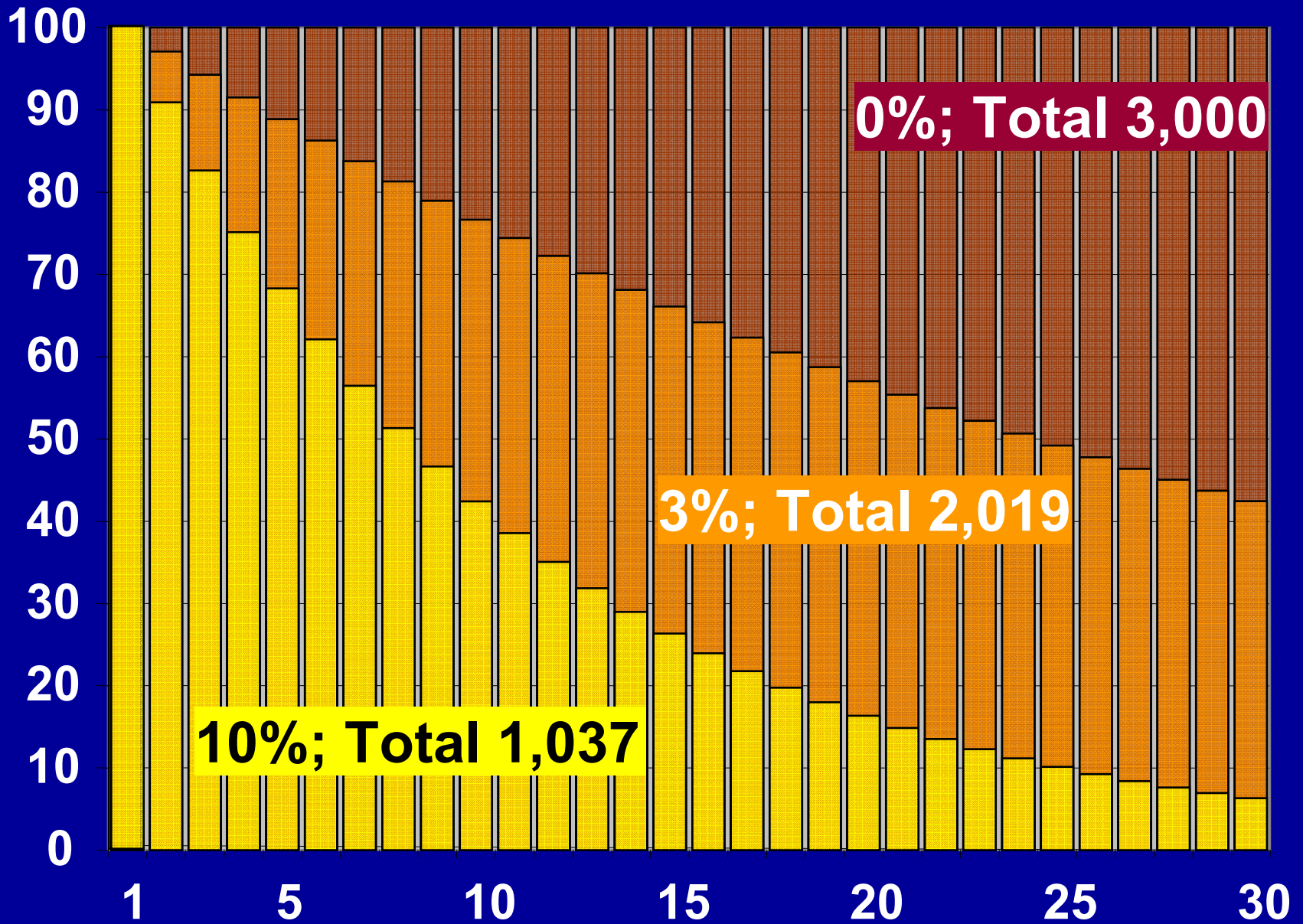


# Net Present Value

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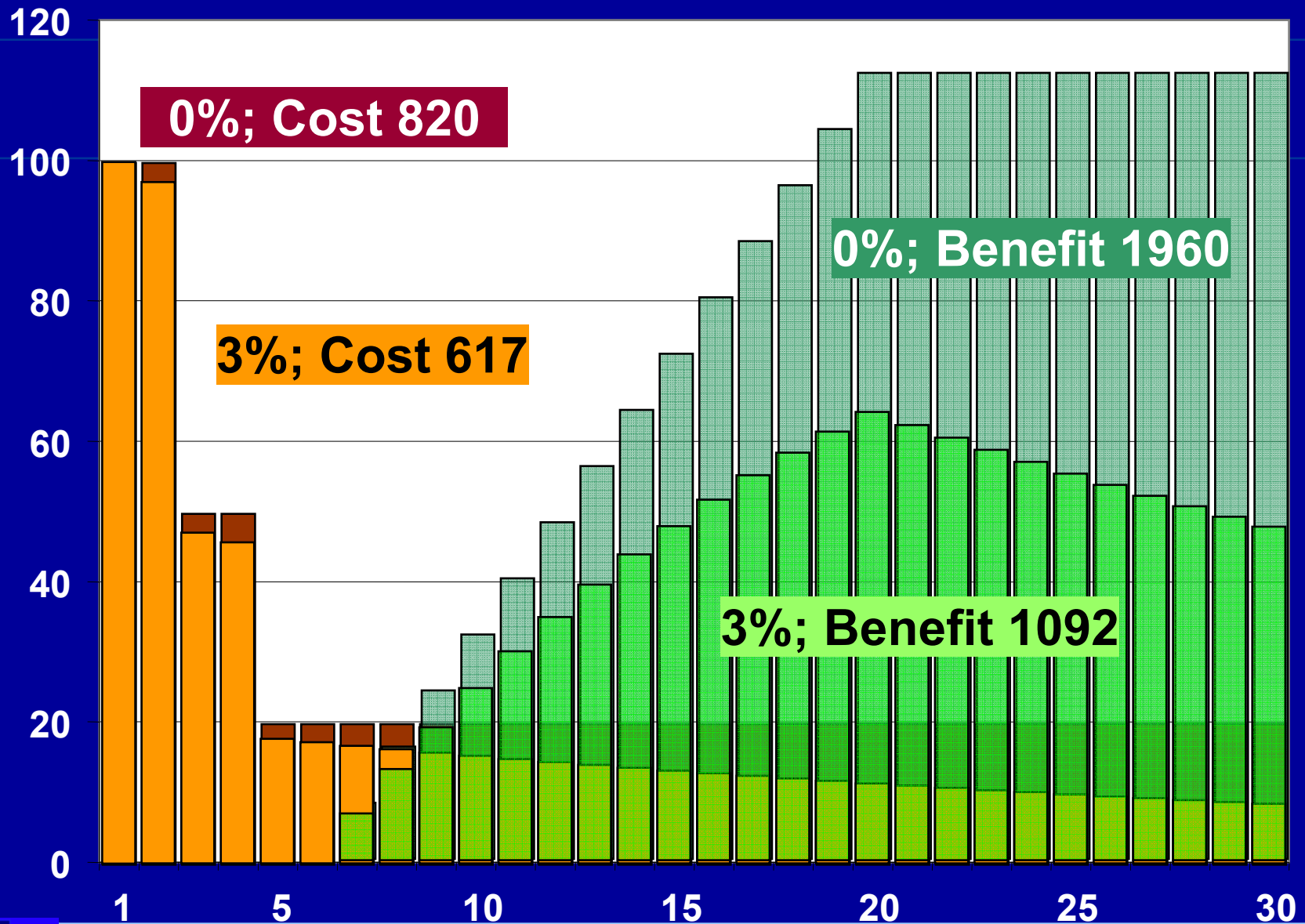
$$NPV = \sum_{t=0}^T (benefits_t - costs_t) * \frac{1}{(1+r)^t}$$





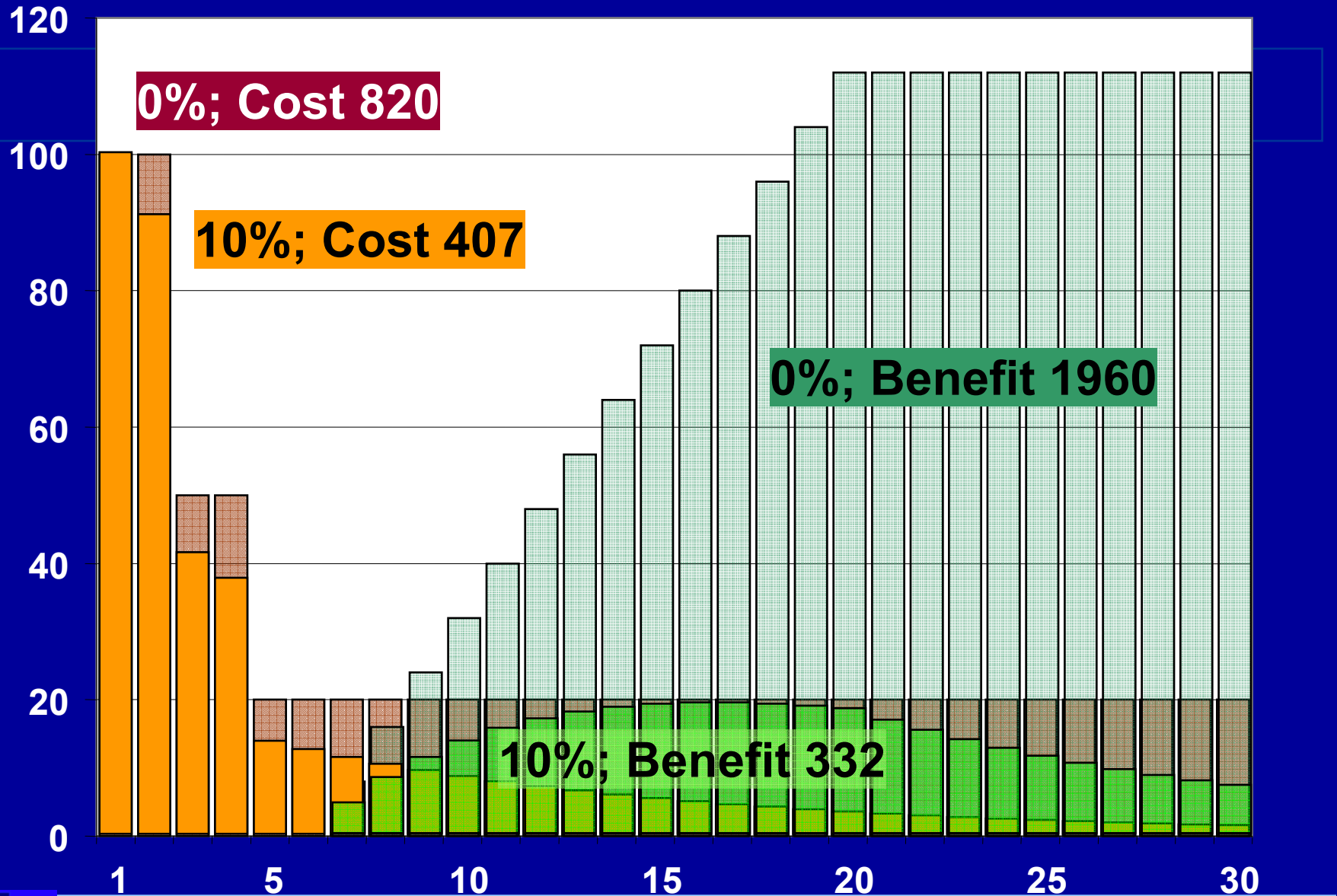
3% discount rate

NPV > 0



10% discount rate

NPV < 0



0%; Cost 820

10%; Cost 407

0%; Benefit 1960

10%; Benefit 332



# Usefulness of CBA

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- *Technique that helps to decide if a:*
  - project
  - program
  - policy

*Will increase or diminish social welfare,  
valued in economic terms*



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# Valuing benefits in Cost-Benefit Analysis



# Methods for expressing non-monetary benefits in monetary terms

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- *$\Delta$  production*
  - Human Capital
  - Revealed Preference  
(wage-risks studies)
- *Contingent Valuation (willingness-to-pay)*



# Cost-Benefit Analysis

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## *Implementation Obstacles :*

- Difficult and controversial to allocate monetary value to changes in, e.g.:
  - Morbidity and mortality
  - Educational attainment
  - Environmental preservation



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# *Cost – Effectiveness Analysis*



# Cost – Effectiveness Analysis

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- *Only useful when comparing costs and consequences of two or more alternatives*
- *Only useful when the competing alternatives produce a common result*

**e.g.:**

- **school promotions**
- **averted chickenpox cases**
- **reduction in hr/km traveled**



# Cost – Effectiveness Analysis

**Identify a common outcome for the alternatives to be comparable**

## *Examples of effectiveness measures*

<b>Intervention</b>	<b>Effectiveness Measures</b>
<i>Rotavirus Vaccination</i>	<i>Averted childhood diarrhea cases or deaths</i>
<i>Diabetes Treatment</i>	<i>Days with glucose under control</i>
<i>Scholarships</i>	<i>School years concluded</i>
<i>Water Supply</i>	<i>Days with piped water</i>



# Steps to consider in CEA...

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## *IDENTIFICATION OF RELEVANT ALTERNATIVES*

- CEA makes no sense when analyzing only one alternative
- It estimates cost per unit of effect
- This value alone does not tell you if an intervention is a “good buy”



# Steps to consider in CEA...

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## *IDENTIFICATION OF RESULT MEASURES*

- *Intermediate*
  - Number of people who stop smoking
- *Final*
  - Averted cases of lung cancer
  - Averted deaths due to lung cancer or COPD



# Steps to consider in CEA...

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- *Adverse effects of the Intervention*
- *Costing*
  - Program/Intervention Costs
  - Averted costs
  - Externalities (e.g. productivity losses of third parties)

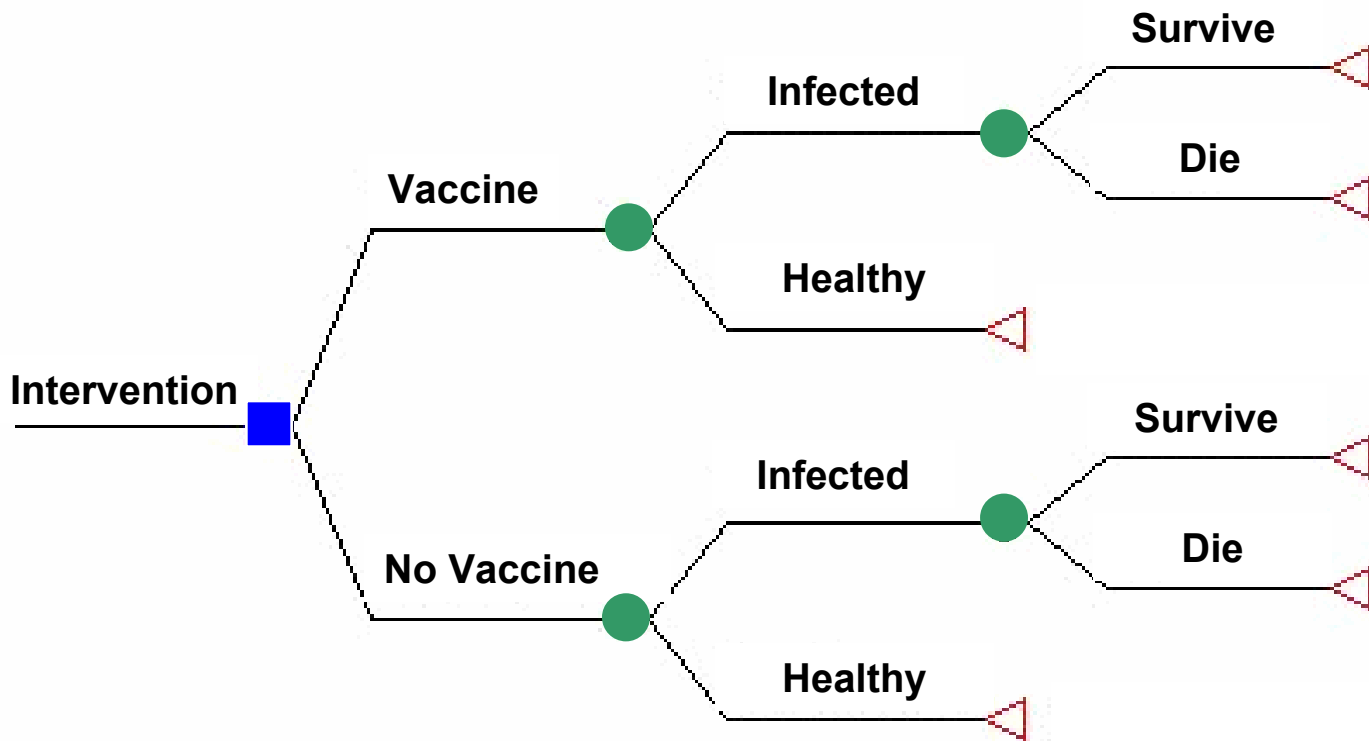


# Design

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- *Conceptual Model*
  - Flow diagram of the relevant interventions
  - Decision Tree or other way to model the process (Markov Model)
  - The quality of the results depends on the quality of the model
    - **Parameter uncertainty can be readily addressed, not so for uncertainty related to structure of the model**





# Sensitivity Analysis

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- *Model variables have different levels of uncertainty*
- *In absence of empirical data, one must make informed assumptions (e.g. about the effectiveness of new technologies)*
- *When there are methodological debates different scenarios can be modeled (e.g. discount rate, productivity losses)*



# Sensitivity Analysis

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- *Explores the sensitivity of the model's results to variation in values of input parameters*
- *Tests the robustness of the conclusions by varying uncertain parameters across their "plausible" range*



# Sensitivity Analysis, steps to follow...

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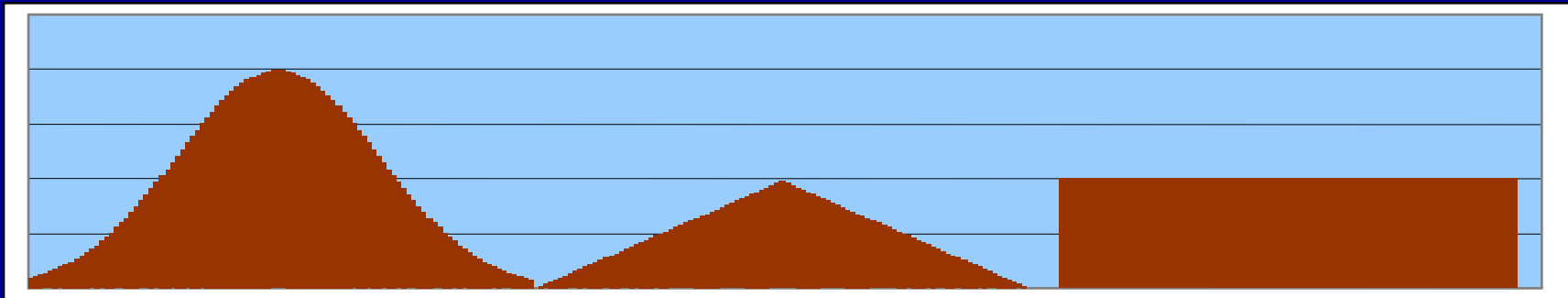
- *Specify a plausible range across which uncertain parameters vary*
  - Take into account the known distributions of parameters based on empirical data



# Types of Sensitivity Analysis

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- *Univariate*
- *Multivariate*
  - Scenarios (optimistic, baseline, pessimistic)
- *Probabilistic*



- *Threshold Analysis*



# Cost-Effectiveness Measures

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- *Cost per unit of produced effect*
- *A lower cost per unit is preferred*



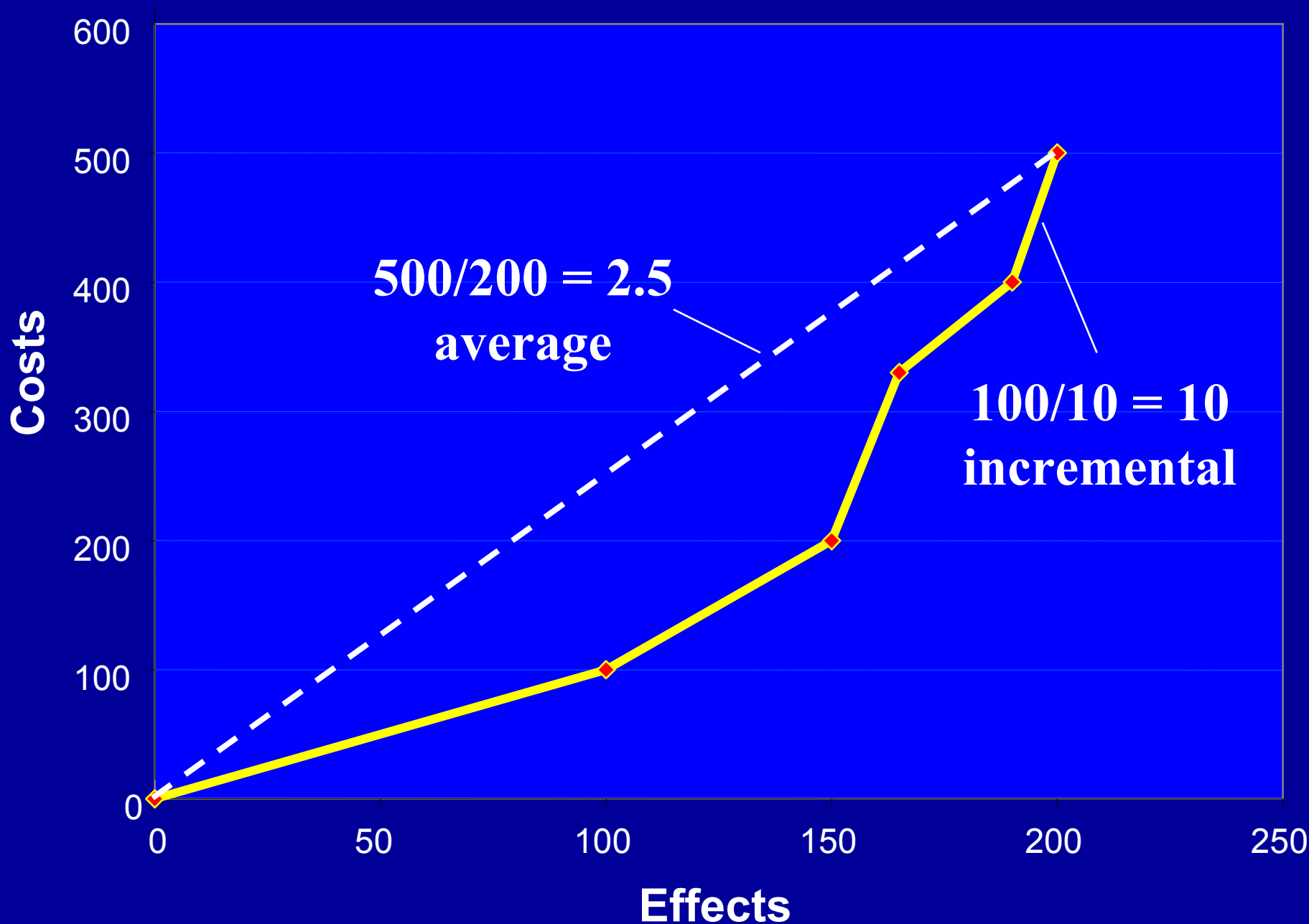


FIGURE 5.5 Drummond



# Interpretation of Cost-Effectiveness measures

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- *Dominance*
  - Program A dominates B when its effectiveness is greater and its cost lower than program B



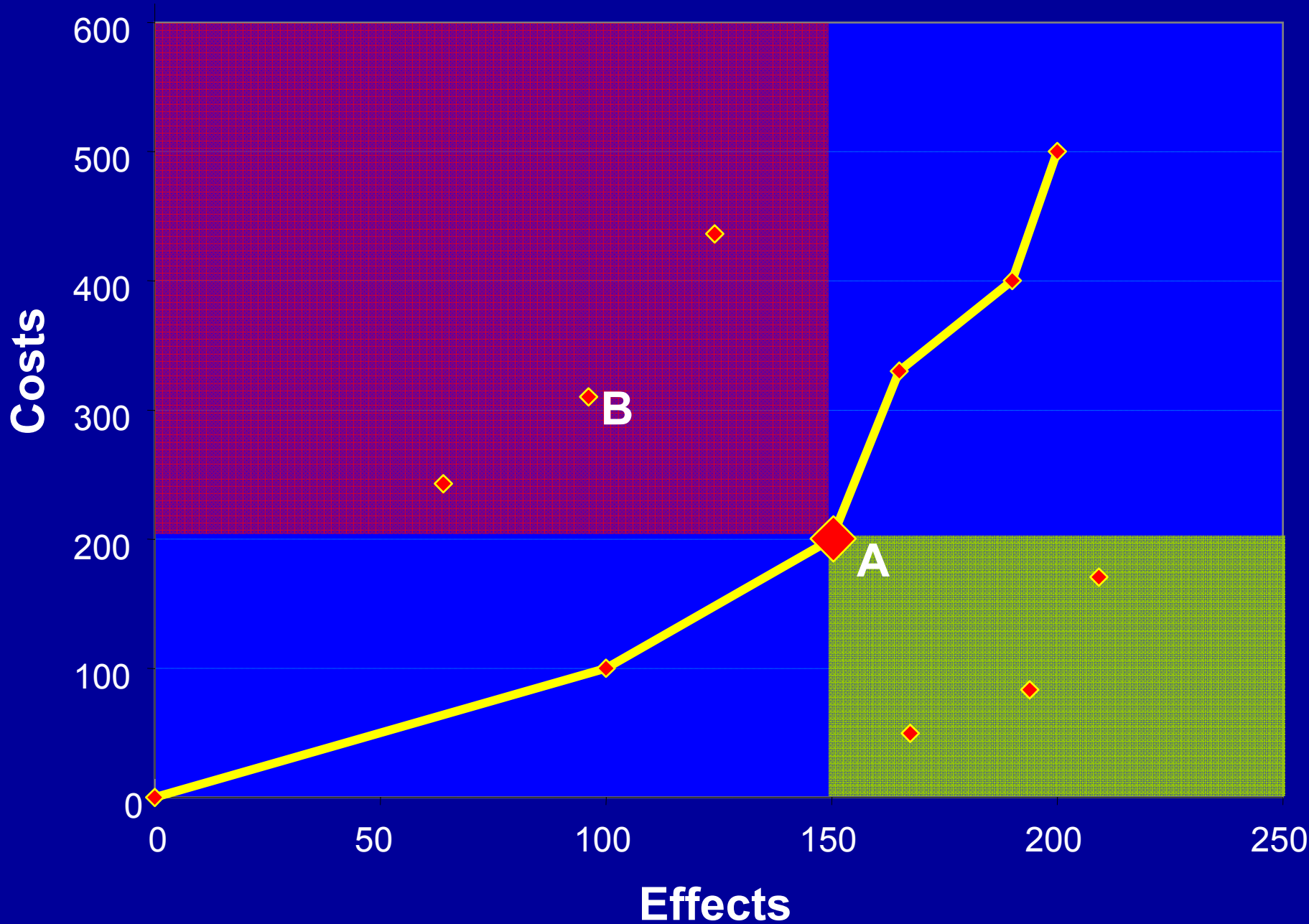


FIGURE 5.5 Drummond



# Interpretation of Cost-Effectiveness measures

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- *Dominance*

- Program A dominates B, when its effectiveness is greater and its cost lower than program B

- *Extended Dominance*

- When a combination of two programs (A & C) is more CE than another one (D)



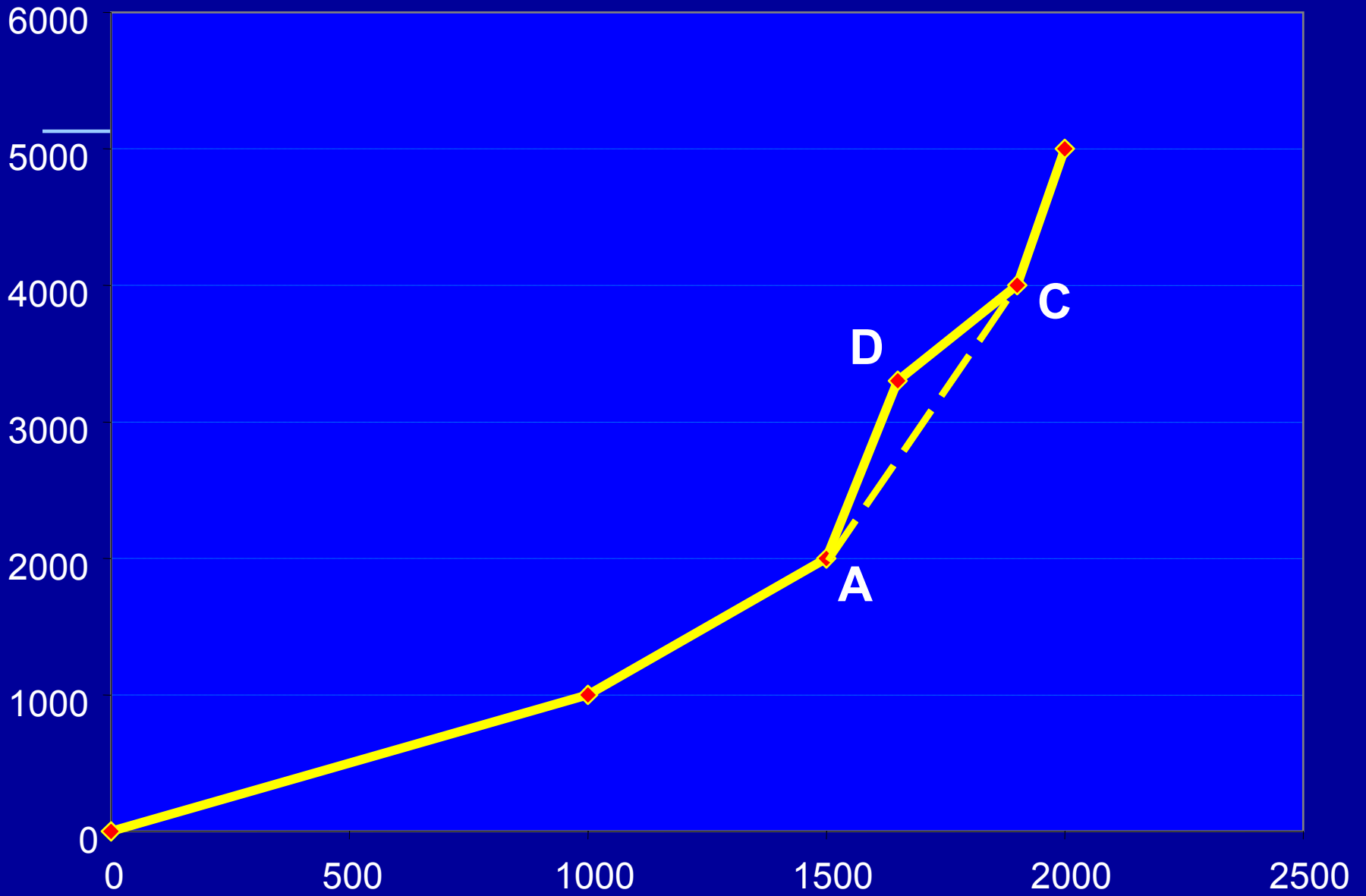


FIGURE 5.5 Drummond



# Critic Evaluation of Articles

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1. *Was a well-defined question posed in answerable form?*
2. *Was a comprehensive description of the competing alternatives given?*
3. *Was there evidence that the programmes' effectiveness had been established?*
4. *Were all the important and relevant costs and consequences for each alternative identified?*



**INSP15** Cambié la palabra artículo por estudio... me pareció importante esta sección para que los tomadores de decisiones puedan tener una idea de cuáles son las cosas que deben verificar en un estudio de ACE... para que tengan una idea de si está bien hecho o no.  
INSP, 05/18/2006

# Critic Evaluation of Articles

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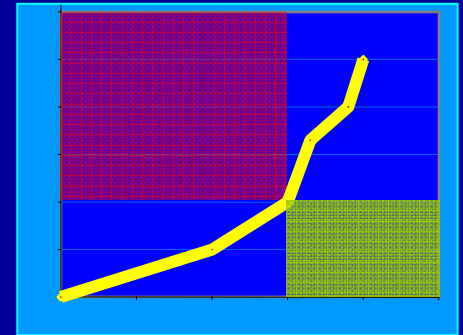
5. *Were costs and consequences measured accurately in appropriate physical units?*
6. *Were costs and consequences valued credibly?*
7. *Were costs and consequences adjusted for differential timing?*



# Critic Evaluation of Articles

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8. *Was an incremental analysis of costs and consequences of alternatives performed?*



9. *Was allowance made for uncertainty in the estimation of costs and consequences?*

10. *Did the presentation and discussion of study results include all issues of concern to users?*



Cost-benefit and cost-effectiveness analyses help to decide which basket of interventions is the best to achieve a specific objective.

But... not only should we know **WHAT** to implement, but also, **HOW**.

# ¿ Why cost?

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- *Evaluate efficiency in two equivalent programs*
  - Which one provides greater benefits, given a fixed amount of resources
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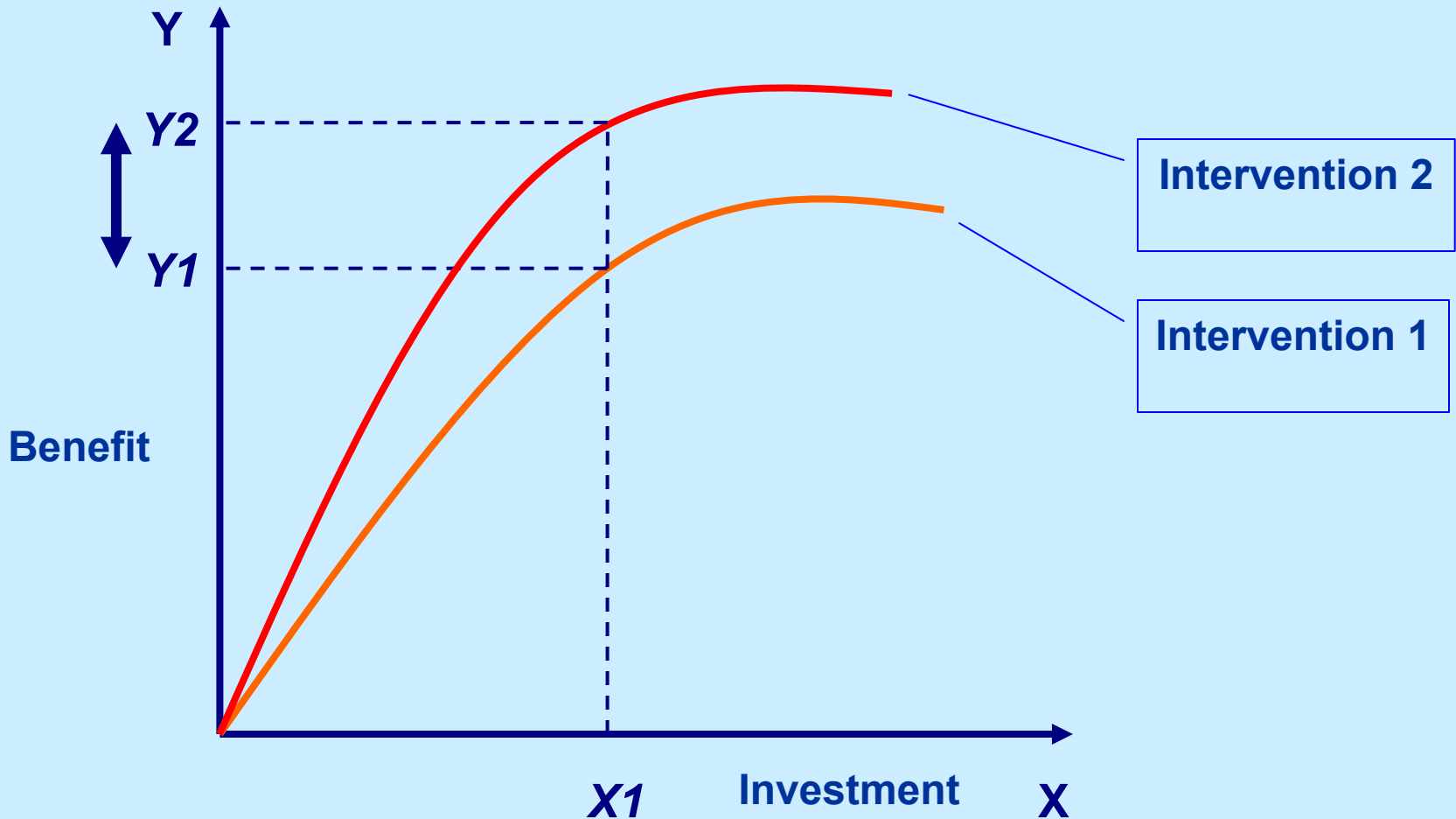
# Efficient Allocation vs. Efficient Production

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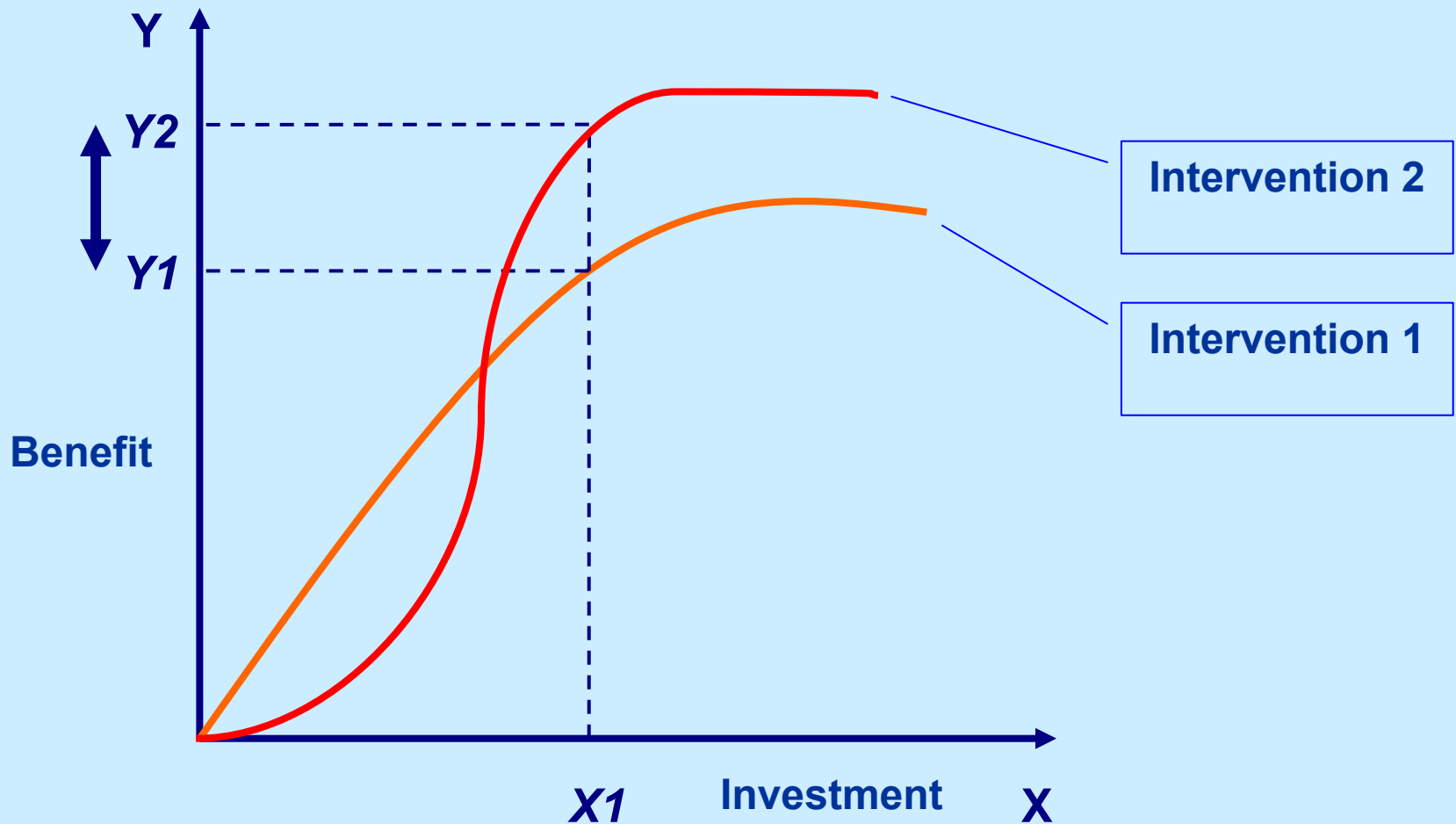
- *Allocative efficiency*
  - Allocate resources to those interventions that provide the maximum “value for money”
  - CBA & CEA
- *Technical Efficiency*
  - Make the most of the allocated funds to each intervention
  - Efficiency Analysis and its determinants



# Production Function and Allocative Efficiency



# Production Function and Allocative Efficiency



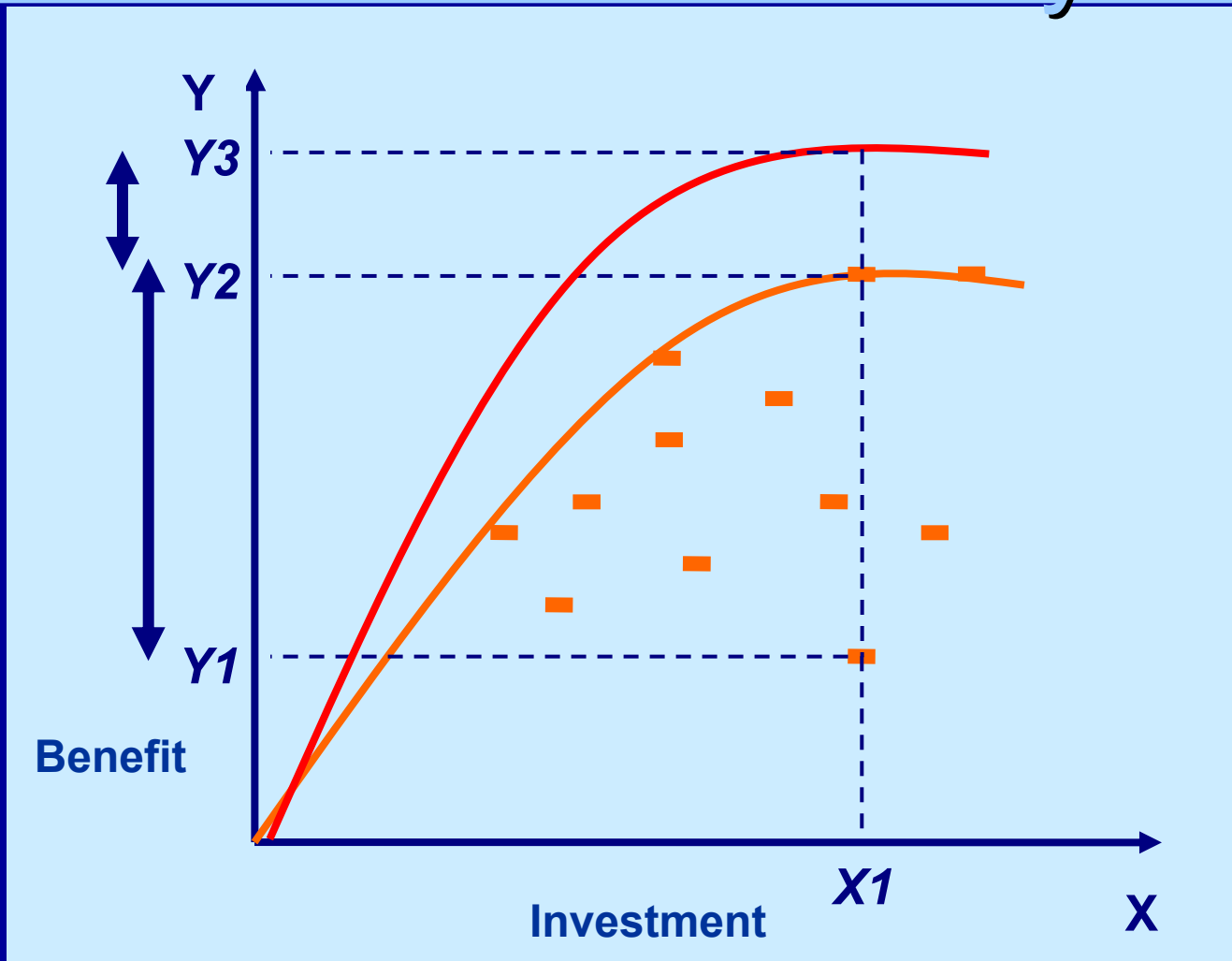
# Allocative Efficiency

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- *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*

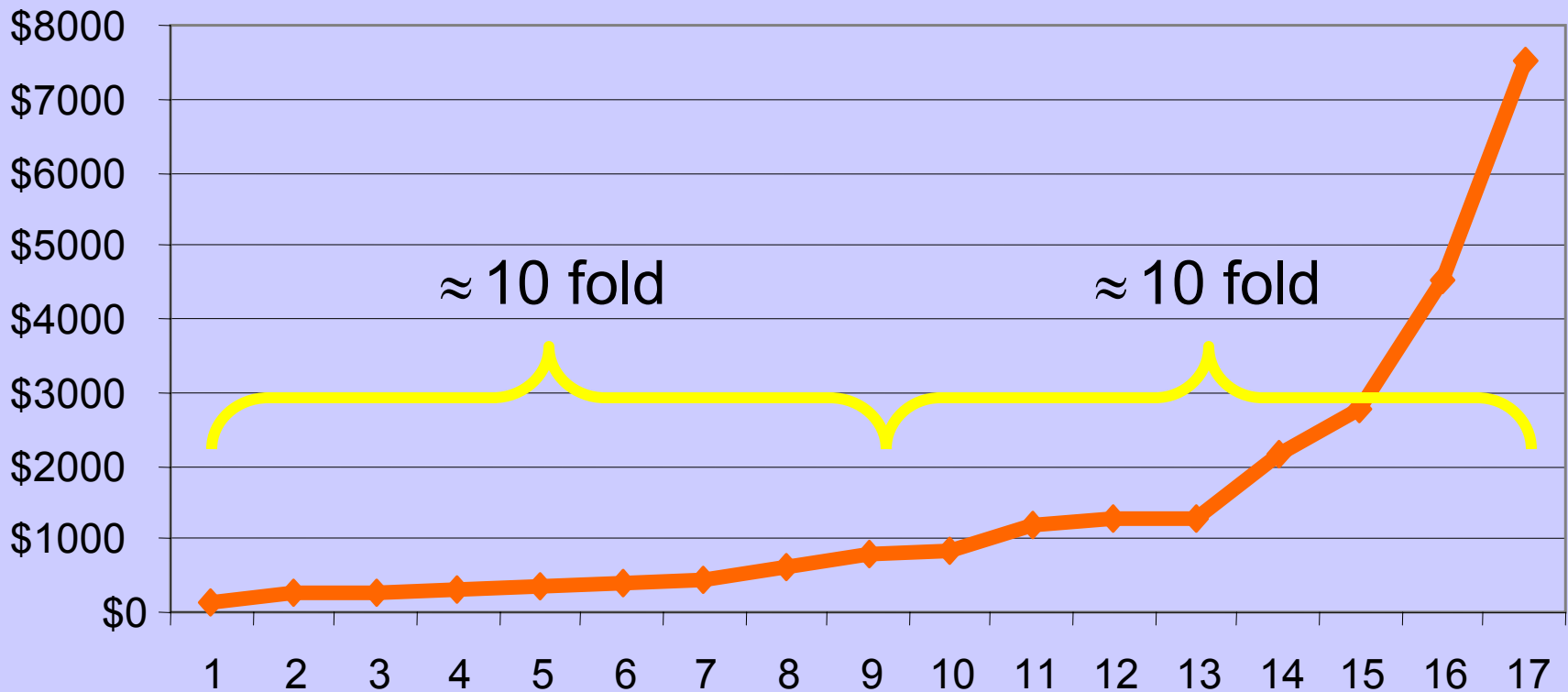


# Production Function and Technical Efficiency

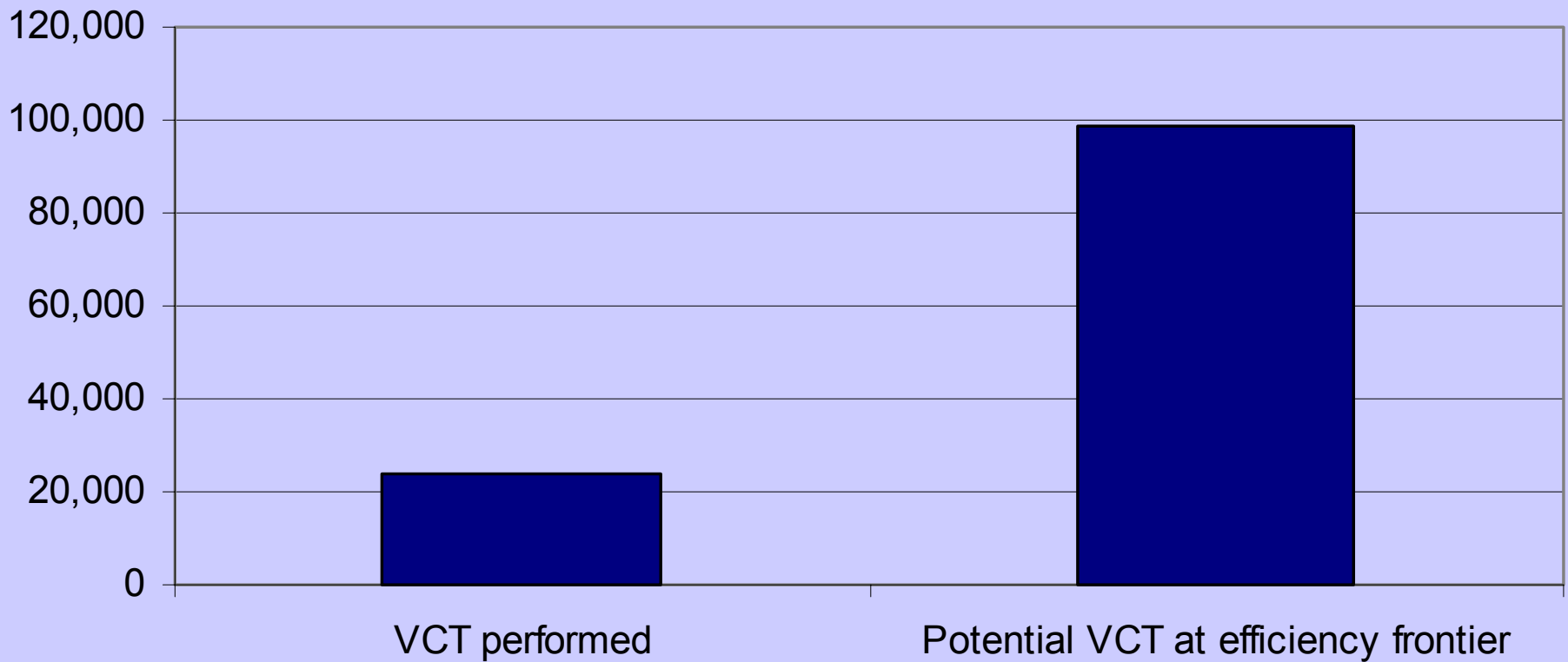


# Technical efficiency in VCT: 17 sites in Mexico

## Cost per client in 17 VCT sites in Mexico



# Technical efficiency in VCT: 17 sites in Mexico



# Potential gains from technical efficiency improvements

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- *Possible to greatly increase social welfare just by improving the technical efficiency of the interventions/programs already funded*
- *In many cases the benefit may be greater than that obtainable with a shift to a more “cost-effective” mix of interventions (allocation efficiency)*



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*No program will be efficient if it is not well managed – and one can't manage well what one can't measure*

