



Cost-Effectiveness Analysis (CEA)

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Introduction

Cost-effectiveness analysis (CEA) is an economic evaluation method that compares the costs of different policies or programs. It involves comparing policies and programs by how much they cost to achieve the same outcome.

The outcome will usually be the main benefit of the program, for example lives saved, student reading scores improved, or job seekers placed in employment.

When to use

- CEA is generally used to review/evaluate a program that has already been implemented (often referred to as ex post or post implementation). It can be used before implementation in some cases (often referred to as ex ante or pre implementation).
- It is particularly effective if a rigorous impact evaluation has already estimated the impact of the program, or if there is good data available to understand the impact of the program. The CEA can then be used to calculate the impact per dollar spent on the program.
- CEA tends to be used in areas where it is difficult, or not meaningful, to try to convert benefits into a dollar value. For example, in accident safety education where the primary benefit may be lives saved.¹
- CEA focuses on one particular benefit such as 'lives saved' or 'hospital emergency department room visit avoided'. This means it is particularly useful where there is one benefit that is of primary interest. This is often suitable in a government context, where a program might have multiple potential outcomes/benefits, but one outcome/benefit that is of primary interest.
- An advantage of CEA is that because it can be kept very simple when the impact of a program is known, it can be conducted by people without specialist expertise.
- CEA can also help to communicate simple and clear results to non-expert audiences. For example, the main output metric is often something like: 'the program cost \$100,000 per each additional life saved'. This is simpler than the output metrics generated by some of the other economic evaluation methods.

See the [ACE guidance on different evaluation methods](#) for common uses of each method.

Limitations

- CEA is generally focused on one particular outcome of interest (for example, lives saved). This means it can be less useful if the proposal has multiple benefits that are all of approximately equal interest.
- CEA can be less useful for comparing proposals if their intended outcomes are unrelated. For example, lives saved versus educational outcomes.

- Because benefits are not valued in monetary terms, CEA can identify the more cost-effective way of achieving a given outcome but it cannot indicate whether the preferred option is a net benefit to society.

Key concepts

Required data

A cost-effectiveness analysis requires two pieces of data:

- an estimate of the program's impact on the outcome of interest, and
- an estimate of the cost of the program.

Estimate of program impact

In conducting a CEA, the analyst must first find an estimate of the impact of the program. This will ideally come from a rigorous impact evaluation. If a rigorous impact evaluation is not available, an alternative option is to attempt to estimate the impact of the program using assumptions or comparisons to similar programs.

The impact of the program can be measured in many different ways depending on the outcome of interest. For example, some outcomes could be 'lives saved', 'standard deviation increase in student reading scores', or 'learning gains equivalent to 1 more year of education.'

The measure of impact must be the same between each of the different options being compared and must be naturally measurable.

Program costs

In a CEA, the program costs of interest are generally financial costs. In a government context, this is usually the financial cost to the government. Though there may be situations where it may be appropriate to incorporate broader costs into the CEA such as in-kind costs to other organisations, or even the time costs to program participants.

In terms of financial costs, the focus is usually the *incremental* costs of running a program. For example, say a program provides extra tutoring to school children with poor reading skills. This would usually not include any costs associated with the overall operation of the school but could include some administrative/overhead costs associated with running the tutoring program itself.

Overall, the most important rule with calculating program costs is that the same approach is adopted for all the different options being compared. It is critical a 'like-for-like' comparison can be made between the different options.

Key result metrics: cost effectiveness ratios

There are two simple ways to calculate the ratio of costs and effectiveness. A cost per unit of effectiveness ratio (CE) or an effectiveness per unit of cost ratio (EC).

$$\text{Cost per unit of effectiveness ratio} = CE_i = \frac{Cost_i}{Outcome_i}$$

$$\text{Effectiveness per unit of cost ratio} = EC_i = \frac{Outcome_i}{Cost_i}$$

where:

$Cost_i$ = the total cost of option i

$Outcome_i$ = the outcome achieved by option i

The choice between CE and EC will generally depend on the context, and the evaluation question. The cost-per-unit of effectiveness ratio is used more often as it can compare the costs of different programs that have the same outcome, which is the primary purpose of CEA.

The effectiveness per unit of cost ratio can be useful when comparing two programs with different outcomes – for example, if spending \$100,000 on Program A will save 5 lives, whereas spending \$100,000 on Program B would save 300 Quality Adjusted Life Years across many people.

ACE or EC ratio will often be used to compare the cost-effectiveness of a new program to the cost-effectiveness of an existing, 'business-as-usual' (BAU) program. If the new program is found to be more cost-effective, then it may be worth shifting funding toward the new program. For example, consider a primary health care program that is intended to support people with chronic health conditions and reduce the frequency of hospital admissions. If policymakers were interested in the cost effectiveness of the program, the 'cost per hospital admission avoided' could be compared to the average cost of a hospital admission. The program might pay for itself if the costs of the program were less than the business-as-usual event of a person being admitted to hospital.

Example of a cost-effectiveness analysis

An advantage of CEA is that they do not have to be complicated. The UK Education Endowment Foundation conducted some cost-effectiveness analysis in education that was summarised:

To get a one-month improvement for one student, personal academic coaching cost £280, individual reading assistance cost £209, the mathematics teaching program cost £60, and the philosophy-based intervention cost £8.38. So while all the programs 'worked', some were a whopping 35 times more cost-effective than others.¹

1 Dr Andrew Leigh, 'How the randomistas can help fight inequality', speech to Presbyterian Support Northern Seminar Series on Child Wellbeing, https://www.andrewleigh.com/how_the_randomistas_can_help_fight_inequality

How to design

1. Define the parameters of your project

- **Define the scope:** Clearly define the scope of the project or intervention you are evaluating. Why are you evaluating this intervention? What decision will it inform?
- **Identify the objectives and outcome:** What is the purpose of the intervention, policy or program you are evaluating? What is the measurable outcome of interest?
- **Specify the options available:** Identify the set of intervention options of interest.

2. Measure costs and program impacts

- **Identify costs:** Identify the key costs for each option.
- **Identify the program impact:** For each option, find an estimate of the impact of the program on outcomes of interest.

3. Calculate the key ratios

- **Decide which metric to use:** First decide whether to calculate the CE or EC ratio based on which ratio is most helpful to answer the evaluation question. It is rarely helpful to calculate both the CE and the EC.
- **Calculate the key metric for each option:** Calculate the CE or EC ratios for each of the options. Refer to the Key Concepts section for calculation details.
- **Compare across options:** Using the relevant ratio (CE or EC), compare each intervention option. Identify the intervention option that is most cost-effective using the CEA metrics.

4. Interpret the results and report the findings

- **Clearly present the results of the CEA:** Present all results and recommendations in a transparent and clear manner. This can be done very simply (see the example above) or in a more detailed report. A more detailed report may include:
 - Summary of costs and outcomes
 - Relevant CEA metrics for all options
 - Limitations of the analysis
 - Distributional analysis – a discussion or analysis of how results vary for different sub-populations like marginalised communities
 - Qualitative benefits and/or costs that were not quantifiable and so were not incorporated into the CEA.

Resources

Better Evaluation, [Cost-Effectiveness Analysis guidance](#)

Abdul Latif Jameel Poverty Action Lab (J-PAL), [Conducting cost-effectiveness analysis](#)