
8. Determining Present Value and Conducting Sensitivity Analysis

Monetised costs and benefits often involve impacts that occur over time. Comparing options must therefore include a comparison of total costs and benefits from each option over the entire time period that impacts are assumed to be relevant for.

Thus, this step can be thought of as answering the question:

What is the present value of impacts and how to deal with uncertainty?

8.1. Determining present values of costs and benefits

Usually, regulatory regimes are intended to be stable and long-lived so depending on the context, evaluation of costs and benefits is likely to span multiple years or even multiple decades.

Even if monetised costs and benefits are attributed to future years, a question that arises is, how do we aggregate them and value them today? This is where the concept of discounting is utilised to evaluate future monetised values in present value terms. Discounting is based on the principle that money has a time value. That is to say that, receiving a hundred rupees a year from today does not carry the same value (purchasing power) as a hundred rupees received today.

This can be seen in two ways. First is that if you invest a certain amount of money today, you are able to earn interest on it. Therefore, receiving a hundred rupees today is nominally the same as receiving a hundred rupees plus interest on it, a year from now. However, inflation erodes some purchasing power over time as well. Subtracting the rate of inflation from the rate of interest equals what is called the 'real rate of interest' i.e. which reflects the true purchasing power of money after netting out the effect of inflation.

This real interest rate can be used to discount future monetised values to arrive at their equivalent present values.

Another way to understand the exercise of arriving at the present value (PV) is that it allows us to convert future costs and benefits into equivalent values in today's terms, using a discount rate, reflecting the principle of time preference, whereby individuals and societies generally value present consumption more than future consumption of a similar magnitude.

UK Impact Assessments routinely present costs and benefits in present value terms over a specified appraisal period, typically 10 years. The Green Book framework ensures consistency in discounting across policy areas.

In the United States, agencies are required to present discounted costs and benefits using multiple discount rates. They are also required to explicitly report both annualised and present value estimates, allowing policymakers to compare options across time horizons.

The European Commission's Better Regulation Toolbox requires discounting of future impacts and emphasises transparency in assumptions regarding time horizons and discount rates.

8.2. Methodology: Discounting and Net Present Value

In practice, present value is calculated by applying a discount factor to future costs and benefits. Once the present value of costs and the present value of benefits are calculated using the discount rate, a net present value of an option is arrived at by subtracting the present value of costs from the present value of benefits, i.e.

Net Present Value (NPV) = Present value of benefits - Present Value of costs

A positive NPV indicates that a regulatory option generates net benefits over time and is therefore economically justified.

Different jurisdictions prescribe standard discount rates. Generally, a combination of factors influences the choice of discount rates. Generally speaking, the prevailing real interest rates (net of inflation) in risk-free investments form a benchmark for the value of money. However, often, in regulatory contexts where costs and benefits are felt across society, a 'social rate of time preference (S RTP)' may also be applied. The S RTP reflects society's rate of time preference of money. In general, it is understood that societies display a greater degree of patience than individuals or firms. This means that the S RTP is usually lower than the prevailing risk-free interest rate.

The UK's HM Treasury recommends a social discount rate of 3.5% in its **Green Book**. The **US OMB** Circular A-4 recommends using 3% and 7% to reflect different perspectives on the opportunity cost of capital. The European Commission similarly requires discounting in impact assessments to ensure temporal comparability.

However, inflation in India usually is higher than these economies and therefore short-term interest rates set by the Reserve Bank tend to be higher as well. In India, the 10-year government bond rate which ordinarily provides yields of around 7-8% per annum could be utilised as a basis for arriving at a discount rate.

The choice of discount rate can significantly affect results. A higher discount rate reduces the present value of future benefits, potentially biasing analysis against long-term interventions such as environmental or infrastructure regulation.

The higher the discount rate, the higher is the rate at which future costs and benefits 'lose' value over time. An interesting example of how changing the discount rate in evaluation of future costs and benefits can change policy recommendations is when by using a 7% discount rate, a clean power plan

of the US Environmental Protection Agency was found to not yield net benefits as compared to when a 3% discount rate is used.

Second, the selection of the time horizon is critical. Some benefits—such as improved competition or innovation—may materialise over extended periods and may be underestimated if the time horizon for evaluation is too short.

Third, distributional considerations may arise where benefits accrue to future generations. This can have implications for how to fund options. For instance, major urban infrastructure investment in countries like New Zealand and Australia is funded significantly out of property rates/taxes which distribute the cost burden across generations.

OECD guidance highlights the importance of considering such intertemporal effects in regulatory decision-making.

8.3. Addressing uncertainty - Sensitivity Analysis

RIA must also address uncertainty in estimates and assumptions. More often than not, policy is made under conditions of incomplete information on various aspects of the problem and the impacts from various interventions. Impacts depend on several factors that may not be directly controllable by policy makers either. Broader macroeconomic, environmental, political and social factors also can impact the magnitude of impacts. Therefore, any quantification or monetisation of costs and benefits needs to acknowledge the presence of uncertainty and present ranges of estimates to capture the possible extremities of magnitudes of impacts.

Sensitivity analysis is the primary tool used for this purpose. Sensitivity analysis involves systematically varying key assumptions—such as discount rates, behavioural responses, compliance costs, or uptake rates—to examine how results change under different scenarios.

The United States Office of Management and Budget requires agencies to conduct sensitivity analysis for “key uncertainties” and to present results under alternative assumptions¹ The OECD similarly emphasises that RIA should test the robustness of conclusions by exploring best-case and worst-case scenarios.

8.3.1. Types of Sensitivity Analysis

In practice, several forms of sensitivity analysis are used.

(a) Parameter Sensitivity

This involves varying key parameters such as:

- discount rates
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- compliance costs
 - number of affected stakeholders

For example, US regulatory analyses often present results using both 3% and 7% discount rates to illustrate how conclusions depend on time preference assumptions.

(b) Scenario Analysis

Scenario analysis examines outcomes under different plausible scenarios—for example, low, medium, and high uptake of a regulatory intervention.

The UK telecoms **Smart Data** Impact Assessment uses scenario analysis to estimate benefits under different switching rates and adoption levels, reflecting uncertainty in consumer behaviour.

(c) Monte Carlo and Probabilistic Analysis

In more complex RIAs, probabilistic techniques may be used to model uncertainty across multiple variables simultaneously. While less common, such approaches are increasingly used in environmental and financial regulation.

By modelling different assumptions, sensitivity analysis allows regulators to explore these possibilities and ensure that RIA does not rely on a single deterministic outcome.

Integrating Present Value and Sensitivity Analysis

RIAs typically present:

- Base-case NPV estimates (using central assumptions)
- Alternative NPVs under different discount rates or parameter assumptions
- Ranges of outcomes reflecting uncertainty

For example, a regulatory option may produce:

- NPV of INR 5 million under central assumptions
- NPV of INR 3 million under pessimistic assumptions
- NPV of INR 7 million under optimistic assumptions

This approach ensures that policymakers understand not only the expected outcome but also the range of possible outcomes and associated risks.

Understanding the range of possible outcomes also helps policymakers select options depending on the level of their aversion to risk. If policymakers value predictability of impacts, then options that do not lead to large changes in net present value when underlying parameters change can be selected.

Present value analysis enables comparison of impacts occurring at different points in time, ensuring that regulatory options are evaluated on a consistent basis.

Sensitivity analysis complements this by testing the robustness of conclusions under uncertainty and by highlighting the potential range of outcomes.

Together, these analytical steps help produce a comprehensive picture of overall costs and benefits of each option that have been evaluated over time and have incorporated ranges to address uncertainty. This now allows policy practitioners to aggregate all the costs and benefits under various scenarios and make comparisons across options.

References

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