Policy Briefings

BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

PB 01-2014 / January 2014 / www.bc3research.org

DISCOUNTING THE VALUE OF NATURAL RESOURCES IN COST-BENEFIT ANALYSIS: A CASE STUDY FOR POLICY MAKING

Aline Chiabai[1] and Ibon Galarraga[1]

When evaluating public projects, the use of the proper social discount rate is one of the most critical issues, as it will play an important role in determining if the cost-benefit ratio will be in favor of the project implementation or not.

The issue of discounting has been addressed by many authors trying to reconcile the wellbeing of present and future generations. The decision about the proper discount rate is particularly significant when it comes to evaluate policies having major environmental impacts in the long run, as in the climate change context, or decisions leading to environmental degradation and biodiversity losses, which will have to be borne by future generations. Ethics and financial considerations often conflict in this topic. The discount rate represents currently the biggest uncertainty when assessing the economic impacts of climate change.

In this context, governments play a major role in determining the social rate of discount. While it is generally recognized that the market rates cannot be used to evaluate projects with long-term environmental impacts, it is not clear which should be the social discount rate to use. The Ramsey rule, based on the rate of pure time preference, provides a useful framework for addressing the issue of intergenerational discounting. Its empirical application is, however, not exempt of many problems.

Key Points

- *The issue of discounting (i.e. how future cost and benefits are valued today) plays a major role in policies with long-term effects on the natural environment, such as those required in a climate change context, or decisions which might lead to environmental degradation and biodiversity losses with impacts on future generations.*
- *The "equivalency principle" suggests the idea that two pieces of land, one developed and the other one undeveloped, should be given the same utility (and therefore economic value) by future generations, if they are identical in size, environmental, ecological and site-specific attributes.*
- *In practical terms, the principle implies that the discount rate to be applied for projects with long-term environmental impacts on undeveloped land, should be calculated by assuming equal present value for both types of land (developed and undeveloped).*
- *The case study carried out in the Basque Country supports the idea of using low discount rates for the projects mentioned above, sustaining, therefore, a policy action oriented towards the preservation of the environment.*
- *If the environment and natural resources are to be sustainably managed, market discount rates should not be used to account for future environmental quality in any cost-benefit analysis.*

Positive rates of time preference suggest that current generations are more concerned about the short-term consequences of an action taken now and less about its long-term effects, with strong implications for future generations. The same rational applies to "spatial discounting", which refers to the rate at which people discount impacts occurring in distant geographical locations. Again, positive rates denote a major concern for the local impacts compared to those propagating in remote areas. As it happens with time discounting, its magnitude should depend on the effects generated by the decision taken, whether they are localized or might be spatially widespread

THE EQUIVALENCY PRINCIPLE: AN ETHICAL RULE FOR DISCOUNTING

Against this background, Chiabai et al (2013) propose a practical rule to help policy makers to identify the discount rate in cost-benefit analysis carried out for projects planning infrastructures on undeveloped land, with long-term environmental impacts on future generations. The idea is based on the fact that two pieces of land, one developed and the other one undeveloped, should be given the same utility (and therefore the same economic value) by future generations, if they are identical in size, environmental, ecological and site-specific attributes. By definition, developed lands are those designated (with administrative

permission) for residential or commercial/industrial use, while undeveloped lands persist close to their natural state. However, the reality is that a piece of land that has been granted an administrative permission to build, will see its market price going up tremendously, while the price of an identical piece of land without this administrative designation will remain much lower. In these situations, when local or national governments are confronted with decisions about preserving a land in its natural state or planning an infrastructural development, the choice will depend on the economic value of the developed/undeveloped land, as well as on the discount rate to be used if long-term impacts are expected. The proposed rule, the so-called "equivalency principle", suggests that the discount rate to be applied in these occasions should be calculated by assuming equal present value for both types of land (developed and undeveloped). The economic value of the developed land is given by its market price, while for the undeveloped land we need to refer to non-market values expressed ideally by the Total Economic Value (TEV), which includes all benefits (use and non-use calculated by stated or revealed preferences). The application of the rule is viable if the area under analysis is characterised by a reasonable equilibrium between developed and undeveloped lands. Otherwise, in case of highly degraded areas with strong economic-oriented industrial development, for example, the assumption of equal present values for the two types of land would result in unfair decisions, as the highly degradation of the natural land should lead to even higher present values for the latter.

We illustrate this principle in a specific case study in the Basque Country in Spain, within an investment project which attracted recently a lot of attention, and whose purpose was to build a new seaport in Pasaia (Gipuzkoa) in a natural area having high ecological values, the cliffs of Jaizkibel Mountain.

CASE STUDY: INVESTMENT PROJECT IN THE BASQUE COUNTRY

Study site

The construction of a new seaport in the town of Pasaia, in the province of Gipuzkoa started more than 10 years ago. Many arguments have been made in favour and against the proposal, as it was planned in a cliff named Jaizkibel with significant environmental attributes. The whole area was incorporated in the Natura 2000 network comprising 2,400 hectares of natural land with 15 zones declared of high ecological interest. After several studies were presented under the Environmental Impact Assessment (EIA) procedure of the Ministry of the Environment, Rural Affairs and Marine Issues of the Spanish Government, and strong social opposition, the project was finally abandoned.

The area of Jaizkibel consists of cliffs with important geological attributes, small beaches and gullies formed by the courses of streams, non-wood forest area with scrubland, pasture land and seabed harbours. Its considerable environmental value is due to the presence of a remarkable landscape, the seabed life and the autochthonous fauna and flora, with some endemic plants being extremely rare in Europe and in danger of extinction.

Cost-benefit analysis and choice of discount rate

In order to make a sound decision about the investment project, whether to build the port or not, it is important to assess the expected market benefits generated by the construction of the port and compare them with the negative impacts on the surrounding ecosystem in a cost-benefit framework.

The expected market benefits can be associated with changes in incoming and outgoing maritime traffic, the construction of new transport lines, as well as the development of industrial, commercial and residential infrastructures in the adjacent area (see Table 1).

Table 1: Annual market benefits and environmental costs.

Net market benefits per year (million, €2010)	
	543
Environmental costs per year (million, €2010)	
High impact	188
Medium impact	375
High impact	584

1. Note: for comparability, all costs and benefits are presented in €2010. Values for market benefits are net of investment costs.
2. Source: adapted from Chiabai et al (2013).

Total market benefits are then compared with the total environmental costs calculating the Net Present Value (NPV) of the investment project. This value is very dependent on the discount rate used.

In order to illustrate the application of the "equivalency principle", three different assumptions on the discount rate are hypothesized (Table 2). In a first instance, a market rate of 11% is assumed for both costs and benefits. In this case, the net present value would be positive, and the project would therefore be justified, only in the scenarios of lower and medium environmental impact (with a net present value of respectively 3.6 and 1.7 billion €2010). In the third scenario, however, the high expected impact would lead to a negative present value of -0.4 billion (€2010).

In the second example, costs and benefits are discounted using different rates: a 4% discount rate is applied for the environmental impacts, while the rate is kept at the market level of 11% for the benefits. In this case, the project would lead to a positive present value only under the first scenario, when the environmental impacts are expected to be the lowest.

Table 2: Net present value derived from building the seaport in the period 2010-2050, based on CBA (million, €2010; constant TEV flows and discount rate for market benefits 11%).

Discount rate applied to environmental costs	Net present value (B-C)		
	Lower environmental impact	Medium environmental impact	Higher environmental impact
11%	3550	1,674	-411
4%	1383	-2660	-7154,
3%	na	na	-9318
1.93%	na	-6008	na
0.96%	-1469	na	na

As a third example, we apply (for the environmental costs) the discount rates calculated following the rule of the "equivalency principle" in the case study area. The principle says that the present values of both developed and undeveloped land affected by the implementation of the project should be equivalent. This implies that the discount rate is computed by simply dividing the annual flows per hectare of benefits generated by the undeveloped land by the price per hectare of the developed land (see Chiabai et al, 2013 for more details). The latter is represented by the observed market price for residential and industrial land located in the port area and adjacent zones, with effects potentially expanding in all the administrative region of Gipuzkoa. For this reason, we use as a reference the price of residential and industrial land registered in the Gipuzkoa region.

The discount rates resulting from the application of this rule are relatively low (namely 0.96%, 1.93% and 3 % for low, medium and high impact respectively, assuming constant flows of benefits). The application of the proposed principle suggests also that the discount rates should be site specific, and their magnitude should differ spatially.

Going back to the cost-benefit analysis, in the third example the application of the rule would reveal a negative ratio in all three scenarios suggesting the rejection of the project even in the case of low environmental damage (Table 2).

IMPLICATIONS FOR POLICY

If sustainable use of natural resources is to be guaranteed, the discount rate to be applied in cost-benefit analysis for investment projects should follow a simple rule of equity, based on the fact that future generations would give to the natural land at least the same value given by present generations. This is what we showed in the case study for Jaizkibel. Appropriate selection of discount rate is vital for project evaluation. In our case study, the result of the analysis changed completely showing no economic rationality of such an investment.

The equivalency principle presents several advantages. The first is to simplify the discussion and avoid uncertainties in assumptions and estimations about the expected welfare of future generations and the long-term impacts of some decisions on land use changes. Secondly, the principle allows for a range of discount rates, whose magnitude depend on the total economic value of the natural resource (basically the willingness to pay of individuals) and the spatial location of the land. Good information should be at the very base of policy making and the equivalency principle contributes to it.

REFERENCES

Chiabai A, Galarraga I, Markandya A and Pascual U (2013) The Equivalency Principle for Discounting the Value of Natural Assets: An Application to an Investment Project in the Basque Coast, Environmental and Resource Economics 56, 4:535-550.

This Policy Briefing was written by Chiabai, Aline[1] and Galarraga, Ibon[1]. [1][BC3, Basque Centre for Climate Change], Alameda Urquijo 4, 48008 Bilbao
*. * Corresponding author address: aline.chiabai@bc3research.org*
Cited as: Chiabai, A. and Galarraga,I. (2014) Discounting the value of natural resources in cost-benefit analysis: A case study for policy making,BC3 Policy Briefing Series 01-2014. Basque Centre for Climate Change (BC3), Bilbao, Spain.
The BC3 Policy Briefing Series is edited by Aline Chiabai, Mikel González-Eguino and Unai Pascual.
BC3, Basque Centre for Climate Change, is a research institution based in the Basque Country directed by Prof. Anil Markandya. BC3 aims to contribute to long term research on the causes and consequences of climate change and provides policy-relevant analysis to address environmental challenges. The opinions expressed in this policy briefing are responsibility of the authors and do not necessarily reflect the position of Basque Centre for Climate Change (BC3).
The BC3 Policy Briefings are available on the internet at
http://www.bc3research.org/policybriefings
Enquiries regarding the BC3 Policy Briefings:
Email:mikel.gonzalez@bc3research.org

BASQUE CENTRE
FOR CLIMATE CHANGE
Klima Aldaketa Ikergai