ADAPT

Quantifying the costs and benefits associated with climate change risks and adaptation

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CCRP REPORT

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Executive Summary

Given the inevitability of some degree of climate change and the slow progress that is being made of reducing emissions of greenhouse gasses, the case for strategies of adaptation are receiving more attention at international level and in policy and guidance documents produced by the likes of the Intergovernmental Panel on Climate Change, the European Environmental Agency and the European Commission.

This report sets out the findings of the ADAPT Project. The objective of the project has been to examine the role that economic appraisal methods, including Cost Benefit Analysis (CBA), can play in the choice of adaptation options, and to make recommendations on possible approaches. The specific aims of the project have been to:

- Formulate methods to allow decision makers to choose between adaptation options in the face of climate and socio-economic uncertainty;
- Develop guidelines for the application of economic appraisal methods to adaptation choices;
- Test a decision support tool with a case study;
- Recommend how economic appraisal methods can be incorporated into adaptation frameworks.

This report describes current thinking with regard with climate projections and adaptation. It finds that climate modelling has come to acknowledge the considerable uncertainty attached to future projections. In this context, conventional methods of policy or project appraisal, including CBA, will continue to have a role, but within a wider framework of adaptive risk management.

Cost benefit analysis and climate change

CBA is routinely used in project appraisal and is recommended by the Department of Finance for projects in excess of €20 million. However, the application of CBA to climate change is challenging. This is mainly due to the high degree of uncertainty attached to future impacts. There is much uncertainty over the direction and rate of climate change. Uncertainty is also associated with human behavioural responses, socio-economic change, economic growth, rates of technological development and agreement on the mitigation of emissions. There are various ways in which climate modelling may choose to characterise or present this uncertainty. Much climate modelling has assumed that uncertainty can be reduced. A range of emissions 'storylines' may be referenced each of which rests upon certain assumptions with

regard to economic development and mitigation. To simplify the message for policy makers, scenarios have often been developed with reference to preferred or median climate projections. However, a reliance on these "single trajectory" models can actually obscure much of the uncertainty. Recent extreme weather events have indicated that low probability/high impact events could be an inherent feature of climate change in both the short and long term.

The most recent IPCC Working Group 1 report (2013) has attached qualitative statements of likelihood and expert confidence to climate projections. In independent models, probabilities are increasingly being allocated to impact projections. The role that both mitigation and adaptation can play in moderating climate impacts is also being acknowledged. However, significant uncertainty remains.

Cost benefit analysis and adaptation

Adaptation was once proposed on a predict-and-provide logic in response to climate scenarios. Now a more continual process is proposed that may call upon a variety of appraisal methods at different stages. Of these, CBA has many attributes. It compares costs and benefits in the same units, i.e. monetary units. It examines these costs and benefits from a societal perspective to decide whether or not a project can make a positive contribution to social welfare. It allows for approaches that can convert non-market social and environmental costs and benefits into monetary units so these are fully represented in the decision making process. In addition, CBA can be used to examine distributional factors and takes the lifespan of a project into account through the use of discounting.

The reliance on quantitative data means that values are not subjective and that the analysis can potentially be understood and replicated by others. Alternative methods such as multi-criteria analysis may seem more straightforward or transparent than CBA, but require clear definitions of the rationale used to apply particular weights or scores.

However, the quantitative data needed for CBA is not always available early in a process unless sufficient resources are made available for its collection as well as its proper interpretation and analysis. Furthermore, CBA can be applied where there are estimates of risk, but it is poorly equipped to account for uncertainty. Indeed, there is no single method available that excels in this area, although sensitivity analysis and computer-based simulation can be applied to particular variables.

Appraisal of adaptation options

In this report we describe how economic appraisal can be part of a wider framework of *adaptive risk management*. This provides a strategy whereby iterative steps allow for an understanding and interpretation of risk through learning and feedback. The report describes the various methods that are available to appraise adaptation options in this context at successive stages as information becomes available. .

There is a role for *robust adaptation* methods in this framework to identify why or where receptors or infrastructure is most vulnerable to climate change risk. Measures are sought which strengthen resilience and adaptive capacity. Where possible, initial measures should be no regret, low cost or win-win and provide benefits even in the context of familiar adverse weather events. These could include measures such as information exchange, early warning systems and incentives to householders and the private sector to take autonomous measures to increase their own resilience.

If projections of continued climate change persist, and it there is a risk of extreme events with significant consequences, then more fundamental measures will become necessary. The framework of adaptive risk management allows the adapting organisation to continually re-assess risk through stakeholder engagement, feedback loops and the collection of new information. In the initial phases, much of this information is likely to be qualitative. Methods such as cost-effectiveness analysis or multi-criteria analysis can be used to appraise adaptation options. However, as data is collected over time from the implementation of initial measures or commissioned studies, these methods can be complemented or succeeded by more quantitative approaches. Once evidence is forthcoming on the probability of climate impacts, on autonomous adaptation, distributional consequences and the value of impacts in non-market sectors, then economic appraisal becomes feasible. CBA is especially relevant where a project has social or environmental implications once the range of adaptation options has been narrowed down or if it is decided that a large project is needed.

Decision pathways are an extension to this process that pro-actively manage the impact of uncertainty. A distinction from the adaptive risk management framework is that a set of objectives for adaptation is identified from an early stage along with a range of possible adaptation options. The need to implement a particular option is triggered by the realisation of pre-determined climate indices. A pathways approach presumes more pre-planning that adaptive risk management, but the appraisal of options proceeds in a similar manner. The selection of some adaptation options may remove the prospect for other later options, but as

far as possible the route to adaptation remains flexible and responsive to new information on risks and impacts.

Recommendations

This report recommends that the appraisal of adaptation options should fall within a framework of continual adaptive risk management. Adaptation options should be selected according to principles of sustainability and aim to be robust to varying circumstances. This requires that decision makers begin by assessing their receptors' levels of vulnerability and resilience and then strengthen adaptive capacity by implementing low cost, no regret or win-win measures in the first instance where possible.

A pro-active approach is proposed in which adaptation objectives and climate thresholds are broadly agreed at the outset. Thereafter, adaptation proceeds using iterative steps, monitoring progress, collecting new information and re-assessing strategy using progressively more quantitative methods as experience grows and data is collected. Although most adaptation options will have been identified, the actual route to adaptation is subject to specific climatic triggers being realised. There is a clear role for economic appraisal, including CBA, to determine the viability of adaptation options and to address impacts of social and economic significance once this can be supported by sufficient information. Further research will be needed to provide guidance on impact types and adaptation responses based on applications to particular sectors in the public and private domain or at national or local level.

The key recommendations are to

- Implement an adaptive risk management framework for the progressive appraisal of adaptation options;
- Assess the vulnerability of receptors and implement robust adaptation measures to reduce this vulnerability and increase resilience;
- Select further robust adaptation measures which are resilient to changing circumstances, which begin with low cost measures that deliver win-win outputs where possible including resilience to more familiar climate events;
- Once the essential climate risks are understood, manage uncertainty through the adoption of decision pathways in which adaption measures and options are identified at an early stage along with the climatic indices that would trigger their implementation;
- Use progressively more sophisticated appraisal methods to determine the viability and effectiveness of these adaptation options beginning with more qualitative or score-based

approaches and culminating in more quantitative methods such as CBA where there are implications for social well-being.

- Undertake involved studies within government departments or agencies to quantify impacts and to appraise adaptation options using the framework proposed.