

REAL OPTIONS APPROACH TO VALUATION OF THE 'VOLUNTARY TARGETS' PROPOSAL

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1. OBJECTIVE

The aim of this research proposal is two fold. First, the research will help to reveal the deficiencies of the 'voluntary targets' (VT) proposal, which has been under consideration by the Conference of Parties to the Kyoto Protocol as a possible architecture of the post-2012 climate change mitigation regime, and to improve its implementation design. Second, we formulate a real option valuation (ROV) model of the VT proposal. The ROV model concedes the managerial flexibility embedded in the VT proposal for which the standard cost-benefit analysis is not suitable. This approach resolves the complex climate change mitigation problem at the firm and government level. This proposed work is the first part of a three-stage project that aims to address valuation, bargaining and strategic behaviour of the parties, and policy implementation of the VT proposal.

2. BACKGROUND

Soon after the Kyoto protocol was drafted, a series of research papers attempted to address one of its main deficiencies – lack of developing countries participation. A feasible architecture of a new climate change framework is the 'voluntary targets' (VT) proposal.

The theoretical foundation of this framework was laid in the paper by Philibert [3] and subsequently developed in [4]. The author argues that providing developing countries with 'non-binding targets' would ensure wider participation in climate change mitigation. More precisely, each developing country would be allocated an emission budget. At the end of the year, if a developing country's level of greenhouse gas emission exceeded the amount stipulated in the budget, the country is not obliged to purchase emission allowances from other countries to compensate for the deficit nor be subject to any penalty. On the other hand, if the country had a surplus of emission allowances, i.e., its emission level was lower than that stipulated by the budget, it can sell these emission permits in the international market. Since under this scheme developing countries are not obliged to decrease their greenhouse gas emissions but instead have the right to abate, which is supposed to have value, if the net present value from emission reduction is positive. The main advantage of this proposal is thus that developing countries would not risk their economic growth and development that are often positively correlated with greenhouse gas intensity of the economy. Evidently, however, providing developing countries with such right would mean a 'limited certainty [of] the global environmental outcome' [1]. Furthermore, 'non-binding targets' scheme may lead

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to a distortion at the international emission allowances market caused by an over-supply of emission permits. Viguier [5] addressed this problem by suggesting a ‘rent-sharing’ approach. The essence of this approach is that developing countries would be provided with the same right as under the ‘non-binding target’ proposal; however, a certain proportion of actual emission reductions would be withdrawn from the market. The proportion of the emission allowances withdrawn from the market would be determined in a way that would not cause a negative marginal welfare of the developing countries from emission reduction.

The existing research suggests the three stage convergence of the obligations of Annex I (developed) and non-Annex I (developing) countries:

- (1) Grace period – developing countries are assigned ‘non-binding targets’ and allowed to trade the positive balance thereof.
- (2) Rent sharing period – a certain proportion of emission credits produced by developing countries has to be completely withdrawn from the market.
- (3) Developing countries take on binding obligations within the existing Kyoto Protocol framework.

At the policy level, the proposed scheme (termed ‘voluntary targets’ (VT) proposal) has been recently put forth for discussion of the next (post-2012) commitment period of the Kyoto Protocol [2]. Although the main discussion thereof has revolved around the duration of each of the three stages, given the willingness of the developing countries to enlarge the grace period, the principal issue of how to measure the benefits and costs of the developing countries under the new regime has not been raised. Nonetheless, if the developed countries wish to secure a greater participation in the Protocol, they must be able to prove that this scheme is economically beneficial for firms in acceding countries.

3. RESEARCH PLAN AND METHODOLOGY

The research project is organised into three stages (see Figure 1). First, we develop a real option valuation (ROV) framework for the VT proposal. In Stage 2, we formulate a game-theoretic model that can address the bargaining aspects of the scheme. In Stage 3, we intend to design the policy and consider the implementation of the scheme.

This research proposal constitutes the first stage of the research project. Our goals here are to:

- (1) Demonstrate the shortcomings of the VT proposal and provide a solution to create incentives for industry and governments in Non-Annex I countries.
- (2) Formulate an alternative valuation framework to cost-benefit analysis.

Our preliminary findings suggest that the current design of the VT proposal fails to recognise the fact that it is firms that reduce emissions not the governments. The solution to this problem is to develop a financial instrument that would incentivise firms in non-Annex I countries to carry out emission reduction projects. The role of the governments in this instrument design is to intermediate between the capital markets and the firms by creating portfolios of emission reduction projects backed by the proceedings from the sale of emission credits produced by the firms.¹

¹If the critical mass is reached, this portfolio can be securitised. Alternatively, the governments will act as intermediary borrowers.

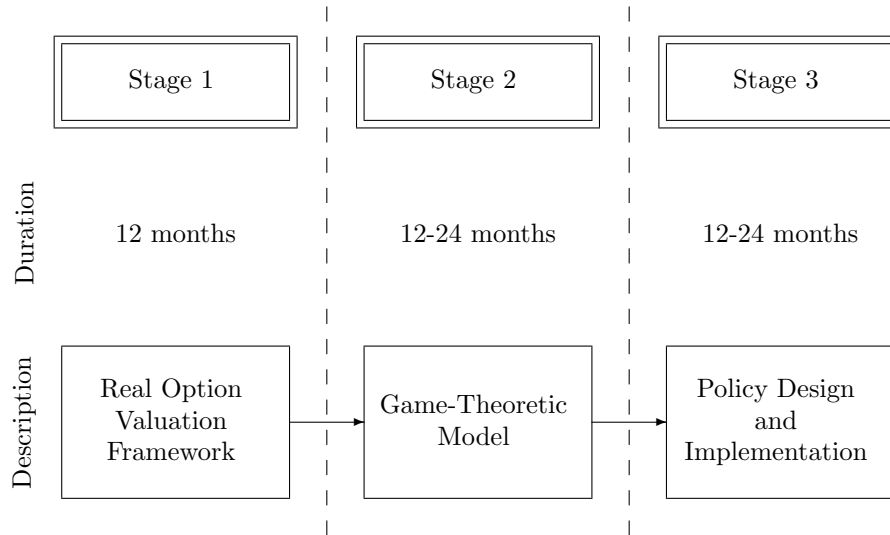


FIGURE 1. Research Plan

The ROV model we develop addresses the climate change mitigation problem at the micro-level and concedes the managerial flexibility embedded in the VT proposal. Formally, this flexibility is the option to upgrade the technology by individual firms. In valuing the options embedded in the ‘voluntary targets’ proposal we assume that the price of emission credits – one of the main factors determining the willingness of the firms in developing countries to engage in emission reduction – is the sum of short-term deviations and equilibrium price, where the former are assumed to revert to zero following an Ornstein-Uhlenbeck process and the latter is assumed to follow a Brownian motion process. The assumptions about the shapes of intra-sectoral marginal abatement cost functions are inferred from the data of the 4CMR,² the Cambridge Econometrics and the EBRD.³ Emission allowances prices and project-specific risks are inferred from the data by the IETA.⁴

4. CONTRIBUTION TO THE AREA OF FINANCE AND SUSTAINABILITY

Our results will help to demonstrate the potential for ROV models in environmental economics. It will provide the foundation for a formal framework for micro-level research in the post-2012 climate change mitigation systems. By demonstrating the deficiencies in the existing architecture of the VT proposal, we aim to improve the policy design and its implementation. The financial instruments proposed in our research will facilitate the abating firms’ access to capital markets, hence improve the cost-efficiency of the proposal.

REFERENCES

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²4CMR is the Cambridge Centre for Climate Change Mitigation Research.

³EBRD is the European Bank for Reconstruction and Development.

⁴IETA is the International Emission Trading Association.

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