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Dual discounting in climate change mitigation in the forest sector

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ABSTRACT

The efficiency of potential climate change mitigation is predicated on future costs and benefits and thus heavily influenced by the discount scheme. Dual discounting involves discounting carbon and monetary values differently; stand level modeling efforts show that it improves the profitability of afforestation projects. However, these stand level results may not hold across other age classes and stocking levels. Using a partial, spatial equilibrium model of the Norwegian forest sector, we analyze the impacts of a dual discounting scheme on climate change mitigation efforts. Dual discounting results in less mitigation efforts in the first decades but substantially higher long-term mitigation efforts.

Introduction

Climate change policy involves a long-term outlook. Terms such as intergenerational equity and sustainability are typically used to convey the need to maintain key ecosystem services over periods of more than a human lifetime. The choice of discount rate is central in such policy analyses due to its importance in long-term cost-benefit analyses. The basic rationale for discounting future costs and

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benefits ranges from alternative values of capital to individuals' preferences of consumption over time. However, as long-term climate change mitigation projects often fail the cost–benefit criterion when using standard discounting, alternative justifications for undertaking such projects exist (e.g. Cline, 1992; Arrow et al., 1996; Yang, 2003; Sáez and Requena, 2007; Almansa and Martínez-Paz, 2011; Kula and Evans, 2011).

Economists argue that the most cost-effective path to mitigate global warming is by assigning a global price on carbon emission, either through a cap-and-trade system (Keohane, 2009; Stavins, 2007) or carbon tax (Nordhaus, 2009). Either policy could be complemented by a carbon sequestration credits system that generates carbon offsets from e.g. forest management (Aldy and Stavins, 2012).

Simulating yields of carbon credits in an afforestation project, Kula and Evans (2011) suggest using a dual discounting approach where carbon payments are subject to a lower discount rate than monetary values. Lowering the discount rate turns the net present value of the case project positive. However, the result that additional resources should be allocated to climate change mitigation when discounting carbon less does not necessarily hold for all types of forestry carbon offset programs. Having initial forest carbon stocks may actually lead to opposite results with less short-run mitigation as the first periods' harvest may to a larger extent be offset by long-run carbon sequestration. The objective of this paper is to test the hypothesis that a lower discount rate on carbon leads to less climate change mitigation efforts in the short run. For that, we use a partial, spatial equilibrium model of the Norwegian forest sector which projects forest management, harvests, wood processing and consumption, trade and greenhouse gas (GHG) fluxes for the next decades. Contrary, we also test the hypothesis that a high discount rate on carbon leads to higher carbon emission abatement in the short run. We analyze the impacts of a carbon tax/subsidy applied to all estimated GHG fluxes in the sector converted into CO_2-equivalents for five discount rates on carbon payments: 8%, 6%, 4%, 2% and 0% p.a. using 4% p.a for monetary values in all cases. The hypothetical carbon price equals 12.50 €/tCO_2eq[1] reflecting European cap-and-trade prices in 2010–2011 (co2prices.eu, 2012). Carbon prices and discount rates are held constant over the modeling time horizon. The paper continues with a review of discount rates in climate policy analyses and in forest carbon offset models. The model used is then described in "Methods" section, while "Results" section emphasizes the contrasts of climate change mitigation efforts over time across different discount rates. The paper ends with a discussion and the conclusion summarizes the results.

Discounting in climate policy analyses

A discount rate is typically either based on the social time preference (STP) or the social opportunity costs (SOC), which in an economy with perfectly functioning capital markets and an absence of taxes would coincide (Pearce and Turner, 1990). The SOC reflects the productivity of capital and thus the alternative cost of resource allocation. Externalities, taxation, sub-optimal income distribution and imperfect information are arguments against the use of capital market rates in public cost–benefit analyses (Hepburn, 2007). The standard Ramsey STP function (see e.g. Cline, 1992) is composed of per capita economic growth (g), the elasticity of marginal utility of consumption (η) and the pure time preference (p) and equals $g \times \eta + p$. While η indicates the increase in utility of higher income, p expresses the "impatience" of individuals, i.e., that consumption today yields higher utility than future consumption.

The Stern Review of the Economics of Climate Change (Stern, 2006) and resulting debate illustrates the importance of the discount rate in climate policy analyses as well as disagreements among scientists on the appropriate rate. The Review advocated strong action on reducing GHG emissions soon. This conclusion followed from the calculated total costs of climate change if no action taken being at least 5% of per-capita consumption, but could be as high as 20% "now and forever" (Stern, 2006, p. x), contrasted to the costs of stabilizing the atmospheric CO_2 concentration on 550 ppm of about 1%

[1] Throughout the paper, tCO_2eq refers to metric tons of CO_2eq.