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Valuing greenhouse gases emissions and uncertainty in transport cost benefit analysis

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Abstract

The transport sector has an important and increasing role in greenhouse gases emissions, and cost benefit analysis (CBA) of transport projects should give in this regard accurate and objective information. Indeed, many countries have included this concern in their CBA guidelines, but it typically consists simply in adopting an official value per ton of carbon emitted. Does this mean that the issue is correctly treated by CBA? Since "the devil is in the details" this paper reviews key items influencing the quality of CO2 emission valuation, estimating the order of magnitude of their effects and taking into account the nature and degree of imprecision and uncertainty associated with them.

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Keywords: climate change; externality; emission valuation; uncertainty

1. Introduction

The transport sector has an important and increasing role in greenhouse gases (GHG) emissions: in France, it represents 34% of the national GHG emissions (13% in 1961), in OECD countries 27% (19% in 1961). Global climate change is a growing issue in the public debate, and cost benefit analysis (CBA) of transport projects should give in this regard accurate and objective information.

Indeed, many countries have included this concern in their CBA guidelines, but it typically consists simply in adopting an official value per ton of carbon emitted. Does this mean that the issue is correctly treated by CBA? Since

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"the devil is in the details" this paper reviews key items influencing the quality of CO2 emission valuation, illustrating the order of magnitude of their effects and taking into account the nature and degree of imprecision and uncertainty associated with them. In CBA, valuation of CO2 effects is represented by the product of a unit value and a physical quantity. After presenting some insights on the first item of this product, the paper focuses on the second one and on the uncertainties associated with it.

In section 2, after a rapid review on the issue of fixing a unit value for CO2 emissions which is supposed to capture also the uncertainties associated with the effects of a marginal ton of CO2 emitted, we discuss the relevance of the usual international comparisons on CO2 values and propose an indicator more appropriate for transport CBA comparisons. Section 3 then discusses the quality of estimation of the variations in physical CO2 quantities emitted due to a given transport project, using feedback from ex-post studies. Section 4 presents the methods proposed in France for dealing with risks and uncertainties in CBA, with a focus on systemic risks, i.e. the risks associated with the links between the benefits of an investment and economic growth. Section 5 develops risk treatment methods for CO2 issues and gives illustrations for several types of emission reduction projects. Section 6 concludes the article.

2. Unit value of CO2 emissions and transport project CBA

There are several ways for approaching the issue of carbon value. The first consists in determining the carbon cost which optimizes the level of carbon emissions, by means of cost-benefit analysis. It is consistent with the usual procedure for monetising environmental effects such as air pollution or noise under a Pigouvian approach (damage cost). It nevertheless involves difficulties.

On the technical level, those difficulties were reflected in the discussions around the Stern report (2006), which adopted that approach. The other kind of difficulty raised by a cost-benefit procedure has to do with the international nature of the CO2 externality. From the national point of view of most countries, the benefits derived from self-imposed CO2 emission constraints are very limited and would justify only very limited constraints, international coordination and assessment are more adapted for such a global issue.

The cost-effectiveness procedure followed by the French authorities (Quinet A. in year 2008 completed by Quinet E. in year 2013), which is aimed at determining the shadow carbon price enabling France to meet its CO2 emission commitments, does not present the difficulties mentioned above. It should be noted, moreover, that the French commitments largely cover European agreements on the matter and are much more demanding than the agreements concluded at world level. France is faced with three sets of major commitments: the Kyoto Protocol, Europe's commitments to reduce greenhouse gas emissions unilaterally by 20% from 1990 levels by 2020, or even by 30% in the event of greater international effort on climate objectives; and the perspectives announced by the French Government in the Planning Act of 13 July 2005 "Establishing Energy Policy Guidelines" (confirmed by a new law project issued in July 2014), which supports the objective of reducing developed countries' emissions to a quarter of their existing level by 2050.

In Quinet (2008), several evolution paths were considered after 2030. In 2013 the Quinet Commission identified one specific path for public investment assessment: after 2030 the projection rule should follow the Hotelling principle (growth of the carbon value equal to the discount rate). So as to give a more precise idea on the evolution of CO2 values in France, the first unit value for CO2 emissions in transport CBA was introduced in 1995. It was then worth 74€2000 (constant value). This value was updated in 2004, rising at 100€2000 with an annual increase of 3% to be applied from 2010 on. The newest values still begin at 100€2000 for the year 2010.

Thus, when we consider only the values to be applied for present emissions, it seems that nothing has changed much in CO2 valuation during the past twenty years: indeed, the unit value just increased by one third, rising from 74 to 100 euros per ton of carbon (values for emissions in 2010). But when combined with the rules adopted for carbon value's evolution, for the discount rate and for the time horizon considered in transport CBA, it translates in fact into a sharp increase of CO2 valuation's weight in net present value (NPV) estimates. To illustrate this, we consider the net present value of sparing one ton of carbon (with certainty) each year over the time horizon considered in CBA. We see from table 1 that the corresponding value, according to the 1995 guidelines, would be a little less than one thousand euros. The 2005 guidelines, adopting an initial value increased by one third, but also a lower discount rate (4% instead of 8% previously) and a dynamic relative price rule, ends up in multiplying by 4 this value, around 4 000 euros. Extending the time horizon to 140 years instead of 50 years, as is proposed for the new French guidelines and still using the same relative price rule would lead to another sharp increase, around 10 000 euros. And adopting the full recommendations for the new guidelines would almost double this amount. As a whole, it means that the final