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Do overarching mitigation objectives dominate transport-specific targets in the EU?

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HIGHLIGHTS

- ▸ We review the European Union's climate and transportation policy.
- ▸ We describe the IMACLIM-R model and how it represents transport.
- ▸ We develop an EU carbon pricing scenario that meets its aggregate CO_2 targets.
- ▸ This does not require meeting biofuel nor g/km 2010 to 2020 objectives.
- ▸ We conclude on the policy implications of this apparent inefficiency.

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ABSTRACT

This research investigates if the stringent 2020 and 2050 overarching CO_2 mitigation objectives set out by the European Union dominate its 2010 to 2020 targets specific to the transportation arena, specifically its biofuel penetration objectives and gram CO_2 *per* kilometre emission caps. Using a dynamic recursive general equilibrium model, IMACLIM-R, we demonstrate that these overarching targets do not dominate the interim transportation targets when the carbon policy triggering compliance with the mitigation objectives boils down to the theoretical least-cost option of uniform carbon pricing. Ground transportation is confirmed as quite insensitive to high carbon prices, even when such prices are applied over a long term. It is tempting to conclude that pursuing the mitigation objectives specific to transportation will impose unnecessary costs. However, because of the second best conditions prevailing in actual economies, and of the risk of lock-in in carbon intensive trajectories, we conclude with the urgent need for some ambitious transport-specific policy design research agenda.

1. Introduction

The European Union developed two important and related strategies concerning transportation and sustainability in 2001. The first, the White Paper on Transport, investigated the trends in transport for the coming decade and proposed a number of policy packages (Commission of the European Communities (CEC), 2001a). The second, the Sustainable Development Strategy (SDS), articulated, for the first time, an integrated EU policy on sustainability (Commission of the European Communities (CEC), 2001b). Recent reviews of both documents reaffirmed and extended the commitments of European policymakers in these areas. The White Paper on Transport was central to European policymaking in this area for the period up to 2010 and received considerable attention from policymakers and researchers alike. It has recently been replaced by a new strategy for the period up to 2020 (Commission of the European Communities (CEC), 2011a). However, relatively little academic focus has centred on the potential impacts of the SDS on transportation trends in the European Union. Its overriding environmental objective is to cap the increase in global temperature rise to 2 °C above pre-industrial levels by the end of this century. In order to achieve this goal, the European Union (EU) has committed itself to stringent interim targets in carbon dioxide (CO_2) emissions reductions by 2020 and 2050, respectively. The target is to reduce EU emissions by 20% compared to 1990 levels in the absence of any international agreement by 2020 and by 60 to 80% by 2050 (Council of the European Union (CEU), 2007). This 2050 target was subsequently raised to an 80 to 95% reduction objective in late 2009 through a European Council stated objective within the

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context of a broader international agreement (Directorate-General for Energy (DGE), 2011). More recently, the European Commission adopted its ''Energy Roadmap 2050'' as a basis for developing a long-term European energy use framework that also enshrines the 80–95 % target (Commission of the European Communities (CEC), 2011b). It is clear that the pursuit and achievement of these long term targets will, almost by necessity, impact on future trends in European transportation.

In this paper, we investigate the impact of these overarching carbon constraints on the more focused short-term transportation objectives outlined in the SDS. To do this, we project the state and trends of European transportation up to 2050 in a business-as-usual or reference scenario, and compare it to an ambitious carbon-pricing scenario that proxies for the 2020 and 2050 emissions targets, at least at their pre-2009 levels.[1] The reference and carbon-constrained scenarios are projections of the global dynamic recursive computable general equilibrium model IMACLIM-R. The model has specifically been developed by CIRED to guarantee a full consistency between macroeconomic and energy balances. Our purpose is to develop the above scenarios with the aim of exploring whether reaching both the interim 20% and the long-term 60–80 % reduction in CO_2 emissions by 2020 and 2050 through standard carbon pricing necessarily 'dominates', i.e., implies compliance with, other targets specifically related to the transport sphere outlined in the SDS—and develop a better understanding as to why it does or does not.

The outline of the paper is as follows: Section 1 presents some key transportation trends in the European Union as it stands, it also outlines some of the problems associated with transport, and investigates some of the key Europe-wide policy responses developed by policymakers. Section 2 briefly reviews the SDS, paying particular attention to its role in relation to transport. Section 3 presents an overview of the IMACLIM-R model and reports key assumptions and general results of the baseline and policy projections. Section 4 focuses on transport and tests the hypothesis outlined above. Finally, Section 5 concludes with some policy observations.

2. Transportation trends in the European Union

The growth in demand for road transportation in Europe has been rapid in recent decades. European policymakers turned towards analyzing and mitigating the negative impacts of these trends with the publication of the first White Paper on transportation in 1992. But by 2001, the number of cars in the EU had trebled over 1970 levels to almost 175 million and continued to grow by about 3 million cars a year at the turn of the century (Commission of the European Communities (CEC), 2001a). In tandem with this, personal mobility on the continent doubled (Commission of the European Communities (CEC), 2006) and increased by another 7% in the period up to 2008 (Commission of the European Communities (CEC), 2011c). As a result, between 1995 and 2004 road transportation grew by 19% for passenger cars and by 35% for freight movements (measured by passenger–kilometres and tonne–kilometres, respectively), continuing a long seen trend. Only with the economic crisis, beginning in 2008, did these trends slow (Commission of the European Communities (CEC), 2011c). The impact on Europe's oil consumption and emissions of greenhouse gases is significant. Transport accounts for over 30% of final energy consumption in the EU. By 2006 the road transportation sector accounted for 44% of total freight transport (tonne kilometres) and almost 85% of total passenger transport (passenger kilometres) (Commission of the European Communities (CEC), 2006). The White Paper Midterm Review (Commission of the European Communities (CEC), 2006) notes that the private car accounts for three-quarters of passenger transport while transport by bus and coach combined accounts for less than 10% (these latter modes have grown by a modest 5% over the last decade). As a result of such trends, private cars account for half of energy consumed by transport (European Environment Agency, 2012). Emissions from domestic transport contributed 21% of all CO_2 emissions in Europe—one of the fastest-growing sectors; such emissions grew by 23% over the period 1990 to 2010.[2] With road transportation heavily dependent on oil (it accounted for 67% of final European demand for oil in 2006 and by 2008, over 95% of energy use in road transportation was made up of gasoline and diesel (Commission of the European Communities (CEC), 2011c)), it alone accounted for almost 85% of CO_2 emissions from transport in 2006 (Commission of the European Communities (CEC), 2006). These trends have not changed markedly in the interim despite the economic crisis since 2008. They raised environmental concerns that, coupled with increased concerns about security of energy and institutional changes within the EU, have moved transportation towards the centre of the European policy agenda over the last two decades.

The European Commission has long recognised the economic costs of excessive growth in road transport demand (*cf.* e.g., Commission of the European Communities (CEC), 1992; Commission of the European Communities (CEC), 1993). It often results in congestion because of the public good nature of road space (Sterner, 2003). But the costs of road transport are not restricted to users of the infrastructure. Indeed, the external costs of road traffic congestion,[3] were projected to more than double from 0.5% of EU gross domestic product (GDP) in 2001 by the end of the decade (Commission of the European Communities (CEC), 2001a). The recently published White Paper (Commission of the European Communities (CEC), 2011a; Commission of the European Communities (CEC), 2011c) estimated that congestion costs would reach €200 billion *per annum* by 2050. The additional costs of road transportation also include accidents, road damage externalities and environmental costs. The latter costs consist of regional environmental effects (including barrier effects imposed by transportation infrastructure,[4] acidification and noise) and air pollution (with both local and global impacts). This point is especially relevant given the increase in transport-related greenhouse gases (GHG) emissions and previously stated broader European commitments to the Kyoto Protocol and other initiatives to reduce GHG emissions, exemplified by programs such as the European Union Emissions Trading Scheme. Partly as a result of increasing emissions from road transport sources (up by 2% since 1990; Commission of the European Communities (CEC),

[1] We restricted our analysis to the less extreme pre-2009 levels for the simple reason that the −80% threshold is barred by some of the technical asymptotes built in the current version of IMACLIM-R—which are meant to reflect the current state-of-the-art of bottom-up expertise on both intermediate and final energy consumptions. Clarke et al. (2009) provide a discussion of the reasons why extreme abatement targets cannot be achieved by models similar to IMACLIM-R (as the SGM model, which takes part to the study they report on).

[2] Road Transport: Reducing CO_2 emissions from vehicles, European Commission Climate Action: http://ec.europa.eu/clima/policies/transport/vehicles/index_en.htm

[3] Congestion occurs because the motorist's private marginal costs diverge from the cost he/she imposes on society. The externalities can manifest themselves as delays in business transactions, excess business and private time lost to congestion, etc.

[4] For instance: severance impacts on ecosystems or communities arising from the construction of a motorway.