Energy Policy 37 (2009) 3854–3862

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Energy policy in transport and transport policy

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ARTICLE INFO

Article history:
Received 15 April 2009
Accepted 15 July 2009
Available online 14 August 2009

Keywords:
Transport
Energy
External costs

ABSTRACT

Explanations for, and indirect evidence of, imperfections in the market for private passenger vehicle fuel economy suggest there is a reasonable case for combining fuel economy standards and fuel or carbon taxes to contribute to an energy policy that aims to reduce greenhouse gas emissions and improve energy security. Estimates of key elasticities, including the rebound effect, indicate that the positive and negative side-effects of fuel economy measures on transport activities and external costs are limited. However, an energy policy for transport does not replace a transport policy that aims to manage the main transport externalities including congestion and local pollution. Conventional marginal cost estimates and standard cost-benefit reasoning suggest that policies that address congestion and local pollution likely bring benefits at least as large as those from fuel economy measures. But the large uncertainty on the possible effects of greenhouse gas emissions constitutes a strong challenge for standard cost-benefit reasoning. Emerging results from methods to cope with this uncertainty suggest that policies to stimulate the widespread adoption of low-carbon technologies in transport are justified.

1. Introduction

Concerns about volatile and rising oil prices and about potentially very costly consequences of greenhouse gas emissions have fueled public debates about the need to manage energy consumption through policy interventions. Oil price changes in recent years highlight developed nations' reliance on oil imports, so that energy security is again a major policy concern. With respect to climate change, there is a growing political consensus that the expected costs justify action to reduce emissions of greenhouse gases. For both these reasons, the widely held view is that the prevailing pattern of energy consumption needs to change, although just how it needs to change is less clear. Since road passenger transport represents a large and growing share of overall emissions of CO_2 and an even larger share of oil consumption, it is routinely assumed that considerable further efforts to reduce transport energy consumption and emissions are required and justified to reach overall societal emission abatement targets, despite the fact that relatively strong policies to moderate transport energy consumption are already in place. This paper discusses some of the argumentation on this issue.

The first goal of this paper is to sketch the scope for cost-effective greenhouse gas abatement efforts in transport. Is requiring large efforts in transport in line with the principle that emissions should be reduced first where doing so is cheapest? Many studies on burden sharing have found that abatement costs are higher in transport than in other sectors, so that cost-effectiveness requires relatively modest efforts from transport (depending on the target, of course). This argument is challenged on the grounds that there are "imperfections" in private vehicle purchase decisions that lead to low investment in fuel economy. Many studies on burden sharing ignore these imperfections, and taking them into account may change results concerning the effort required from transport, in a cost-effectiveness framework. However, whether these imperfections constitute a market failure that leads to underinvestment in fuel economy compared to the efficient level is less obvious.

The problem of low willingness to pay for better fuel economy at least partly stems from consumers' reluctance to pay up front in return for uncertain reductions in fuel expenditures, and translates into limited incentives to improve fuel economy improvements on producers' part. Taking a cost-effectiveness view, fuel economy regulations are a reasonable way of handling this problem, as they reduce producers' uncertainty on what levels of fuel economy to provide on average. A binding standard directs producers towards deploying technological potential towards better fuel economy. Nevertheless, the standard may entail a loss of consumer surplus as alternative deployments of technological potential may generate greater consumer satisfaction.

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[1] Section 2.1 and parts of Section 2.2 of this paper build on JTRC (2008a), *The cost and effectiveness of policies to reduce vehicle emissions*, JTRC Discussion Paper 2008-9, ITF/OECD, Paris. Section 3 builds on Small and Van Dender (2007b), *Long-run trends in transport demand, fuel price elasticities and implications of the oil outlook for transport policy*, JTRC Working Paper 07-16, ITF/OECD, Paris. Thanks to David Greene, Peter Mackie, Chris Nash, Ken Small, Steve Perkins, and to participants at a seminar at the Institute of Transport Studies, University of Leeds, for their generous comments. The responsibility for views expressed in this article and for shortcomings and errors is mine.

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doi:10.1016/j.enpol.2009.07.008

The justification for a fuel economy standard is that it reduces uncertainty in the market for vehicle fuel economy. A standard then is a complement to fuel taxes and not a replacement. Fuel taxes are well suited to internalize externalities related to fuel consumption, and to a lesser extent those related to miles driven. High fuel taxes will also help manufacturers attain the fuel economy standard, as they narrow the gap between consumers' aspirations and the requirements of the standard. In addition, high fuel taxes provide an incentive for the development of alternative technologies, which will be needed if carbon emissions from transport are to fall drastically. The presence of a binding fuel economy standard itself increases the need for such an incentive, as the improved fuel economy makes conventional technology cheaper to use, which weakens the incentive to develop alternatives.

The second goal of the paper is to put energy policy in transportation in the broader context of transport policies to manage the main transport externalities. Policies to reduce transport energy use may increase or reduce transport activity, depending on the policy approach followed, but evidence suggests these effects are of limited magnitude. We argue that better management of transport externalities merits continuing attention, since the benefits of reducing the external costs of congestion and local air pollution are considerable. Estimates of average external costs suggest that mitigating driving-related externalities yield large benefits, exceeding those of better energy policy in transport. Distance based charges and congestion charges are useful components of a policy package to handle congestion and local air pollution.

We argue there is a reasonable case for fuel economy standards to correct imperfections in the market for vehicle fuel economy, and that there are external costs associated with vehicle use that justify charging policies. What would be the impact of policies that improve the efficiency of these markets as best as they can? Without providing a quantitative estimate, it is safe to say that a policy based on the available evidence concerning the expected damage caused by these market failures would reduce the growth rate of transport emissions of greenhouse gases, but would very likely not reduce them or even stabilize them. With respect to greenhouse gas emissions, this implies that the expected damage from greenhouse gas emissions used in the cost-benefit analysis leads to considerably lower abatement than contained in policy statements that call for drastic reductions of emissions, including those from transport.

We explore some reasons for this gap between political aspirations and the results from a standard analysis, focusing on the question whether the use of expected values of damage from externalities in cost-benefit analysis is appropriate. For externalities that are relatively well understood, such as congestion and local air pollution, the answer is yes. But for greenhouse gas emissions and climate change, the presence of large uncertainties may require a different approach. Within such an alternative approach, large uncertainty may lead to ambitious targets for greenhouse gas emission reductions. What would such targets imply for transport? Given that stabilization of global passenger transport emissions at 2010 levels requires a fuel economy of 3.5 l/100 km on average by 2050 under expected global growth of the vehicle stock and vehicle use (JTRC, 2008b), ambitious targets likely can only be met at reasonable cost through widespread adoption of low-carbon-intensity technologies. From this we conclude that the presence of strong uncertainty justifies efforts to develop further alternative technologies and bring them to the market. High fuel prices, through taxes or through high pre-tax prices, are an important incentive in this regard. Credible commitment to climate change targets, also in times of high oil prices, is another prerequisite. In addition, public support for research and development is useful when the social returns to innovation are larger than the private ones.

The structure of this paper is as follows. Section 2 discusses the cost of greenhouse gas emissions abatement in private road passenger transport, paying particular attention to decisions on fuel economy in the vehicle purchase market. In Section 3, we provide an overview of the interactions between energy policy in transport and policies to handle other transport externalities, and discuss externalities related to greenhouse gas emissions and to energy security in some detail. Section 4 concludes.

2. Cost-effective ways of reducing CO_2 emissions from road passenger transport

In deciding how to achieve an abatement target for greenhouse gas emissions, however determined, it makes sense to start with the cheapest abatement opportunities and select increasingly expensive options until the target is reached. Section 2.1 briefly reviews some attempts to provide empirical content for this least-cost principle from a general equilibrium perspective. Section 2.2 presents technology cost estimates suggesting that no regret fuel economy improvements are available in transport, discusses possible explanations for why such no regret options are not realized in the market, and how fuel economy standards can be expected to improve the market outcome at low cost. Fuel economy standards reduce the cost of driving so increase the demand for it (the rebound effect), and this affects the policy's economic cost. Section 2.3 reviews evidence on the rebound effect, concluding that is small enough that fuel economy standards are effective tools to reduce fuel consumption with limited impacts on other external costs of transport.

2.1. Comparing abatement costs across sectors

Applied general equilibrium models of various degree of detail have been used to obtain an economy-wide view of greenhouse gas abatement opportunities, their costs and their effects on emissions. These studies usually adopt the standard assumptions of the applied general equilibrium tradition, including perfect competition and constant returns to scale across the economy. For example, Proost (2008) discusses a study of burden sharing between sectors for Belgium, based on relative resource costs of the adoption of less emission-intensive technology and on losses in surplus resulting from cost increases. There is no permit trading among countries and nuclear power generation is assumed to be phased out by 2030 (a policy that may be reversed), leading to higher abatement costs in power generation. The study finds that the effort in the transport sector is very small for abatement targets of less than 10%, and stays well below the country-wide effort as targets become more stringent over time; see Table 1. Nearly all abatements in transport are realized through the adoption of alternative technologies (specifically, alternative fuels used in conventional engines), not through a reduction of transport activity of passenger car transport (which entails a loss of consumer surplus).[2]

According to this study, sectors should not be expected to contribute in proportion to their share in economy-wide emissions, as abatement costs may strongly differ between them. In

[2] These results partly depend on the assumption that the structure of transport prices does not change. Reforming transport prices to align them more closely with marginal social costs reduces transport activity and emissions, perhaps by some 10%. Since such a reform improves welfare (see Section 3), including this option in the set of feasible reforms would increase the optimal effort from the transport sector.