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A regression on climate policy: The European Commission's legislation to reduce CO_2 emissions from automobiles

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ABSTRACT

As part of its efforts to reach the targets of the Kyoto Protocol, in April 2009 the European Commission enacted new legislation to reduce the per-kilometer CO_2 emissions of newly registered automobiles. This paper critically assesses this legislation with respect to its economic and technological underpinnings. First, we argue that the reliance on targets based on per-kilometer emissions not only conceals the true cost of compliance and thereby stifles informed public discourse, but is also less cost-effective than alternative measures such as emissions trading. Second, the emission targets stipulated in this legislation are based on linear-regression methods that we demonstrate to be poorly justified and misleading. Using instead stochastic-frontier analysis, which is argued to more accurately reflect the industry's technological status quo, alternative targets are consequently proposed.

1. Introduction

Alongside electricity generation, the transport sector constitutes the largest source of greenhouse gas emissions in the industrialized world. In 2005, this sector was responsible for 20% of the European Union's CO_2 emissions (EEA, 2007, p. 64), roughly three fifths of which can be attributed to private automobiles (COM, 2007b, p. 2). While emissions have decreased in sectors such as industry and agriculture, both dropping by 11% between 1990 and 2005, road traffic is one of the few sectors in the EU-15 in which emissions have increased, rising by 26% over the same period (EEA, 2007, p. 65).[1] This trend threatens to thwart efforts to achieve the targets of the Kyoto Protocol, under which the EU[2] is to reduce greenhouse gases by 8% relative to the 1990 level between 2008 and 2012.

To maintain climate protection policy on track, the European Commission enacted new legislation under the auspices of Regulation No. 443/2009 to reduce the per-kilometer CO_2 discharge of newly registered automobiles. This regulation, which includes legally codified targets for the maximum allowable CO_2 emissions, is motivated by two principal considerations. The first is that the transport sector has thus far not been integrated into the EU's greenhouse gas Emissions Trading Scheme (ETS), which commenced operation in 2005 as the largest multi-country certificate trading scheme worldwide.

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[1] The increase in emissions from the transport sector is attributable to several factors, including increases in vehicle kilometers traveled and growing rates of automobile ownership. In 1990, for example, there were 355 vehicles per 1000 residents in the EU, a figure that increased by 31% to 465 vehicles by 2003. The growth in the number of newly registered cars in the EU over this time interval reached 36%, rising from 156 to 212 million (COM, 2007a, p. 5).

[2] The EU-15 refers to the 15 original Member States of the European Union. We use the term EU to refer to the enlarged union, which includes the EU-15 countries in addition to the 12 new Member States.

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Second, it is now clear that the voluntary commitment of the European Automobile Manufacturer's Association (ACEA) to reduce average emissions to 140 g CO_2/km by 2008, negotiated with the Commission in 1998, has not been met.

The core of this new legislation is the so-called *limit value curve*, relating the vehicle mass to a corresponding CO_2 emission limit. A key implication following from this curve is that the emission reduction required of heavy vehicles is disproportionately higher than the reduction requirements of light vehicles. This legislation has been met with vigorous opposition ever since its first draft was published in December 2007.

In this paper, we explore the scientific basis of this legislation from both an economic and statistical angle. Given the EU's definitive decision on the use of efficiency standards as an attempt to lower emissions, our aim here is an incidence analysis, rather than a thorough comparison of diverse policy instruments from an economic welfare perspective. This is because it is well-known from economic textbooks that instruments such as taxes and emissions trading are generally superior to mandated standards with respect to economic efficiency (Kolstad, 2000, p. 145). In fact, as Frondel and Vance (2009) show both theoretically and empirically, mandates actually undermine the effectiveness of taxation by reducing the per-kilometer cost of driving. With respect to statistical considerations, we argue that while the Commission's limit value curve is based on linear-regression methods, a stochastic-frontier approach appears to be more appropriate, because front runner manufacturers are relatively more important for the determination of the technological frontier.

The following section begins with an overview of the Commission's legislation, subsequently focusing on its economic implications for the highly differentiated automobile market as well as on its cost-effectiveness in reducing emissions relative to the ETS. Section 3 scrutinizes key assumptions underpinning the approach, finding that these misrepresent the current state of automotive technology and therefore may overestimate the feasibility of achieving the stipulated emissions targets. In Section 4, alternative reduction targets, based on stochastic-frontier analysis, are proposed that are argued to more accurately reflect the industry's technological evolution to date. The last section summarizes and concludes.

2. The commission's legislation and its economic valuation

The Commission has taken an offensive posture in formulating policies that aim at mitigating the role of human agency in climate change (COM, 2007a). The stabilization and, ultimately, reduction of greenhouse gases in the EU is regarded to be a cornerstone of this effort. By 2004, however, greenhouse gas emissions in the EU-15 decreased by only 1.5% relative to the base year 1990, a modest achievement with respect to the EU's Kyoto target of an 8% reduction by 2012 (EEA, 2007, p. 24). Much is riding on the success of the Emissions Trading Scheme (ETS) in realizing this goal. This instrument was introduced in 2005 as a centerpiece of climate policy, and is considered in the environmental economics literature to be an economically efficient means of effectively reducing emissions (Baumol and Oates, 1971, p. 47).

Among the participants of the ETS are electricity producers and the energy-intensive industry branches. Road transport is not included. Rather than pursuing the integration of this sector, as is stipulated for air traffic, the Commission set technological standards for reducing the CO_2 emissions of automobiles. This legislation falls under a more general strategy for the reduction of CO_2 emissions from road traffic that is based on three pillars: (i) voluntary commitments of the associations of European, Japanese, and Korean auto manufacturers, (ii) guidelines on labeling and the provision of information to consumers, and (iii) tax measures favoring vehicles that have light fuel requirements. After reviewing the strategy in 2007, the Commission concluded that without additional policy measures, the original goal of 120 g CO_2/km by 2012 could not be reached (COM, 2007a, p. 8). The prevailing view is that these three pillars should now be complemented by legislative limits on CO_2 emissions from newly registered vehicles, which are to be enforced with the threat of penalty payments for non-compliance (COM, 2007b, p. 21).

In April 2009, the Commission enacted new legislation in form of Regulation No. 443/2009 that allows maximum per-kilometer CO_2 discharges to increase with the mass of vehicles. The core of this legislation is the so-called limit value curve, whose slope is such that manufacturers of heavier vehicles must achieve higher percentage reductions in emissions than manufacturers of lighter vehicles. The limit value curve remained unchanged despite vigorous political opposition in the aftermath of its publication in December 2007. The curve is given by the following linear equation (COM, 2007b, p. 26):

$$E_{CO_2} = 130 + 0.0457(M - 1289), \tag{1}$$

where M denotes the vehicle mass in kilograms and E_{CO_2} designates the allowed emissions in grams per kilometer. According to Eq. (1), the CO_2 discharge of a new car with a mass of 1289 kg, which is nearly identical to the sales-weighted average of 1288.8 kg of 2006 (COM, 2007c, p. 5), must be reduced to 130 g CO_2/km by 2012.

A convincing justification for the shape of this curve, reproduced in Fig. 1, has regrettably been absent from the Commission's public communications. In particular, the slope of 0.0457 of the limit value cuvre is a critical parameter that remains largely unmotivated and seemingly arbitrary, despite an extensive addendum to the Commission's approach that was published in January 2008 (COM, 2008a). From a public welfare perspective, however, it is of immediate relevance whether the limit value curve reflects the future state of technological development and is thereby among the most cost-effective means of reaching the emission targets.

Of equal relevance are the likely market impacts. It is reasonable to assume that the limits on per-km emissions will have varying effects on the highly differentiated market segments of the automobile industry, so that the competitive position of individual manufacturers will necessarily change relative to the current market equilibrium. Manufacturers situated in market segments in which the specified emissions are relatively difficult to attain will incur higher compliance cost than other