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THE EFFECT OF STANDARDS AND FUEL PRICES ON AUTOMOBILE FUEL ECONOMY: AN INTERNATIONAL ANALYSIS

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Overview

The share of transportation in total energy consumption and greenhouse gas (GHG) emissions is increasing, particularly in OECD countries, because of continuous growth in total vehicle kilometers traveled and stagnancy in automobile energy efficiency. In the European Union (EU), for example, the transport sector almost cancels out other attempts to meet the 8% GHG reduction target under the Kyoto protocol. With the exception of biofuels, other fuel/engine combinations are still not mature for mass production, and even commercially available hybrid powertrains are experiencing quite slow penetration rates. It therefore becomes imperative for OECD countries, if they are to ensure progress in limiting GHG emissions and meet their Kyoto commitments (where applicable), to succeed in improving the fuel economy (FE) of conventional gasoline- and diesel-fueled passenger cars.

One way to raise the fuel efficiency of new cars is through FE standards, either mandatory or as a voluntary commitment of the automotive industry. A second way is to increase fuel taxation in order to induce purchases of more efficient cars and discourage private car travel. Mandatory fuel economy standards have been in force in the U.S. since 1978 (although, with a small exception for light duty trucks, they have not been tightened after 1990). Other countries followed later, and currently Canada, Australia, Japan, the EU, Switzerland, China, Taiwan and South Korea have implemented mandatory or voluntary standards.

The adoption of standards has induced fuel economy improvements, or at least it has ensured that fuel economy of new cars will not deteriorate despite consumer preferences for extra energy-consuming amenities and safety features. However, there are voices in the U.S. (where most of the experience has been gathered) arguing against standards and favoring increases in fuel taxes instead. The reservations range from doubts whether the current type of Corporate Average Fuel Economy (CAFE) standards are appropriate (e.g. NRC, 2002) to rejection of the idea of any type of standard whatsoever (e.g. Kleit, 2004).

The aim of this paper is to analyze the impact of FE standards and fuel prices in new car fuel economy with the aid of time series analysis of data from several countries worldwide. Similar work was previously presented by Espey (1996), but with data up to 1990. At that time, only the U.S. had FE standards and even these standards correlated closely with the time trend because standards had been rising fairly steadily until 1990. Therefore the impact of the FE standard in that work could not be separated from the overall time trend. A paper with the same rationale (but different methodology) was that of Greene (1990), who simulated the manufacturers' decision making process and concluded that FE standards played a greater role than fuel prices in improving new car FE levels in the U.S. However, data came from the U.S. only and, as in Espey (1996), involved a period of rising standards only. Thus this paper extends previous analyses by including recent data from several world regions and putting the results in the context of current policy discussions worldwide.

Methods

We estimated a log-linear equation with new-car FE as the dependent variable and the following explanatory variables: FE standard, real gasoline price (with lags of 0 to –3), and a time trend to capture autonomous technical progress and changing consumer awareness. Data were obtained from official sources such as the U.S. EPA, the IEA and the European Commission, covering the U.S. (cars and trucks), Canada (cars and trucks), Australia, Japan, Switzerland and 13 EU countries, thus building an unbalanced panel of 279 observations. For

Japan and some EU countries, we employed Chow tests to test for the existence of a structural break between two periods: one for the years up to 1995 (approximately the time of adoption of the first FE target values in both Japan and the EU), and one for the post-1995 'with standards' period. For all those countries, the hypothesis of no break was clearly rejected. Hence we continued the analysis with two distinct parts of our panel:

a. the 'with standard' data (238 observations), which comprise effectively all observations from the U.S., Canada and Australia and the post-1995 data for Europe and Japan and
b. the 'pre-standard' data (41 observ.), containing the pre-1995 data for Germany, France, Sweden, the UK, Japan.

For each sample we ran regressions using the above mentioned variables through pooled least squares with country fixed effects.

Results

In both samples, only one price variable was found to be statistically significant, that of lag 1. Estimated coefficients (i.e. 'elasticities') for the 'with standards' panel were approximately 0.7 for FE standards, -0.1 for price and -0.002 for the time trend and were all significant.

Using the 'pre-standard' sample of 41 observations with lagged gasoline price and time trend as regressors, we estimated statistically significant coefficients of –0.3 and –0.007 respectively.

Then we selected those countries for which both pre- and post-standard observations were available. Running the same regression for these countries and the whole period (pre- and post-standard – 83 observations), the price and time trend coefficients were almost the same as previously (–0.3 and –0.008 respectively). In all estimations, heteroskedasticity and serial correlation consistent standard errors were calculated.

Conclusions

The results presented in this paper have significant policy implications in view of intense discussion as regards the future of FE standards worldwide.

Firstly, estimations with the 'with standards' sample help to address the following question: If there is a certain FE target for the future (as currently discussed e.g. in the EU for the year 2012 or beyond), how much should fuel prices be raised in order to achieve this result without resorting to further voluntary or mandatory FE standards. The paper discusses this issue with the aid of concrete examples from Europe and the U.S.

Secondly, the comparison of pre- and post-standard regressions might serve as an answer to another important policy question: How might fuel consumption evolve without further standards and at today's fuel prices? This is a very relevant issue as several European long-term energy/transport models assume that automobile fuel economy will continue to improve at fast rates (similar to those observed in Europe between 1995 and 2003) even without post-2010 FE regulations (see e.g. the review of Zachariadis, 2006). Results shown here provide an indication that, regardless of whether there are FE standards or not, price elasticity and the rate of autonomous technical progress do not change considerably. In other words, without stricter FE standards and at fuel prices around or below $40 (in 2004 prices) per barrel (in line with the IEA's predictions for the 2010–2030 period – IEA, 2005), one could expect only minor FE improvements between 2010 and 2020.

Still, the analysis shown here cannot help to draw conclusions on the cost-effectiveness and the welfare impact of alternative policy paths (e.g. raising FE standards vs. increasing fuel taxes). The paper mentions some important results from such studies carried out in the U.S. (e.g. Goldberg, 1998; Greene and Liu, 1988; Kleit 2004) and outlines elements of future work that could expand this analysis in Europe and Japan.