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Energy Efficiency and Rebound Effect in European Road Freight Transport

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The depletion of fossil fuels and the environmental damage generated by its use have led to the application of policies that aim to diminish fuel consumption. These policies set out to promote energy efficiency enhancement as primary means for tackling the environmental and energy issues. This has been especially acute for the case of energy intensive sectors such as transportation. For the case of road freight transport in the European Union (where transport accounts for 25% of total energy-related GHG emissions) the objectives have been to reduce GHG emissions by 80-95% below the 1990 levels by 2050. However, the European Commission recognises that the specific targets for the transport sector should be adjusted downwards to 60% due to the complexity of the sector, which means that the initial objectives will not be easily achieved. Nevertheless, the development and deployment of new and more efficient technologies is still considered as the main strategy to deal with the energy and environmental problems from transport.

One issue that has been frequently overlooked when these policies have been designed is the existence of the so-called rebound effect. In its most basic definition, the concept describes the reaction that may occur when there is an energy efficiency enhancement. The improvement implies a reduction in the implicit marginal cost of providing a specific energy service and hence may lead to an increase in the demand of that service. This response is related to an increase in energy consumption that can partially or totally offset the expected gains that should be direct consequence from the energy efficiency improvement.

This idea has frequently been debated in the academic literature, where diverse definitions and approaches have been used to identify and measure this behaviour. Due to the heterogeneity among the definitions, empirical strategies, sectors and countries analysed, a broad variety of results have been obtained. In the case of

transport, the values range between 10 and 30%, which means that a non-contemptible portion of the expected savings are not achieved because of this type of reaction. However, there is scarce empirical studies that analyse the rebound effect for the case of road freight transport despite the potential relevance of this phenomenon for this particular sector. Ignoring rebound effects can lead to overstating the benefits of some policy measures, which in turn can facilitate making wrong decisions such as the (over)allocation of public funds to ineffective environmental and energy policies. Therefore, policy makers may need to take rebound effect into consideration for air quality, energy security, and climate change policy reasons.

In this paper we analyse the energy efficiency and the rebound effects for road freight transport in 15 European countries during the 1992-2012 period. We use a recently proposed methodology based on the application of a stochastic frontier analysis approach to estimate an energy demand function. This procedure allows us to study the influence of potential determinants of the rebound effect in the sector. We show that the weight of the road freight transport with respect to railway, the share of trucks with respect to the total number of vehicles in the sector and the quality of logistics in the countries have an incremental effect on the rebound effect.

Our results also show on average a fuel efficiency of 90.9% and a rebound effect of 17.6% for the countries and the period analysed. Moreover, for some countries, the rebound effect reaches non-negligible values (up to 61.6%) which seem to justify the application of specific policies aimed to reduce rebound effect and not only enhancing energy efficiency. Overall, we obtain large rebound effects for the countries that are more fuel efficient (e.g., Austria, Germany or Netherlands) and low rebound effects for less fuel efficient countries (e.g., Italy or Spain).

Finally, we examine through a simulation exercise that even in countries that exhibit low levels of rebound effect, the unexpected environmental impact after an efficiency improvement can be significant due to the magnitude of the transport activity and/or the marginal cost of the externalities in those countries. In summary, the rebound effect looks to be not a minor issue and thus it is worthwhile to consider specific policies that ideally should be combined with adequate price signals in the sector, the promotion of intermodality and the provision of alternative and environmentally friendly means of transport.

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