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MACROECONOMIC ASSESSMENT OF VEHICLE CARBON POLICIES USING A TRANSPORT CGE-MODEL FOR GERMANY

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Overview:

The transport sector is a significant contributor to EU greenhouse gas emissions and therefore in focus of substantial climate policy regulation in Germany and the EU. Transport is responsible for around a quarter of EU greenhouse gas emissions making it the second biggest greenhouse gas emitting sector after energy. More than two thirds of transport-related greenhouse gas emissions are from road transport, which makes up one-fifth of the EU's total emissions of carbon dioxide (CO₂). Passenger cars alone are responsible for around 12%. While emissions from other sectors are generally falling, those from road transport have continued to increase since 1990. In this regard, the EU has adopted a comprehensive strategy to reduce CO₂ emissions from new passenger cars sold in the EU. The overall objective is to reduce the average emissions of the new car fleet to 120 g CO₂/km. Due to its mobile and local emissions, the transport sector is difficult to regulate within an emissions trading scheme, as is done in the energy sector, i.e. mainly electricity generation. As the major regulatory measure, the EU therefore focuses on CO₂ emissions standards for new passenger cars. The Regulation (EC) No. 443/2009 sets the average CO₂ emissions for new passenger cars at 130 g CO₂/km, by means of improvement in vehicle motor technology. A further reduction of 10 g CO₂/km, or equivalent if technically necessary, is to be delivered by other technological improvements and by an increased use of sustainable biofuels. Although not mandatory, several Member States have amended their car taxation schemes and introduced a CO₂-related element to complement the emissions standards for passenger car production by more use-related instruments such as differentiated car end energy taxes. In this regard, Germany has implemented a CO₂-oriented vehicle tax, which tackles car ownership. It consists of two parts, (a) a fee for the cubic capacity of the vehicle (2€ per 100 ccm) and (b) a fee for its CO₂ emissions (2€ for each g/km above 120 g/km). Both supply-side and demand-side approaches are supposed to contribute to the reduction of CO₂ emissions from passenger cars by influencing consumer choice and behavior via the costs of purchasing and operating a vehicle. From an economic point of view, however, it is disputable whether mandatory standards are advisable, since they do not allow equal marginal abatement cost of carbon across the economy, i.e. they do not implement carbon reduction at lowest cost. Furthermore, the challenge in designing an appropriate CO₂-oriented vehicle tax lies in the definition of the underlying tax rate. Setting such vehicle carbon policies also yields uncertainties regarding their macroeconomic consequences, i.e. concerning the competitiveness of manufacturers, the direct and indirect costs imposed on business and the benefits that accrue in terms of stimulating innovation and reducing energy consumption. In this paper we quantify the macroeconomic implications of these carbon policies. Two main questions drive our analysis: (1) which mechanisms do these policies trigger in transport demand? (2) How do these policies perform in terms of macroeconomic cost efficiency?

Method:

To assess transport demand and cost efficiency simultaneously we develop a static small open economy Computable General Equilibrium (CGE) model for Germany which entails a detailed disaggregation of the transport sector. CGE models represent the interactions of economic agents on markets in terms of price-induced production and consumption decisions. Due to their total-analytic framework, CGE models are especially suited to capture feedback effects between one agent (or sector) and the rest of the economy. In our model consumers can satisfy their transport demand by choosing between different transportation modes, i.e. public modes and private cars. Public transport distinguishes air, rail and local public transport. Private car technologies are differentiated by engine size and fuel used. Furthermore, we distinguish between committed and supplementary mileage of cars. The approach is based on the assumption that buying an automobile implies a certain minimum of kilometers driven per year. Consequently, the committed mileage is characterized by the rental cost for the car and the variable cost implied by minimum kilometers driven. In addition, it is possible to drive more kilometers – the supplementary mileage – which are only characterized by variable cost. Committed mileage therefore makes use of the vehicle stock which combines existing cars and new car purchases. This takes into account the durable goods characteristics of vehicles as input into the production of private transport. The CO₂ oriented vehicle tax is implemented as a circulation tax on the vehicle stock. Efficiency standards are modeled as a

separate good which constitutes a joint output and additional input in vehicle production both at the same, varying in the degree of the CO₂ performance of each car technology. Whereas the tax affects the costs of owning a car, standards affect the costs of producing it and therefore influence the vehicle price. Both policies influence the consumer's decision on how to satisfy transport needs.

Results:

Having implemented the vehicle carbon policies into the model, we conduct scenario analyses, varying different tax rates for different vehicle sizes and fuels, in line with the imposition of the emissions standards. As a result, the model calculates the changes in macroeconomic aggregates and welfare due to the imposition of vehicle based carbon policies. Furthermore, due to the disaggregated representation of private transport alternatives and car technologies, the model also determines the change in the modal split of private transport as well as the composition of the vehicle fleet.

Conclusion:

This indicative numbers are used to assess the consequences of the carbon efficiency standards as well as the increased vehicle tax in order to gain more insights into the rational of these policies.