How much should gasoline be taxed when electric vehicles conquer the market?

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Externalities from gasoline combustion encompass the impacts from emissions of several 'local' air pollutants such as carbon monoxide and of carbon dioxide influencing global warming. Further externalities are directly related to vehicle mileage - as opposed to the combustion of fuel - such as congestion, accidents and noise. The various traffic related externalities provide a potential rationale for public policy aimed at reducing travel demand or, more specifically, the consumption of gasoline and vehicle mileage of private passenger cars. Economic market-based instruments such as gasoline taxes are approved instruments to achieve such goals (Sterner, 2007) and, in addition, to generate a significant share of tax revenue in a relatively efficient way due to the inelastic response of gasoline demand and vehicle mileage with respect to gasoline prices. The taxation of gasoline is characterized by great variability across different countries and recent research has analyzed existing fuel/gasoline tax levels from an economic efficiency point of view (De Borger and Mayeres, 2007; Lin and Prince, 2009; Mayeres and Proost, 2001, 2013; Parry, 2011; Parry and Small, 2005; Parry and Timilsina, 2009; West and Williams, 2007; to name only a few).

However, the composition of the passenger car fleet will be subject to fundamental changes in the near future due to the emergence of electric mobility. Electric Vehicles (EVs) are seen as a major contribution to sustainable mobility and several countries set targets for the number of EVs to be reached. For example, the German federal government pursues the strategy of achieving one million EVs by 2020. In this case, the diffusion of EVs might call for readjusting previously determined optimal gasoline tax levels for at least two main reasons: first, there are significant differences with respect to traffic related marginal external costs caused by EVs compared with conventional fuel-powered cars and, second, on account of differential tax treatment among car types (fuel vs. electric power), increases in fuel taxes may exacerbate the distortions created by other taxes in the economy.

Against this background there is an astonishing lack of information on how to efficiently adjust gasoline taxes under emerging electric mobility. This paper contributes to the discussion on optimal fuel taxes by examining the structure and level of (second-best) optimal gasoline taxes in the presence of electric mobility. First, the optimal (nationwide) gasoline tax is analytically derived allowing for fuel price change induced substitution between conventional fuel-powered gasoline and diesel cars as well as EVs while accounting for the interaction of the gasoline tax with broader fiscal system. Second, the model is applied to Germany using empirical evidence especially on marginal external costs of different car types, transport related characteristics and behavioral responses of car drivers to changes in e.g. fuel prices.

Under a wide range of scenarios regarding market diffusion of EVs and behavioral responses of car drivers with respect to fuel price changes, the present analyses suggest need for a mild downward adjustment of the gasoline tax provided that the benchmark is the (nationwide) optimal gasoline tax which arises out of the today's situation where the share of EVs on the passenger car fleet is negligible. Nonetheless, compared with the current (non-optimal) gasoline tax level amounting to 0.65 €/liter in Germany, on
efficiency grounds the gasoline tax should be increased considerably even with strong diffusion of the passenger car fleet with EVs.

References:


