

Effectiveness of Car Fuel Taxes in Europe

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Overview

The use of light and heavy duty vehicles accounts together for around 21% of the European Union's CO₂ emissions. Given the non-negligible fraction of road transport emissions the European Union (EU) has to reduce the CO₂ emissions from vehicles to reach its climate goals. The instruments chosen to curb these emissions are binding targets for the average emission of a manufacturer's car fleet and price mechanisms like excise taxes on fuel consumption. The effectiveness of command and control mechanisms like binding targets is predetermined by definition and therefore does not need any further analysis. However, the effectiveness of car fuel taxes is anything but predetermined or easily predictable. In this article we try to come up with an estimation of the effectiveness of car fuel taxes in Europe. We will do so by estimating consumer's quantity reaction on price changes.

Estimating the reaction of car fuel consumers to changes in price has been researched heavily in the past. One of the latest examples in this literature is Hughes et al (2008). They investigate a change in price elasticities over time and state short run price elasticities for the 1970s and the first decade of the 21st century. Whereas the estimations for the short run price elasticity in the 1970 are with -0.34 of medium size according to the meta-analysis by Brons et al (2008) Hughes et al find very low price elasticities of about -0.077 for the recent past. Two more recent articles by Davis and Kilian (2011) and Li et al (2012) improved on the previous gasoline demand estimation literature in two respects. First they address the possible endogeneity of the price in the estimation of gasoline demand which can lead to a biased estimator due to the simultaneity of price and demand. Second Davis and Kilian were the first who distinguished between net of tax price and tax impacts on the consumption behaviour.

Both Davis and Kilian (2011) and Li et al (2012) accommodate the price endogeneity by instrumenting the price with a term including gasoline taxes and the crude oil price. Thereby they simultaneously tackle the second caveat in the existing literature – the assumption of an equal impact of the net price and the tax on the consumption behaviour. It turns out that their estimates of the tax elasticity are at least twice what their estimates of the price elasticities are.

Methods

Our aim is to re-study the question of how consumers react to price and excise tax changes using a unique data set including 11 European countries. This data set includes also data on diesel consumption in addition to gasoline, since diesel plays a more significant role in Europe. Our panel covers the period between 1990 and 2012 on a monthly basis. By including lags and leads in our analysis we find an anticipation and a catch up effect.

Results

In our preferred specification we also find that consumers reduce their consumption relative to the previous month when the excise tax is increased. Our effect is even stronger than in the previous literature, namely -0.82% in the case of gasoline consumption and -1.00% in the case of diesel consumption, both for a 1% tax increase. However, we also find that consumers anticipate the increase in the unit tax by increasing the consumption in the previous month as well as returning back to the old consumption behaviour in the month following the tax change. This anticipation effect in the month before the tax change and the catch up effect in the month after the tax change dampens the overall tax effect. Ignoring these two effects, especially the anticipation effect leads to an overestimation of the tax effect. Our results show that this pattern can more strongly be observed in the case of diesel consumption than in the case of gasoline.

Conclusions

To estimate the effectiveness of fuel taxes correctly it is important to control for consumer's intertemporal purchase shifting due to the anticipation of tax changes. By omitting the anticipation effect the tax effect is overestimated. The results for Europe are in the same ballpark as the results for the US despite the higher tax level in Europe. We therefore support the notion that tax price and tax elasticities are rather constant.

References

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