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Distributional Effects of the German Biofuel Quota

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Overview

Biofuels are seen as mean of decreasing dependency of fossil fuels in transport and reducing greenhouse gases. In Germany a blending quota was introduced in 2007 and stepwise increased to ensure that a certain percentage of fossil fuels are substituted. This case study addresses the distributional effect of this policy. It analyzes the revenues of the supply side (petroleum industry, biofuel industry, agricultural industry), the effects on fuel price on the marketing level including energy and value added taxes on fuels and the resulting impact on demand side (freight transport, commercial passenger transport, private passenger transport).

Method

The distributional effects are calculated based on official data for the year 2012. To extract the impact of the blending with biofuels we compare the reference case with a blending quota of 6,04% (biodiesel) and 4,15% (bioethanol) to a no policy case without substitution of fossil fuels. The total demand for fuels measured in energy units is kept equal in both cases. The quantity measured in volume differs in both cases due to the different energy content of blended versus pure fossil fuel.

The supply side is split into petroleum industry, biofuel industry, agricultural industry and both domestic and imported products and intermediates are considered. Detailed information on prices, quantities, production processes is taken into account for this bottom-up approach.

On the marketing level we differentiate between effects on price and taxes and the responding revenues. According to official statistics of the mineral oil industry the net fuel price can be split into product price and contribution margin. The impact of the blending on this price constitutes is analyzed using time series. Due to lack of more detailed data we only derive an estimate for a maximum price effect. So the distributional effects are calculated for two scenarios: only blending-induced quantity effects and both blending-induced quantity and price effects. Whereas the change in energy tax revenues is only due to quantity effects and hence the same for both scenarios, value added tax revenues differ.

The split of the fuel demand into freight transport, commercial passenger transport and private passenger transport is derived by combining various official statistics on fuel consumption and vehicle fleet. The change in spending derived on the marketing level are distributed according to this split taking into account the different taxation of commercial sector and private households.

Results

In 2012, biofuel industry received revenues of 3.5 billion Euros through the quota regulated sales of biofuels. The share of revenues of biodiesel is 72%. German production is around 84% both for bioethanol and biodiesel.

The German biofuel industry receives agricultural inputs which generate revenues for the German agricultural sector 2.4 billion Euros. Most of the German agricultural sector revenues come from energy plants for the production of biodiesel (91%) compared to bioethanol (9%). The foreign agricultural sector receives at least 1.0 billion Euros.

Due to the German biofuel quota 3.4 billion litres of fossil fuels are substituted by biofuels. This leads to a loss of revenues of 2.2 billion Euros for the petroleum industry, 72 % diesel, 28 % petrol.

The analysis of the marketing level showed that at maximum 4.4 ct or 5.7% of the consumer price (without taxes) of diesel is an increase due to the blending with biodiesel, the corresponding numbers for petrol are 3.1 ct or 4.3%. The consumption of fuel is about 0.60% or 2.25% higher (diesel and petrol respectively) compared to pure fossil fuels and relating to volume units. We derive the extra spending, i.e. the part of the spending on fuels which can be explained by using blended fuels instead of pure fossil fuels. Only taking into account the quantity effects, we can show that at minimum 1.2 billion Euros i.e. 1.28% of the spending on fuel can be explained with the biofuel quota. 0.6 billion Euros are the minimum additional tax revenues. Including also the maximum price effects, extra spending add up to 4 billion Euros, or 5% of total spending. Maximum tax revenues are 0.9 billion Euros.
On the demand side we differentiate between freight transport, commercial and private passenger transport. We find that these three groups spend 25.9, 9.5, 59.0 billion Euros on fuels respectively (value added tax relief for freight transport and commercial passenger transport included). The proportion of these spendings due to the biofuel quota is between 0.59, 1.02, 1.63% (only quantity effects) and 4.10, 4.19, 4.31% (maximum price effects).

Conclusions

Additional system analytic costs could be quantified as 1.3 billion Euros in 2012. When looking at distributional effects single actor groups might have a burden much higher and others might benefit.
The Ex-Post analysis shows that in 2012 the blending regulated with the German biofuel quota leads to extra spending between 1.2 and 4 billion Euros. Private Transport, i.e. households are confronted with an over proportional increase, as they have to bear extra taxes and extra spending for the fuel itself. It would be interesting to further investigate the distributional effects on different income groups.
State benefits from additional tax revenues of at least 0.6 billion Euros, so the German switch from tax relieve policy for biofuels to quota policy had a positive impact on government budgets. Comparing this number to the environmental benefits quantified with only 0.1 billion Euros in 2012, one could even raise the provocative question if it is rather a fiscal than an environmental policy, possibly even a regressive one.
The German biofuel sector generates revenues of 4.22 billion Euro through sales of biofuels and by-products, the German Agriculture sector of 1.5 billion Euro, but substantial parts of revenue are still generated abroad. So one important question for the future will be how German biofuel industry will compete internationally.
The loss on the production level of the petroleum industry can be quantified with 2.2 billion. The impact on the integrated industry reaches from slightly negative to clearly negative and depends on processes of the marketing level. Pricing is not transparent and possibly even strategic. Depending on this, the loss on production level might partly be passed on to consumers.
This study shows that a simple analysis of distribution of extra spending, additional / lost revenues based on empirical data can be already very complex. It did not include indirect effects like impact on food prices, impact of increased spending for freight transport on various economic sectors, impact of new biofuel sector on investment goods and intermediate inputs from other sectors, and analogue to this impact of less fossil fuel production on investment and intermediates from other sectors etc. Including such induced / indirect effects would need a much more complex model.
This study is an Ex-Post analysis of distributional effects. Looking into the future, lower biofuel prices (learning effects) and higher fossil fuel prices compared to 2012 and the increasing transparency on the fuel market could alter the results substantially.