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ANALYSIS OF THE EUROPEAN BIOFUEL USE TARGETS

OVERVIEW

Former domestic biofuel development occured in several countries such as France a century ago. Following some decades, it strongly decreased in the 1960s, mostly due to the emergence of cheaper fossil fuels and better opportunities for crops. Then, the oil shocks of 1973 and 1979 made the interest for biofuel reappear, especially in Brasil and in the United States.

Energy is one of the most important factors of production in the global economy and 90% of the commercially produced energy is from fossil fuels such as crude oil, coal and gas, which are non-renewable in nature. Much of the energy supply in the world comes from geo-politically volatile economies, which create concerns about energy supply, and more specifically about transportation fuel supply. Moreover, awareness of fossil resource scarcity and the high world energy demand, which is still increasing according to the International Energy Agency (IEA), induce a trend of rising energy prices. Furthermore, in our climate change context, greater recognition of the negative environmental consequences of fossil fuels have spurred the search for renewable energy, especially transportation fuels. All these reasons have driven interest in transportation biofuels in most countries over the world.

Biofuels have become a high priority in the European Union in particular. Three pillars sustain the European biofuel development: enhancement of the energy security (suffering by concerns of oil dependence), reduction of greenhouse gas (GHG) emissions and sustainment of the agricultural sector. By promoting significant subsidies and targets for renewable energy production from agricultural sources, the European Union has been emphasizing production and use of biofuels, which is emerging as a growth industry in the current economic environment. Though, the impacts of these incitatives policies, without which making biofuels is unprofitable due to high production costs, reach far beyond the border of these economies.

Further, questions remain about the economic interest of biofuels, as well as the biofuel social and environmental cost&benefit analysis. Much expertise has been applied but results usually differ, even when studies focus on the same issues. Consequently, this divergence continues to increase the controversy surrounding the biofuel development. Biofuels have been receiving greater attention in the recent years from researchers. Most of them focus on the impacts of biofuel production on the agricultural sector, employing cost-accounting procedures, partial equilibrium or computable general equilibrium (CGE) frameworks. Some studies highlight the agricultural land use changes in particular.

Focusing on the European Union, the purpose is to assess the implications of biofuel programs, like European biofuel use targets, on the agricultural sector, the transforming industry and the refinery ones.

METHODS

The nature of the biofuel production chain, affecting the pattern of both the energy demand and the agricultural resource use, motivates us to employ a soft coupling modelling approach between three economic mathematical programming models. Two of them, the European agricultural supply model AROPAj (developed by INRA and desaggregated into 1307 farm-groups) and the European refinery model OURSE (developed by IFP and representing the 109 European refineries), are existing and experimented models, which have been improved for the coupling. The third model is a new one focused on the biofuel transforming industry sector, representing the 282 current operating biofuel units and considering the by-production as well as the GHG emissions. Our partial equilibrium approach keeps the well desaggregated level of the three modelling results over the European Union, and takes into account the geographical dimension as well as some crossing effects. So we develop a soft coupling optimization framework, using price adjustments to determine the optimum, to model the complex current European biofuel context. It can shed light on the feasability of European biofuel policies, European biofuel use targets in particular, in a short term. First, following our short term approach, the biofuels under consideration are the producible ones, which today are the fatty acid methyl ester (FAME, more commonly called biodiesel) and the ethanol.

RESULTS

The results point at the biofuel importation issue. For the 2010 target, as well as the 2020 one, the feasability is compromised mainly due to the agricultural resource availability and the production capacity constraints. Currently, with strong assumption on agricultural resource availability and without any consideration of biofuel unprofitability, only 3.34% and 2.3% by energy content of the diesel and the gasoline demand respectively could be substituted.

Regarding the spatial availability of the raw agricultural products and consequently the transportation cost between the farms and the transformers, and regarding the production capacities of the biofuel transformation sector, we assess the biofuel costs related to the three major routes: oilseed biodiesel (mostly rapeseeds), cereal ethanol (mainly wheat) and beet ethanol. These costs could be considered as minimum supply prices associated to the biofuel production sector when the capacity constraint holds. Let us recall that by-product pricing is taken into account in the assessment. The other side of the biofuel markets can be approached through the marginal cost of the refinery outputs. In addition to this cost assessment, we compute a minimum transportation cost between geo-referenced refineries and geo-referenced transforming industries. Regarding the profitability of the refinery sector, the net marginal cost could be considered as a minimum price value when they meet transforming industries.

Clearly the biofuel process chain including farmers, transformers and refiners, is profitable when public support comes at a high level. When the European biofuel use target is the one proposed for the year 2010, the average minimum public support estimate is around 300 € per ton of biofuel.

CONCLUSIONS

Then, we go on the determination of the optimum biofuel substitution rate, environmentally and economically consistent. To do so, we aim at implementing the advanced biofuels in the three models considered above, which means the lignocellulosic biofuels made from biomass like perennial crops. For now, we improved the AROPAj modelling by adding the miscanthus as an eligible perennial crop for the European farmers. Else, many studies shed light on the advanced biofuels for their environmental interest compared to the current biofuels, which compete with food and feed demand for resources and appear less environmentally friendly. Though, the question of the biofuel carbon debt remains with advanced biofuels.

Moreover, as AROPAj model integrated Common Agricultural Policy (CAP) changes, which means mainly the sugar beet market reform and the set-aside mandatory suppression, we could run AROPAj with scenario including CAP changes, updated prices and lignocellulosic crops to enlarge our analysis.