RENEWABLE ENERGY TRADE IN EUROPE: EFFICIENT USE OF BIOFUELS

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Overview

Biofuels is arguably an important component for a sustainable energy supply. In addition, biomass as a feed-stock in the production of biomaterials e.g., biobased chemicals and plastics, have a potential to be used as a substitute for fossil fuels, thus reducing the demand for fossil fuels but also imposes further demand increases on biofuels. These economic activities are collectively termed bioeconomy. As the term suggest, the bioeconomy aims at reducing the dependence on fossil fuels, but it also suggest a more technical advanced approach in how we use the biomass, than conventionally. The conversion of biomass to energy, biomaterials and other products are based on economics decisions, which are governed by e.g., the level of technological knowledge, relative prices and policies. Of special interest in this study is how policies affect the use of biofuels and in particular forest biofuels.

This development – the increasing utilization on biofuels – makes it important to use the biofuels efficiently. Since countries are endowed with different volumes of biomass resources. Countries with low levels of endowments might find it difficult to expand their biofuel utilization and invest in other, less cost efficient renewable energy technologies in order to meet policy targets. By trading a higher overall efficiency can be achieved. That is, trade facilities the allocation of resources between countries and will increase the efficiency for the trade partners. In 2015, the GHG emissions in EU had fallen 22% below 1990 levels, the share of renewable energy has increased to 16.6% and the primary energy consumption has decreased by 12% (European Commission, 2017). Thus, more efforts are thus need in order to archive the renewable and efficiency targets set by the EU. When investigating trade between countries, the most standard method used since the 1970s is the gravity model. Studies has been made with both simple forms of the gravity equation and with more elaborate specifications (e.g., Stay and Kulkarni, 2015; Frankel and Wei, 1993). However, only a few studies have been made estimating trade of forest products (e.g., Buongiorno, 2015; Buongiorno, 2016; Akyüz et al., 2010).

The purpose of this study is to estimate the value of forest products and to determine the effects of the trading countries' economic characteristics. In addition, the study also aims to make a forecast of the trade flow for the years 2015 to 2020 based on economic growth projections. A trade gravity model is developed and implemented on EU28 countries for the period 2005-2014.

Methods

The theoretical approach for explaining the trade patterns of biofuels in Europe is based on a so-called trade gravity model. The trade gravity model has become a commonly used empirical method to evaluate and predict trade patterns. The model has been applied in numerous specifications and contexts. Anderson (2010) argues that the gravity model is the leading empirical model in economics regarding international trade flow. The main driver of trade in a gravity model is the size of the economies. Large economies will trade more with other large economies than they are with smaller economies. This approach is fairly uncontroversial.

In order to estimate the specified gravity model, a fixed-effect panel estimation is done. The fixed-effect approach allows us to capture heterogeneities between countries. The fundamental gravity model includes information on trade flows, economic size of the trading partners and the distance between them (e.g., Stay and Kulkarni, 2016):

$$T_{ijt} = A\left(\frac{Y_{it} \times Y_{jt}}{D_{ij}}\right) \quad [1]$$

Where T is the trade between countries i and j in time-period t, A is a constant, Y is the economic size of the trading countries and D is the distance between them. In addition, the model is expanded by including variables for common borders, common currency and forest endowments. The common border and common currency are designed as dummy variables set to unity if the exporting country shares a common border with the importing country and if they have the same currency, respectively. The forest endowment variable represent how rich the trading countries are in forest products and is proxied by the total production of industrial roundwood, woodchip and particles in the countries.

The panel data set include trade between 28 countries over a 10-year period with two forestry products, containing some 15,120 observations. The data on trade is collected from FAOSTAT database and is measured as annual export values in thousands US dollars from each reporting country to each partner country, for the years 2005-2014 (FAO, 2016). The trade value was first converted into constant 2005 dollar value using the consumer price index from the U.S. Bureau of Labor Statistic database (2016) and afterwards to Euros using IMF exchange rates. The income variable is measured by Gross Domestic Product (GDP), which is collected from the IMF database for the years 2005-2020. The years 2016-2020 is projected GDP. The distance variable is measured as the distance in kilometers between the capital cities. The data on distance is collected from the European Commission distance calculator (European Commission, 2016). Data on the endowment variable is collected from FAOSTAT database.

Results and conclusions

The results indicate an overall good performance of the model. The results indicate that a 10% increase in the exporter's GDP (Y_i) will increase the trade value by 6.4% (±1.7%) for woodchips and particles (HS4401) and decrease it by 6.9% (±2.2%) for industrial roundwood (HS4403). The effect of a 10% increase in the importer's GDP (Y_j) will increase the trade value of woodchips and particles (HS4401) by 3.6% (±0.1%) and by 8% (±0.2%) for industrial roundwood (HS4403). The distance between the countries affect the trade value negatively. For woodchips and particles a 10% increase in distance, decreases the trade value by 10.6% (±0.4%) and for industrial roundwood by 15.4% (±0.5%). A 10% increase in forestry endowment will increase the trade flow value by 2.2% (±1.1%) for woodchips and particles and by 4.4% (±1.5%) for industrial roundwood. Furthermore, if the trading countries share a common border the trade value increases by 3.3 and by 3 million Euros for woodchips and particles and for industrial roundwood, respectively. If the both trading countries are have the same currency (i.e., Euro) the trade value increases by 0.17 million Euro for woodchips and particles and by 0.41 million Euro or industrial roundwood. The only disconcerting result is that the income variable for the exporting country exhibit a negative sign for industrial roundwood, instead of a positive sign as expected by the trade gravity model. That is, the negative sign of the exporter's GDP for industrial roundwood (HS4403) contradicts the theory of the gravity model.

The estimated results is used to forecast trade in woodchips and particles by using projections on the trading countries income levels. For simplicity, the forest endowment is assumed to be constant during the forecasted period. The aggregated trade value of woodchips and particles are projected to increase by almost 100 million Euros until 2020, corresponding to a 29.3% increase. Finland, France, Germany and Sweden, which are the largest producers of woodchips and particles, all have a positive trend for the future trade values. France and Germany have a higher growth in absolute trade values compared to Sweden and Finland. They are also expected to have a higher growth rate. The trade values are projected to increase by almost 2.9 and by 2 million Euros for Sweden and Finland, respectively. For France and Germany the trade value is projected to increase by 9.6 and 13.8 million Euro, respectively.

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