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Income volatility of energy crops: the case of rapeseed

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ABSTRACT

The adoption of energy crops may generate significant benefits from reduced foreign energy dependence, improved rural economies, and achieved environmental goals. Nevertheless, important issues arise, as these crops are strongly competed by other, presumably more standard, uses of farmland and their choice will be restrictive, unless profit becomes a powerful motive for farmers. The abolishment of specific policies supporting first generation biofuels gives rise to the question whether the tactic of bioenergy land use change is just to be abandoned by European farmers. The present paper endeavours to evaluate the reduction in income volatility in the case of the rapeseed energy crop, a cultivation extensively used in biofuels in the European Union, employing the concept of entropy. The results provide a vague picture regarding the limitations in rapeseed income volatility among the European member states. Consequently, the issue of income uncertainties as a determinant of bioenergy cropland demand has been left pending. The innovation of the study lies in the use of entropy concept and the Kapetanios and Shin unit root test in the case of income volatility for energy crops in the European context. The estimation of the random components with the assistance of auto-regressive integrated mean average models may provide a tool for confining income uncertainties with the assistance of other policy schemes, including insurances, within the Common Agricultural Policy.

1. Introduction

Energy issues found in the spotlight recently, seem to affect national economies substantially, both, in the European, as well as at the global level. Climate change combined with the escalating cost of fossil fuels and the unfavourable prospect of reduction in their inventories, have turned the interest to Renewable Energy Sources (RES). The European Union (EU) confronted energy and climate challenges through a policy context that targeted the mitigation of the problem of global warming, the air quality improvement, and the limitation of energy consumption (Ajanovic, 2013). The EU energy policy is developed, primarily, under the climate and energy package (set by EU in 2007 and enacted in legislation in 2009), that aims at saving 20% of greenhouse gas (GHG) emission compared to 1990, covering 20% of the energy consumption by RES and improving energy efficiency by approximately 20%.

Particularly, the two EU directives issued in 2009, affect the types of energy used in the transport sector and consist key elements of the “energy package”; namely, the directive on Renewable Energy (RED), and the directive on fuel quality (FQD) (von Lampe et al., 2014). The first one is a strict directive, setting the following targets; a 20% of the overall EU energy consumption (heating, cooling, and electricity) to come from RES by 2020 as well as 10% of the total EU energy consumption in the transport sector. The second one concerns the issue of clean and dirty fuels, declaring that by 2020, fuel suppliers must prove that they have mixed their energy fuel mix with cleaner fuels, so that their fuels could be decarbonising by 6%. This directive aims to address both dirty fossil fuels as well as biofuels that save emissions (Kampman et al., 2012).

Both targets are expected to be met, mainly by increasing the use of biofuels. As a renewable energy source, bioenergy contributes to the alteration in the use of conventional energy sources, since it reduces carbon dioxide emissions, preserves non-renewable resources, enhances energy security, and promotes regional development (Nguyen et al., 2010). As regards the rural sector, its role involves farm diversification by means of employment creation and income generation in underdeveloped rural

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areas (Elghali et al., 2007). Under this perspective, energy crops are strongly competed by other, presumably more standard, uses of farmland and, consequently, if energy crops are not profitable, they will not be preferred. In this way, the farmers' decisions are a key determinant for potential supply, and the impediments of widespread adoption of energy crops involve, primarily, financial returns and the fact that competing cultivations have been much more rewarding due to their high prices (i.e., wheat) in the last few years, as described by Sherrington et al. (2008). On the one hand, the use of crops for bioenergy production has increased their prices, mainly due to the increased demand for food. On the other hand, it is argued that low prices are not beneficial for a market, as prices should reflect the actual marginal production costs; this is not the case in the EU, due to agricultural subsidies that keep prices low (Ajanovic et al., 2013). Nevertheless, farmers depend on market prices as a motive to cultivate, and thus, the previously mentioned competition of feedstock use for bioenergy may create an overall "healthier" market (Valentine et al., 2012).

Furthermore, a farmer's decision is determined by the existence of trusted information concerning technical and agronomic aspects of cultivation, as well as contract agreements on energy crops (Villamil et al., 2008). In this respect, the role of the Common Agricultural Policy (CAP) is pivotal, since its major objective is to contribute positively to farm income, confining income variability. The introduction of direct payments has been essential for consistent market-oriented reforms, enhancing the competitiveness of the agricultural sector, and encouraging farmers to adapt to market conditions and differentiate their farms. The ongoing reformed CAP (2014–2020) offers a safety net, used in cases of significant price volatility, compared to the extended use of market measures widely used in the past.[1] Thus, the production of farm-based renewable energy sources is expected to be in line with some of the objectives set by current policy schemes; for example, ecosystem goods and services, since the measure of Single Payment Scheme (SPS)[2] is abolished and replaced by a more social and environmental friendly production orientation for the farmer (Convery et al., 2012).

Risk management tools could also contribute to confront income uncertainties and market volatility that hamper the agricultural sector's possibility to invest in competitiveness. The objective of these tools (including an income stabilisation tool compatible to the new WTO green box) is to assist the EU member states to mitigate both production and income risks, as well as to support safeguarding instruments and mutual funds. What is of great significance, is the fact that the new policy instruments should be in line with the already existing CAP measures (Tangermann, 2011). Still, the implementation of such policies requires an insight in the size of volatility, either of income or of production. Actually, the measurement of volatility provides the initial status, given that the target is already set; a fact that makes the role of risk management tool specific and clear (Velandia et al., 2009).

Drawing attention to the above issues, the present study aims to assess rapeseed income volatility through entropy for all EU countries. The calculation of entropy for the income from rapeseed generated a new time series, wherein its behaviour was gauged through time with the assistance of different unit root tests. The methodology involves the application of a GLS-DF linear unit root test, along with the Kapetanios and Shin (2006) non-linear unit root test. This paper is outlined as follows: the next section reviews the bioenergy market, whereas Sections 3 and 4 describe the methods employed, and the results, respectively. Section 5 discusses the results of the study and the final section concludes.

2. European bioenergy policy context

Bioenergy production primarily aims at the greenhouse gas (GHG) savings. Achieving such a goal may lead to indirect land use change, which in turn results in displaced food and animal feeding production. Land use diversification in favour of energy crops is a challenge for agriculture, mainly due to the entailed environmental risks, along with the possibility of biodiversity reduction if the crops are cultivated in monoculture farming (Iriarte et al., 2010). Presently, such diversification may occur primarily through the conversion of one type of land use into a bioenergy plantation (Direct Land Use Change-DLUC), as the means for gauging GHG emissions incorporated in the Directives does not account for emissions due to indirect land use change (ILUC). The main drawback has to do with the uncertainty in linking to the quantification of the GHG emissions (Di Lucia et al., 2012). Only in October 2012, did the European Commission tender a proposal to amend the Directives, so as to address the GHG emissions generated through ILUC and further enhance the sustainability criteria set upon the introduction of the RED (European Commission, 2012). Intriguingly, on 28 April 2015, the European Parliament voted to approve the new ILUC Directive, which contained a cap on the contribution of food-crop-based biofuels to 7% in transportation, placing more emphasis on the production of advanced biofuels from waste feedstocks. Member States are required to report the estimated ILUC emissions, the minimum GHG-saving threshold of 60% for new installations, and the increase in the contribution of advanced biofuels to the targets of the RED, in order to boost their diffusion.

Yet, the repercussions of indirect land use change related to biofuels policies are still questionable in the international literature (Ahlgren and Di Lucia, 2014). The unintended consequences of biofuel production and use, have stimulated discussion of other potential economic, social, and environmental impacts, including effects on food security, environmental justice, and biodiversity conservation (De Gorter and Just, 2010). Biodiesel, originated from plants like rapeseed, sunflower, soybean oil, and others (first generation biofuels), is a good solution, in rural development terms, for the substitution of conventional energy sources like fossil fuel, despite the clearly emerging picture of small, or even negative ecological benefits of their extended use. Such negative effects of bioenergy production may refer to: the reduced local food availability if energy crop plantations replace the subsistence of farmland, the increased wood removals leading to the degradation of forest ecosystems, the increased food prices for consumers, the reduced soil quality due to intensive cultivation of energy crops, and the deforestation and greenhouse emissions that may increase because of the demand for land for energy crops. On the other hand, potential benefits may include the diversification of agricultural output, higher income for farmers as food prices will rise, infrastructure and employment development in rural areas, decrease in energy dependence in rural areas along with access to affordable energy sources for rural enterprises, and rural economic development incentives (Kampman et al., 2012).

Despite the fact that the EU is the major producer of biodiesel in the world, representing about 65% of global output (Hassouneh et al., 2011), questions have arisen concerning the motives of the implemented policies on first generation biofuels, given the fact that the ecological impact of their use may be small, or even negative. The key answer is found in the distributional effects of biofuel policies. Particularly, Keeney (2009), as cited in Deppermann et al. (2014), argued in a survey on the distributional

[1] Direct payments to farmers, price support, export subsidies.

[2] The SPS is paid in the form of a single annual payment based on the value of the payment entitlements held by the farmer, and replaced in 2003, most previous existing agricultural schemes linked to specific sectors (coupled aids).