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Where have all the funds gone? Multiregional input-output analysis of the European Agricultural Fund for Rural Development

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ABSTRACT

The new European Agricultural Fund for Rural Development (EAFRD) was purposely established to "contribute to the promotion of sustainable rural development throughout the EU community". This paper addresses the sustainability of the EAFRD from a triple bottom line perspective in a multiregional input-output model. This framework allows us to study both the trade relations within the EU target regions and also the relations of the EU with some other regions in the world. Additionally, the model allows us to determine the losses (leakages) or gains (boosts and feedbacks) of a wide range of effects. On the other hand, this framework allows a simultaneous consideration of socioeconomic and environmental fund effects to identify their causes and flows and to clarify and reallocate benefits and responsibilities across levels and regions. The estimation of direct and indirect impact effects in an EU country clarifies the following: a) how the leakages to other regions generate a final economic impact that redistributes the prior fund distribution; b) how relevant the countries' participation in global production chains are; and c) how the potential existence of an ecological unequal exchange is assessed. The main data originate from the WIOD database and the European Network for Rural Development.

1. Introduction

Paraphrasing the well-known folk lyric, a most pertinent question relating to the rural development financial effort of European Union (EU) is, "*Where have all the Funds Gone*?" Numerous critics of place-based EU Policies focus on spillover effects, which is understood as economic, social and environmental leakages of budgetary funds *via* imports to outer, non-targeted regions or people-selected groups. This relevant question could be answered at two different levels: the targeted regions or selected groups; or the EU as a single unit. This paper will address both levels with regard to the new European Agricultural Fund for Rural Development (EAFRD), commonly labelled as the *second pillar* of the Common Agricultural Policy (CAP).

The EU's CAP has traditionally been considered the flagship of European policies. For over five decades, CAP has addressed the challenge of maintaining productive and vital rural areas all over Europe. Initially, CAP did this by focusing on productivity and food provisioning; later, by addressing the problem of sustainable incomes to farmers and preventing food surplus. In recent decades, the focus has shifted to rural decline and environmental sustainability. The seminal document "The Future of Rural Society" (EC, 1988) alerted readers to the three problems of the rural world: the pressures of modern development, the rural decline and the abandonment of areas that are furthest from the mainstream community life and access. This document underwent a radical change in tone after decades of a prevalent agrarian vision.

According to Irwin et al. (2010), a century of research on rural development (RD) has taught us certain lessons, and these include that "rural economy is no longer a farm economy", and "sector-based policies are neither efficient nor effective rural development policies". It appears that the EU's CAP has become aware of this, considering the major redefinition accomplished in the late 1990s when CAP redirected its efforts into a market-and-income support (first pillar) and rural development (second pillar). This major change was reinforced in 2005 (EC, 2005a) with the creation of two new funds for financing each of the pillars: the European Agricultural Guarantee Fund (EAGF) to support markets and incomes, and the European Agricultural Fund for Rural Development (EAFRD) to address rural decline.

This new EAFRD was established to "contribute to the promotion of sustainable rural development throughout the EU community, thereby complementing the market and income support policies of the common agricultural policy, the cohesion policy, and the common fisheries policy"; and specifically, "for improving the competitiveness of agriculture and forestry by supporting restructuring, development and innovation", "for improving the environment and the countryside by supporting land management", and "for improving the quality of life in rural areas" (EC, 2005b). To achieve this, the European Union endowed the fund with 96,109 million euros (M€), which was assumed would mobilize more than 151,125 M€ of total public expenditure in current prices. Such large financial efforts were expected to produce

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substantial achievements regarding RD improvements. Otherwise, the future of the new fund would be dramatically compromised.

RD evaluation is not an easy task given the intertwining of the quantitative and qualitative elements involved. RD is distinct from rural growth, which usually means "more of everything". This more-of-everything does not fit in with a vision of rural areas that entails economic diversification, sustainability, physical enhancement, cultural and human potential and the involvement of local people in a bottom-up process. Therefore, the process methodology and intangibles are outcomes as relevant as the quantitative variables and, regretfully, not as easy to grasp (OCDE, 2009; Ray, 2000). The "common monitoring and evaluation framework" established by the fund addresses these outcomes in the target regions. However, considering the globalization process and the subsequent commercial openness, it is worthwhile to consider that certain impacts will be spread through regions, and perhaps countries different from the targets.

Social and economic development and the search for sustainable consumption of goods and services are primary objectives to promote global sustainability (WSSD, 2002). In this paper, we assess the impact of EAFRD from the perspective of the three main aspects of sustainability: economy, social and environment. These are commonly known as the triple bottom line or TBL (Kucukvar et al., 2014). The TBL provides useful and deep bulk information that simplifies the decision making process for policy makers (Foran et al., 2005). In this paper, in accordance with (Grazi et al., 2007), we will use a complete set and subsets of indicators to evaluate the TBL in order to quantify and map how impacts have spread within the EU and globally. This set and these subsets were also used to improve the quality of policy recommendations for future EU policy plans.

The study of fund leakage based solely on economic spillover effects could provide inconsistent results regarding sustainability. Moreover, the integration involved in the TBL analysis we conducted eliminates the need for simultaneous, rather than separate, consideration of socio-economic and environmental effects. This integration also provides helpful insights regarding system interconnections and feedbacks that, according to Liu et al. (2015), are the core elements with key roles in global sustainability. The resulting impacts have been classified as direct impacts, those directly linked to the funds received by the country concerned, and indirect impacts, those which are triggered by other countries' final demand and which constitute a boost from the perspective of the country that receives it and a leakage for the country that is sending it.

In accordance with Wood and Garnett (2010), we have preferentially chosen a large set of indicators (total output, value added, employment by skills level, GHG emissions, blue water,[1] fossil fuels and materials) that cover a wide range of economic, social and environmental impacts for a better evaluation of TBL sustainability and the assessment of the possibility of an unequal regional impact regarding the positive or negative character of the impacts. The aggregation of indicators usually diminish the quality of results and, in many cases, could be subjective; nevertheless, we must assume that recent literature has proposed interesting synthetically refined indicators to evaluate interacting criteria such as that proposed in Rowley et al. (2015).

The methodological approach to evaluate TBL is a multiregional input-output (MRIO) model. The input-output (I-O) approach has been extensively used since the 1950s to evaluate the impacts of policies targeting agricultural and rural challenges (Irwin et al., 2010). The extension to the Environmental Input-Output models, proposed by Leontief in his Nobel Prize speech, is a common tool used in recent years to evaluate the environmental impacts of countries, industries and household demands (Ewing et al., 2012; López et al., 2013; Steen-Olsen et al., 2012; Weinzettel et al., 2014; Wiedmann et al., 2013; Zafrilla et al., 2014). In addition, this tool is commonly used in the framework of TBL analysis (Foran et al., 2005; Kucukvar et al., 2014; Onat et al., 2014; Wood and Garnett, 2010).

This multiregional approach is a novelty in the study of EU policies such as the EAFDR; nevertheless, the literature using single-region and multiregional models have previously been used to appraise European Funds effectiveness. For instance, Perez et al. (2009) used the Spanish interregional I-O model (SIRIO) to estimate the economic output, value added and employment impact of the EU structural funds received by Spanish regions during the period 1995–1999. A similar study was conducted by Llano (2009) for interregional connections. Additionally, a previous paper by certain authors (López et al., 2011) provided a similar indicators analysis for the Castilla-La Mancha Regional Programme using a single-region model. More recently, using an approach different from the one in our paper, a Computable General Equilibrium (CGE) model, Espinosa et al. (2014) attempts to assess the economic impact of different CAP potential reforms in a bi-regional context according to the guidelines of future EU policies such as the "EU 2020 Strategy".

Specifically, the MRIO model proposed will allow us to study the intra-EU and non-intra-EU trade relations of target regions to determine the losses or gains of impact effects from the TBL perspective because of increasing trade globalization. Affluence is a main driver of the human footprint because increasing income is followed by a proportional increase in imports (López et al., 2016). For the EU, an increasing income per capita in years prior to the 2008 Great Recession, suggests an increasing degree of industry and consumption path openness (Arto et al., 2014; López et al., 2014); and thus, the study of EAFRD effectiveness under a TBL requires an MRIO model to properly evaluate the economic, social and environmental leakages and boosts produced by the funds.

The paper is organized as follows: Section 2 describes the methodological approach and data sources; Section 3 shows the main results; and Section 4 provides conclusions and a discussion.

2. Methodology and data

2.1. Multiregional input-output model

In the standard multiregional input-output (MRIO) model framework, regions and countries are included with their own technology, and trade is divided into intermediate trade, with specific industry destinations, and final trade.

The basic input-output equation is as follows (Miller and Blair, 2009):

$$\boldsymbol{x}^{r} = \boldsymbol{A}^{rr}\boldsymbol{x}^{r} + \boldsymbol{y}^{rr} + \sum_{s \neq r} \boldsymbol{A}^{rs}\boldsymbol{x}^{s} + \sum_{s \neq r} \boldsymbol{y}^{rs} \tag{1}$$

where x is the output of the region indicated in the superscript, A^{rr} is the domestic matrix of coefficients of production (intraregional matrix), A^{rs} is the trade between industries from region r to region s (intermediate exports of region r or intermediate imports of region s); both are calculated as

$$\boldsymbol{A}^{ij} = \boldsymbol{Z}^{ij}\left(\hat{\boldsymbol{x}}^{j}\right)^{-1} \tag{2}$$

where $y^{rs.}$ is the final trade between industries in region r to final agents in region s (final exports of region r or final imports of region s). In matrix form, including m regions, Eq. (1) becomes:

$$\begin{pmatrix} \boldsymbol{x}^{1} \\ \boldsymbol{x}^{2} \\ \boldsymbol{x}^{3} \\ \vdots \\ \boldsymbol{x}^{m} \end{pmatrix} = \begin{pmatrix} \boldsymbol{A}^{11} & \boldsymbol{A}^{12} & \boldsymbol{A}^{13} & \cdots & \boldsymbol{A}^{1m} \\ \boldsymbol{A}^{21} & \boldsymbol{A}^{22} & \boldsymbol{A}^{23} & \cdots & \boldsymbol{A}^{2m} \\ \boldsymbol{A}^{31} & \boldsymbol{A}^{32} & \boldsymbol{A}^{33} & \cdots & \boldsymbol{A}^{3m} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{A}^{m1} & \boldsymbol{A}^{m2} & \boldsymbol{A}^{m3} & \cdots & \boldsymbol{A}^{mm} \end{pmatrix} \begin{pmatrix} \boldsymbol{x}^{1} \\ \boldsymbol{x}^{2} \\ \boldsymbol{x}^{3} \\ \vdots \\ \boldsymbol{x}^{m} \end{pmatrix} + \begin{pmatrix} \sum_{r} \boldsymbol{y}^{1r} \\ \sum_{r} \boldsymbol{y}^{2r} \\ \sum_{r} \boldsymbol{y}^{3r} \\ \vdots \\ \sum_{r} \boldsymbol{y}^{mr} \end{pmatrix} \tag{3}$$

[1] Blue water refers to ground and surface water extracted for economic use. It differs from "green water" -direct rainwater consumption by plants- and from "grey water" -the volume of freshwater that is required to dilute pollutants (Hoekstra et al., 2011). Henceforth referred to in the present paper simply as "water".