Land Use Policy 68 (2017) 179–188

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Levelling the playing field for European Union agriculture: Does the Common Agricultural Policy impact homogeneously on farm productivity and efficiency?

Sonia Quiroga[a,*], Cristina Suárez[a], Zaira Fernández-Haddad[b], George Philippidis[c,d]

[a] Department of Economics, Universidad de Alcalá, Spain
[b] Management Centre for the Evaluation and Monitoring of Social Programs, Secretariat of Social Development, Mexico
[c] Aragonese Agency for Research and Development (ARAID), Unit of Agro-Food Economics and Natural Resources, Centre for Agro-Food Research and Technology (CITA), Zaragoza, Spain
[d] University Loyola Andalusia, Department of Economics, Seville, Spain

ARTICLE INFO

Keywords:
Productivity
Technical efficiency convergence
Environmental subsidies
CAP
EU

ABSTRACT

Originally conceived as a post-war policy vehicle for ensuring agricultural self-sufficiency, the Common Agricultural Policy (CAP) has evolved into a multifunctional instrument designed to satisfy a diverse portfolio of European Union (EU) policy objectives including nature protection. Notwithstanding, whilst the CAP has become more environmental and socially responsible, it is still expected to deliver an efficient farm production system capable of competing on world markets. The current paper combines a farm business panel dataset for 98 EU territories with a Stochastic Frontier Analysis (SFA) approach, to assess the impact of four contemporary broad categories of CAP subsidy programs on efficiency and environmental sustainability. In accordance with the literature, this study more correctly defines inputs as "facilitating", whilst following recent methodological developments, crop-subsidies are treated as an endogenous strategic variable in the production function. Comparing between two discrete time periods, further tests are conducted to examine the hypothesis of technical efficiency convergence across european territories. The results suggest that first pillar crop subsidies and pillar two environmental programs generate a disincentive effect on productivity, whilst in general, the CAP promotes technical efficiency convergence within Europe.

1. Introduction

With 28 Member States, the European Union (EU) has evolved to an unprecedented level of complexity in terms of its institutional capacity and legal governance, whilst almost 60 years on from its inception, the central tenets of promoting peace and prosperity continue to apply. As one of the foundations of the European project, the Common Agricultural Policy (CAP) has been instrumental in helping to achieve this aim. Initially conceived as a vehicle for stimulating agricultural production and promoting self-sufficiency through direct subsidy payments, the CAP has evolved into a complex multifunctional policy instrument to balance an array of policy concerns encapsulating (*inter alia*) food security, a more equitable distribution of payments, the maintenance of rural livelihoods, environmental concerns and, more recently under the banner of 'bioeconomy', jobs and growth (EC, 2012).

Over time, the design and implementation of CAP payments has had to adapt in recognition of these emerging and sometimes conflicting, policy goals. To this end, through subsequent agricultural policy reforms ('MacSharry' (1993–1999), 'Agenda 2000′ (2000–2004), 'Mid Term Reform' (2005–2007), 'Health Check' (2008–2012)), production-linked, or 'coupled' subsidies, have been substituted by a system of transfer payments tied to a registered land area (i.e., de-coupled). Aside from placating the concerns of WTO trading partners and providing greater transparency, this policy shift afforded flexibility to link CAP payments directly with non-market (mainly environmental) goals (known as 'cross-compliance').

In order to reconcile this fundamental reorientation of agricultural support with an array of heterogeneous EU member farming structures, the views of national governments, farming unions and other stakeholders, de-coupled payment allocations were initially calculated on the basis of agricultural receipts from a historical reference period – suggesting a partially coupled link to production through time. Subsequent attempts under the Mid Term Reform to modify this formula to a single 'flat rate or regional' payment (i.e., all farmers in a

* Corresponding author at: Universidad de Alcalá, Plaza de la Victoria, 2, Alcalá de Henares, 28802, Madrid, Spain.
E-mail address: sonia.quiroga@uah.es (S. Quiroga).

http://dx.doi.org/10.1016/j.landusepol.2017.07.057
Received 24 October 2016; Received in revised form 31 March 2017; Accepted 29 July 2017
0264-8377/

defined region receive the same per-hectare payment) were met with resistance, leading to a 'hybrid' option where some payments are regionalised and others based on historical levels. A full transition to a flat rate payment is envisaged in the coming years. Finally, under the Health Check, Article 68 (previously Article 69) allows all member states to retain up to 10 per cent of their national ceilings for decoupled payments to provide (coupled) support to specific sectors. Although to some, this may be seen as a backward step, such voluntary coupling mechanisms will be maintained within the CAP reform 2014–2020.

Over the last 15 years, additional structural reorientation in the manner of CAP support comes under the dichotomy of pillar 1 (market support) and pillar 2 (rural development) payments to further reinforce the notion of a sustainable multifunctional agricultural production system. Introduced under the auspices of the Agenda 2000 reforms, Pillar 2 payments currently constitute approximately 40% of all agricultural spending.[1]

With the emergence of a range of CAP subsidies, an understanding of the influence of these changing support programs on agricultural productivity and technical efficiency and the extent to which they influence agricultural productivity convergence across a rich diversity of European agro-climatic regions, is of paramount importance to policy makers. In theory, coupled and even decoupled subsidies can impact on production through four mechanisms: (i) by affecting the relative price of inputs and outputs; (ii) through income effects which impact on both investment decisions and the allocation and quality of on- and off-farm labour, where the farmer is no longer under any obligation to produce; (iii) through changes in risk perception because of the subsidies' insurance effect, and (iv) through farm growth or exit from the industry (Kumbhakar and Lien, 2010; Zhu and Oude-Lansink, 2010). Other authors (Kleinhanss et al., 2007) note that changes in farmer work-motivation, investment decisions and distribution of input-output could take place if there is a combination of income and insurance effects.

Stochastic frontier production functions (SFA) with technical inefficiency effects have been widely used to analyse agricultural outputs (e.g., Solís and Letson, 2013; Battese and Broca, 1997; Battese and Coelli, 1995). Moreover, employing an econometric framework, further research forges a link between agricultural subsidies and farm performance. Some authors (Guan and Oude Lansink, 2006; Skuras et al., 2006) focus on farm productivity effects, characterising subsidies as a traditional input to the production function. Whilst insightful, subsidies are not technically traditional inputs because they are not necessary for production and cannot produce any output on their own. Other work (Hadley, 2006; Guan et al., 2006; McCloud and Kumbhakar, 2008; Zhu and Oude-Lansink, 2010; Zhu et al., 2008, 2011) employs stochastic frontier analysis where subsidies are treated as a facilitating input affecting productivity only through the technical efficiency equation. This approach removes the above mentioned shortfall but does not address the direct relationship between productivity and subsidies. A recent development in the literature (Kumbhakar and Lien, 2010) is to treat subsidies as an endogenous factor influencing productivity and technical efficiency.

The current study also employs an SFA approach akin to Kumbhakar and Lien (2010), to examine the relative impacts of different first and second pillar CAP subsidies on production and technical efficiency in cropping activities over a fourteen year sample period. A broad selection of EU geographical territories are considered, with the objective of capturing the heterogeneity in their dependence on subsidies as well as other characteristics such as farm structure and cropping patterns. A further novelty of this work is to examine the degree to which the CAP has facilitated convergence in technical efficiency across territories comparing over two discrete time periods within the sample. More specifically, β- and σ-convergence criteria in terms of technical efficiency are applied to more precisely determine the mobility and dispersion of productivity and technical efficiency across EU members. Section 2 discusses the dataset and methodology. The main results on efficiency and cross-country convergence are shown in Section 3. Section 4 concludes.

2. Data and methods

2.1. Effects of CAP subsidies on efficiency framework

Assuming perfect competition and risk neutrality, decoupled subsidies do not affect farmers' short term marginal production decisions (Kumbhakar and Lien, 2010). In practice, however, owing to the factors outlined in the previous section, these assumptions do not hold. The approach here is to characterise subsidies as having an indirect impact over crop-output in three ways: (i) by changing productivity of traditional inputs (technology effect), (ii) through shifts in technological change, and (iii) by influencing technical efficiency (McCloud and Kumbhakar, 2008; Kumbhakar and Lien, 2010). In summary, a subsidy is a *"facilitating input"* if it complies with the following conditions: (i) it is not necessary for production, (ii) it cannot, in itself, generate production, and (iii) it affects productivity through at least one channel (McCloud and Kumbhakar, 2008). Studies that only analyse the effect of subsidies (especially crop-subsidies) complying with only one condition disregard the important relationship between productivity and the various forms of subsidies.

Subsidies linked to production may introduce some endogeneity problem derived from the distribution process of the payments. Here, crop-subsidies are modelled as an endogenous variable in the production function as well as an exogenous variable in the inefficiency model. This premise is based on the fact that this variable can be influenced by farmers. However endogeneity does not appear in the technical inefficiency equation because there is no evidence that subsidies are reserved for the most efficient regions (Zhu and Oude-Lansink, 2010).

The above mechanism is characterized employing an equation system described below:

$$y_{1it} = f(x_{jit}, y_{2it}; \beta) + v_{it} - u_{it} \quad (1)$$

$$y_{2it} = h(w_{it}; \theta) + c_i + \xi_{it} \quad (2)$$

where y_{1it} is the natural logarithm of the average crop-production per farm in the *i-th* region and *t-th* period. In Eq. (1), $f(x_{jit}, y_{2it}; \beta)$ is a function of the input-vector of the average farm in the *i-th* region and the *t-th* period (x_j), the coupled subsidy expressed as the percentage share of crop-production (y_{2it}), and a vector of unknown parameters (β). To allow for the presence of technical change in this production function, a time-trend t is added. The error component is $\varepsilon_{it} = v_{it} - u_{it}$, where v_{it} is a vector of random variables, which is assumed to be independent and identically distributed ($v_{it} \overset{iid}{\sim} N(0, \sigma_v^2)$). Finally u_{it} is the non-negative technical efficiency element which follows a truncated normal distribution and is assumed to be independently distributed as $u_{it} \overset{iid}{\sim} N^+(z_{it}\delta, \sigma_u^2)$, with z_{it} defined as the vector of variables that capture inefficiency and δ the corresponding vector of parameters.

In Eq. (2), $h(w_{it};\theta)$ is a function of w_{it} variables which denote farm characteristics and structural change, whilst θ is a vector of parameters to be estimated. The variable $c_i = N(0, \sigma_c^2)$ is the unobservable individual specific effect and $\varsigma_{it} = N(0, \sigma_\varsigma^2)$is the random disturbance.

As there are two endogenous variables (y_{1it} and y_{2it}) in Eq. (1) and one (y_{2it}) in Eq. (2), the estimation procedure follows two steps. Firstly, subsidy Eq. (2) is estimated by fixed effects (FE) or random effects (RE), taking into account the nature of c_i which captures the unobservable individual specific effects in the subsidy function. Secondly, the predictions of the subsidy equation are substituted into Eq. (1) and then a Stochastic Frontier Analysis (SFA) estimation is performed (Battese and Coelli, 1995). The efficiency scores obtained from the Eq. (3):

$$TE_{it} = \exp(-u_{it}) \quad (3)$$

[1] Including national co-financing payments on pillar two schemes.