

## Valuing Social Sustainability in Agriculture: An Approach Based on Social Outputs' Shadow Prices

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**Abstract :** Interest in sustainability has gained ground among practitioners, academics and policy-makers due to growing stakeholders' awareness of environmental and social concerns. This is particularly true for agriculture. However, relatively little research has been conducted on the quantification of social sustainability and the contribution of social issues to the agricultural production efficiency. This research's main objective is to propose a method for evaluating prices of social outputs, more precisely shadow prices, by allowing for the stochastic nature of agricultural production that is to say for production uncertainty. In this article, the assessment of social outputs' shadow prices is conducted within the methodological framework of nonparametric Data Envelopment Analysis (DEA). An output-oriented directional distance function (DDF) is implemented to represent the technology of a sample of Catalan arable crop farms and derive the efficiency scores the overall production technology of our sample is assumed to be the intersection of two different sub-technologies. The first sub-technology models the production of random desirable agricultural outputs, while the second sub-technology reflects the social outcomes from agricultural activities. Once a nonparametric production technology has been represented, the DDF primal approach can be used for efficiency measurement, while shadow prices are drawn from the dual representation of the DDF. Computing shadow prices is a method to assign an economic value to non-marketed social outcomes. Our research uses cross sectional, farm-level data collected in 2015 from a sample of 180 Catalan arable crop farms specialized in the production of cereals, oilseeds and protein (COP) crops. Our results suggest that our sample farms show high performance scores, from 85% for the bad state of nature to 88% for the normal and ideal crop growing conditions. This suggests that farm performance is increasing with an improvement in crop growth conditions. Results also show that average shadow prices of desirable state-contingent output and social outcomes for efficient and inefficient farms are positive, suggesting that the production of desirable marketable outputs and of non-marketable outputs makes a positive contribution to the farm production efficiency. Results also indicate that social outputs' shadow prices are contingent upon the growing conditions. The shadow prices follow an upward trend as crop-growing conditions improve. This finding suggests that these efficient farms prefer to allocate more resources in the production of desirable outputs than of social outcomes. To our knowledge, this study represents the first attempt to compute shadow prices of social outcomes while accounting for the stochastic nature of the production technology. Our findings suggest that the decision-making process of the efficient farms in dealing with social issues are stochastic and strongly dependent on the growth conditions. This implies that policy-makers should adjust their instruments according to the stochastic environmental conditions. An optimal redistribution of rural development support, by increasing the public payment with the improvement in crop growth conditions, would likely enhance the effectiveness of public policies.

**Keywords :** data envelopment analysis, shadow prices, social sustainability, sustainable farming

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