

Extended Abstract

Paper/Poster Title	Eco-performance Of Crop Producers In Ukraine: A Parametric Approach
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Abstract	<i>200 words max</i>
<p>Existing empirical literature on crop production in Ukraine mainly focuses on measures of productivity, economic and technical efficiency. However, there has been limited evidence on how crop producers perform from an environmental perspective. This study provides the first attempt to empirically estimate the level of eco-efficiency in crop production using farm-level panel data from Ukraine. To address the research question, the hyperbolic environmental technology distance function methodology is employed. Our preliminary results suggest that the average environmental technical efficiency for crop producers in Ukraine is 0.74 over the period 2017-2019. Assessing the eco-performance of Ukrainian crop farmers can be relevant for the policy-makers given the growing interest towards a sustainable Ukrainian agricultural sector in the presence of increasing environmental pressures.</p>	
Keywords	Eco-efficiency, distance function, stochastic frontier model, crop production
JEL Code	Agriculture: Agriculture and Environment Q15
Introduction	<i>100 – 250 words</i>
<p>The agricultural sector in Ukraine contributes noticeably to the country's economy by being the third most important contributor, after industry and trade, of gross value added in GDP. At the same time, agriculture is among the top 5 sectors of the Ukrainian economy adding to the N2O emissions of the country. Agricultural sector in general produces along with desirable outputs (crop output in this study) also undesirable ones (such as GHG emissions, pollution from applied chemical fertilizers and pesticides etc.), and they should be both considered in the assessment of sector's performance. Given the currently available empirical literature, there are virtually no empirical studies that aim to measure the environmental performance of agricultural production in Ukraine. Thus, this research can contribute to the existing literature by shading light on whether and how eco-efficient crop farms in Ukraine might be.</p>	
Methodology	<i>100 – 250 words</i>
<p>To address the research question, we use recent farm-level accounting data collected by the State Statistics Service of Ukraine. These are panel data covering crop production of agricultural producers in the period of 2017-2019. We create a balanced panel with focus on production of cereals and sunflower, which are major crops in terms of sowing land and output shares. These crops account also for a noticeable share of total chemical fertilizers application. We estimate crop farms' environmental</p>	

efficiency by applying an econometric model based on a parametric hyperbolic technology distance function approach, which allows including both desirable and undesirable outputs (Mamardashvili et al., 2016, Adenuga et al., 2019). We consider greenhouse emissions (N₂O and CO₂ emissions) originating from application of mineral fertilizers and fuels' usage as undesirable outputs. Coefficients of the hyperbolic output distance function are estimated based on the error components frontier model with a translog specification for the underlying production function (Battese & Coelli 1992). We control for additional explanatory variables that influence the production frontier such as climatic variables, irrigation and pesticide practices.

Adenuga A., Davis J.; Hutchinson G.; Donnellan T. and Patton M. (2019). Environmental Efficiency and Pollution Costs of Nitrogen Surplus in Dairy Farms: A Parametric Hyperbolic Technology Distance Function Approach. *Environmental & Resource Economics* 74(3): 1273-1298

Mamardashvili P., Emvalomatis G., and Jan P. (2016). Environmental Performance and Shadow Value of Polluting on Swiss Dairy Farms. *Journal of Agricultural and Resource Economics* 41(2):225–246.

Results	100 – 250 words
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The parameter estimates of the hyperbolic distance function satisfy the monotonicity conditions at the sample mean: non-decreasing in desirable outputs and non-increasing in undesirable outputs and inputs. The preliminary results of the analysis showed that the average eco-efficiency estimate of crop producers in Ukraine is 0.74 with virtually no variation over the considered years. There is a quite low level of heterogeneity in environmental technical efficiency across crop farms. These estimates imply that on average producers of cereals and sunflower in Ukraine can improve their production results by increasing crop output by 35% and simultaneously contracting undesirable outputs by 26%. Exogenous factors included in the model, such as mean temperature and total precipitation levels, appeared to have highly statistically significant effect on crop output, while the effect of irrigation dummy is not statistically different from zero.

Discussion and Conclusion	100 – 250 words
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This study contributes to the existing literature by providing the first estimates of the environmental performance (using eco-efficiency measurement) of crop producers in Ukraine. The results indicate how (in)efficiently farms are performing, which reflect the maximum possible level of desirable outputs and minimum level of bad outputs given the quantities of inputs used. This research emphasizes that it is important to account for undesirable outputs when evaluating the performance of crop producers.