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Technical and Environmental Efficiency in Agriculture: A Case in Asia

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Abstract

The agricultural sector dominates the economies of most Asian countries. With the agro industrialization in Asia, inorganic inputs such as fertilizers and pesticides have been utilized in modern commercial agricultural practices. However, a number of issues are raised with the excessive use of environmentally detrimental inputs in agriculture. Hence, the main concern of agriculture-based countries is to increase production while minimizing environmental pollution. This study aims to assess both technical efficiency and environmental efficiency of agricultural production in Asia using a stochastic frontier analysis with a panel data set of 48 countries in Asia during 1990-2018. Chemical pesticide is treated as the only environmentally detrimental input in this estimation. As the Bayesian method of analysis has more advantages over the frequentist method, this study uses Bayesian analysis. Results show that all the considered factors of production *viz.* land, labor, fertilizer, and pesticides show a positive impact on agricultural production while the total agricultural production is highly dependent on fertilizer use. Furthermore, the average technical efficiency of agricultural production in Asia is 71% and ranges from 69% to 75%. This indicates producers are on average executing about 71% of best practice output in their use of agricultural inputs and technology. The average value of the environmental efficiency for environmentally detrimental input is ranging from 20% to 25% with an average value of 22%. The low environmental efficiency specifies that the agricultural production value could be maintained, reducing more than 75% of the pesticide input while using observed values of other inputs. Therefore, there is a great potential for improving the environmental impact of agricultural production by the optimum use of pesticides and enhancing environmental efficiency of agriculture in Asia. Technical efficiency scores and environmental efficiency scores show decreasing trends and slight decreasing trends over time, respectively. Thus, environmentally detrimental inputs should be used in a sustainable manner in order to reduce the negative externalities of agricultural production on the environment. The results prove the usefulness for reallocating input resources and improving environmental efficiency in agriculture.

Keywords: Agriculture, Environmental efficiency, Stochastic frontier analysis, Technical efficiency