The Economic Impact of Climate Change on Agriculture in Sub-Saharan Africa: A Case of Eastern Africa

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Abstract

This paper examines the economic impact of climate change on East Africa's agriculture using the standard, and stochastic production function approaches with a panel data over a period of 40 years. Alternative specifications have been estimated to deductively test the economic effects of climate change on agriculture in the region. The empirical results from the base model in the standard production function estimation reveal that precipitation and its standard deviation, and standard deviation of temperature substantially affect the agricultural sector of the region. Three scenarios are assumed in this study on the basis of climate projections by different institutions and researchers for East Africa. I find that the economic impact of climate change ranges from a net benefit of 0.8% to a net cost of 6.5%. Based on the estimates, the economic impact is forecasted for 2050 by simulating the growth rates of inputs obtained from FAO and using the climate projections. Accordingly, the percentage deviation of agricultural output at 2050 climate levels from the long term climate averages (1961-1990) ranges from a net benefit of 1.3% to a net cost of 4.5%. A likelihood ratio test has been undertaken to assess the importance of irrigation in adapting the impacts of climate change and found to be highly significant.

In order to explore the relevance of climate inside and outside the main growing season, a seasonal climate data has been included and the impacts are estimated. Once again the importance of precipitation and its standard deviation are confirmed during the Spring season. This is really important result in terms of explaining crop production in the region as the Spring season is the main planting season for cereal crops in most East African countries. Finally, the standard production function has been extended to include risk analysis following Just and Pope (1978) stochastic productions function. Accordingly, precipitation and intra-annual standard deviation of temperature are found to be risk increasing variables. Another very important result is that irrigation is found to be significantly risk decreasing variable in line with the likelihood ratio test result from the standard production function model.

To sum up, climate change has significant impact on the agricultural sector of the region. Therefore, policy makers should consider comprehensive and integrated solutions by incorporating climate issues into their policies and programs. More importantly, strong emphasis has to be given to expansion of irrigation as it is found to be promising in adapting and reducing the risk associated with climate change.