CEEPA
The Centre for Environmental Economics and Policy in Africa
University of Pretoria

POLICY BRIEF

No. 18. December 2015

Incorporating Environmental Externalities in Total Factor Productivity Analysis: The Case of Soil Erosion in Nigerian Agriculture

Abstract

In this study, we argue that conventional methods of measuring agricultural productivity which only uses information about marketed inputs and outputs do not give a true representation of how sustainable the activities of the sector are. Motivated by the Solow-type growth accounting framework, we use the Törnqvist index formula to construct input, output and TFP indices for Nigerian agriculture between 1980 and 2010. We account for environmental externalities by incorporating off-farm damage costs of soil erosion based on different assumptions about possible scenarios of the extent and trajectory of damage costs.

The results show that when externalities are not accounted for, productivity in the Nigerian agricultural sector is over-estimated. This conclusion is robust to the different assumptions about damage cost scenarios made. The policy implication emerging

Chuku Chuku Agbai
Department of Economics, University of Uyo, Uyo, Nigeria.
chukuachuku@gmail.com, chukuchuku.econs.lect@uniuyo.edu.ng
+234 806 724 7177
and
Department of Economics, University of Manchester, Manchester, U.K.
chuku.chuku@postgrad.manchester.ac.uk
+44 0777 660 4518

Figure 1: Farmers terracing land to control soil erosion (photo source CCAFS)

from the study is that reducing off-farm erosion damages through improved soil conservation practices will significantly improve productivity and sustainability in the Nigerian agricultural sector. Further, specific government interventions requiring mandatory soil conservation practices, mixed with incentive based policies could be used to reduce the potential effects of soil erosion externality in Nigeria.

Report Summary

The growing recognition of the importance of environmental externalities for sustainable human existence has led to an increasing awareness amongst economists and policy makers of the need to incorporate and take account of environmental factors when measuring productivity. This study concentrates on soil erosion externalities from agricultural productivity in Nigeria because of its size in GDP and the far reaching impacts it has on other aspects of the national economy. Recent estimates by the World Bank shows that soil degradation from agriculture and other sources affects over 50 million Nigerians and leads to GDP losses of over $300 million

per annum. An index number based approach is used to compute the productivity of the agricultural sector in Nigeria. The conventional total factor productivity (TFP) measurement is first done and then, it is compared to an environmentally adjusted TFP measurement where the environmental adjustment involves incorporating the cost of soil erosion in productivity measurement. The results clearly show that without accounting for environmental externalities, agricultural productivity in Nigeria is over estimated.

Assessing the damage cost of soil erosion from agricultural productivity in Nigeria

To fully understand the extent to which soil erosion from agricultural production can affect productivity measurement, it is important to understand how erosion caused by agricultural activities affect other sectors of the economy. We show in this study that under different scenarios, the danage cost of soil erosion could vary between N11.5 and N39.15 per ton in current value terms. These estimates are obtained by using state-of-the-art transformations of studies done using the Universal Soil Loss Equation (USLE).

The need to integrate soil conservation practices in agricultural processes

The finding that soil erosion is significantly expensive and leads to overestimation of the productivity potential of the Nigerian agricultural sector implies that production activities in the sector are not currently sustainable. Soil erosion and its impact on agricultural productivity could be mitigated by incorporating soil conservation practices as an important component of the agricultural production process.

"Soil erosion and its impact on agricultural productivity could be mitigated by incorporating soil conservation practices as an important component of the agricultural production process."

By integrating soil conservation practices, it is possible to significantly minimize the impact of the erosion externality and bring conventional and environmentally adjusted measurements of productivity in the agricultural sector as close as possible.

Policy options to help mitigate soil erosion and improve agricultural productivity

Since the results from the study shows that when soil erosion damage costs are properly accounted for, agricultural productivity in Nigeria is less than what it had been found to be using conventional measurement techniques in the past, policy interventions are therefore required to control this externality. Specifically, government could potentially use a mix of de facto and incentive based polices to mitigate agricultural soil erosion. By de facto policies, government could directly institute mandatory requirements for farmers to incorporate soil conservation practices before they could get any support from government, including; credit, seedlings and fertilizers. On the incentive side, government could pay pro-rated compensatory allowances to farmers who make provision for waterpoints, forest roads, terracing and other soil conservation infrastructure.

CEEPA

The mission of the Centre for Environmental Economics and Policy in Africa (CEEPA) is to enhance the capacity of African researchers to conduct environmental economics and policy enquiry of relevance to African problems and increase the awareness of the role of environmental economics in sustainable development for economic managers and policy makers. CEEPA's Policy Brief series seek to inform a wide an general audience about research and policy findings from CEEPA studies.

Research Sponsors

Sida IDRC CRDI

CEEPA gratefully acknowledges the support provided by the key sponsors for the research summarised in this policy brief. They are the International Development Research Centre (IDRC) and the Swedish International Development Cooperation Agency (Sida). The findings, interpretations and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the Board of Executive Directors of IDRC, Sida or our other sponsors. IDRC and Sida do not guarantee the accuracy of the data included in this work.

Centre for Environmental Economics and Policy in Africa (CEEPA) University of Pretoria, Room 2-7, Agricultural Annex, 0002 PRETORIA, South Africa. Tel: +27 (0) 12 420 4105, Fax: +27 (0) 12 420 4958. www.ceepa.co.za