Land degradation and sustainable agricultural growth: an environmental economic assessment of selected countries

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Summary:

These results emphasize the importance of "getting prices right" and implementation of sustainable land and water management practices if future growth in food and agricultural output is to be sustained in developing countries.

After price distortion, the variable of greatest significance is the degree of land degradation. The regression results strongly suggest that land degradation in developing countries does constitute an immediate as well as long run threat to these countries' capacity to produce food. The estimation in this study failed to capture the off-site damage from land degradation.

Most developing countries are more dependent on their natural resources, notably land and water, and land degradation significantly threatens agricultural growth. Soil and water conservation is of great importance to sustainable economic development. Past development efforts have been based on the exploitation of natural resources in many developing countries. Policy reforms are needed to protect the soil base.

The policy reforms should focus on increasing economic incentives conservation. Appropriate economic incentives for millions of farmers are vital to channel development activities into sustainable development patterns. The appropriate economic incentives may include increasing agricultural prices to the competitive level, reducing taxation on agricultural production, establishing effective property rights, providing subsidies and assistance for conservation practices, and eliminating input subsidies.

Price distortions result in great losses of agricultural production in many developing countries. "Getting prices right" also applies to the argument for a sustainable pattern of growth. One of the most important causes of environmental degradation is that environmental services are undervalued.

Anotace:

Výsledky zdůrazňují význam "správné tvorby cen" a realizaci metod trvale udržitelného rozvoje pro budoucí růst zemědělské výroby.

Proměnná nejvyššího významu, po pokřivení cen, je stupeň degradace půd. Většina rozvojových zemí je více závislá na přírodních zdrojích a degradace půd značně ohrožuje produkční možnosti.

Ochrana půdní základny se vyžádá též politické reformy, které by se měly zaměřit na zvýšení ekonomických podnětů pro uchování přírody. Ty by měly zahrnovat: zvýšení zemědělských cen na konkurenční úroveň, snížení zdanění zemědělské výroby, upevnění efektivních vlastnických práv, poskytování pomoci pro účely uchování přírody a vyloučení dotací vstupů.

Pokřivení cen vyúsťuje ve velké ztráty zemědělské produkce v mnoha rozvojových zemích.

Key words:
Land degradation, developing countries, policy reforms, price distortions

Klíčová slova:
Degradace půdy, rozvojové země, politické reformy, pokřivení cen

Introduction

This paper briefly reviews some key environmental economic and sustainability concepts relevant to land use and agricultural growth. It also presents the results of an analysis of the factors determing the agricultural and food production growth rates in a sample of 23 developing countries. The results of this analysis and additional analysis for 10 countries in Eastern Europe are combined to develop some policy implications for sustainable land and agricultural growth.

In the simplest materials balance model, Freeman et al. view the environment as a large shell surrounding the economic system. It has the same relationship to the economy as does a mother to an unborn child -- it provides sustenance and carries away wastes. Raw materials flow from the environment, are processed in the production sector (that is, converted into consumer goods), and in part, pass on to the household sector. The materials returning to the environment from the household sector are wastes or residuals. Not all of the materials inputs that enter the production sector are embodied in the consumption goods flowing to the household sector. These are the wastes or residuals from production.

If the environment's capacity to absorb or assimilate wastes or residuals were unlimited, there would be no major environmental problems. However, the assimilative capacity of the environment is limited and in the case of some residuals like mercury it has no assimilative capacity.

Sustainability of agriculture and other natural resource based systems is a very popular concept, but the concept has many ambiguities and alternative points of view. These viewpoints can be grouped into three distinct categories including: (1) a purely physical concept for a single resource such as a fishery where the rule is to use no more than the annual increase in the resource, (2) a physical concept for a group of resources or an ecosystem where a variety of system outputs involve trade-offs, and (3) an environmental economic concept with emphasis on economic rationality and some minimal level of environmentally sustainable economic growth. A statistic or steady state notion of agricultural sustainability does not address the projected global increases in population and demand for food.

Historically, economic development has been based heavily on exploitation of natural resources, particularly of land resources. High population pressure on land, poorly defined

property rights, and limited fossil energy supplies, result in land degradation that is generally more serious in the developing world.

The exploitation of natural resources, particularly in developing countries continues in large part because they are not priced at their marginal social values. This underpricing in turn occurs because many centrally planned as well as private market economies with imperfectly defined and enforced property rights fail to fully internalize the external costs or environmental service benefits related to the use of these natural resources.

The planned economy or private market imperfections at the microeconomic or watershed level in the case of soil erosion also manifest themselves as imperfections in national income accounting at the macroeconomic level. Repetto argues that by ignoring natural resources [or the broader notion of environmental services], statistics such as the gross national product (GNP) can record illusory gains in income and mask permanent losses in wealth. As a results, a nation could exhaust its minerals, erode its soils, pollute its aquifers and hunt its wildlife to extinction - all without affecting measured national income.

Land Degradation and Ag Growth Model

A recent study focused on identifying the factors that determine the agricultural production growth rate and in testing the effects these factors have on agricultural growth in developing countries. Specifically, this study involved statistical estimation of an aggregate agricultural growth function based on cross-country data for 23 developing countries. Special attention was devoted to environmental degradation, and agricultural pricing policy and to the policy implications resulting from the effects these variables have on agricultural and food production growth.

This study was concerned with estimating the relative changes in output rather than the absolute levels of output. Thus, the dependent variables are expressed in relative terms as a percent change or average level of output during the study period.

The agricultural or food production growth function can be established by estimating the coefficients between agricultural/food production growth and the changes in the relevant independent variables. The aggregate agricultural or food production growth function can be expressed in the following form:

$$Y_g = f(A_g, L_g, Q, F_g, M_g, G,)$$

where,

Y_g = growth rate of agricultural or food production
A_g = rate of change in labor input
L_g = rate of change in land cropped
F_g = rate of change in fertilizer consumption
M_g = rate of change in machinery power utilization
Q = quality of arable land or soil
G = government policies, e.g., price, land use

The approach used in this study involves estimating a cross-country agricultural growth function based on a sample of 23 developing countries. Variations in agricultural growth rate are accounted for by differences in the growth rate of agricultural inputs and related factors. All the date used in this study are from the period of 1971-80.

Analysis and General Results

The six independent variables in the model can explain as high as 82 percent of the variance in total agricultural production, and about 78 percent of the variance of food production when growth is measured by the average index.

Land Degradation and Area Change

Land degradation tends to affect food production more significantly than non-food agricultural production. The result seems to confirm the belief that land degradation does threaten food production growth. It also impedes income increases in rural areas because of a direct relationship between farmers' income and food production growth.

The amount of arable and permanent crop land is strongly related to agricultural and food production growth. Reduction in severe land degradation should increase the future availability of arable and permanent land which may increase agricultural output.

Eastern European Evidence

Table 1 presents secondary data from World Resources, 1994-95, on agricultural growth, cropland per capita, percent change in cropland and forest/woodland, and fertilizer, water and irrigation use in Bulgaria, Czechoslovakia, Germany, Greece, Hungary, Italy, Poland, Romania, Turkey and Yugoslavia.

Although these 10 countries share some common characteristics, there are differences in the agricultural growth, land use and environmental indicators. For example, five (Bulgaria, Italy, Romania, Turkey and Yugoslavia) of the countries had a decline in per capita and three (Bulgaria, Romania and Yugoslavia) a decline in aggregate agricultural output from 1979-81 to 1990-92. The country (Turkey) with the largest aggregate growth in agricultural output during this same time period had a decline in per capita terms.

Cropland hectares per capita in 1991 varied from .5 in Hungary to .15 in Germany and for these 10 Eastern European Countries the average (.36) was higher than the world average (.27). All 10 countries had a decline in cropland since 1979-81 ranging from -0.61 in Greece to -4.41 in Romania. The average cropland decline for the 10 countries of -2.1% is in contrast to a world average increase of 1.8%. The percent change in forest and woodland hectares since 1979-81 in the 10 countries presents a different picture. Only Yugoslavia experienced a

decline (-1.4%) and the average increase for the region of 1.9% is in sharp contrast to the average global decline of -7.8%.

Average annual fertilizer use in kilograms per hectare in the 10 countries in 1979-81 and 1989-91 was approximately double the world rates.

The most often mentioned agriculturally-related environmental problems in the region are: (1) fertilizer contamination of surface and groundwater, (2) soil erosion, and (3) soil compaction. In addition, the damage to forest from air pollution is cited as a serious problem in the region.

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