United States Department of Agriculture

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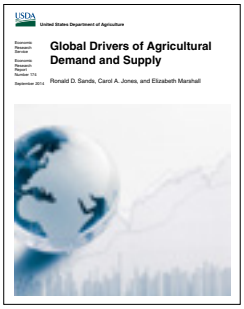

Find the full report at *www.ers.usda.gov/publications/err-economic-research-report/err174*

Global Drivers of Agricultural Demand and Supply

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What Is the Issue?

Recent volatility in agricultural commodity prices, coupled with projections of world population growth, raise concerns about the ability of global agricultural production to meet future demand. A number of factors are likely to affect the potential for future agricultural production. These include demand drivers such as changes in population and per capita income, as well as supply drivers such as changes in agricultural productivity. The world's population is projected to grow from 7 billion to approximately 9 billion by 2050, and per capita income is projected to grow in nearly all the world's regions. Agricultural productivity has improved rapidly in recent decades, but prospects for future growth are uncertain, especially in light of climate change. ERS examines hypothetical economic and agricultural effects of potential changes in agricultural productivity, population, and per capita income by 2050. These supply-and-demand drivers will determine not only what farmers will produce in the future, where they will produce it, and how affordable it will be, but also how much land and other scarce resources the sector will use.

What Did the Study Find?

- *Effects of a change in population*. For a 10-percent increase in global population, total crop consumption and production is projected to respond at nearly the same rate. Crop yield, however, increases by only 5 percent for this increase in population, even as increased demand for agricultural commodities pushes prices higher and encourages producers to use more yield-enhancing inputs. Crop area also responds to higher crop prices in this population scenario, with an expected increase in area of 4 percent.

- *Effects of a change in per capita income*. For a 10-percent increase in global per capita income, consumption and production of major crops is projected to increase by approximately 3 percent. Crop yield increases by 3 percent in this scenario, and cropland area increases by less than 1 percent.

- *Effects of a change in agricultural productivity*. A negative shock to global agricultural productivity could come about through a decrease in investments in agricultural research and development over time or through other economic or environmental factors such as climate change. This study did not simulate climate change, but it did consider a 20-percent decline in global productivity by 2050 for major field crops. The primary adjustments to the

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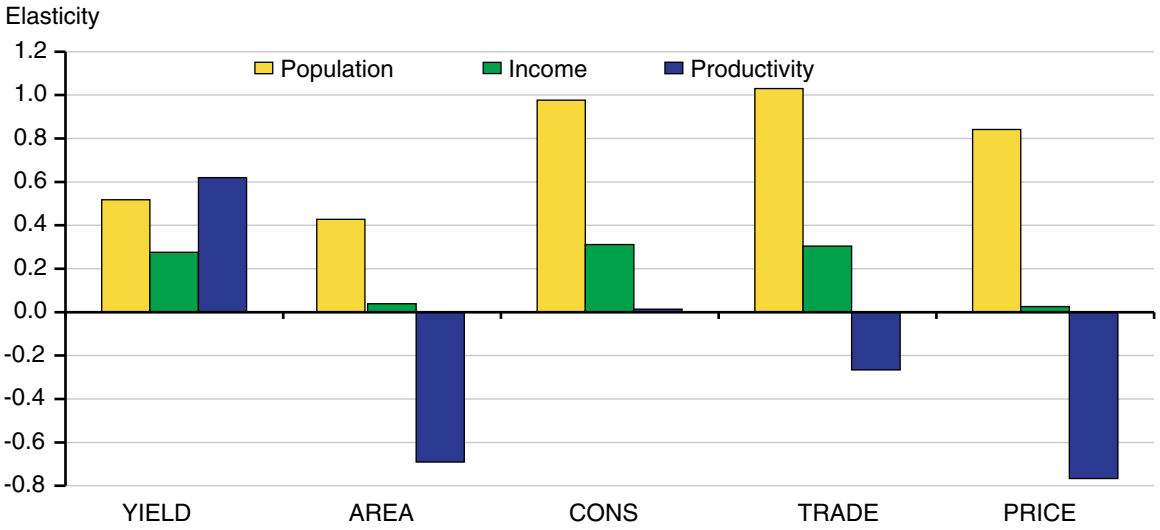
Elasticities of economic responses to three key drivers



An elasticity is the ratio of percent changes: the percent change in an economic response (e.g., consumption) for each percent change in a driver (e.g., income). When population or income is the driver, economic responses move in the same direction. Yield moves in the same direction as productivity, while cropland area and price move in the opposite direction of productivity. YIELD = average yield of major field crops in tons per hectare. AREA = global area of major field crops. CONS = global consumption = global production. TRADE = global exports = global imports. PRICE = price index of major field crops: wheat, rice, coarse grains, oil seeds, and sugar.
Source: USDA, Economic Research Service using Future Agricultural Resources Model scenarios.

change in productivity are in crop yield and cropland area. Through increased use of nonland inputs such as fertilizer and capital equipment, the realized decline in crop yield of 12 percent is less than the initial decline in productivity. To further compensate for the effects of the shock, land area supplied for field crops is projected to increase by 14 percent. At a global level, crop consumption and production are equal, and both decline slightly. World trade volume increases as crop production shifts among world regions. Average prices for field crops increase by 15 percent in this scenario, providing incentives to expand land area and increase use of nonland inputs in agricultural production.

For all scenarios, the percentage change in crop production is approximately the sum of percentage changes in yield and cropland area.

How Was the Study Conducted?

This study was conducted in parallel with a global economic analysis of potential climate impacts organized by the Agricultural Model Intercomparison and Improvement Project (AgMIP). The Future Agricultural Resources Model (FARM) used in this study is 1 of 10 participating models that incorporate global coverage of major field crops and other crop types. FARM is an economic model that simulates agricultural and energy systems for 13 world regions through 2050. Primary data sources include the United Nations (population projections), the Food and Agriculture Organization of the United Nations (agricultural production), the International Energy Agency (energy balances), and the Global Trade Analysis Project at Purdue University (social accounts).

A global reference scenario through year 2050 was constructed using medium-fertility population projections, moderate income growth, and crop productivity data (assuming no climate change impacts) provided by AgMIP to each modeling team. Model output includes consumption and production of agricultural commodities, yield and world prices of major field crops, and land use by crop type. To isolate the sensitivity of model variables to key drivers, a number of additional scenarios were constructed that varied the values of individual drivers one at a time, relative to the reference scenario: low- and high-population scenarios; a low-income scenario; and two low-productivity scenarios.