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# Brazil's Agricultural Land Use and Trade: Effects of Changes in Oil Prices and Ethanol Demand

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## What Is the Issue?

A prominent issue related to land-use changes in Brazil is the westward expansion of agriculture into the country's frontier region, which includes the surrounding Cerrados savannah. The conversion of range, pasture, and other land to cropland in Brazil is due not only to rising domestic and international food demand but also to rising ethanol production, expanding demand for sugarcane, the main feedstock used in Brazil. In fact, sugarcane area increased 35 percent in the period 2008-14, and sugarcane is now planted on 14 percent of Brazil's total cropland (65.4 million hectares) (1 hectare equals 2.47 acres). Since the demand for ethanol is inexorably linked to that of petroleum, oil prices can affect production and land-use decisions for ethanol feedstocks and, in turn, for other agricultural commodities. This study examines how longrun changes in oil prices could affect Brazilian ethanol production and resulting cropping patterns. It also considers the implications for world agricultural markets.

## What Did the Study Find?

The study examined the effects of two oil-price scenarios—sustained high prices and sustained low prices from 2015 to 2024—on Brazilian agricultural land use. A reference scenario is based on the assumptions in USDA's *Agricultural Projections to 2024*.

*High-price scenario.* In this scenario, the oil price rises 40 percent above the reference, or baseline, price in 2015, followed by another 7-percent increase in 2016 and small changes relative to the baseline price thereafter through 2024 (for a sustained average increase of 45 percent above the base price). With increasing oil prices, the demand for ethanol increases relative to that for gasoline, raising the price of ethanol and creating incentives to increase production. Consequently, sugarcane area increases by 946,000 hectares during the forecast period, or about 11 percent of current sugarcane area. This expansion helps boost sugarcane production by 75 million tons as well as the share of sugarcane milled for ethanol production. Most of the additional ethanol produced in Brazil would be consumed domestically, while a small share would be exported. With sustained higher oil prices,

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higher crop production costs, and lower returns for most crops, the area planted to food and feed crops other than sugarcane falls by an annual average of 12,300 hectares in 2015-19. With continued demand for food and feed crops, after 2019, prices and returns for other crops and livestock recover, leading to an additional 293,000 hectares of arable land brought into “other” crop and livestock production. With lower domestic production of sugar, corn, soybeans, rice, and cotton due to high oil prices, Brazilian exports of these commodities decline over the period. Given Brazil’s dominant position in global export markets for sugar, soybeans, and corn, this leads to higher world prices for these commodities throughout the period.

*Low-price scenario.* In this scenario, the oil price decreases 18 percent below the reference price in 2015, followed by 6-percent declines over the next 2 years and a 1-percent annual decline thereafter through 2024. A sustained fall in oil prices would be expected to trigger a drop in demand for ethanol as well as a drop in prices for agricultural inputs (energy, fertilizer, etc.). In this scenario, ethanol use in Brazil falls by an average of 16 percent annually in 2015-24. Over the same period, expected returns to Brazilian sugarcane producers would fall about 10 percent annually, leading to a decrease in production and freeing up nearly 4 million hectares of land for other agricultural uses. With lower oil prices, additional arable land is brought into field crop production (2.5 million hectares), livestock production (1.1 million hectares), and permanent crop production (46,000 hectares), while the remaining 335,000 hectares remain fallow. With lower energy costs and higher production, Brazil’s exports of sugar, soybeans, corn, cotton, rice, and meat increase during 2015-24.

Oil prices in the reference scenario are projected to continue to increase during the next decade, although at a slower pace than over the last half decade. In the high-price scenario, oil prices reflect parallel changes with respect to the reference price whereas oil prices in the low-price scenario reflect the continued (and divergent) decline in oil prices relative to the reference price. As a result, the increase in land use in the high-price scenario is not symmetric to the decrease in land use in the low-price scenario, where the reduction in revenue arising from ethanol production outweighs the benefits of lower chemical, fertilizer, and energy-related input costs.

## **How Was the Study Conducted?**

A dynamic multicommodity model of Brazilian agriculture based on policy, macroeconomic, and world petroleum price assumptions underlying USDA’s 2014 longrun baseline and on ERS-derived projections for Brazilian ethanol was used to generate projections of supply, demand, and trade for grains, oilseeds and products, cotton, livestock products, sugarcane, sugar, and ethanol. The model was combined with 41 other country/regional models to generate global commodity supply, demand, trade, and equilibrium prices for 2015-24. The model was enhanced by the following: (1) explicitly linking the sugarcane sector to ethanol and gasoline demand; (2) modeling the stock of agricultural land (cropland and pasture); (3) adding regional detail to the sugarcane, soybean, corn, and cattle components of the model; (4) including a cropping intensity index in the land-use allocation system to account for the cultivation of more than one crop in a given plot of land in one year; and (5) including region-specific prices paid by farmers for fertilizers and energy inputs. Changes in incentives to produce ethanol and other commodities were derived from high- and low oil-price projections by the U.S. Department of Energy.