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Ethanol: Is Corn the Golden Fuel?

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High oil prices, global warming, and the vitality of the American farm have introduced words such as "ethanol," "E85", and "flexible-fuel vehicle" to American households. However, a December 18, 2007, *New York Times* article, "As Ethanol Takes Its First Steps, Congress Proposes a Giant Leap," shows that the potential costs and benefits of ethanol production should be considered objectively.

"One of the most serious long-term challenges facing our country is dependence on oil—especially oil from foreign lands."
—President George W. Bush, before signing the Energy Independence and Security Act of 2007

In the United States, the effort to reduce oil consumption has focused in large part on converting the starch in corn into ethanol, which can be mixed with gasoline and burned in automobile engines. In December, Congress passed the Energy Independence and Security Act of 2007, which would increase the amount of "biofuels"—ethanol and biodiesel—mixed into transportation fuel from about 4 billion gallons in 2005 to 36 billion gallons by 2022.

Ethanol has become popular in part because many experts contend that burning ethanol emits less greenhouse gasses. As the source crop grows, it naturally absorbs carbon dioxide in the atmosphere. When it is converted to ethanol and burned, the same carbon dioxide is emitted, thus ethanol has been considered "carbon neutral." More recent studies, though, find that when the environmental effects of land clearing for ethanol source crops are taken into account, ethanol produces more carbon emissions than standard gasoline. Further, all ethanol production requires substantial amounts of water and corn-based ethanol production also requires a substantial amount of fertilizer, presenting risks for both water depletion and contamination.

Ethanol is also appealing because it comes from plant material that is domestically grown: Ethanol production is therefore less dependent on other nations, making our fuel supply less susceptible to oil-supply disruptions. However, land constraints limit the supply of corn. Thus, increased demand for corn raises its price and the price of products for which it is an input, such as beef. As more land is used to produce corn, the prices of displaced crops, such as wheat, cotton, and soybeans, also rise; moreover, the carry-over stocks of these crops diminish, increasing the potential for crop shortages and price instability due to adverse weather.

According to a University of Minnesota study, using all corn grown in the United States to produce ethanol would replace only 12 percent of the gasoline used for transportation. For this reason, Congress has begun to promote cellulosic ethanol, derived from plant materials such as switchgrass, which could produce 250 percent more ethanol per acre than corn. Currently, using all corn acres to produce cellulosic ethanol would replace only 30 percent of gasoline used for transportation, but the conversion process is still evolving and new, higher-yield plant sources are being found. Of the 36 billion gallons of "biofuels" required by 2022, 15 billion must be from corn and 16 billion must be from cellulose. Together, the 2022 level of ethanol is "energetically" equivalent to roughly 21 billion gallons of gasoline (15 percent of the gasoline used for transportation in 2005).

Though higher-yield sources of ethanol may temper the disruptive effects on the agricultural sector, additional challenges remain. Currently, automobile engines can burn fuel that is 10 percent ethanol. Offsetting more than 10 percent of gasoline consumption, then, requires a transition to flexible-fuel vehicles, such as those that burn E85, which are currently being promoted with tax incentives. Because the potential impact of ethanol on gasoline consumption is currently low, the costs and benefits of ethanol production must be carefully weighed.

By Joshua A. Byrge, Senior Research Associate, Federal Reserve Bank of St. Louis

Recent Articles and Further Reading on Ethanol

"The Future of Biofuels: A Global Perspective" by William Coyle, USDA, Economic Research Service, *Amber Waves*, November 2007, *3*(6), pp. 24-29.

This article provides an overview of many issues related to ethanol in the United States and abroad.

"Ethanol Expansion in the United States: How Will the Agricultural Sector Adjust?" by Paul C. Westcott, USDA, Economic Research Service, May 2007.

This article includes information from the USDA Agricultural Projections to 2016.

"The Energy Debate: Is Ethanol the Answer?" by Sarah Dougerty, Federal Reserve Bank of Atlanta, *EconSouth*, Third Quarter 2006, *8*(3).

This article provides an overview of many issues related to ethanol in the United States.

Free Data Sources

Data: Feed Grains Database
Description: Statistics on the supply, demand, and prices of various feed grains
Published by: USDA, Economic Research Service
Location: www.ers.usda.gov/data/feedgrains/

Data: Annual Energy Review, Renewable Energy
Description: Includes annual ethanol production and consumption estimates, 1981-2006
Published by: U.S. Department of Energy, Energy Information Administration
Location: www.eia.doe.gov/emeu/aer/renew.html

Data: Basic Petroleum Statistics
Description: A broad range of information related to petroleum, including U.S. motor gasoline consumption and total world oil production
Published by: U.S. Department of Energy, Energy Information Administration
Location: www.eia.doe.gov/basics/quickoil.html

Data: Gross Domestic Product, Table 1.5.6
Description: Includes statistics on personal consumption expenditure on gasoline
Published by: U.S. Department of Commerce, Bureau of Economic Analysis
Location: http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=36&FirstYear=2005&LastYear=2007&Freq=Qtr

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