Food vs. Fuel

Relevant Background

There is concern that bioenergy production will displace food production, resulting in higher food prices, food shortages, and social disruption. This sheet summarizes the current state of bioenergy and food production; analyzes the issue for developed and less-developed countries, and points out ethical issues with food and fuel.

Current State

> *Wood burning accounts for roughly 4% of world energy consumption. Biofuels for transportation accounts for only 0.2% of world energy consumption.*

Fuel ethanol production is concentrated in the U.S. and Brazil, each producing over four billion gallons in 2005. Second tier producers are China (one billion), India (0.5 billion), and France (0.2 billion).[1] Production has increased rapidly in the last two decades.

Biodiesel production is concentrated in Germany (500 million gallons in 2005) and France (100 million gallons) with lesser production in the U.S. (75 million gallons), Italy (60 million gallons), and other predominantly European countries.[2]

Biomass (primarily wood used in combustion) is produced and consumed on a local basis throughout the world, mainly in less-developed countries, where it comprises roughly one third of total energy use.[3]

In terms of energy use, biomass constitutes 4.0% of world energy consumption, while biofuels constitutes only 0.2%.[4] (See the figure below, reprinted from http://en.wikipedia.org/wiki/Image:World_energy_usage_width_chart.svg.)

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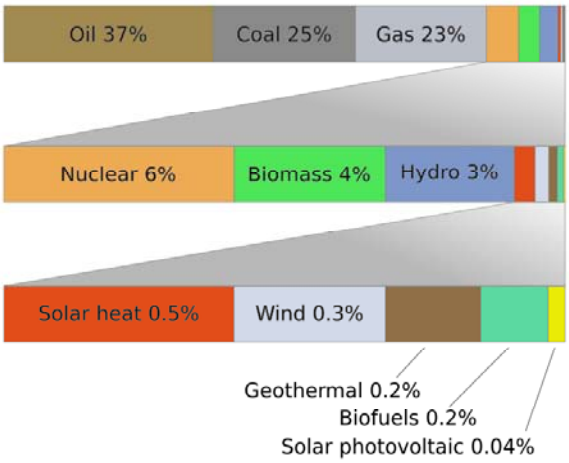
[1] Oak Ridge National Laboratory. http://cta.ornl.gov/bedb/biofuels.shtml.
[2] Earth Policy Institute, citing F.O. Licht, "World - Biodiesel Production (tonnes)," table, World Ethanol and Biofuels Report, vol. 4, no. 16 (26 April 2006), p. 365. http://www.earth-policy.org/Updates/2006/Update55_data.htm#table4.
[3] USDA Economic Research Service. Food Security Assessment, 2006. http://www.ers.usda.gov/publications/gfa18/.
[4] Wikipedia, citing BP Statistical review of world energy June 2006 (XLS). British Petroleum (June 2006). Retrieved on 2007-04-03. and Renewables, Global Status Report 2006 (PDF). Renewable Energy Policy Network for the 21st Century (2006). Retrieved on 2007-04-03. http://en.wikipedia.org/wiki/World_energy_resources_and_consumption.



In terms of U.S. agriculture, corn use for ethanol fuel has grown rapidly, from 35 million bushels in 1980, to 2.2 billion bushels in 2006. Corn for ethanol was the third largest use of U.S. corn in 2006:

- Feed: 6 billion bushels
- Exports: 2.3 billion bushels
- Fuel: 2.2 billion bushels

Ethanol production in Brazil relies primarily on sugar cane.

Market Concepts

> *Bioenergy and food must be understood in a market context. Market factors such as productivity, substitution, income effects, and long-run adaptation must be considered when analyzing food vs. fuel.*

The connection between bioenergy and food is a market issue. Landowners, farmers, bioenergy producers, and energy consumers influence one another not directly, but through market prices. Markets are global, interconnected, and impossible to predict. The price effects of bioenergy production may pop up where they are least expected.

To understand bioenergy and food markets, we need to pay attention to the following factors:

- **Productivity**. Bioenergy production continues to increase in efficiency. Crop yields, biofuels plants, and other factors are becoming more efficient from competitive pressures.
- **Substitutes**. When the price of good *x* rises, buyers (businesses and consumers) will look for substitutes. When substitutes are plentiful, they limit the amount that *x*'s price can rise.

- **Incomes**. People's incomes are rising around the world. As incomes rise, willingness to pay for food increases and demand for meat rises.
- **Short vs. Long Run**. As production and consumption change, the economy adjusts. This adjustment may be slow, in which case prices will rise significantly in the short run, but moderate in the long run.

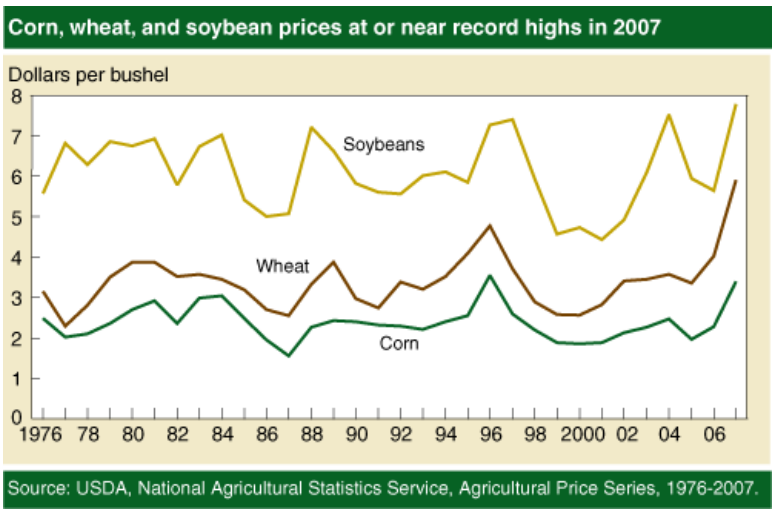
Food and Fuel in the U.S.

> *The effect of bioenergy on food prices in the U.S. is very small and, in the long run, of little significance to household food budgets.*

The food and fuel issue in the U.S. concerns corn ethanol. As noted above, most U.S. corn is used for animal feed. The next two largest uses are export (also destined for animal feed) and ethanol use.

The main effects of increased corn ethanol production has been a reduction of U.S. corn exports and of U.S. soybean exports. Secondary effects are an increase in U.S. corn acreage, a decrease in U.S. soybean acreage, and an increase in foreign corn and soybean acreage.

The effects are driven by price increases in U.S. corn, soybean, and wheat prices as shown below.



However, in the U.S., commodity price increases have little effect on consumer food prices. "In general, retail food prices are much less volatile than farm-level prices and tend to rise by a fraction of the change in farm prices."[5]

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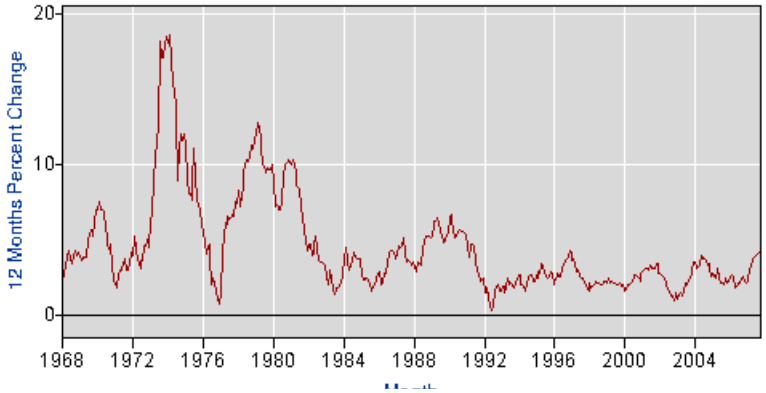
[5] USDA Economic Research Service. http://www.ers.usda.gov/AmberWaves/February08/Features/CornPrices.htm.

For food products that use field corn directly (e.g., cereals, corn sweeteners), a very small percentage of the final price is due to the price of corn. For example, for corn flakes, a "49-percent increase in corn prices would be expected to raise the price of a box of corn flakes by about 1.6 cents, or 0.5 percent."[6]

The effect on meat prices is larger because corn makes up a larger share of final meat prices. However, the effect is still fairly small. Using the same method as for cereal above, the USDA estimates that a 49 percent increase in corn prices would cause roughly a 2.5 percent increase in chicken prices and an 8.7 percent increase in beef prices.[7] The increase would be less in the long-run because animal producers have many alternatives to corn as a feed.

Overall, U.S. food prices rise relatively slowly, as shown in the figure below.[8]



More importantly, the share of U.S. household income spent on food continues to decline as shown in the graph below.[9] In other words, the importance of food prices to U.S. household budgets continues a long-run decline.

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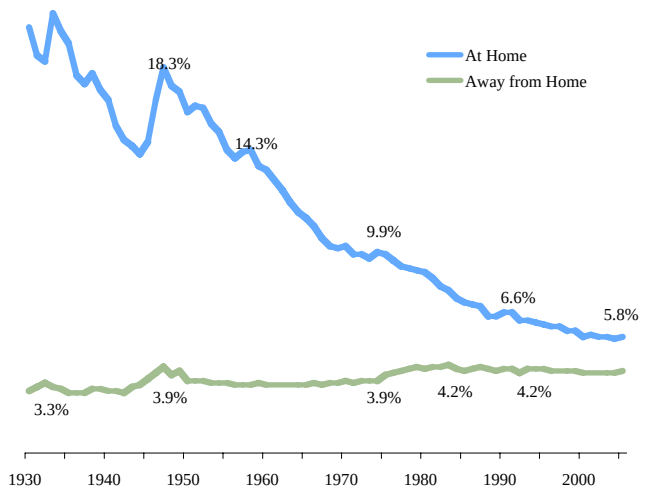
[6] USDA Economic Research Service.
http://www.ers.usda.gov/AmberWaves/February08/Features/CornPrices.htm.
[7] USDA Economic Research Service.
http://www.ers.usda.gov/AmberWaves/February08/Features/CornPrices.htm.
[8] U.S. Bureau of Labor Statistics, CPI, U.S. city average, Food and beverages, 1982-84=100.
http://www.bls.gov/cpi/.
[9] USDA Economic Research Service.
http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/Data/table7.htm.

Percent of U.S. Disposable Income Spent on Food



Less Developed Countries

Biofuel production increases food prices in less developed countries. The significance of these increases varies by country and household. Net exporters benefit from higher prices. Net importers are harmed.

In the U.S. and other developed countries, food is such small part of household budgets and commodity prices are such a small part of final consumer prices, that even dramatic rises in commodity prices have little effect on consumers.

In less developed countries, those conditions may not hold. There, food can be a large part of household budgets and the link between commodity prices and retail prices is much closer.

However, the effect is different for different countries depending on two factors: (a) is the country a net importer or exporter of food? (b) what are the main commodities consumed in the country?

Some poor countries and households are helped by rising food prices, because they are net sellers of food. High food prices hurt food importers and the highly food-insecure. As the USDA summarizes it:

> *"For highly import-dependent or highly food-insecure countries, any decline in import capacity stemming from rising food prices can have challenging food security implications."*[10]

[10] http://www.ers.usda.gov/AmberWaves/February08/Features/RisingFood.htm.

Countries that are most dependent on corn for food will see the greatest food price effects.

> *In general, we find that countries where corn is the major food grain experience larger increases in food basket cost while countries where rice is the major food grain have smaller food basket cost increases. Countries where wheat and/or sorghum are the major food grains fall in between. Consequently, the highest percentage increases are seen in Sub-Saharan Africa and Latin America where food basket costs are estimated to increase by at least 10%. The lowest percentage increases are seen in Southeast Asia, with cost increases of less than 2.5%.*[11]

Economic Development, Food, and Energy

> *Food prices are a small part of economic development problems facing poor countries. Of more importance are capital accumulation, foreign investment, trade opportunities, and technological innovation. Biofuels might* reduce *food and environmental problems in poor countries by providing a more efficient energy source than wood burning.*

Rising food prices from biofuel production are not a serious problem for developed countries, because consumers are able to pay enough more for food to offset the demand from biofuel producers. In other words, corn for ethanol will reach an equilibrium price where the amount that ethanol producers can pay for the corn is equal to the amount that food producers can pay. At this point, the food vs. fuel issue is balanced.

The incomes of those in poor countries are not large enough to outbid demand from biofuels producers. However, food price effects of biofuels are one of many problems facing poor countries. More important factors include foreign exchange availability, population growth, income growth, and export demand.

The correct policy goal is not low food prices as such, but economic development (increased incomes, reduced mortality, etc.) The question is whether policies that limit biofuels production will support economic development in poor countries.

In general, the answer is no. Biofuel and food price policy are very small parts of the economic development equation. Of far greater importance are issues such as political openness, lowering of trade barriers, availability of foreign direct investment, and capital accumulation. In wealthy countries, food is affordable because of those countries' wealth. Not the other way around.[12]

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[11] Ethanol Expansion in the Food versus Fuel Debate: How Will Developing Countries Fare? Amani Elobeid and Chad Hart. *Journal of Agricultural & Food Industrial Organization,* vol. 5, 2007.
[12] See e.g., *Ending Global Poverty: A Guide to What Works* by Stephen C. Smith, 2005.

There is another important factor in the relationship between bioenergy and poor country development: use of energy in poor countries themselves. Roughly one third of energy in poor countries comes from wood burning. This is a highly inefficient energy source that contributes to environmental degradation from excessive tree removal. Biofuels are more efficient and potentially less environmentally stressful than wood burning. Development of mature biofuel technology may increase economic development in poor countries, reduce environmental degradation, and free land for crop production.

> *"However, the newer sources of biofuels, such as ethanol, are more competitive with petroleum in terms of efficiency and under the assumption of continued oil price growth. This efficiency means that, with the growing investment in new technology, the production of biofuels in low-income countries can provide multiple benefits: increasing the supply of energy by converting crop residues, producing energy crops for ethanol, and increasing farm incomes and rural employment where poverty is deep. Energy crops also can grow in marginal and degraded lands where the use of wood fuels has contributed to deforestation, soil erosion, and reduced soil fertility in many parts of the world, particularly in Africa....Deforestation and soil erosion, in turn, reduce potential crop yields, thereby increasing vulnerability to food insecurity."*[13]

Ethical Issues

> *Many people see food and fuel as ethical issues, not economic issues. This point of view must be understood in any communications effort.*

Much of the public reaction to the food vs. fuel issue is an ethical reaction. Arguments based on economics are unlikely to be persuasive for those who see the issue in ethical terms.

For many people, any event that affects food availability or price is ethnically wrong, even if the individual and market will adjust to the change. Thus, any increase in U.S. corn prices may be perceived as having an immoral effect on people in the U.S., even though the net effect will be slight. The offsetting adjustment is not seen as morally relevant to many people.[14]

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[13] USDA Economic Research Service. Food Security Assessment, 2006. http://www.ers.usda.gov/publications/gfa18/.

[14] Comments of Paul Thompson, W.K. Kellogg Chair in Agricultural, Food and Community Ethics, Michigan State University. "In the case of agrifood production, there are some important ways such issues are framed and debated. One is a 'God's-eye' perspective that looks at society and counts numbers—it focuses on the aggregate, not individuals. The other approach stresses individual rights and sees anything that deprives one person of food as ethically problematic." http://newsroom.msu.edu/site/indexer/3322/content.htm.