AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Biofuels, Food & Feed Tradeoffs

Proceedings of a conference April 12-13, 2007, in St. Louis, Missouri.

Edited by

Joe L. Outlaw

Agricultural and Food Policy Center
Texas A&M University
College Station, TX

James A. Duffield

Office of Energy Policy and New Uses
US Department of Agriculture
Washington, DC

David P. Ernstes

Agricultural and Food Policy Center
Texas A&M University
College Station, TX

Sponsored by

Farm Foundation
USDA Rural Development
USDA's Office of Energy Policy and New Uses

75 Farm Foundation
SINCE 1933

Global Aspects of USDA's Baseline Projections for Biofuels

Ronald G. Trostle[1]

Introduction

In the coming decade, the global agricultural sector will be shaped by many economic, policy and technical developments. One of the major factors will be the global expansion in biofuels production.

Increasing energy costs have provided an incentive for many governments to encourage the production of petroleum substitutes from renewable agricultural crops. Currently, many countries are making new investments in biofuel production capacity. The main feedstocks envisioned for these investments in the near term are corn and sugarcane for ethanol, and rapeseed oil and soybean oil for biodiesel. However, other feedstocks are also being used. Other feedstocks for ethanol production include barley, wheat, rye, wine, sweet potatoes, sweet sorghum, molasses and cassava. Other feedstocks for biodiesel include palm oil and other vegetable oils, recycled oils and animal fats from the food industry.

The increasing demand for feedstocks used in the production of biofuels is expected to have a significant impact on global agricultural markets. A number of new supply-and-demand factors will be important, and there is uncertainty related to each factor. Assumptions about these supply and demand factors were incorporated into the 10-year baseline projections for US and world agriculture that the US Department of Agriculture (USDA) made in the November 2006.

What is the USDA Baseline?

Each year, USDA prepares a set of 10-year projections for US and world agriculture referred to as the "Baseline." The USDA Baseline projections are not a forecast about the future. Instead, the projections are a conditional, long run scenario about what would be expected to happen under a specific set of assumptions and conditions.

USDA analysts use a variety of economic models as a starting point for generating the baseline projections. USDA has a domestic crop-area allocation model and a number of US commodity market models. USDA also uses a US model, the Food and Agricultural Policy Simulator (FAPSIM), to analyze detailed technical and policy options. To help analyze global agriculture, USDA has a "Linked Country-Commodity Modeling System" that links 24 commodity markets in 39 countries and regions. Output from these models provide essential guidance to the commodity, country and policy analysts that contribute their expertise and judgment to the final projections. The projections presented here reflect the November 2006 Baseline.

How USDA Modeled Biofuels

USDA's objective was not to model biofuels markets themselves, but rather to focus on the markets for agricultural feedstocks. To incorporate biofuels into our modeling system for international agriculture, USDA used two different approaches, depending on the country: 1) those modeled specifically and 2) those affected indirectly.

Explicit Assumptions for Major Biofuel Producing Countries

In the first approach, explicit assumptions about feedstock growth and demand during the coming decade were made for the six countries that are major producers and/or consumers of biofuels and their feedstocks.. Assumptions about the growth in biofuel production reflected the rapid changes occurring in the biofuels industry and policies related to it. The six countries using this approach are the United States, the European Union (EU), Brazil, Canada, Argentina and China. USDA's assumptions about these countries were based on available data and on assessments of existing policies and statements about future policies. Although there is considerable interest in ethanol production from cellulosic feedstocks, widespread commercial production during the next decade faces many challenges. USDA's projections assume very little commercial production of ethanol from cellulosic sources during the next 10 years.

Below is a brief description of the assumptions and a summary of the projections for these six countries:

United States:

USDA first called attention to the rising importance of ethanol in the February 2003 Baseline report. At that time USDA projected the amount of US corn used for fuel ethanol production would be about 1 billion bushels (bu) by 2012.

[1] Trostle is an agricultural economist with USDA's Economic Research Service, Washington, DC.

The projections were raised slightly in 2004, and again in 2005. The 2006 projections rose sharply because of the impact of the *Energy Policy Act of 2005*. USDA again raised the projections in its 2007 baseline – it was assumed that over 4.3 million bu of corn would be used to produce more than 12 billion gallons (gal) of fuel ethanol by 2016. Biodiesel production is assumed to increase to 700 million gal in 2011 and then level off.

EU:

The EU has used rapeseed oil to produce biodiesel in relatively large quantities over the last decade. At the time USDA made its November 2006 projections, the EU had a target (not a mandate) that 5.75% of total transportation fuel use should come from biofuels by 2010. EU policies allow planting rapeseed on set-aside land and also provide for an area subsidy for biofuel crops, but the EU relies on individual member states to offer tax credits on biofuels. The USDA projections assume that about two-thirds of the target is met by 2010, and due to increasing total fuel use, the 5.75% target is still not quite reached by 2016.

The EU projections further assume that biodiesel accounts for a large majority of total biofuels use. Rapeseed oil is the feedstock for about 80% of EU biodiesel production. In the EU, the area planted to rapeseed and the crushing capacity both increase sharply. In addition, the EU increases rapeseed oil imports from Russia and Ukraine. It also imports palm oil from Southeast Asia, as well as some biodiesel made from Southeast Asian palm oil. The EU also produces some ethanol, most of it from wheat and some from sugarbeets.

Brazil:

Brazil has been the world's largest ethanol producer, but nearly all of it is made from sugarcane rather than grains. For several decades, government programs have encouraged the use of sugarcane for ethanol production to be used as an automotive fuel on a large scale. As a result, Brazil has converted most of its automotive fleet to a crop-based fuel from petroleum. In southern Brazil, some land has been shifted from grain and oilseeds production to sugarcane. The projections assume this trend continues, but at a slower pace.

Brazil's biodiesel production is small relative to ethanol. However, biodiesel production is assumed to nearly double in the next few years. Much of the new capacity will be in the soybean production areas in the Central-West region of the country. The biodiesel produced in this interior region will substitute for petroleum diesel fuel that has to be trucked long distances from the coast to the interior. Sugarcane for ethanol and soybeans for biodiesel do not compete for cropland because they are generally planted in different areas of the country.

Canada:

Canada has mandated that biofuels make up 5% of all motor vehicle fuel by 2010. However, funding for initiatives to encourage biofuel production is limited. Some provinces have production goals and provide some production incentives. Ethanol production capacity is assumed to rise rapidly to about 211 million gal by 2010 from 2.4 million in 2005. Feedstocks include corn for ethanol plants in Ontario and wheat for plants in the prairie provinces.

Biodiesel plants are being built in western Canada that will use rapeseed oil as a feedstock. In the projections, land is shifted to rapeseed from wheat, barley and some reduction in summer fallow. In eastern Canada, at least one biodiesel plant is being expanded that uses soybean oil as a feedstock. Canadian biodiesel production is projected to rise from 13 million gal in 2007 to 58 million gal in 2010.

Argentina:

In Argentina, the production of biodiesel is assumed to nearly triple over the next several years. Argentina has a system of differential export taxes that has one rate for soybeans, a lower tax rate for soybean oil exports and an even lower export tax rate for biofuels. The tax advantage for biodiesel provides an incentive for further investments in Argentina's already large crushing industry. Some of this new biodiesel is to be produced specifically for export. Argentina is projected to import some soybeans from other South American countries in order to keep its crushing facilities running at near full capacity.

Argentina is planning for a limited ethanol production capacity.

China:

In China, corn used to produce ethanol was projected to nearly triple during the projection period, reaching about 354 million bu (9 million tons) by 2016. However, because of China's food security policy, it was assumed that a subsidy for producing fuel ethanol from corn will be eliminated and that China will attempt to focus on ethanol production using nongrain feedstocks such as sweet potatoes and cassava.

Implicit Impacts of Expanded Global Biofuels Production

USDA had a second approach to model the impact of biofuels in other countries. There are many other countries that do not have mandates or targets for biofuel production that will still be affected by world biofuel demand. Their production and use of agricultural products that can be used for feedstocks are affected by the impact of higher world prices that ripple through their borders to affect producer and consumer prices. The impact in a particular country depends on how

open that country's border is and how responsive their producers and consumers are to price changes.

Other Europe and the Former Soviet Union:

For the former Soviet Union and Eastern Europe, USDA made no explicit assumptions about increases in biofuels production. However, the projections reflect an increase in rapeseed production in Ukraine, Russia, Romania and Bulgaria that is generated by higher rapeseed prices. Much of the production gains in this part of the world are destined for EU markets, either has rapeseed, rapeseed oil, or biodiesel.

Southeast Asia (Malaysia and Indonesia):

Concerning Southeast Asia, USDA made no assumptions about increased production of palm oil or its use for biodiesel. However, higher world prices for palm oil stimulate expansion of the area planted to palm oil. Malaysia expects to not only export more palm oil, but also to produce biodiesel for the export market. More of Southeast Asia's palm oil exports will be destined for biofuels use and less for food use.

Africa:

Some countries in Africa are reported to be making plans to produce biofuels. However, this will need considerable investment in manufacturing capacity and in the associated infrastructure. Certainly there is the agronomic potential to grow sugarcane, corn and cassava for biofuels feedstocks. But, will social and political forces lead to policies to encourage biofuels production in a low-income, food-deficit region where food prices are a major concern? The USDA projections assume no significant use of agricultural commodities for biofuels production, beyond those embodied in rising trends in industrial use.

The Impact of Biofuels on Agricultural Markets

During the next three to four years, biofuels production is projected to expand rapidly in a number of countries. What will be the impacts of these increases in biofuel production?

First, the associated increase in the demand for feedstocks will raise the absolute level of agricultural prices, and will also change the relative price relationships among various agricultural commodities.

- Most fundamentally, prices rise for most crops. The price of corn increases the most because the demand for ethanol competes with the demand for corn used for feed and the demand by foreign importers. Although the demand for corn used for ethanol production was the largest contributor to the increase in prices during the past year, some other factors also played a role.

  Prices for other crops also rise. Soybean prices increase because world prices for vegetable oils rise; and in the United States, some soybean acreage shifts to corn production. The prices of other grains, such as wheat, are buoyed by their feed value as a replacement for corn.

- Increased demand for ethanol feedstocks, such as corn, increases the price of corn relative to prices for other crops. In the USDA projections, the soybean-corn price ratio declines because the price of corn rises more than the price of soybeans.

- Prices for vegetable oils also rise in comparison to prices for oilseeds and protein meals because a greater share of the value of oilseeds is derived from the oil content relative to the protein content. In some of the world's growing areas, rapeseed – containing more than 40% oil – becomes more profitable than soybeans – which has only 18% oil.

- Another change in traditional price relationships is that the price of feedstuffs used as a source of energy (such as corn) rise relative to the price of protein feeds (such as soybean meal and distillers grains).

There are some other impacts of the expanding world biofuels production.

- The United States dominates world trade in corn. However, increasing use of corn for US ethanol production and rising world prices limit US export growth. During the next half decade, some countries respond to higher world prices by increasing corn production and exports – most notably Argentina, Brazil, Ukraine, Republic of South Africa and some countries in Eastern Europe. And high prices also trigger adjustments in demand. Still, US corn exports are projected to grow after the ramp up in domestic ethanol production slows in 2009. The US share of world corn trade declines from the historical 60% to 70% range to the 55% to 60% range.

- In Brazil, soybean exports are projected to double, even though Brazil's domestic demand increases for soybean meal for feed and soybean oil for human consumption and biodiesel production. Brazil's growth rate for the area planted to soybeans is projected to average more than 4% a year in response to higher world prices. China is projected to be the major market for Brazil's increase in soybean exports.

- Supplying the projected growth in biofuel feedstocks will require a global increase in the area planted to crops. During the last 30 years, the growth rate for the world's total area planted to ten major field crops has averaged less than 0.2%/year. (The crops include: wheat, rice, corn, barley, sorghum, other feed grains, soybean, rapeseed, sunflowers and cotton). However, in the USDA projections, the projected total area harvested of these crops grows nearly 0.4%/year – more

than double the average rate of the last 30 years. Some of the increased area comes from Brazil where new lands are brought into crop production and from Argentina where some pasture is converted to cropland. The former Soviet Union has land currently idled that was farmed in an earlier era that can be brought back into production. And, of course, existing land can be cropped more intensively. But the land-use implications of the projection scenario do raise the question: how much can biofuel production expand and still remain on a sustainable growth path?

- Another impact of the higher prices of food crops is that food aid shipments from donors to low-income, food-deficit countries may decline. If donor countries do not increase their budgets for food aid when food prices rise, the fixed budget buys less food to donate.
- Another consequence of the growth in biofuels output is that consumers all over the world will spend more on food. For most consumers in high income countries, the impact will be small. But lower income consumers in low-income food deficit countries will have to budget significantly more for food – unless they are a farm family that produces more food than they consume.

Summary

This paper developed a scenario about the future of biofuels in world agriculture. The scenario was based on what USDA knew and, more importantly, on assumptions about things we did not know. The basic story from this scenario can be summarized as follows:

Demand:

Biofuels are a new source of demand for some agricultural products. Demand for feedstocks to produce biofuels will be strong.

Supply:

The agricultural supply chain will need more resources, including land, water, fertilizer and new seed varieties.

Trade:

Some countries, *e.g.*, Ukraine, Russia, Romania, Bulgaria, Indonesia, Malaysia, Brazil and Argentina, will increase production and exports of feedstocks and biofuels. Other countries, *e.g.*, the EU, Japan and South Korea, will become importers of feedstocks and/or biofuels. It is unclear how much trade will occur in feedstocks versus trade in biofuels themselves.

Prices:

Not only will the general level of crop prices rise, but the price relationships among crops change from traditional patterns. Although the impact of biofuels on meats was not discussed in this paper, the baseline scenario also projects higher prices for poultry and beef and particularly for pork.

For more information about the USDA projections, go to: http://www.ers.usda.gov/Briefing/Baseline/.

The Economic Research Service also has a bioenergy briefing room with additional information about biofuels. It is located at: http://www.ers.usda.gov/Briefing/Bioenergy/.