IMPACT OF BIOFUEL CROPS ON U.S. AGRICULTURE: AN OVERVIEW

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Abstract

Biofuel crops are having an impact on prices of commodities, land use, and environmental factors such as water quality, biodiversity, etc. There are critical linkages today that result in the phenomenon of oil and corn prices moving in lockstep. We also see that limited cropland leads to tradeoffs between different crops that affect not only food and feed production, current corn based biofuel production but also future cellulosic production. The current and potential impact of biofuels on the environment and the condition of US farmland is of increasing concern. Policy options include strict cross compliance, moving to cellulosics as quickly as possible and a performance standard. The performance standard has the advantage of being an almost self-regulating mechanism to ensure compliance.

Introduction

The key impact of biofuel crops today stems from provision of inputs to ethanol production – now largely corn and in the future the possibility of cellulosic materials. In terms of corn, in the coming year we expect close to a third of the U.S. corn crop will be devoted to ethanol. There are several important impacts from this.

- The volume of corn is large enough that what ethanol producers can afford to pay for corn becomes a large determinant of corn prices.
- As the corn market is driven, this also drives the markets of other agricultural commodities that compete for the same type and climate of land – in this case especially soybeans
- As producers are driven to produce more corn, this can easily put more strain on the land and the overall environment through more intensive or extensive cultivation.

Oil and Corn Prices

What has happened in the last several years since Katrina is an increasingly tight relationship between oil prices and corn prices through ethanol. The transference works like this: the price of oil tends to determine the price of ethanol – either as a direct energy replacement or with some premium due to octane or other characteristics. (In the future the price of ethanol may be increasingly enhanced by the requirements of a renewable fuels standard, but the basic pricing factor is the price of the gasoline that ethanol substitutes for.) Given that we have an ethanol price (largely determined by oil) then the ethanol producer goes to the market to purchase feedstock for the ethanol plant, in this case corn. Corn is the major cost input to ethanol production, so the ethanol producer cannot pay too much for corn but will buy corn at increasing prices up until the ethanol plant stops making money – i.e. the ethanol from that plant costs more than the price of ethanol.

This relationship is such that as oil prices increase, more can be paid for corn, and as oil prices decrease, less can be paid for corn. Budgets for ethanol plants show that at several different oil prices, there is a corresponding amount that a plant can pay for corn and still break even. Including the fact that the plant gets the per gallon subsidy of $0.51 per gallon, at $60 oil, an ethanol plant can pay up to $3.50 per bushel for corn. At $80 oil, the corn price limit is about $4.75, and at $100 oil, the corn price is about $5.75. However, this tight relationship exists mostly when there are other strong competing demands for corn from livestock feeders, exports, etc. Over the past year we have seen this phenomenon occur. Stocks of all major grains have also been at historic lows. The total amount of corn traded in world markets is about 100 million tons. Some 40+ million tons are going to ethanol. This is as if we are living in permanent drought that reduces world corn production by 40 million tons. In addition, corn prices and oil prices have been driven upward by the decline in the value of the dollar that has made both of these commodities less expensive to those purchasing them with strong currencies like the Euro.

Given the commodity price collapse of recent months, the relationship may not be quite as strong today. Part of the commodities price collapse is built on expectations that there will be a world recession stemming from the financial crisis. Such a recession would tend to scale back demands for all commodities. Given that oil prices have declined from a high of $147 to levels around $80s, we have also seen corn prices come down from close to $8.00 to the $4.00 range. Did the decline in oil prices bring down the corn price? Certainly this was the case to some extent, but the markets were also figuring in less use of corn from other purchasers beyond ethanol plants. But what is evident is that the tighter the overall corn supply, the more likely that oil, through ethanol will drive corn prices. (We are not considering biodiesel because its cost for the basic vegetable oils has put it out of reach economically. Europe is in the process of revising its biofuels policy, largely based on rapeseed oils, because of pressures on that market and concerns about environmental issues from expanded palm oil production in other countries.)

The corollary of corn and oil prices might conceivably be switch grass or miscanthus and oil prices. The key difference here is that the cost of producing ethanol from cellulosic materials is so high (with only distant prospect for a major breakthrough that would slash costs) that there is tremendous downward pressure on cellulosic feedstock prices if cellulosic ethanol is to compete with oil. The critical question here is whether a cellulosic ethanol plant will be able to afford to pay enough to gain a reliable and constant supply of input material. Logistics and transportation become extremely important given that these are bulky low value materials that cannot be transported very far without undue cost for the value of the material.

Competition for Land

We know this is an important factor in the influence of biofuels on agriculture, but we do not have the information base to really assess what is going on and what the likely impacts are. When corn prices exploded upward after Hurricane Katrina, Corn, in essence, bought land from soybeans for the coming planting season, and corn acreage in the US went from 78.3 million to 93.6 million acres. Soybean acreage went from 75.5 million acres to 63.6 million acres. Wheat acreage increased a little and cotton acreage went down by a third. Total major crop acreage went up only 2 million acres. For this year's crop, in response to greatly increased soybean prices

this spring, soybeans bought land back from corn, wheat acreage went up a little and total crop acreage increased a little over 6 million acres.

We have to recognize that there is not a large amount of good quality agricultural land lying fallow. The land set asides from the pre-1996 agricultural programs no longer exist. The CRP is now mostly composed of land that has high conservation or environmental value. This is different from the first cycle of CRP acres that were enrolled in 1987 and contained good cropland that was in essence being retired because of the farm financial crisis.

The corollary for this on the cellulosic side is that there is also not a vast area of "wasteland" available that would be suitable for growing cellulosic materials. Given that one cannot afford to transport such materials very far, the land producing cellulosic materials needs to be able to do this at relatively high yields, and the land needs to be co-located with the processing activity.

Given the run up in commodity prices over the last several years, partially caused by ethanol, low world grain stocks, and a decline in the value of the dollar, we have seen a sharp upward movement in land prices and rents. What has happened is that the initial profit that benefits the grower has been capitalized into the value of the land, and that benefit now goes to the landowner. Higher land prices increase costs not only for corn and major grain production, but will also indirectly increase the cost of providing cellulosic materials for ethanol production. The cost and logistics of cellulosic materials is a much bigger challenge for cellulosic biofuel production than for corn based ethanol.

Pushing the Land

The prospects for high commodity prices and the limitations of the US land base set the stage for our further stressing the land to produce corn, soybeans or cellulosic materials for biofuels. This is a critically important issue today as farmers make decisions about growing biofuel inputs and investors make decisions about investing in biofuel processing plants. One concern is that, again, we have limited knowledge that would allow us to reliably quantify the impact of intensified and extended corn production on water quality, soils health, wildlife habitat, etc. The impacts of such activities are bound by the specific local conditions as well as the agronomic practices in the place where intensification or extensification occurs. The kinds of data gathering that might help us with this are lacking. We believe that there are negative impacts from this, but we cannot be precise in our estimates of damages. We know there are very real water quality concerns as well as overall ecosystem concerns whether we are talking about corn or intensive monocultures of cellulosic materials.

How to Cope with these Concerns

Traditional voluntary conservation programs as they have evolved in the United States may not be sufficient to deal with the extent to which biofuels production may add stress to agricultural systems. We are not just dealing with the additional requirements of producing inputs for biofuels, but also with the requirements we are increasingly facing feeding a growing world population. Part of the concern over the impact of biofuels production is whether expanded

biofuel input production in the US results in pushing the land harder (and increasing CO2 emissions) in other places. The key here is whether one views this concern globally or nationally.

What are some suggestions that have been made to ameliorate negative effects?

- Adopt a meaningful conservation compliance rule for farmers.
- Move to cellulosics as quickly as possible
- Adopt a performance standard for biofuel processors that reaches back to inputs

We had conservation compliance in the 1985 farm bill, and it was severely reduced and enforcement was difficult at best. We could get serious and take a European approach to this.

The move from corn to cellulosics does not necessarily eliminate environmental concerns. Taking large amounts of materials off the land requires nutrient replacement, traffic across the land, and other activities that may affect biodiversity, water quality, etc.

One way to get a lever on the standard of biofuel input production would be to enforce a performance standard on biofuel processors that would, through the market, reach back to the producer of inputs. A large subsidy or renewable standard will be required to make cellulosic ethanol possible. Those receiving the subsidy or benefiting from the renewable fuels standard would be required to ensure that their inputs met certain standards in terms of CO2 emissions, impact one water quality, energy use in production, etc. This is probably the most efficient way such standards could be imposed on such production.

Suggested Readings:

For the sections on Oil and Corn Prices and Competition for Land;

Doering, Otto and Wally Tyner. 2008. U.S. and International Policies Affecting Biofuels Expansion and Profitability. Paper commissioned by the Woodrow Wilson Center for Scholars' Program Biofuels in the Midwest, presented Sept. 7, 2008, Chicago.

For the section on Pushing the Land;

Robinson, Philip, et. al. 2008. Sustainable Biofuels Redux, *Science* Vol 322 (3 October 2008), pp 49-50.

For the section on Oil and Corn Prices;

Tyner, Wally and Farzad Taheripour. 2008. Policy Options for Integrated Energy and Agricultural Markets, *Review of Agricultural Economics*, Vol 30, 3.

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