The U.S. Biofuels Market: Policy Alternatives for the Future

Wallace E. Tyner
Purdue University
765-494-0199
wtyner@purdue.edu

Overview

Currently, the federal policy to stimulate investment in and production of ethanol is a subsidy of 51 cents per gallon of ethanol blended with gasoline. In somewhat different forms, this subsidy has been in effect since the Energy Tax Act of 1978. As of 1980 there was only 200 million gallons of ethanol production induced by this subsidy. The subsidy was essential to stimulate private sector investments in the industry as ethanol was far from profitable with no subsidy. However, in 2007 about 8 billion gallons of ethanol will be produced with the subsidy costing federal taxpayers about $4 billion. Ethanol production is expected to grow to about 12 billion gallons in 2008. The paper describes the market and policy conditions that have led to this rapid growth including the impacts on corn markets and prices.

In addition to the subsidy on ethanol described above, there is a different subsidy on biodiesel. The biodiesel subsidy from agricultural sources is $1/gallon and from sources such as waste grease, it is $0.50/gallon. These subsidies are not equivalent to the ethanol subsidy on an energy equivalent basis.

Methods

The main objective of this paper is to examine alternatives to the current fixed subsidies targeted to ethanol production and biodiesel. Alternatives included are 1)a lower fixed subsidy; 2)a subsidy that varies with the price of crude oil; 3)a two-part subsidy keyed to the imported oil replaced plus reduction in greenhouse emissions; 4)a much higher alternative fuel standard (mandate) such that companies are required to use a certain percentage of alternative fuels; 5)a combination of a higher alternative fuel standard with a variable subsidy; and 6)incentives targeted towards new technologies for cellulosic ethanol or other fuels from cellulose.

Impacts of the different subsidy policy alternatives are illustrated using breakeven analysis. Breakeven corn prices are calculated for a wide range of crude oil prices and under different assumptions regarding ethanol pricing relative to gasoline pricing. The breakeven corn prices are the maximum corn prices that ethanol plants could afford to pay and still earn a 12 percent return on equity capital.

Impacts of alternative fuel standards are quite different from subsidies, especially in terms of incidence. Standards are reflected in the pump price of the blended fuel as companies search for alternative fuels to meet the standard. Depending on the relative costs of alternative fuels compared to crude oil based fuels, the standards cost can run from negligible to quite significant. Subsidies come directly from the government budget and thus from taxpayers. Alternative fuel targets can be met through standards or subsidies or combinations of the two, and this analysis will provide assessments of the likely impacts of the different approaches.

A two-part subsidy incorporating oil import displacement plus greenhouse gas emission reductions would also be quite different in terms of analysis and outcome. Biodiesel has 1.5 times the energy of ethanol, so it would receive a larger subsidy for the oil import replacement component. Ethanol from corn or from cellulose would receive the same oil import replacement subsidy, but cellulose ethanol would receive a much larger greenhouse gas reduction subsidy component.

Results

One can trace out the break-even corn price for any given crude oil price. For example, with crude oil at $60/bbl., the break-even corn price is $4.72/bu. including both the additive premium and the fixed federal subsidy. This figure is for a new plant and includes 12 percent return on equity and 8 percent debt interest. If we consider an existing plant with capital already recovered, we add $0.78 per bushel to yield a break-even corn price of $5.50.

Any number of sensitivity analyses could be performed on the calculations contained in this paper. First, suppose that not all the subsidy gets passed through to dry millers and to the corn price. The first sensitivity assumes the subsidy is effectively 40 cents instead of 51 cents. In other words, this assumes that not all the subsidy gets passed back to ethanol producers. The breakeven corn price with the fixed subsidy becomes $4.37 instead of $4.72. Next suppose that the additive value is 20 cents per gallon instead of 35. The corn breakeven price becomes $4.25. With an additive value of 55 cents, the corn breakeven becomes $5.35. There is no doubt that ethanol has an additive value as an oxygenate and for octane, but it is impossible to predict what it will be as ethanol production increases beyond the needs for octane and added oxygen.

Another type of sensitivity would be to assume that ethanol might be priced equivalent to gasoline on a volumetric basis instead of energy basis. Some argue that in the long term refiners will choose to modify their refining process to produce a lower octane gasoline, say 84 octane, which could be blended at 10 percent ethanol to produce the standard 87 octane regular gasoline. We conducted two sensitivity analyses – one with the supplemental additive value then at zero and one with the additive value at 20 cents. With volumetric equivalent pricing and no additional additive value, the corn breakeven becomes $5.76. With volumetric pricing and 10 cents additional additive value, the corn breakeven becomes $6.08. In all these cases except the lower subsidy pass through and lower additive value, dry millers could afford to pay more for corn than in the base case. Combination of these cases could be done as well, but the approximate outcomes can be inferred from these results.

Conclusions

Ethanol has been subsidized in the US since 1978, and the subsidy has ranged from 40 to 60 cents per gallon over that period. Currently the subsidy is 51 cents per gallon, and combined with $60 oil, ethanol production has become highly profitable. This profitability has stimulated a huge increase in ethanol production capacity with 6 billion gallons of new capacity under construction as of January 2007. This increase in ethanol production is increasing corn demand and prices. Under the current policy, ethanol producers could still invest profitably in new production with corn price as high as $4.72/bu. Other assumptions could yield substantially higher corn prices.

One option, clearly, is to make no change in current policy. With this alternative, the other corn using sectors such as livestock production and corn exports would be forced to make the needed adjustments. Less corn would be used in these sectors, and prices for all livestock products likely would increase.

If government is interested in reducing upward pressure on corn prices, alternatives to the current fixed 51 cent per gallon subsidy could be considered. One option would be to lower the fixed subsidy. This alternative would reduce the pressure on corn prices but would still provide ethanol subsidies under higher oil prices when they are not needed. It is also invariant to underlying market conditions.

A second option would be a variable subsidy that provided an ethanol subsidy, which changes with the crude oil price. The option evaluated in this paper provided no subsidy for crude oil price above $60, and a subsidy that increased 2.5 cents per gallon for each $1 crude price is below $60. This option yields a breakeven corn price for $60 oil of $3.12/bu. compared with $4.72/bu under the current policy.

Another option would be to create a subsidy that attempts to incorporate the two market externalities in oil markets: energy security and climate change. Such a two-part subsidy would provide a higher subsidy for cellulose based ethanol than for corn based ethanol with biodiesel likely being between the two.

Instead of continuing subsidies, another policy path would be to switch entirely to alternative fuel mandates. The mandate approach takes the cost of stimulating production and use of alternative fuels off the government budget and, instead, puts it directly on the pump price of liquid fuels. If the risk of high pump prices in the face of possible low oil prices is deemed unacceptable, another policy alternative would be an alternative fuel mandate combined with a variable subsidy that kicked in at very low oil prices. In that way, higher pump prices could be avoided if oil prices were quite low.

One of our policy challenges is to make the transition from corn based ethanol to cellulose based ethanol. To accomplish that, some incentives targeted exclusively at cellulose based ethanol may be needed.

What is very clear is that much work is needed in delineating the impacts of alternative policy pathways. This paper attempts to illustrate some of the alternatives that will need to be considered.