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How Might Carbon Prices and Energy Costs Affect Returns to Agricultural Producers?

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INTRODUCTION

A report issued by Doane Advisory Services in May 2008 titled *An Analysis of the Relationship between Energy Prices and Crop Production Costs* has received recent attention as some interest groups have used it as evidence of how a U.S. federal cap-and-trade program—or any similar climate policy that creates a price on greenhouse gases (GHGs)—would negatively affect U.S. farmers. The study takes energy prices from EPA's economic analysis of the Lieberman-Warner America Climate Security Act (S. 2191) and combines this with USDA data on input costs from the eight largest crops (by value) in the United States to gauge how the higher energy costs expected under GHG controls translate into higher farm operating costs. Higher farm operating costs are the study's lone measure of farmer well-being, and the authors thereby imply that the economic harm to farmers equals their increased operating costs.

The Doane report usefully addresses an important set of issues. Yet there are a number of reasons why the results provide a misleading view of the impact on farmers of a carbon price:

- Recent projections of cap-and-trade policy in EPA's analysis of the Waxman-Markey bill show smaller energy sector impacts than the estimates used in the Doane report
- The study uses a simple crop budget rather than a full structural economic model to capture the complex market linkages and substitution among inputs that determine net returns to agricultural producers
- The study ignores the following factors that raise the returns to farmers:
    - higher prices received by farmers reflecting the input higher costs
    - biofuels as an income source
    - offsets from agriculture as an income source
- Other recent independent studies of carbon price impacts on agriculture capture many of the missing features identified above and tell a different story

Each of these reasons is further expanded upon below.

Recent projections of cap-and-trade policy in EPA's analysis of the Waxman-Markey bill show smaller energy sector impacts. EPA just performed an analysis of the recently proposed Waxman-Markey draft bill. The new EPA report was released in April 2009 and therefore was not available to Doane at the time of their report. Waxman-Markey calls for similar long-term cuts to Lieberman-Warner, but changes in energy policies and baseline assumptions about technological change, economic activity, and energy efficiency lead to GHG allowance prices for 2020 that are 40% lower in the core scenario (2) than was the case in Lieberman-Warner ($22 rather than $37). This translates into energy price increases of 12.5% for natural gas and 4.7% for oil in 2020 (down from 35% and 27% for 2020, respectively, under Lieberman-Warner).[1] Therefore any energy-related agricultural input cost effects would be much more muted with these estimates.

Lack of a structural economic model to capture substitution and market linkages. The process linking cap-and-trade, allowance prices, energy prices, and commodity production costs is quite complex and is best dealt with using either (1) a partial equilibrium sector model that examines the complexities of the agricultural sector as we link together inputs, feed, consumption, processing, and market prices; (2) a general equilibrium economic model that links together the carbon, energy, land, and agricultural commodity markets (both domestic and global); or (3) some combination of the two. Such an approach can trace the implications of cost shocks in one part of the market through the channels of supply, demand, substitution, trade, and prices. The Doane study does not use any such model. This,

[1] The other two scenarios with slower deployment of nuclear, carbon capture and storage (CCS), and renewable technologies were not run in the Waxman-Markey analysis.

unfortunately, can lead to an incomplete picture of net impacts on farmers, as highlighted in the next several points below.

One of the problems with using simple crop budget calculations rather than an economic model is the implied assumption of *constant rate of input use in the production process*. After establishing a baseline of average production costs by input (i.e., seed, fertilizer, chemicals, custom operations, fuel/electricity) and crop (corn, soybeans, wheat, cotton, rice, sorghum, oats, and barley), the Doane study forecasts changes in total per-acre expenditures by relating the effect of rising energy prices to the cost of each cost item. The use of each cost item (input) is held constant. There are two problems with assuming a constant rate of input use based on a historical series. First, it allows for no substitution among inputs in the short-term. Typically economists estimate substitutability among various inputs in the production process. By focusing on rising energy prices for individual inputs in isolation, the Doane study ignores the possibility that farmers can trade off among inputs, substituting less costly inputs for more costly inputs.

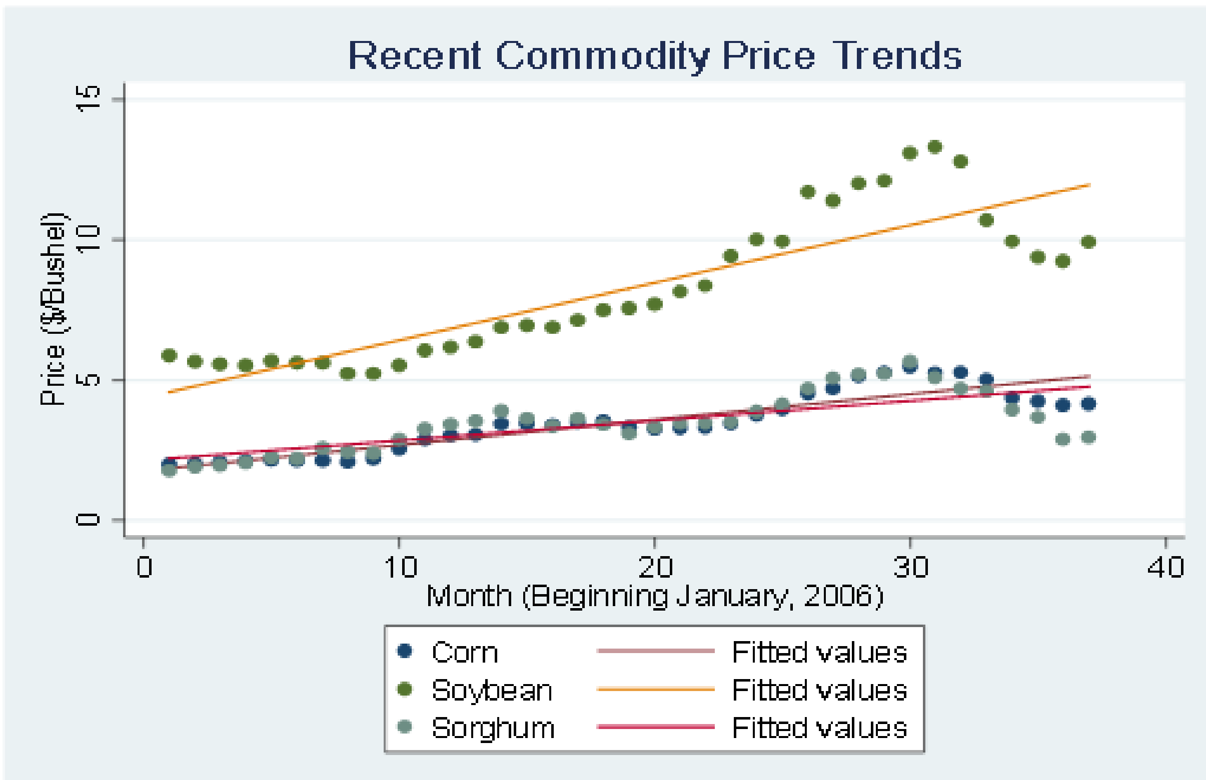
Secondly, the assumption of constant input use ignores the possibility of technological growth or long-term shifts in management practices. While the Doane study authors note that biotechnology adoption and changing management regimes have greatly impacted farm cost structure, they do not discuss the manner in which long-term energy cost trends could lead to similar advances and shifts in production practices. For example, farmers might find it preferable to reduce fertilizer use or switch to no-tillage production in order to avoid the higher costs of fossil fuel–intensive inputs, thereby reducing the impact of higher energy input costs on total cost of production. In an earlier study, McCarl et al. (1999) show that significant energy conservation was attained through the reduced tillage induced by a carbon price.

No pass-through of higher costs to higher prices. One of the consequences of not using a market model is that the analysis does not capture the effect that higher input costs have on market prices for the commodities in question. Quite simply, when all suppliers in the market face higher input prices—as will be the case when energy prices change—these costs will reduce supply and in turn raise the market price received by the farmers. The notion that higher input costs translate to higher output prices is straightforward, simple, and empirically robust. It is true that some of the U.S. commodities are traded in global markets, and some of those markets may have competitors that are not subject to climate policy (e.g., Brazilian soybeans), which can make it harder for U.S. producers to pass on carbon-related costs to consumers. But for the most part, U.S. producers will play a large enough role in the markets they face domestically and abroad that they will have the ability to pass along at least some of the costs in the form of higher prices. Consider what has happened in commodity markets over the last couple of years with higher energy prices. Therefore the Doane report's practice of quantifying the cost-per-acre impact and implying that this fully captures the effect on farmers overstates the case. A model that captures domestic supply and demand conditions and global trade in commodities will capture these price effects and provide a better indication of the net impact on U.S. farmers. Indeed in the conclusions section, the Doane report does acknowledge that energy costs can get passed through in the agricultural sector, but only in arguing that costs for transporting their products off the farm will pass through to farmers in the form of *lower* net output prices. By ignoring the ability of input costs to get passed on to consumers, yet emphasizing that downstream costs get passed forward in the form of lower prices, the report is selective in what it chooses to convey about the energy-related cost impacts.

The report ignores the role of biofuels in farm returns. A carbon price would provide a cost advantage and expand market demand for low–net carbon fuels such as biofuels for use in transportation and electric power. The primary feedstock for biofuels is supplied by agricultural producers, and they reap the benefits of expanded market demand. The most prevalent example today is with corn-based ethanol. Through a variety of government programs, based in part on climate policy objectives, and also in response to rising crude oil prices, the demand for ethanol has expanded dramatically in the last two years. Correspondingly, the price of corn and other crops that compete for land with corn shot up markedly and net farm income hit record levels. And while prices have tapered off some in the last year due to the economic downturn (see Figure 1), they still remain well above historic trends.

Various studies by USDA and academic institutions have attributed 40% or more of the crop price increase to ethanol demand for corn (e.g., World Bank 2009; Fortenberry and Park 2008). It may be that the Doane report authors omit biofuels from consideration because the recently promulgated Renewable Fuels Standard (RFS) essentially mandates a fivefold increase in the use of biofuels by 2022 independent of any separate carbon cap program. One could argue that these benefits will accrue to farmers regardless of the climate policy and that little if any additional biofuel demand will be driven by a cap. But such an omission should be based on a systematic modeling of the biofuels market, the mandate, and climate policy together to draw such a conclusion (see below), which this study does not do.

Figure 1. U.S. Average Market Prices (Monthly). Source- USDA, Farm Service Agency (FSA), 2009



Source: USDA Farm Service Agency (FSA), 2009

No agricultural offsets. By all accounts, agriculture would remain outside of any cap that emerges in a federal climate policy, but would be eligible to supply offsets to the capped sectors. Offsets reduce emissions (or increase sequestration) of greenhouse gases produced by an entity outside of the compliance cap. The offsets are used by a capped entity to offset its own emissions. The economic premise of an offset transaction is that the uncapped reduction is less expensive than the capped reduction, which leaves room for gains from trade. Farmers can participate by sequestering carbon through no-till agriculture, grassland conversion, or tree-planting, or by reducing field emissions of nitrous oxide (N_2O) or methane, both GHGs. Farmers exercise these options in order to sell offset credits; presumably they will not take these actions unless they gain economically from doing so. An EPA report shows that there are abundant opportunities for offset production from the agricultural sector (Murray et al. 2005). The benefit of participating in an N_2O offset program is particularly critical. It's quite possible that landowners could be credited for reducing nitrogen fertilizer use and forgo the higher nitrogen fertilizer prices as indicated by the Doane study altogether. These gains need to be factored into any analysis of the net impacts of a climate policy on agriculture.

Recent studies capturing the joint effect of biofuel demand, carbon prices, higher energy costs, and offsets tell a different story. This is not the first time claims similar to the Doane report have been made, and the prior claims also were met with counterevidence from agricultural economics. A study conducted by Francl et al. (1998) asserted large negative impacts from carbon prices on growers, similar in magnitude to those in the Doane report. Subsequent analyses conducted by EPA (McCarl et al.1999) and USDA (Peters et al. 2001) showed that these impacts were greatly overstated for many of the same reasons stated above (lack of market modeling, ignoring price effects, etc.).

More recently (2008), the interagency Biomass Research and Development Board released a report titled *Increasing Feedstock Production for Biofuels: Economic Drivers, Environmental Implications, and the Role for Research*. This report used the USDA Economic Research Service's Regional Environment and Agriculture Programming (REAP) economic model and Policy Analysis System (POLYSYS) of the U.S. agricultural sector to evaluate the separate and joint effects of biofuel mandates, higher energy input costs, changes in crop yields, and a carbon price on the production, prices, and net returns to agriculture. That analysis confirmed that carbon prices and higher energy costs do raise input costs and can reduce sectoral output, but that these factors generate crop prices that in some cases more than make up for the input cost effects. Taken together with enhanced biofuel demand, the net returns to corn growers from higher energy costs, a carbon price, and increase in yields is a roughly 12% increase in returns relative to the baseline without these factors in play. Net returns from other crop production declines slightly and returns to livestock production are largely unchanged when all factors are taken into effect. The direct effects of a carbon price (given at $25 per ton CO_2 in the early years of the program, which is in the middle to high side of recent core allowance price estimates from studies referenced above), is negative on crop production returns, dropping 2%–6% for corn and other crops respectively.[2] But combining these with enhanced biofuel demand and other energy cost factors still leads to strongly net positive returns for corn and slightly negative returns for other crops, a message that gets lost in the Doane study. The net positive findings for agricultural producers under carbon pricing and biofuel incentives is consistent with other related work on the topic using the type of integrated economic models not used in the Doane analysis (McCarl 2007; Schneider and McCarl 2005).

[2] It is not entirely clear how the interagency study deals with onsite emissions from agriculture (e.g., direct N_2O field emissions from fertilizer use). The report vaguely implies that perhaps these emissions may be assigned a cost in the economic analysis, which if so, would overstate costs to farmers if agriculture remains outside the cap as all current proposals have specified. If agriculture remains outside the cap, farmers would not be liable for these emissions, but could generate financially beneficial offset credits if they engage in projects to reduce these emissions.

SUMMARY

Taken together, it is clear that a carbon price will raise energy costs, and higher energy costs will translate to higher agricultural input costs. But to capture the full essence of how this will affect agricultural producers requires the use of an economic model that translates cost and yield factors into changes in supply, demand, exports, imports, market prices, and producer returns. Simply calculating the per-acre cost effects of higher energy costs only tells part of the story. The rest of the story includes the impact of substitution of lower-cost inputs for higher-cost inputs, changes in crop production patterns, shifts in product supply and demand , and the resulting change in market prices. The net impact of a carbon price, taken alone, may be negative for some agricultural producers when all these factors are modeled. But the impact appears to be quite a bit smaller than the direct energy-cost-per-acre measures put forth in the Doane report. Moreover, taken together with an expansion of biofuel demands that are complementary to a carbon price policy, the net effect on agricultural producers ranges from small net effect to large positive returns (e.g., corn). There is more to the story, since the higher prices received by farmers are paid for by consumers and this is money out of their pocket. These factors also need to be considered in a full economic analysis of agricultural sector. But the story for crop growers and other primary producers, which is the focus of the Doane report and conclusions, appears quite a bit more favorable or less damaging than their estimates suggest.

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