

Costs and Benefits to Agriculture from Climate Change Policy

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Consideration and subsequent passage of the American Clean Energy and Security Act of 2009 by the U.S. House of Representatives focused attention on whether agriculture would be helped or hurt by the policy's objective of reducing U.S. greenhouse gas emissions. Even though Collin Peterson, chairman of the House Agriculture Committee, sought and obtained changes to the legislation that were favorable to agriculture, many farm groups came out in opposition to the bill. One example is the American Farm Bureau Federation, which estimated that U.S. net farm income would decrease by at least \$5 billion per year by 2020. Other farm groups supported the legislation, including the National Wheat Growers Association, which found that the Peterson changes helped shape a policy that will "...ensure that agriculture has a place in any climate change legislation and that producers are able to reap potential benefits rather than just accept coming costs."

Whether agriculture will be a net winner or loser from climate change policy will depend on the details contained in any final piece of legislation. But the sources of agricultural costs and benefits are well known, so it is possible to identify how agriculture could be affected. For example, to the extent that climate change policy leads to increased energy costs, farmers will have to pay more for diesel, electricity, fertilizer, and pesticides. The effects of these cost increases on production levels and market prices will ultimately determine the extent to which farm income is negatively affected by higher energy costs. Another source of costs to agriculture would arise if agricultural emissions of greenhouse gases were subject to a cap. Such a cap could force crop farmers and livestock producers to limit emissions of methane and nitrous oxide, much as the electricity-generating sector will have to meet a cap on carbon dioxide emissions. The House bill explicitly treats agriculture as an uncapped sector, and it is likely that the Senate will follow suit in any bill that they pass. In the House bill, a capped sector would be able to offset excess greenhouse gas emissions by buying emission reductions from uncapped sectors, such as agriculture. This possibility, of farmers selling emission credits, explains why there are supporters of climate change policy within agriculture.

Why a Carbon Cap-and-Trade System Will Increase Farm Production Costs

Currently, U.S. companies face no limits on their emissions of greenhouse gases. A lack of any constraint means that U.S. industry has been able to choose manufacturing methods and technologies that minimize their costs without consideration of their impact on atmospheric greenhouse gas concentrations. In economic terms, greenhouse gas emissions have been external to the internal decision-making processes of companies. Having companies put a non-zero weight on emissions is the first step in cutting emissions.

The fairest policy would seem to be one that requires all companies to reduce their emissions by the same percentage. But economists have shown that such a uniform policy can greatly increase the total cost of meeting a target reduction. It makes more sense for companies that can most easily reduce greenhouse gas emissions to do the greatest share of the cutting, thereby allowing other companies to continue to emit, as long as the overall target is met.

Two policies can achieve efficient emission reductions: a carbon tax and a cap-and-trade program. Under a carbon tax (or a carbon dioxide equivalent tax for nitrous oxide and methane), companies choose to either emit and pay the tax or cut emissions. A straightforward calculation will reveal the best alternative. Companies that can easily cut their emissions will do so. Those that cannot easily cut emissions will pay the tax. The tax is set at a level that increases the price of carbon enough to induce companies to cut their emissions enough to meet the overall targeted reduction.

Under a cap-and-trade program, overall emissions are capped. Companies are free to emit as much as they want as long as they have a permit for each ton of emissions. The trade part of the program allows companies to buy and sell the permits. Those companies that can easily reduce emissions can make money by cutting their emissions and selling their excess permits. Companies that find it too expensive to cut emissions can buy permits and continue to emit.

The key for either policy option is to increase the price of emission, which automatically creates a profit incentive for companies to figure out whether it is better to cut emissions or pay to emit. Thus, it doesn't really matter which option is adopted. What does matter is increasing the cost of emitting greenhouse gases, which in turn will automatically increase the cost of producing those goods that currently result in large greenhouse gas emissions. The industries that are targeted by the House bill are electric utilities, oil refiners, natural gas producers, and some manufacturers that produce energy on site. This means that the price of electricity, gasoline, diesel fuel, home heating oil, and natural gas will increase. It

naturally follows that products that rely heavily on these energy sources will also become more expensive.

Although agriculture contributes about 6.7 percent of total U.S. greenhouse gas emissions, it faces no future emissions cap under the House bill. This does not mean that agriculture will be unaffected by the cap-and-trade program in the energy sector. Higher energy costs will translate directly into higher prices for electricity, propane, and diesel fuel, and domestically produced fertilizer and pesticides. The cost of producing fertilizer and pesticides in other countries will not be directly affected by U.S. legislation, but if other countries limit their greenhouse gas emissions, then their production costs will also increase.

Magnitude of Cost Increases

The amount by which farmers' costs will increase depends on the quantities of energy-intensive inputs they use, the amount of flexibility they have in moving away from more expensive inputs, and the price at which carbon settles. An example for Iowa corn and soybean production illustrates an analysis of energy costs under cap and trade.

Iowa farmers who plant both corn and soybeans use approximately four gallons of diesel per acre to cultivate, plant, and harvest their crops. They also use about 60 pounds of nitrogen fertilizer, 50 pounds of phosphate, and 65 pounds of potash across the two crops. And corn farmers typically use propane to dry their corn.

The carbon dioxide (CO₂) emission from using a gallon of diesel fuel is 10.1 kilograms. Thus, Iowa crop farmers emit about 40 kilograms (0.04 metric tons) of CO₂ per acre in diesel. If the price of CO₂ is \$20 per ton, then farmers will have to pay \$0.80 per acre extra for their diesel fuel.

Natural gas is the primary source of energy used to produce fertilizer. One source (Gellings and Parmenter, 2004) estimates that the energy used to produce, package, and transport different fertilizers is approximately 33,000 British thermal units (Btu) per pound for nitrogen, 7,000 Btu per pound for phosphate, and 5,500 Btu per pound for potash. Natural gas emits 117 pounds of CO₂ per million Btu. This adds up to about 0.14 tons of CO₂ per acre across corn and soybeans. At a price of \$20 per ton of CO₂, this amounts to \$2.85 per acre.

To dry a bushel of corn from 19 percent moisture to 15 percent moisture uses about 0.088 gallons of propane. With a yield of 180 bushels per acre, this amounts to 15.84

gallons of propane per acre for corn drying costs. Emission of CO₂ from burning a gallon of propane is 5.525 kilograms. Thus, at a CO₂ price of \$20 per ton, propane costs would increase by \$1.75 per acre of corn, or by \$0.87 per acre across corn and soybeans (assuming no drying costs for soybeans).

Adding up the extra costs from diesel, fertilizer, and propane at a price of \$20 per ton of CO₂ results in a cost increase of \$4.52 per acre for Iowa's corn and soybean farmers, assuming that farmers make no adjustments to their operations. A different price for CO₂ would change this cost estimate proportionately. To put a cost increase into perspective, the variable cost of producing corn and soybeans in Iowa in 2009 is somewhere around \$300 per acre. Thus even a \$10.00 increase in the cost of production represents a 3.3 percent increase. To add more context to this increase, Iowa corn and soybean farmers receive approximately \$20 per acre in direct payments as part of the 2008 farm bill. In addition, most farmers receive between \$5.00 and \$20.00 per acre in crop insurance subsidies.

Livestock farmers would also be affected by energy cost increases. According to livestock enterprise budgets put together by John Lawrence at Iowa State University, fuel, repairs, and utilities account for about 5 percent of total costs in swine when hogs are produced in confinement. Thus a 20 percent increase in this cost category would increase Iowa's average cost of producing hogs by about 1 percent.

Magnitude of Benefits from Agricultural Carbon Offsets

The price of emission permits in a cap-and-trade program will be determined by the cost of reducing greenhouse gas emissions from capped sectors of the economy, or by the cost and availability of offsets from uncapped sectors, such as agriculture. The Peterson amendment to the House bill identified offset activities that agriculture could provide. Some of these include conservation tillage, reduced nitrous oxide emissions caused by fertilizer use, increased biomass sequestration from use of winter cover crops and reduced use of fallow, and reductions in methane emissions from livestock production. In addition, crop producers could convert their land from crop production to tree production.

Benefit for Crops

Conservation tillage has been advocated for years as a way to reduce costs and increase soil health. And it is now the rare farmer who does not try to keep tillage operations to a minimum. But adoption of no-till has stagnated. A widely used estimate of the annual amount by which soil carbon can be increased from adoption of no-till farming is one ton of

CO₂ per hectare, or about 0.4 tons per acre. At a \$20-per-ton carbon price, this amounts to \$8.00 per acre.

The costs of no-till must help explain the stagnation in the number of farmers willing to adopt this method. Some of these costs in Iowa are the cost of a no-till planter, the perceived benefit of fall tillage after corn to help break down the corn stover, and, for farmers who plant continuous corn, the delay in planting and/or germination caused by late-to-warm soils. Despite these costs, a significant number of farmers would likely move to no-till with an offer price of \$8.00 per acre.

Farmers obtain large benefits from nitrogen fertilizer, and there is uncertainty about how to control nitrous oxide emissions from crop production. Therefore, the only prescription for low-cost reduction of nitrous oxide emissions is to increase the efficiency with which nitrogen fertilizer is used. But this prescription holds true with or without energy policy incentives, particularly with the high fertilizer prices recently, so for now it is unclear how much crop farmers can benefit by trying to reduce nitrous oxide emissions.

According to the U.S. Environmental Protection Agency, planting trees can sequester between two and nine tons of CO₂ per year (see www.epa.gov/sequestration/rates.html). In the Corn Belt, sequestration rates are about four tons per acre. At a price of \$20 per ton, this can generate between \$40 and \$180 per acre per year (\$80 for Corn Belt land). Of course, to obtain this revenue, a farmer must quit growing crops and put up an investment to establish a forest. It is unlikely that crop farmers on productive land will increase profits by swapping cropland for forests. Even if the CO₂ price were to double, the returns to growing crops would quickly rise if a lot of prime cropland were taken out of production and put into forests. It is more likely that owners of land that is more suitable for forests than crops will find it worth their while to establish trees as a carbon offset. But most of this type of land has already been taken out of crops over the last 30 years, so the amount of U.S. land that can be converted in response to the cap-and-trade policy is probably quite limited.

Benefits for Livestock

Livestock producers can reduce methane emissions by covering their anaerobic lagoons or by investing in anaerobic digesters to stabilize their manure. Estimates of the reduction in methane emissions vary dramatically across types of operations and adopted mitigation technologies. There are examples of dairy farms that produce the equivalent of five tons of CO₂ reductions per year per cow. At a price of \$20 per ton, this generates \$100 per cow per year. Of course, any net benefit or net cost of using and capturing the methane

must be added or subtracted from this \$100. For comparison, the same cow may produce 20,000 pounds of milk per year, which generates perhaps \$1,000 per year in milk revenue in excess of feed costs at a milk price of \$15 per hundredweight.

Is Agriculture a Net Winner or Loser from a Carbon Cap-and- Trade Policy?

If the United States adopts a cap-and-trade policy to combat climate change, the negative impacts on agriculture will likely be relatively small, particularly if agricultural emissions remain uncapped. Once companies here and abroad have a profit incentive to find low-cost ways to reduce greenhouse gas emissions, it is doubtful that carbon dioxide prices will rise high enough to dramatically increase agricultural production costs. If other major agricultural producers also face increasing production costs because their countries adopt carbon-reducing policies, then U.S. producers will not lose their competitive advantage. Furthermore, if production costs do rise significantly, and if most of the world's farmers face these higher production costs, then most, if not all, of the higher costs will soon be reflected in higher commodity prices that will compensate farmers for their higher costs.

Similarly, the benefits from providing carbon offsets to capped sectors of the economy will be modest as well. Benefits will accrue as more crop farmers will move to no-till farming, and a price for carbon will enhance the economics of methane recovery systems in livestock operations.

Given the likelihood of modest costs and benefits from a cap-and-trade system, perhaps agriculture should look at whether a cap-and-trade policy will change growing conditions for the better or worse as a deciding factor in whether to support a change in policy. Given how much irrigated agriculture in the West relies on consistent mountain snowfall and Corn Belt agriculture relies on warm summers with abundant rainfall, any disruptive change in climate will have a far greater impact on livelihoods than will the price of carbon. ♦

Work Cited

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