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Mr. Chairman and Members of the Committee, thank you for the invitation to participate in today's hearing on energy issues and U.S. agriculture. In my statement, I will profile the role of energy in U.S. agriculture and discuss the effects of this year's increases in energy prices on agriculture as both a user and a producer of energy.

Energy use in U.S. agriculture

The primary forms of energy used on U.S. farms and ranches include diesel fuel, gasoline, natural gas, liquid petroleum (LP) gas and electricity. Farmers also use significant amounts of energy indirectly through energy intensive farm inputs, such as commercial fertilizers and pesticides. Both direct and indirect energy consumption for farm production required 1.7 quadrillion British thermal units (BTUs) in 1998, the most recent year of complete data, or about 2 percent of total energy consumed in the United States (figure 1).

Increased energy efficiency. U.S. agriculture has changed the forms of energy used and become much more energy efficient over time. Energy use grew during the 1960s and 1970s, peaking at 2.2 quadrillion BTUs in 1978. High energy prices, stemming from the oil crisis that started in the early 1970s and lasting through 1982, led farmers to become more energy-efficient. Many farmers switched from gasoline-powered to more fuel-efficient diesel-powered engines, adopted conservation tillage practices, shifted to larger multifunction machines, and adopted energy-saving methods of crop drying and irrigation. These energy-saving measures helped farmers reduce direct energy use on the farm by 41 percent from 1978 to 1998, while productivity grew sharply (figure 2).

One of the most notable changes in farm energy consumption over the past 30 years has been the substitution of diesel fuel for gasoline (figure 3). Gasoline use has dropped from 42 percent of total direct and indirect energy used on farms in 1965 to only 8 percent in 1998, while diesel's share of total energy has risen from 13 percent to 26 percent. Producers switched to diesel fuel equipment as farms grew in size. As farmers scaled up their operations they began to purchase large scale equipment with more horsepower. Heavy-duty vehicles generally are powered by diesel engines because they are more energy efficient than gasoline engines. Thus, diesel powered equipment has become the standard on U.S. farms.

The adoption of energy-conservation tillage practices also has contributed to decreasing fuel use on U.S. farms. Conservation tillage leaves 30 percent or more of the plant residue on the soil surface after planting. It requires far less energy than conventional-till that involves extensive field preparation prior to planting. Adoption of conservation-till on major field crops, such as corn and soybeans, began to increase significantly in the 1980s.

Commercial fertilizers (nitrogen, phosphate, and potash) are the most energy intensive farm input, accounting for about 47 percent of total energy required in farm production in 1998. Fertilizer consumption grew throughout the 1960s and 1970s, peaking at 23.7 million nutrient tons in 1981. Since the mid-1980s, fertilizer use has remained relatively stable, ranging from about 19 million tons to 22 million tons from 1984 to 1998. Use declined from its peak level in 1981 because of fewer planted acres and stabilizing rates of application.

Manufactured pesticides (including herbicides, insecticides, and fungicides) also require large amounts of energy. Pesticides used on major crops increased rapidly in the 1960s and 1970s, rising from 215 million pounds in 1964 to 572 million pounds in 1982. Pesticide use declined between 1982 and 1990, as commodity prices fell and large amounts of land were taken out of production by Federal programs. Since 1990, pesticide use has been growing, but at much slower rate than the 1960-80 period. Pesticide use grew from 498 million pounds in 1990 to 566 million pounds in 1995.

Energy use by commodity. Direct energy expenditures as a share of total farm cash production expenditures may be used as a measure of energy intensity for various commodities. Energy expenditures for liquid fuels (diesel, gasoline, and LP gas) and electricity on U.S. farms can vary significantly by commodity type. Poultry, which requires large amounts of LP gas and electricity for controlling the temperature of indoor facilities has the highest energy expenditure ratio. Crops that require moisture removal, such as tobacco, cotton, peanuts and grains, also have relatively high energy expense ratios (figure 4). Crop dryers use various forms of energy, including natural gas, LP gas, and electricity. Irrigating crops like rice, tobacco, cotton, and peanuts can also increase energy expenses.

The prices that farmers pay for fuels, including gasoline, diesel, LP gas, and natural gas, are more volatile than other farm input prices, such as fertilizer, machinery or general supplies. Over the past 8 years, the fuels price index reached its lowest point in March 1999 at about 65 percent of the 1990-92 average price (figure 5). Since that time it has doubled, reaching a high in March 2000 of about 130 percent of the 1990-92 average. Fuel prices have remained high since March, with the latest estimate for June at 126 percent of the 1990-92 level. Gasoline prices paid by farmers have increased the most since last summer, followed by diesel prices, while LP prices fell. USDA does not collect natural gas prices paid by farmers; however, data collected by the Energy Information Administration on residential consumers indicate that natural gas prices have increased this year. The March 2000 price for natural gas was $6.82 per thousand cubic feet, up from $6.00 the previous March. Fertilizer prices have increased steadily over the past decade, but do not seem to have been affected yet by the recent petroleum price spikes. Pesticide prices have remained steady and are not expected to rise in the near future.

Effects of higher energy prices on energy-using agriculture

Farm expenses and income. Because farm production relies on energy, energy prices can have a significant effect on farm expenditures and incomes. During the energy price increases of the 1970s, energy's share of total farm production expenses rose from 11 percent in 1972 to 16 percent by 1981 (figure 6). Direct energy costs went from about 3 percent of total farm production expenditures to 6 percent. As fuel supplies stabilized, direct energy costs returned to a 3 percent share of production expenses by the end of the 1980s and remained in that range until recently. Costs associated with indirect energy also increased significantly in the 1970s. The amount of money spent on indirect energy went from 8 percent of total farm production expenditures in 1972 to 11 percent in 1975. The share of indirect energy expenditures returned to 8 percent in 1983 and then steadily rose to almost 11 percent in 1998.

This year's spike in fuel prices is helping to push total farm production expenses to an expected $199 billion in 2000, 3 percent over 1999, the first significant rise since 1997. Farm direct fuel expenditures are forecast to rise to $8 billion in 2000, up $2.2 billion or 39.5 percent from 1999, which is about 4 percent of total farm production expenditures, the highest percent since 1986.

However, the recent oil price increases thus far are not having the same type of effect on indirect energy costs as in the 1970s, and these indirect costs are expected to decline $0.4 billion in 2000. The share of indirect energy expenses as a percent of total farm production expenses declined 1 percentage point in 1999 and is expected to decline by 0.4 percent in 2000. The impact of higher fuel prices will also be felt in higher expenses for machine hire and custom work and perhaps further down the road in higher farm chemical expenses.

Although farm expenditures for fuels are expected to increase by $2.2 billion in 2000, net cash farm income is projected to increase by $1.5 billion from 1999. The increase in farm income reflects supplemental income assistance provided in legislation enacted in 1999 and 2000 that will help offset higher inputs costs for many producers this year.

Average spot price of natural gas (Henry Hub) for January 1 to June 30, 2000 was 48 percent higher than for the same period in 1999. The price of natural gas in June of 2000 was $1.89 per million BTUs higher than in January 2000 and more than $2.00 higher than in June 1999. Higher demand for natural gas for power generation, seasonality of U.S. natural gas storage, and higher oil prices have pushed up natural gas prices at wholesale and retail levels. For example, natural gas generation increased from 275 billion kilowatt hours in 1996 to 325 billion kilowatt hours in 1998. Natural gas generation is projected to increase to 517 billion kilowatt hours by 2005. If steady demand increases maintain higher natural gas prices, costs of manufactured input could rise for farmers in the future, because natural gas is the primary energy input for manufacturing nitrogen fertilizer and pesticides. However, since natural gas is only one component of the final price of these products, a 10 percent increase in the costs of natural gas will generally result in a less than 10 percent increase in the cost of these inputs.

Mitigation potential. Farmers are limited in what they can do to mitigate the effects of higher energy prices, although some options are available. Where possible, some producers may be able to employ different production strategies, such as reducing field operations by switching from conventional tillage practices to no till or minimum till; adjusting fertilizer application rates; or using animal manure and green fertilizer. Some producers may also have been able to switch to crops which require less fertilizer, such as soybeans instead of corn, although this year's acreage data, which showed more corn acres than expected, suggest such switching was not prevalent. And in spite of higher oil prices, acreage planted to the major crops is up, from 330 million acres in 1999 to 331 million in 2000.

Since many farmers own fuel storage tanks they can purchase fuel when prices are low and store it for later use. This allows them to avoid seasonal price spikes, for example, that occur in the summer when gasoline demand traditionally goes up and in the early winter when heating oil demand increases diesel prices. Some producers may even be able to reduce price by hedging in the futures markets.

Over the long term, farmers could replace old and energy inefficient farm machinery with more energy efficient equipment. In addition, more advanced farming practices could be adopted, such as precision farming that optimizes the use of chemicals and fertilizers. New seed varieties are also reducing chemical requirements.

Post farm-gate impacts. The effects of higher energy prices on off-the-farm activities are also affecting producers. Higher diesel fuel prices are increasing the costs of transporting agricultural commodities from farm to consumer. Increases in transportation costs increase the basis–the difference between prices at the farm and at terminal markets–and they can reduce the price first buyers bid for farm commodities as their processing and distribution costs increase. As a result, farmer could receive lower prices for their products.

More energy is used to transport, process, and market agricultural commodities than energy used on the farm to produce these commodities. Modes of transportation of farm commodities from farms to storage facilities, processing center, and marketing and distribution for domestic and export markets are truck, rail and barge. Barge and rail are used for long haul, while trucks are used for finished products and for short haul. Railroads and inland waterways are the most cost effective transportation modes to move bulky products long distance. Although railroads transported approximately 40 percent of all U.S. grains to final market destinations in 1997, railroads hauled more than 70 percent of all grains from the Upper Great Plains.

Increasing fuel costs will not affect railroads as much as airline and truck transportation, but will affect railroads more than barge transportation. Trains are three times as fuel efficient as trucks, moving 384 revenue ton-miles of freight per gallon of fuel consumed in 1998. Although, Class I railroads used more than 3.6 billion gallons of diesel fuel in 1998 at a cost of a little more than $2 billion, diesel fuel expenses were only 6.2 percent of total operating revenue and only 7.4 percent of total operating expenses.

The effect of increasing fuel costs upon railroad tariffs is hard to estimate generally. Railroad tariffs are bound on the bottom by their marginal costs and at the top by the rates of competing rail, truck and barge carriers. Due to the use of differential pricing by railroads, it is likely that those shippers most reliant upon railroad transportation will face the highest rail tariff increases. Thus, rail tariffs for shippers in the Plains States may increase more than those for shippers located closer to barge transportation. For those shippers having access to water transportation, rail rates probably will increase little more than the price increases for barge transportation. However, for those shippers whose only other alternative is truck transportation, railroads have the ability to increase rail tariffs dollar-for-dollar with truck tariff increases. When differences in the quality of transportation service are not considered, higher fuel prices will tend to favor railroad over truck transportation.

The cost of marketing U.S. foods has increased considerably over the years, mainly because of rising costs of labor, transportation, food packaging materials, and other inputs used in marketing, and also because of the increase in convenience and service provided with the food. Marketing costs accounted for 80 percent of the $585 billion consumers spent for domestic farm food, not including imported foods, in 1998. The remaining 20 percent, or $119 billion, represents what is paid for the raw farm commodities. Components of the post-farm marketing costs are labor, packaging, transportation, energy, advertising depreciation, rent, interest, and profits. Higher energy prices will increase energy costs as well as the transportation cost of food marketing. In 1998, energy accounted for 3.5 percent and transportation 4 percent of total marketing costs of food. Labor accounted for 39 percent and farm value of food accounted for 20 percent in 1998.

Higher energy costs will increase the costs of processing, cold storage and marketing and distribution of food products. In the long run, the higher price of energy on food production will likely be transferred largely to consumers. In 2000, the all-food CPI is forecast to increase 2 percent. The higher oil prices thus far do not appear to have affected retail food prices. Although energy costs could be a source of upward pressure on the food CPI later in the year, this year's large supplies of crops and meats are likely to keep the retail food CPI stable.

Effects of higher energy prices on energy-producing agriculture

Higher energy prices and the dependence on imported oil highlights the great potential of U.S. agriculture to produce large amounts of energy. Crops, crop residues, and forest residues, as well as energy crops planted on idle or marginal crop land, could be converted to various form of energy, such as ethanol, biodiesel, and biopower. Ethanol from grains now account for almost all of U.S. biofuel production. In 1999, about 1.5 billion gallons of ethanol were produced by 58 ethanol plants located in 19 States. This year production is projected to increase to 1.6 billion gallons. Total US production capacity is 1.87 billion gallons with another 175 million gallons under construction and over 600 million gallons are under planning.

Efforts are under way to convert cellulosic materials, such as grass and wood, to ethanol. Four companies are planning to build cellulosic ethanol plants in the United States in the near future. According to Department of Energy projections, cellulosic ethanol production by 2010 may increase to about 300 million gallons. Currently, corn stover is a feedstock of choice due to its large concentrated supply and relatively low cost compared to other feedstocks.

Because ethanol only accounts for 1.2 percent of the U.S. gasoline supply, its price does not affect the overall price of gasoline. Instead, the price of ethanol is affected by the price of gasoline, other oxygenates, and octane. Consequently, as energy prices have increased this year and corn prices rose over fears of a dry summer, the price of ethanol increased from $1.18 per gallon in January 2000 to $1.35 by June 2000 (figure 7). However, the price of ethanol is still cheaper than MTBE and all grades of gasoline. The net corn cost, which is the price of corn, minus the price of coproducts, divided by the number of gallons of ethanol produced per bushel of corn, for the average wet mill was $0.33 per gallon in 1999. The net corn cost increased from $0.34 per gallon in January 2000 to $0.54 in May 2000, in response to higher prices of corn. With corn prices now declining and a large harvest in prospect, assuming average weather from here on, net corn costs for ethanol plants are expected to decline, providing an incentive to expand production.

Government policies encouraging bioproduct and bioenergy development

Agriculture can play a major role as a supplier of bioenergy. The major objective of Executive Order 13134 and the recently enacted legislation sponsored by Chairman Lugar, the Biomass Research and Development Act of 2000, is to boost production of bioproducts and bioenergy threefold by 2010. Both USDA and the Department of Energy are working closely together to implement the EO and the new act and expand use and production of bioproducts and bioenergy, utilizing agricultural resources.

To help achieve these goals, USDA proposed using Commodity Credit Corporation funds to boost production of ethanol and biodiesel during the next three fiscal years. A proposed rule is now nearing completion. USDA is also proceeding with implementing Section 769 of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Act of 1999 to provide new authority to use Conservation Reserve Program (CRP) land for pilot biomass projects. Specifically, Section 769 of USDA's FY 2000 appropriations act provides that the Secretary shall approve not more than six projects, no more than one of which may be in any State, under which land subject to CRP contracts may be harvested for recovery for biomass used in energy production if: (1)

no acreage subject to the contract is harvested more than once every year and (2) not more than 25 percent of the total acreage enrolled in any crop reporting district is harvested in any year. In addition, no portion of the crop on the pilot land may be used for any commercial propose and participants participating in the project must agree to a 25 percent reduction of the annual rental payment they would normally receive in the CRP for each year in which the acreage is harvested. We expect these two programs to be important steps in the continuing effort to realize the potential of U.S. agriculture to help meet the U.S. demand for clean, affordable energy.

That completes my statement Mr. Chairman and I would be pleased to respond to questions.

Figure 1

Estimated farm energy use, 1998

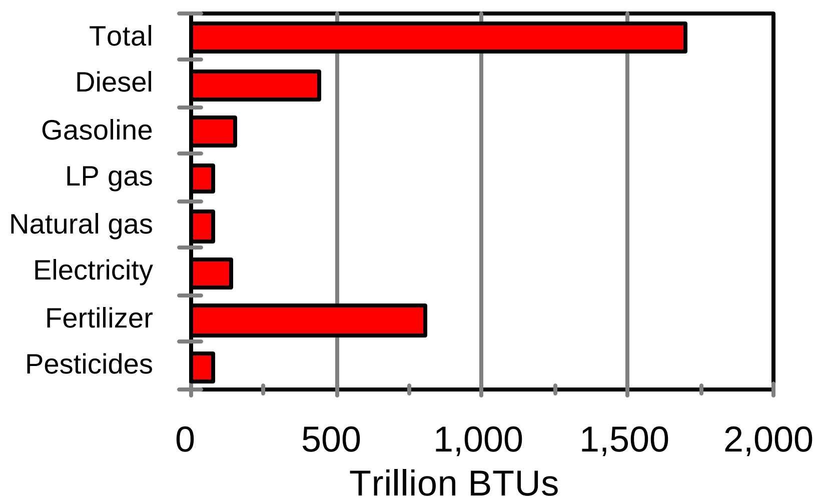


Figure 2

Farm output per unit of energy

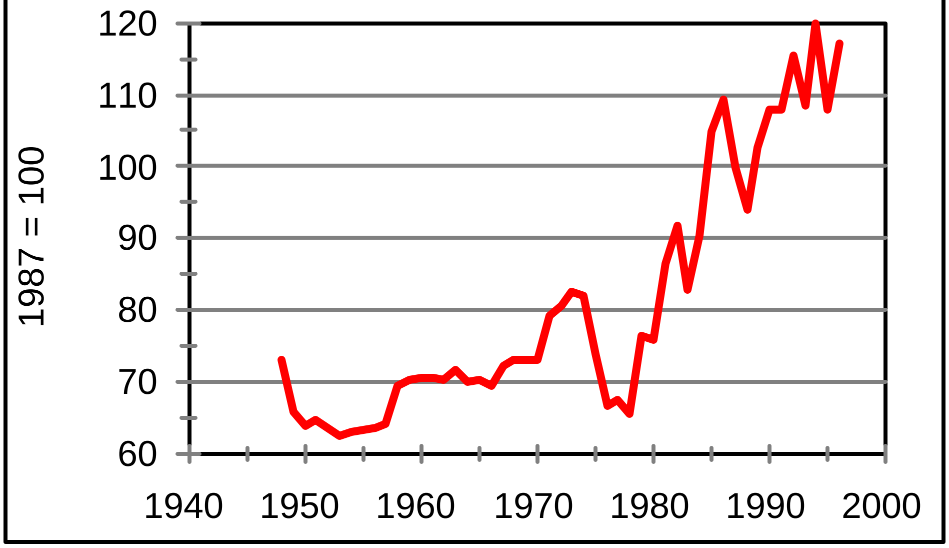
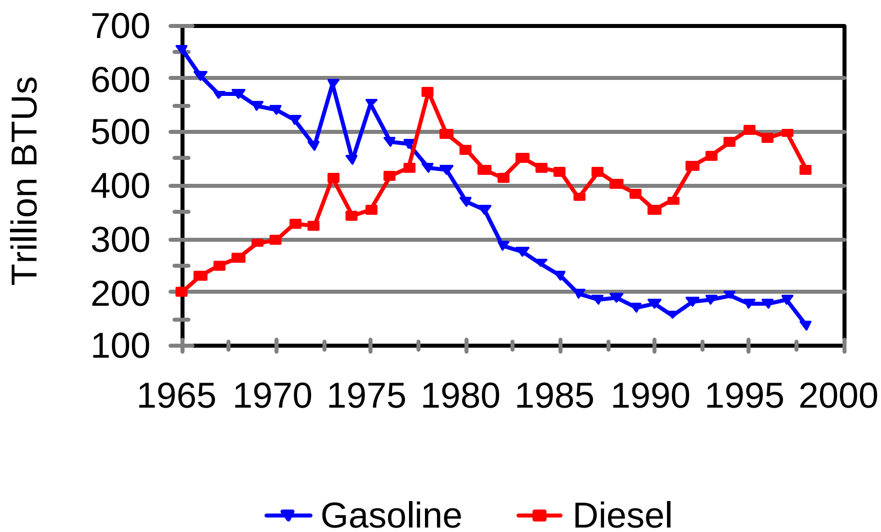


Figure 3

Farm gasoline and diesel fuel use



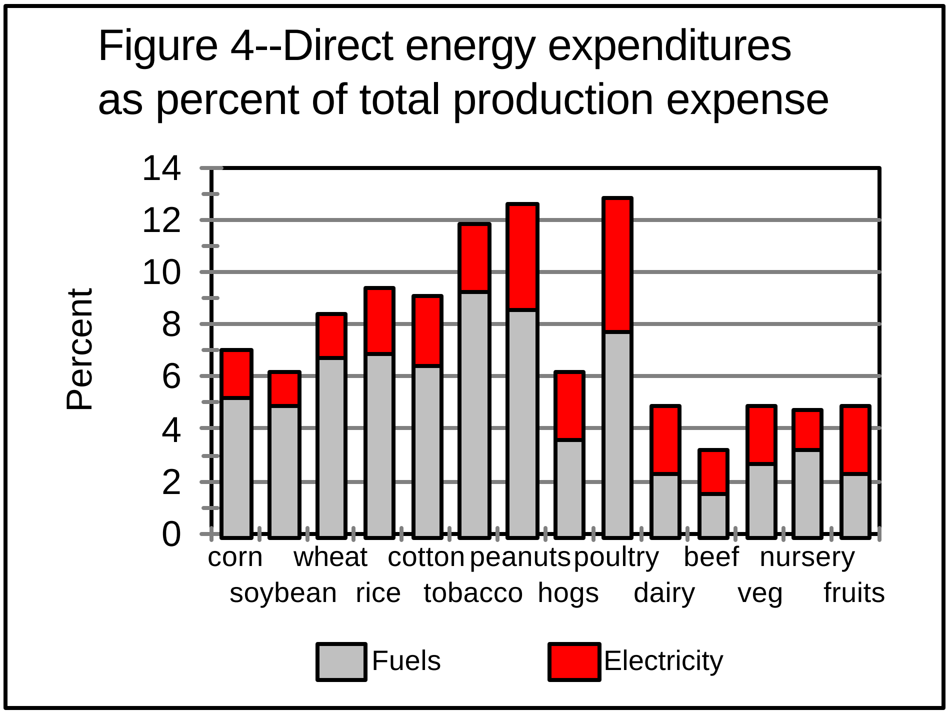


Figure 4--Direct energy expenditures
as percent of total production expense
Percent
14
12
10
8
6
4
2
0
corn
soybean
wheat
rice
cotton
tobacco
peanuts
hogs
poultry
dairy
beef
veg
nursery
fruits
Fuels
Electricity

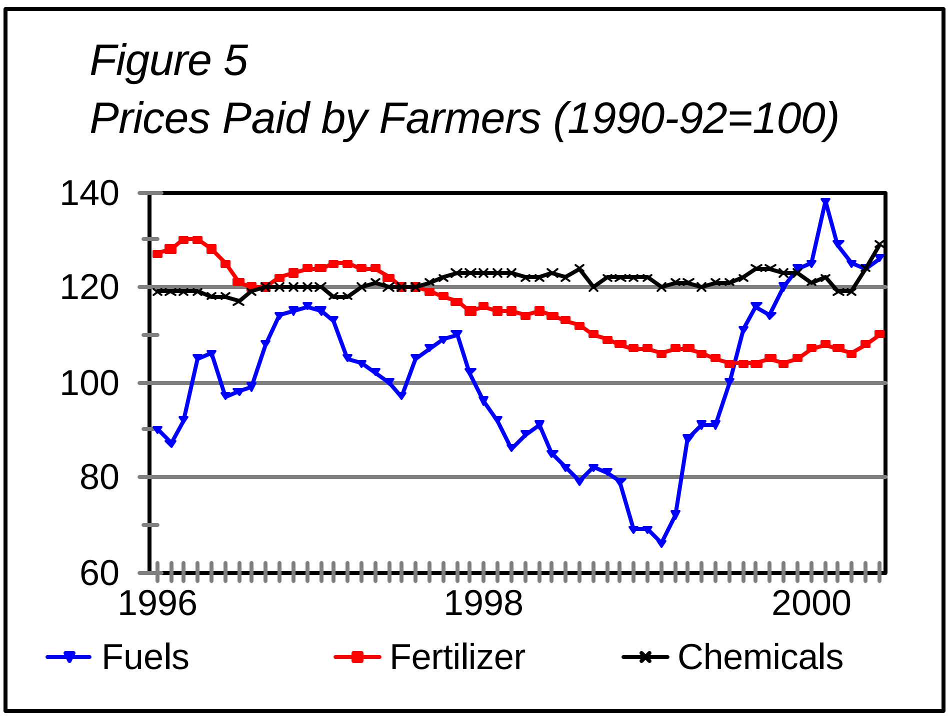


Figure 5
Prices Paid by Farmers (1990-92=100)
140
120
100
80
60
1996
1998
2000
Fuels
Fertilizer
Chemicals

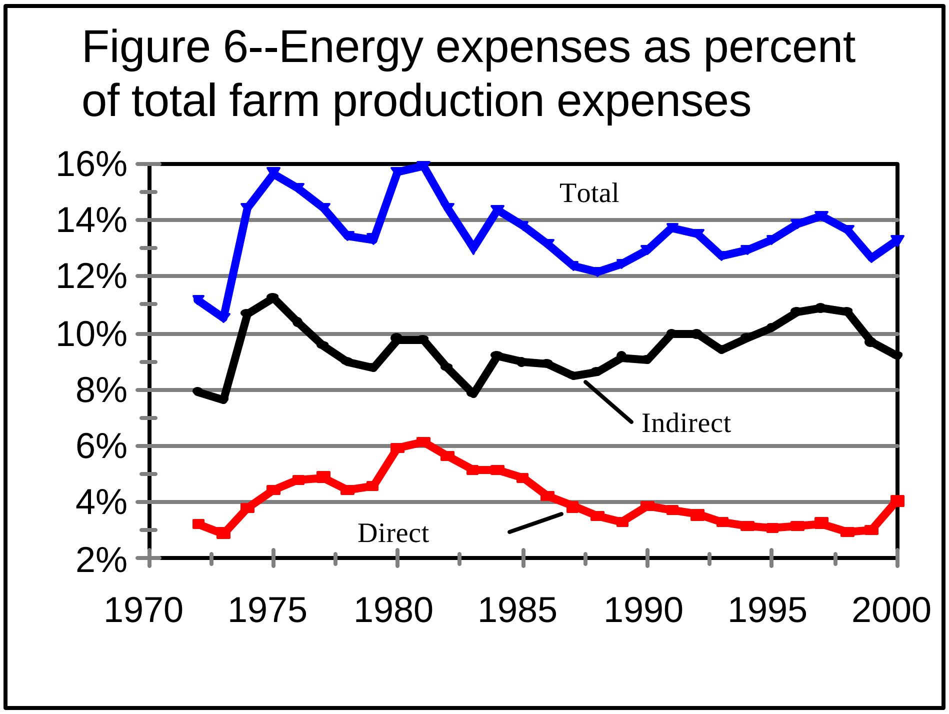


Figure 7

Net corn cost