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Feeding the Factory Farm: Implicit Subsidies to the Broiler Chicken Industry

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Abstract

Since the passage of the 1996 Farm Bill, the U.S. market prices of soybeans and corn have dropped 21% and 32%, respectively. These commodities are sold on the market at a price below what they cost to produce. If U.S. agricultural policies contribute to this trend, then they do so to the benefit of commodity purchasers, particularly the industrial operations that use the commodities as raw material inputs. Corporate-owned livestock operations are a case in point. This paper focuses on the broiler chicken industry, which, in the United States, is fully industrialized and vertically integrated. We compare the average costs of production for broiler feed components—corn and soybean meal—with market prices, and then use these cost-price margins to estimate the amount broiler companies save by being able to purchase feed at a price below production costs. We find that the broiler industry gained monetary benefits averaging $1.25 billion per year between 1997 and 2005 when, following the passage of the 1996 Farm Bill, market prices dropped far below production costs. In contrast, broiler industry gains from low market prices averaged a much smaller $377 million per year between 1986 and 1996. We conclude that the corporate broiler industry is a major winner from changes to U.S. agriculture policy that have allowed feed prices to fall. This finding is not significantly altered when we adjust our calculations to account for the overvaluation of agricultural land, nor does it appear to reverse under future cost/price scenarios. As policymakers turn their attention to the 2007 Farm Bill, they would do well to examine the ways in which agribusiness firms in general, and industrial livestock operations in particular, benefit from policies ostensibly designed to support family farmers. Current U.S. farm policies may be driving industrialization in the livestock production system if they give factory operations the appearance of being more cost efficient than diversified, independent operations that grow their own feed.

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Introduction

The passage of the 1996 Farm Bill marked one of the most significant shifts in U.S. agricultural policy since the 1930s. In the ten years since its passage, researchers have examined the impacts of these reforms on agricultural producers and markets both at home and abroad (see, for example: Waller 1996; Smith 1997; Knutson 1998; Scott 1999; Anderson 2001; Ray 2001; Orden 2002; Zulauf 2003). Among the trends revealed in domestic research are lower commodity prices and stagnant or declining net farm income for U.S. farmers (Ray 2003; Wise 2005, based on USDA/ERS data).

Many of the most vocal critics of U.S. farm policy, including some major players in World Trade Organization agriculture negotiations, many U.S. government officials, and some prominent development groups, point to U.S. farm subsidies as the culprit behind overproduction and declining commodity prices (Oxfam 2003; Beattie 2005; Council of Economic Advisors 2006). Meanwhile, U.S. agribusiness groups and some domestic farm advocates counter that subsidies are a necessary expense if the U.S. government hopes to maintain a vibrant farm sector (American Farm Bureau Federation 2006).

The debate over subsidies has moved the focus off some of the most dramatic and important farm policy changes codified in the 1996 Farm Bill—among them, the elimination of remaining supply control programs—and the impact of these changes on the agricultural supply chain. The development of sound proposals for farm policy reform hinges on an understanding of how U.S. agricultural policy relates to and affects the structure of the food system, and on recognizing which parties win and which lose in the current policy environment.

Intuitively, most readers probably recognize that when the prices of commodities such as corn and soybeans decline, purchasers of these commodities will benefit. But who are these purchasers, and to what extent have they benefited from policy changes that have affected commodity prices? We approach these questions in the following way. First, we examine the extent to which the market prices of corn and soybeans have been below average production costs, and whether that cost-price margin grew following the policy changes associated with the 1996 Farm Bill. Large cost-price margins would signify a failure of the market to compensate family farmers for producing these crops,

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which could be detrimental to the wellbeing and livelihoods of farm households. Second, we posit that if prices for corn and soybeans, key ingredients in industrial livestock feed, fell further below costs after the 1996 Farm Bill was enacted, industrial broiler chicken companies have likely benefited. These companies purchase feed from the market, and feed costs constitute 60% of production costs. Our research focuses specifically on the broiler chicken industry because its high level of concentration and vertical integration allows production cost estimates to be generalized with relative ease. We attempt to quantify the monetary value of the industry's gains from farm policies that allow feed prices to decline below production costs, compared to a policy scenario in which market prices accurately reflect the cost of production.

The structure of this paper is as follows. In section 1, we review relevant literature on the link between feed prices and the economic wellbeing of the corporate livestock industry, and examine other literature that has attempted to compare the market price of agricultural commodities to the crops' costs of production. Surprisingly little research has been done on this subject. Section 2 provides an overview of U.S. agricultural policies, particularly for corn and soybeans, and examines the extent to which the 1996 policy reforms lowered market prices below what they were before supply management policies were fully dismantled. We find market prices for corn and soybeans significantly lower than they were before the reforms, and much further below production costs. Section 3 discusses the evolution of the U.S. broiler industry, the most concentrated segment of the nation's livestock sector and the most important source of animal protein in the U.S. diet.

In sections 4 and 5, we present our methodology, data, and findings. We use a methodology that compares average costs of production with market prices for corn and soybeans, and then uses these cost-price margins to estimate the amount that broiler producers save when they are able to purchase feed at a price below the cost of production. We refer to these savings as an "implicit subsidy"—not a direct subsidy to the industry from the government, but a reduction in the industry's costs resulting from the structure of U.S. farm policy. Stated differently, the implicit subsidy measures how much industrial broiler companies gain from purchasing feed under current policy conditions, compared with what they would pay for feed if federal farm policies were structured to ensure that feed prices reflected the cost of producing the feed components.

We find that between 1997 and 2005, corn was sold on the market at an average of 23% below what it cost to produce, and soybeans were sold at 15% below production cost. These cost-price margins are significantly larger in the post-Farm Bill period than they were in the eleven years prior, when the margins averaged 17% for corn and 5% for soybeans. These margins translate into monetary gains for corporate broiler facilities, which, since the passage of the Farm Bill, have been able to purchase feed at a price 21% lower than the production cost of the feed components. That gap would be even higher if market prices accurately reflected the cost of producing feed plus a reasonable profit for those involved in the production process—namely, farmers. In dollar terms, we estimate that between 1997 and 2005, the broiler industry gained an average of $1.25 billion per year in "implicit subsidies"—cost savings resulting from U.S. agricultural policies that let corn and soybean market prices, and feed prices in turn, fall below production costs. This implicit subsidy was over $850 million per year above the average implicit subsidy in the pre-Farm Bill period. Because feed is the largest single variable expense in broiler production, the implicit subsidy reduces overall broiler operating costs by 13%, compared to a scenario where feed was priced at cost of production.

In section 6, we discuss the implications of our findings, particularly for other industrial livestock sub-sectors such as hogs, in which some diversified family farmers are still trying to compete with factory farms. Our initial calculation suggests similar cost reductions for corporate hog farms from U.S. agricultural policy, which provides them with an important boost to their competitive advantage over family farmers who do not purchase the majority of their animal feed from the market. In this section, we also address the inflation of land value estimates in the USDA data and examine future cost-price scenarios for corn and soybeans in light of expanding demand for corn-based ethanol.

We conclude with a brief discussion of the implications for U.S. agricultural policies and the needs for future research. As policymakers turn their attention to the 2007 Farm Bill, it is important to examine the ways in which agribusiness firms in general, and industrial livestock operations in particular, benefit from policies ostensibly designed to support family farmers. As this study suggests, most diversified family farmers would be better served by policies that ensure market prices in excess of production costs. To the extent such policies reduce the current cost advantages enjoyed by industrial animal factories, they will further the stated goals of U.S. agricultural policy, and will perhaps help reverse the trend toward concentrated industrial hog and beef cattle production.

I: Research Rationale

At the time the 1996 Farm Bill was passed, it was arguably the biggest change to U.S. farm law in sixty years. Prior to the 1996 Farm Act, federal farm policy employed schemes like grain reserves and set-asides, which increased prices by controlling supply. These tools were stripped away in 1996; within four years, production of corn, soybeans, and other commodities had risen sharply, while market prices and net farm income had stagnated or declined. Through a series of emergency payments that were made permanent in the 2002 Farm Bill, Congress wrote into law a system in which farm income was supported by government payments, instead of by higher market prices for farm products. Under the new system, market prices fell below the cost of production, and government spending on farm subsidies went through the roof. In 2000 alone, government aid made up 100% of net farm income in eight states (Keeney 2003). Despite record subsidy levels, however, net farm income failed to rise.

On its face, this system may appear to make little sense: why would the government replace price stabilizing policy with a policy based on low market prices and massive taxpayer subsidies to farmers? Adding to the confusion is the irony of what happened to agricultural markets after the signing of the 1996 Farm Bill. Although market prices for crops like corn and soybeans fell, farmers' production of these crops increased. The political and economic reasoning behind these paradoxes will be addressed in Section 2. For now, we will simply note three major trends that characterized the post-1996 Farm Bill period: rising production of commodities like corn and soybeans; falling market prices for these crops; and government subsidy levels that grew in response, as they attempted to make up for unprofitable market prices and provide a reasonable income to America's farmers.

It wasn't just U.S. farmers who saw market returns for their products fall in the aftermath of the 1996 Farm Bill. Falling prices in the United States led to falling prices around the world (Watkins 2002). The Minneapolis-based Institute for Agriculture and Trade Policy (IATP) and the development agency Oxfam International took the lead among development and farm policy advocacy groups in examining the impacts of low commodity prices on international markets, though many other analysts have weighed in on the subject (Watkins 2002; Berthelot 2003; Oxfam 2003; Ray 2003; Ritchie 2003). Both IATP and Oxfam supported their theories by calculating "dumping margins" for U.S. farm crops, defined as the difference between production costs and the market prices of exported U.S. commodities. The IATP method combines USDA estimates of the farmer cost of production, government input subsidy estimates from the OECD, and an added cost for transportation and handling to find a "true" cost of production for farm products. A product is dumped if it is exported at a price less than what it cost to produce. Work by Oxfam, IATP, and IFPRI has examined the impact of dumping on developing country producers, and has concluded that the impact has often been quite negative (Watkins 2002; Oxfam 2003; Ritchie 2003). In brief, this research suggests that U.S. agricultural policy provokes depressed prices for basic commodities, leading to reduced net farm income for many U.S. producers while at the same time undercutting developing country markets when those commodities are exported at a price that does not accurately reflect production costs.

Curiously, despite an extensive review of agricultural economics literature dating back to 1960, we were unable to find much literature that asked a logical follow-up question: If many U.S. and developing country producers are hurt by depressed commodity prices, and if U.S. agricultural policies have played a role in encouraging this price trend, then who benefits from such policies? Our literature review revealed only a small group of analysts who address this question. Of those who do, several explicitly name the industrial livestock sector, input providers such as Monsanto, and agribusiness purchasers and traders as major beneficiaries from low commodity prices (see Ray (2003), Berthelot (2004) and Wise (2005)). Several other analysts have called the public's attention to the general benefit that industrial livestock producers enjoy when the price of feed inputs such as corn and soybeans falls (Skaggs 1997; Skaggs and Falk 1998; Ishmael 1999; Rae 2000; Farm Foundation 2006). Others discuss the role of low feed prices in the structural transformation of the livestock industry. Caron (1987) and Holtslander (2002) credit cheap feed with a role in the growth and industrialization of the livestock production system in Canada, while Halverson (2000) does so for the United States. A 2005 report by the USDA/ERS names cheap feed in the United States as one factor driving the integration and industrialization of U.S. and Canadian hog production systems. Hogs are increasingly bred and raised to feeder pigs in Canada, and then shipped to the United States for fattening in confined operations because of relatively cheaper feed prices (Haley 2005).

A review of statements by representatives from the livestock sector suggests that the industry recognizes the importance of low-cost feed to its economic viability, and supports policies that keep the prices of corn and soybeans low. In a hearing before the House Agriculture Committee in 2001, representatives of the National Pork Producers Council, Perdue Farms, the National Cattlemen's Beef Association, and the American Sheep Industry Association laid out their positions on the content of the upcoming 2002 Farm Bill. The representatives advocated for the continuation of market-based pricing for feed grains and oilseeds, and of subsidy programs that fill the gap between lower market prices and a higher target price (Congressional Press Release 2001; Tarter 2001). The pork industry representative suggested that, if politically necessary, Congress should pass additional income support programs for farm households to keep them solvent despite low prices (Determan 2001). Among the specific policies supported by industry representatives were a reduction in the federal soybean loan rate (the price paid to soybean producers) and the continuation of planting flexibility. Representatives criticized government programs that could raise the price of feed grains, including mandatory set-asides, production controls, or a farmer-owned food security reserve (Congressional Press Release 2001).

Our literature review revealed a general understanding by industry, academic, and NGO sources of the benefits to industrial livestock operations from low-cost feed. However, we discovered a dearth of economic research that calculated the monetary gains to the livestock sector from policies that drive feed prices below production costs. The lack of empirical research exclusively devoted to this question limits the public's ability to understand the full economic and structural impacts of U.S. farm policy.

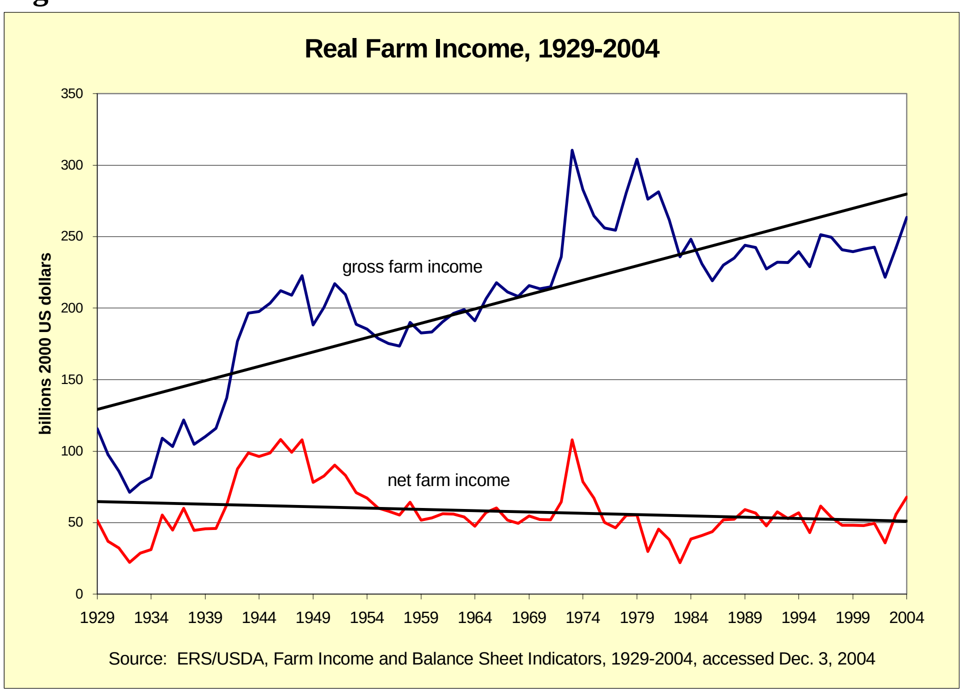
II: General Policy Background

Over the last twenty years, U.S. agriculture policy has become increasingly market-oriented. Major policy changes took place during the 1996 Federal Agriculture Improvement and Reform (FAIR) Act, when supply management tools that had been used since the 1930s to control market prices and ensure a fair return for farmers were dismantled. Advocates of this shift argued that supply management and price stabilization strategies resulted in economic inefficiencies and distorted markets, preventing farmers from responding to price signals.

Meanwhile, opponents of the shift underscored the unique nature of agricultural markets and production patterns. Drawing on economics literature dating back to the first half of the 19th century (see, for example, Peek 1922; Warren 1924), some in the agriculture policy community asserted that a deregulation of agricultural markets would result in unmitigated overproduction and falling prices. Unlike other industries, they claimed, agricultural producers do not tend to respond to price signals by reducing supply when prices decline. Agriculture is unique in several respects: it requires large capital investments with a slow rate of return, which puts pressure on producers to continue producing even when prices fall; and, as a "living" industry, agriculture cannot simply be turned on and off depending on market signals. The market is made up of a large number of small producers, each of whom is unable to individually influence price through his or her output decisions. Individual farmers may respond to declining prices by reducing hired labor, but they generally do not reduce production; instead, they continue to produce as much as possible so as to spread fixed costs across the maximum amount of output (Warren 1924). When prices drop so low that farmers are unable to remain in business, they generally sell their farms to another producer, leading to increasing concentration and continued overproduction (Wise 2004). The policy prescription was clear: the sector as a whole would be unable to reduce supply and ensure fair prices without government intervention (Harl 2003; Ray 2003; Wise 2004).

The argument against the removal of supply control mechanisms has gained traction since passage of the 1996 Farm Bill. Soybean market prices dropped 21% between 1996 and 2005, while corn market prices dropped 32%. At the same time, corn production increased 28%, and soybean production rose by 42%. Input costs rose; the farmer cost of production per acre between 1996 and 2005 increased by 14% for corn and by 12% for soybeans (USDA/ERS 1986-2005; USDA/ERS 2005). The squeeze of rising production costs and falling prices resulted in an inflation-adjusted average decline in net farm income of 15.5% between 1996 and 2003 (Ray 2003).

Figure 1: Real Farm Income



Despite the failure of the 1996 legislation to live up to its goals of stabilizing agricultural supply and demand, supply control measures were not reinstated in the Farm Security and Rural Investment Act of 2002. Instead, Congress passed a bill that mirrored and in some ways expanded the 1996 policies, ensuring that taxpayers would continue to shoulder the difference between the low market prices for agricultural goods and higher target prices set by Congress.

Since its inception in the 1930s, modern U.S. farm policy has tried to buffer farmers from some of the vulnerabilities inherent in agricultural markets, and to ensure them a steady income. In the last ten years, however, net farm income has declined or remained stagnant, while farmers' input costs have grown (Ray 2003; Wise 2005). Ironically, the squeeze on farm households has been accompanied by skyrocketing rates of government payments to farmers.

The Farm Policy Paradox

How did we get to the farm policy paradox we have today? If farmers' incomes are not rising under the current system, then who benefits from agriculture policies that allow the market price for commodities to fall? Below, we provide a brief overview of some of the important changes in U.S. commodity policy in recent years in order to lay the groundwork for interpreting the research findings that follow.

While the specific details of U.S. agricultural commodity policy have changed over the last seventy-three years, their apparent core purpose has been to support farmers' income in a market that is often volatile and tends toward overproduction. To do this, commodity policies have been designed to either control supply (including by taking land out of production or creating reserves), establish a target price, or pay the difference between the target price and the market price. Commodity programs have not been aimed at all producers and agricultural goods, but rather, at specific non-perishable crops. The list of commodities has generally included corn, soybeans, cotton, rice, wheat, sugar, barley, oats, and sorghum (Marlow 2005).

Starting with the passage of the Agricultural Adjustment Act in 1933, and continuing over the next thirty years, acreage reduction and set-aside programs were central to U.S. farm policy. The tools were utilized as a way to influence prices indirectly by restricting the use of land for agricultural production, and thereby constraining the supply of agricultural commodities (Westcott 1999). Beginning with the 1965 Food and Agricultural Act, however, farm legislation began to move away from controlling supply, instead paying the difference between target and market prices (Marlow 2005). Slowly but surely, government control over supply and demand was rejected in favor of a market-oriented approach that, it was claimed, would allow U.S. farmers to take advantage of rising demand in the global marketplace (Dimitri 2005). The result has been a major adjustment of the farm income support burden. Income that had once been supported by higher prices paid by the purchasers, processors, and consumers of U.S. farm products increasingly came to be supported by government payments.

Important shifts towards deregulation occurred with the 1985 Food Security Act and 1990 Food, Agriculture, Conservation and Trade Act. In particular, the repayment rate for the Marketing Loan Assistance program, which up until 1985 served as a floor price for program crops, was allowed to decline when the world market price fell below the previously announced loan rate. The 1990 Farm Bill established Loan Deficiency Payments (LDPs), which would pay the farmer the difference between the loan rate and the MLA repayment rate. The 1990 Farm Act also initiated greater planting flexibility by allowing up to 15% of crop base acres to be planted to any crop without affecting crop bases or deficiency payments (Ash 2006) . With a *de facto* floor price no longer in place, Congress effectively gave up the tool it had traditionally employed to enforce a fair price in the marketplace (Marlow 2005).

The 1996 FAIR Act marked the most significant shift away from previous commodity policies since the 1930s. At the time it was authorized, the market prices for most commodities were on an upswing due to increased domestic and export demand. Economic forecasters' optimism was buoyed by studies such as a 1994 report sponsored by the National Grain and Feed Association, *Large-Scale Land Idling Has Retarded Growth in U.S. Agriculture,* which predicted that export demand would continue to grow and asserted that if the U.S. crop area was not liberated from set-aside programs and put back into production, the agriculture sector would find itself left behind in the global marketplace (Abel 1994). Guided in part by such thinking, supply controls were further dismantled in 1996 (Ash 2006). At the same time, a new form of government support payments to farmers, Production Flexibility Contract (PFC) payments, were put in place of previous income support programs. These payments were "decoupled" – not directly tied to farmers' current production decisions, but based on their planting history – and meant to decrease over time so that farmers would be weaned off government support (Dimitri 2005). Eventually, farmers were expected to alter their planting decisions in response to price signals in the marketplace, acting their part as rational players in the global economy (Marlow 2005).

The prophecies proved to be wrong, however, at least in the short term. In mid-1997, the Asian financial crisis hit, reducing global demand for U.S. goods; by 1998, market prices for crops had dropped due to high domestic and world production and a precipitous decline in export demand. The U.S. Congress hurried to bail out farmers by authorizing massive emergency payments, called Market Loss Assistance (MLA) payments. These continued through 2002, when the Farm Security and Rural Investment Act—a bill containing the largest commodity title in history—was authorized and passed by Congress. The 2002 Farm Act not only continued authorizing the marketing assistance loans, but it also institutionalized the MLA payments; these became Counter-Cyclical Payments (CCPs), called such because they rose when prices dropped and vice versa. The PFC payments that had been envisioned as "transitional" in 1996 were also continued in the form of Direct Payments (DPs) (Westcott 2002). According to the policies' supporters, DPs are decoupled and CCPs partially decoupled from production, and are calculated using a farmer's historical base (Marlow 2005). The 2002 Farm Act provided some additional support to farmers through increased safety net payments, but the tools of price stabilization and supply control remained off the table.

Building on policies crafted during the 1980s and 90s, the 2002 Farm Act guided the United States to its current paradoxical state. U.S. farm policy maintains the semblance of free-market orientation by ostensibly keeping most payments decoupled from production, and by allowing farmers greater planting flexibility. At the same time, however, it maintains high taxpayer transfers to farmers. Market prices have dropped below production costs; government payments prop up land values and rental rates (Harl 2003). An additional paradox is that of the political lobbies that, in an environment of policy failure, oppose any major changes to existing farm legislation (American Farm Bureau Federation 2006). By examining the evolution in farm policy with respect to two program crops, corn and soybeans, and by following the policies' impact on market prices and farmers' net returns, we can see that the real winners are not those who produce these commodities, but those who purchase them at a low cost.

A Closer Look at the Impact of Farm Policy: Soybeans and Corn

Over the past ten years, both soybean and corn yields and planted acreages in the United States have climbed steadily to record levels (Ash 2006). New varieties of seeds and improved applications of fertilizers and pesticides have had a positive effect on yields. Meanwhile, an increase in planted acreage can be attributed to various changes in farm legislation. Starting in the 1990 Farm Act, soybean producers became eligible for marketing assistance loans; in the 2002 Farm Act, farmers were allowed to establish soybean base acres for the first time and could therefore receive direct and counter-cyclical payments (Ash 2006). Planting flexibility policies, which were first initiated in 1990 and then expanded in the 1996 FAIR Act with the removal of most restrictions on planted acreage, also had a significant impact on production. All of these factors have led to an increase in cross-price elasticity: when prices for soybeans or corn increase, farmers are more likely to shift production from other crops into soybeans, corn, or to adopt half-corn, half-soybean rotations (Ash 2006).

The assertion that farm legislation, particularly the 1996 FAIR Act, had an impact on soybean production levels is consistent with a 2000 study conducted by the USDA Economic Research Service in conjunction with the University of Tennessee's Agricultural Policy Analysis Center. The study used economic modeling to estimate the effects of 1996 farm legislation, and projected that the policy change would have the biggest impact on soybeans, causing an increase of over 2 million planted acres by 2005. It projected that under the 1996 policy, soybean market prices would be roughly 5-6% ($0.35/bu) lower between 2000-2005 than under a scenario based on the previous policy regime. The study also projected that corn acreage would decrease between 1996 and 2005 because farmers would convert more corn to soybeans or other competing crops.

As a result of projected lower planted acreage, the study predicted higher returns per bushel for corn farmers (Lin 2000).

The findings on soybeans were more than borne out by 2005—acreage in fact increased by 11 million acres (see Figure 2) (USDA/ERS 1986-2005; USDA 2006). However, the corn projections were less accurate. The study did not foresee a massive increase in demand for corn for ethanol processing or a precipitous drop in soybean market prices; corn acreage actually increased overall between 1996 and 2005. The demand for corn still failed to keep up with supply, however. While the average market price received by corn growers between 1987 and 1998 was above the loan rate, between 1999 and 2001 the national corn price received by farmers was generally below the $1.89 per-bushel loan rate, and government payments have constituted most of the returns to farmers (see Figure 3) (Chambers 2004).

Figure 2: Soybean Acreage and Price

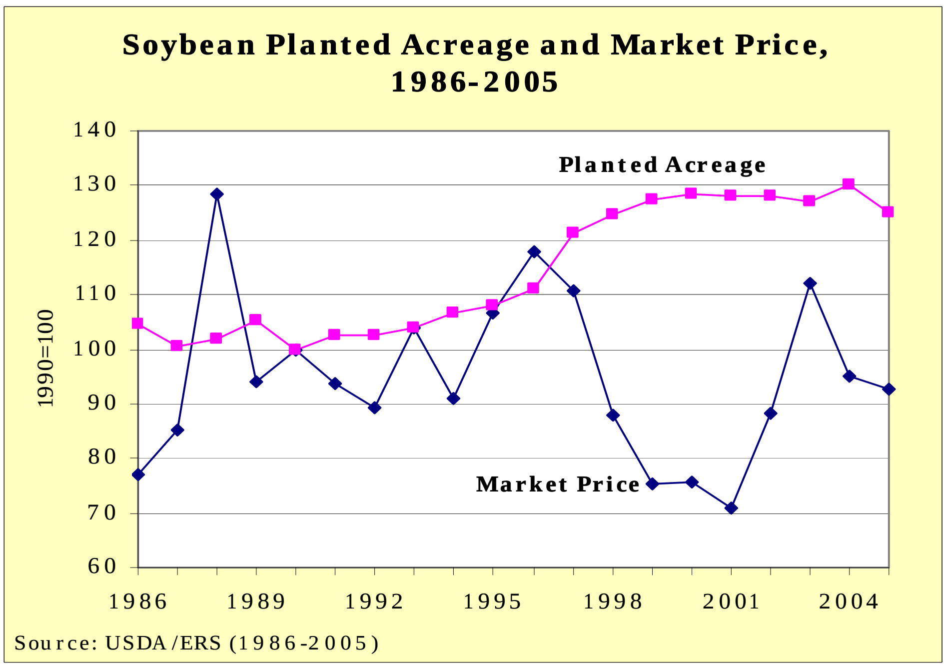
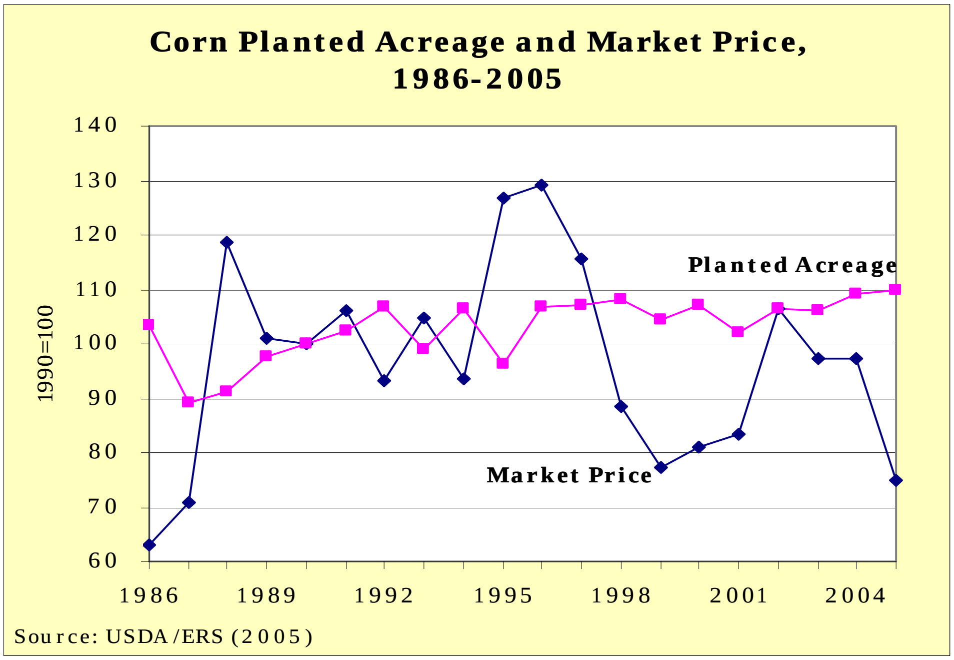


Figure 3: Corn Acreage and Price



Moreover, although planting flexibility allowed for the rapid expansion of soybean acreage, the contraction in acreage has been less forthcoming. For example, in 2001 when soybean market prices dropped to levels not seen since 1972, U.S. farmers planted a record 75.4 million acres (Ash 2001). While troubling for soybean producers, the subsequent low prices have been a boon for the industrial livestock industry and other bulk purchasers of U.S. farm products, which have been able to greatly expand production (Ash 1998).

III: Structural Changes in the Broiler Industry

The present-day broiler chicken industry is worlds away from the industry that existed in the first half of the 20th century, due largely to processes of consolidation, integration, and industrialization that have taken place over the last sixty years. These processes have shaped the industry into a concentrated production system controlled by a small number of large agribusiness firms; these firms oversee all links in the production chain, including breeding and the hatching of chicks, the milling of feed grain, the grow-out stage, and the processing and packaging of finished birds. Helped along by changing consumer preferences, massive production increases, and falling costs, the broiler industry now contributes the largest share of animal protein in the American diet (Steedle 1986; USDA/NASS 2002).

The history of the broiler industry in the United States is one of consolidation – massive growth in production capacity, and massive decline in the number of farmers involved in the industry. Through the early part of the 20th century, most chickens were raised on small farms or in backyard flocks, and their meat was largely a by-product of egg production. Independent feed mills, breeders, hatcheries, producers, and processors traded with each other in a system of often unstable spot markets. Beginning in the 1940s, however, feed stores began selling chicks, feed, medicine and equipment to growers, and then buying the grown chickens back for processing and sale. This system, pioneered by Georgia feed store owner Jesse Jewell, marked the beginning of a process of consolidation and control of the production chain by one central party (first the feed store owners, and later packers and agribusiness firms, broadly referred to as "integrators").

The independent businesses that once made up the poultry production process were integrated through a system of contracts or outright ownership of production stages by the integrators, who reduced costs by coordinating production at each stage to avoid overproduction and shortages, and by utilizing economies of size to purchase feed, medicine, and equipment at a bulk discount. Although many broilers continue to be hatched and raised by growers who contract independently with integrators, the integrators retain ownership of the birds during the entire life cycle, from breeding to slaughter and sale. Processing facilities and feed mills are part of the integrated company, and the finished broilers are sold by marketers at the integrated firm (Knoeber 1989; Aho 1999; Goodwin 2005).

The process of consolidation is nowhere better illustrated than by time series data on the number of broiler production facilities in the United States. In the 1930s, the hatching of broiler chicks was spread among some 11,000 independent facilities with an average capacity of 24,000 eggs. By 2001, the number of hatcheries had declined by 97%—to only 323—but with an average incubator capacity of 2.7 million eggs. Over 170 million broiler chicks are now turned over to grow-out facilities each week in the United States. Broilers have increased in size along with the industry; the average live weight of a broiler went from 3.03 pounds in 1945 to 5.06 pounds in 2001 (USDA/ERS 1997; USDA/NASS 2002). Factors that influenced how and why this process took place are discussed below.

Why did integration happen?

A number of analysts have explored the factors that lead to the consolidation and integration of the broiler industry (Henry 1960; Steedle 1986; Aho 1999; Paul 1999; MacDonald 2004). Key to their theories is the nature of spot markets in broiler production: these markets were historically quite thin, meaning that they were highly sensitive to local variations in volume. In the absence of integration, over- and under-production in one link along the chain affected the economic outcome for every other firm along the chain, as well as for competitor firms. During seasons of low demand, the broiler industry had to reduce volume at all points along the chain; if this process was not done in a coordinated fashion, the result was localized volume and price instability

(Henry 1960; Steedle 1986; Aho 1999). Integration was one way of dealing with unstable spot markets and volume control problems. Because the integrator controlled the entire process, production decisions could be made and coordinated by a central authority. Growers supported the idea of integration because it reduced the risk they faced in spot markets by providing contracts that guaranteed a set price for their product (Aho 1999; Paul 1999). Integration also reduced the transaction costs faced by different firms in the production chain. Economists tend to take either a risk-sharing or a transaction cost approach to integration analysis, but some analysts acknowledge that both factors provided an incentive for the transformation of the industry (MacDonald 2004).

Integration also helped to address issues of quality control and price differentiation for broilers. Since the quality of a bird is generally not discernable until processing, the only spot market in which quality and price differentials could exist was that between processors and retailers. Some economists argue that the lack of differentials at earlier points in the process led to inefficiency in the industry, and that integrators reduced that inefficiency by exercising direct control over all stages of production, resulting in greater quality consistency (Henry 1960; Bugos 1992; Paul 1999; MacDonald 2004). Integration also allowed firms to complete the entire production process in a localized area, an extremely important cost-reducing factor given the high rate of bird death and weight loss during transport. Contracting with hatcheries, grow-out facilities, and processing plants in the same area—what McDonald refers to as "site specificity"—helped to minimize the loss in value that broilers experience during transport, as well as to reduce transport and feed costs for integrators (MacDonald 2004).

Finally, some analysts highlight the role that integration has played in the diffusion of new technology along the broiler production chain (Knoeber 1989; Bugos 1992; Knoeber 1995; Paul 1999; MacDonald 2004). Off-farm firms with access to significant capital can tap into new technology and credit opportunities more easily than individual growers, and are willing to make investments in genetic research, feed development, and other production technology. Contracts shift the risks of developing and introducing these new technologies from producers to integrators, while contracts that base compensation rates on grower productivity and performance have helped encourage technology adoption. Analysts credit this system for increased efficiency in the broiler industry; the performance of growers is largely determined by the efficiency with which feed is converted to meat, the growers' success in reducing mortality, and their attention to quality control, all factors that can be influenced by the use of new technologies. Under the current contractual regime, grower performance determines pay-out rates by the integrator, giving growers an incentive to adapt to new technologies in order to ensure the greatest long-run returns (for more information on performance contracts, see Knoeber 1989).

As a result, feed efficiency doubled between 1945 and 1970, and labor productivity rose an annual average of 10.5% per year over the same period (MacDonald 2004). Production costs for broilers dropped by nearly 90% between 1947 and 1999 (Aho

1999). These dramatic efficiency gains helped propel the broiler industry to the position of prominence it holds today among animal protein suppliers to U.S. consumers.

In pursuit of these efficiencies and the profits that accompanied them, agribusiness firms engaged in a frenzy of integration and consolidation in a small number of broiler-producing states beginning in the late 1940s. Presently, the top 15 broiler-producing states account for 94.4% of all production, and the top 8 states-- Arkansas, Georgia, Alabama, North Carolina, Texas, Louisiana, Missouri, and Mississippi— account for over 70% (USDA/ERS 1987-2005). Most facilities in these states are controlled by fewer than 50 agribusiness firms, with the top four firms producing 56% of all the broilers in the country (Aho 1999; Goodwin 2005; Hendrickson and Heffernan 2005). The horizontal integration of firms into a few massive and powerful broiler companies is a relatively recent phenomenon; between 1982 and 2002, the top four broiler firms experienced a five-fold increase in the number of broilers they produced and sold. The eight-firm concentration ratio increased from 44.1% to 66.6%. (Goodwin 2005).

These firms benefited from a massive increase in the amount of poultry consumed by American households, due in part to consumer concerns over the health implications of red meat intake. Between 1969 and 1992, total broiler sales increased by almost 3 billion head, or over 120% (USDA/ERS 1997). The retail value of broilers in the United States topped $43 billion in 2004 (USDA/ERS 1987-2005; USDA/NASS 2002).

Hidden Risks and Costs of the Integrated Model of Broiler Production

The process of vertical integration coincided with a growing prevalence of contract arrangements in the industry. These two phenomena played no small role in the production and feed-efficiency gains experienced by the industry, and in the reduction in production costs. While these improvements are significant and should not be discounted, vertical integration and contract arrangements have also brought new risks and costs to industry players and consumers. A few of the negative implications of the system are outlined below.

Contracts

Today, the 30-year trend towards vertical integration and contract-based production in the poultry industry is essentially complete. The USDA reports that 90% of broilers produced in the United States are now under production contracts (Hamilton 1995). While contracts have been an essential tool to increase production and marketing efficiencies in the broiler sector, recently some have voiced concern that contracts have led farmers to exchange production and price risks for contract risks (MacDonald 2004).

Hamilton (1995) outlines the uniqueness of poultry and livestock contracts, which raise particular legal concerns. For example, under most broiler production contracts, the contractor, not the grower, owns the animals, but livestock contracts usually require significant investments in fixed capital assets, which are shouldered by the grower. In most instances, the contracting company retains some if not all control over the grower's production methods, reducing the autonomy of the grower in the interest of quality control. Production contracts have proliferated in the market so extensively that they have, in many cases, priced out other options and limited growers' production and marketing choices. As a result, growers may be locked into a contract relationship that does not serve their needs. They may be placed in a position where they have to accept unattractive arrangements or face going out of production (Kolmer 1963){Carstensen, 2003 #142}.

Building on these characteristics of poultry production contracts, existing research documents some of the specific problems. Studies show that integrators pass on downward price movements in livestock markets more fully to contract farmers than they do price increases. For example, two studies report that declining domestic demand for broilers in the mid- to late-1990s led contractors to reduce their payments to farmers producing broilers (Lee 1996; Morison 1996). At the same time, because income is usually fee-based and contractually determined, farmers have often had little opportunity to profit from rising market prices (Perry 1999).

Other studies indicate that farmers are at risk for exploitation because they have unequal bargaining power with large contract firms. With increased industry concentration, farmers have fewer choices over the company with whom they contract. Furthermore, because terms of contracts are not generally publicized, farmers may find it difficult to compare prices and conditions across contracts (Carstensen 2003). A 2004 USDA/ERS study of production contracts in the broiler industry showed a broad range for compensation paid to growers by contract firms. 25% of contract producers received fees of at least 26 cents a head, while another 25% received fees of no more than 16 cents a head (MacDonald 2004).

Over the last decade, these concerns have increasingly found voice in the legal arena. One lawsuit, which involved fraud and breach of contract by the agribusiness giant ConAgra, awarded compensatory damages to growers after ConAgra employees were found guilty of incorrectly weighing delivery trucks of broilers for slaughter and underpaying growers as a result (Hamilton 1995).

Other Concentration Issues

If large producers in concentrated markets are able to realize economies of size, concentration may, in some cases, lead to lower production costs, greater input demand, and lower consumer prices. However, concentration can also present a risk to consumers and growers. Economic theory suggests that the concentration of market power in a small number of firms could negatively affect competition and the price discovery process, skewing the market prices of inputs and livestock output as well as industry wage rates (Knoeber 1995; Carstensen 2003). Contractual arrangements and vertical integration can act as a barrier to entry to smaller firms because they limit market outlets; work by Harper et al. (2002) suggests that this has been a particular problem for mid-sized livestock producers, who are unable to find processing and packing facilities that will accept their meat. For independent producers who remain in business following a wave of concentration in their sector, trading on spot markets may become more volatile because prices are based on fewer trades. In addition, if quality premiums in contract arrangements are not made publicly available, small producers may be subject to price discrimination. (IATP 1999; MacDonald 2004).

With respect to the consumer and society at large, research suggests that concentration and integration may reduce the benefits of industrialization by ultimately making the system less efficient, impacting prices, and/or reducing consumer choice (Murphy 1999; Hendrickson 2001; Heffernan 2002; Taylor 2002; Carstensen 2003; Vorley 2003). When only a few firms dominate the industry, they may limit the spread of innovation, and market preference may skew towards the firms that gain market power, not those that exhibit the most innovative production, marketing, or distribution techniques. Concerns exist, then, that a system lauded for efficiently disseminating new technologies may ultimately stifle innovation and technological change (IATP 1999; MacDonald 2004; Farm Foundation 2006).

Human and Environmental Health Impacts of CAFOs

While the average poultry house in the 1950s contained ten thousand birds, today few feed companies would sign contracts with farmers who produce less than 125,000 birds a year. The USDA currently designates a livestock or poultry operation as a confined animal feeding operation (CAFO) if it houses more than 1,000 units. 1,000 animal units translates into between 30,000 and 100,000 broilers, depending on the watering and waste management systems that are used inside a broiler house[2] (USDA 2006). A large and growing literature documents the direct harm to human and environmental health from emissions, byproducts, toxic waste, and infectious agents that are produced when hundreds of thousands of birds are confined to a one-story metal structure that is generally hundreds of feet long and up to fifty feet wide. Documented impacts include increased particulate matter air and water pollution; elevated nutrient and hormone levels in water sources; soil degradation due to elevated nutrient levels; and compromised human health due to odor (Lorig 1991; Cressie 1997; Cole 1999; NRDC 2000; Schiffman 2000; Wing 2000; Marks 2001; ISU 2002; Oemke 2004; Easton 2005; Walker 2005).

One study in particular, published in 2002 by Iowa State University and the University of Iowa Study Group, addresses the public health and environmental impacts of CAFOs, particularly regarding the impacts on air quality. Among other findings, the report documents the respiratory diseases and dysfunction among swine and poultry workers from exposures to complex mixtures of particulates, gases, and vapors within CAFO units. It also highlights other important considerations surrounding CAFOs beyond air emissions, including concerns about water quality, the health of CAFO

[2] Animal unit conversion is a technique used by the USDA to determine pollution equivalents across different types of animals; for example, one unit equals one slaughter cow or 2.5 hogs.

workers, the socioeconomic impact on rural communities, and the emergence of antibiotic resistant microorganisms (ISU/UISG 2002).

The findings of environmental damage from confined livestock operations, as well as the concerns raised by the contract system, suggest that there are hidden costs to industrial livestock production. Thus far, however, economic analyses have largely supported the industrialization of the livestock sector based on cost efficiency and economies of size and scale (see, for example, McBride and Key 2003). Our research raises doubts about the efficiency assumption by highlighting another factor in the economics of industrial livestock firms: below-cost pricing of the corn and soybeans used to make animal feed.

IV: Methodology and Data

To estimate the gains to the broiler industry from low-priced feed components, we build on methodologies developed by others for the purposes of estimating the "dumping margins" for U.S. crops exported at prices below their production costs (Berthelot 2003; Oxfam 2003; Ritchie 2003). For our purposes, the methodology used in this literature for calculating the cost of production is of particular interest.

IATP's Ritchie uses USDA estimates of the average economic costs for commodity producers. Total economic costs include full ownership costs for operating a farm business. Included in this category are all variable and fixed cash expenses except interest payments; capital replacement; estimated costs of land; an estimated cost of unpaid labor; and the cost of capital invested in production inputs and machinery. IATP then divides these costs by yield for each crop to calculate the total cost of production per bushel (Ritchie 2003). The USDA estimates land values using the cash rental rates for comparable acreage in the area, while the estimate of the value of the farmers' unpaid labor is based on wages in the local labor market (McBride 2005). This category of costs will hereafter be referred to as the Farmer Cost of Production, or FCOP.

The USDA FCOP estimate does not include any government payments. Because IATP is not trying to estimate the leakage of subsidy payments outside the farm sector, but instead to determine the true farmer costs of production for different crops, the only subsidy payment added to the FCOP is input subsidies. The rationale is clear: Input subsidies are a direct cost of production covered by the government. Input subsidy data comes from the Organization for Economic Cooperation and Development (OECD), the main international body charged with gathering and reporting agricultural support data for member countries (OECD 2005). OECD reports annual data in its Producer Support Estimate (PSE) category for Payments Based on Input Use. The category includes payments affecting specific variable input costs, such as the Agricultural Credit Program, Energy Payments, Grazing Payments, Extension Service, Emergency Conservation Program and Farmland Protection Program, and others (Ritchie 2003).

IATP then adds the cost of transportation and handling to their full cost of production estimates, since the project's goal is to determine international dumping of agricultural commodities, measuring the export price against the full costs of producing the good and bringing it to the Gulf port. Admittedly, their transportation estimates are simply residuals; they are calculated as the difference between the market price in commodity-producing states and the market price at the Gulf, and vary widely from year to year. IATP uses an average transport cost for each commodity for all of its calculations.

Other analysts have elaborated on IATP's methodology in an attempt to provide what they believe are more accurate estimates of the true cost of producing supported crops, but these methods are more problematic. Oxfam America calculates export dumping margins for corn by multiplying U.S. corn subsidy payments per ton, as reported by the Commodity Credit Corporation, by the total volume of exports to Mexico (Oxfam 2003). The resulting number is presented as an "implicit subsidy" to exported U.S. corn. This technique suggests a direct transmission of subsidy to price, and may overestimate the dumping margin, perhaps by a significant amount.

Trade analyst Jacques Berthelot critiques both Oxfam and IATP, suggesting that a more realistic picture of production costs would be the farmer cost of production, as calculated by the USDA, plus the full amount of government subsidies paid to a particular crop. He notes, however, that government subsidies are intended to offset the costs to the farmer of land and unpaid labor. To avoid double-counting these costs—since they are also included in the USDA FCOP estimate—he takes out the USDA land and unpaid labor line items (Berthelot 2003). His methodology is problematic, however, in that it also assumes direct transmission of subsidy to price; a "fairer" market price would equal the FCOP plus subsidies. This methodology, too, may produce unrealistic estimates of dumping, mainly because some subsidies are politically determined supplemental returns to land and labor on the farm. They do not directly reflect costs, making them less useful to the dumping definition.

By including only explicit government subsidies to inputs, IATP has avoided some of the problems mentioned above. Of all subsidy categories, input subsidies are perhaps the most reflective of direct costs of production. The inclusion of only input subsidies will likely return a conservative estimate for the total cost of producing a crop, since some of the government payments not included in the calculations are also likely to be used by farmers to offset rising production costs.

One strength of the IATP methodology is that it is consistent with a World Trade Organization definition of dumping, a definition currently applied mainly to non-agricultural market goods. The WTO calculates dumping as the difference between the "normal value" of a good—the value it would have in the exporting country market—and the export price of the good. It proposes several alternative techniques to calculate "normal value" of the good. If the good is not normally sold on the home country market, or if market distortions complicate pricing, the WTO allows member countries to estimate the price using a comparable price for a like product exported to a third country, or by constructing the cost of production in the country of origin based on producer and government records, and adding a "reasonable amount" for administrative, selling, and general costs (WTO 1994). IATP's methodology is most compatible with this final technique. USDA ARMS survey data, on which production cost estimates are based, are a reasonable proxy for producer records. Government support for inputs is included as well, as it offsets a direct cost to the producer. Transportation and handling falls under the category of "general costs." Together, these costs of production are compared to the export price for agricultural products to determine international dumping.

While its compatibility with a WTO definition of dumping is a clear attribute of the methodology, the IATP calculations are not without limitations. One important critique is put forth by IATP itself: agricultural land values in the United States are distorted by government policies. Several analysts explore the politically-derived nature of land values in the United States, bringing into question the USDA land value estimates included in the FCOP calculation. (Weersink 1999; Ryan 2001; Gardner 2002; Shaik 2005) Shaik et al. (2005) demonstrate a positive correlation between crop returns and agricultural land values, and between farm program payments and land values. In other words, because several government subsidy programs are tied to base acreage, the value of the subsidy is capitalized into the value of agricultural land. Shaik et al. estimate that between 1938 and 1980, the share of agricultural land values generated by farm program payments was as high as 30 to 40 %; Between 1980 and 2004, the share declined to an average of 15 to 20 % (Shaik 2005). This latter finding supports that of Ryan et al., who conclude that land values were inflated by government farm payments by an average of 19 % between 1990 and 2001 (Ryan 2001).

If the costs of agricultural land are overvalued, USDA estimates of the FCOP may present a misleading picture of true production costs to farmers. A positive correlation between farm program payments and land values will tend to show a similar correlation between government subsidies and overall farmer production costs; conversely, reducing subsidies will diminish returns and drive down land values, resulting in lower farmer costs of production. The relationship between land values, farm income, and cost of production makes it difficult to judge how cost/price margin calculations can be used to evaluate the effects of policy change, since falling land values may reduce the FCOP numbers enough to show significant reductions in cost/price margins.

While USDA FCOP calculations may be politically derived, at least in part, they do reflect actual costs of land – mortgage payments, rental payments, insurance, taxes, etc. – so we proceed with our analysis using this data. Later, we perform a sensitivity analysis to determine the extent to which lower land-cost estimates would affect our findings. We adjust the IATP methodology for use on domestic markets by eliminating transportation and handling costs. We then use USDA farmer cost-of-production estimates for corn and soybeans in the North Central region of the United States (USDA/ERS 1986-2005; USDA/ERS 2005), plus government input subsidies for each crop (OECD 2005), to create an estimate of the full cost of producing corn and soybeans.[3] This full COP is then compared to the price of the crop on local markets to find the cost-price margin. We complete these calculations for the years 1986-2005. The market price estimate for 2005 is taken from the USDA's World Agriculture Supply and Demand Estimates (WASDE) Report for January 12, 2006 (USDA 2006), while all other years are taken from the Feed Grains Database and Oil Crops Yearbooks of the USDA/ERS (USDA/ERS 1986-2005; USDA/ERS 2005).

Using these cost-price margins, we estimate the gains that accrue to industrial broiler chicken producers through their ability to purchase feed corn and soybean meal on the market at a price below what it costs to produce them. According to industry contacts and the USDA/ERS, broiler feed is a mixture of about 60% corn, 25% soybean meal, and 15% additional ingredients (generally including bone meal or protein supplements, vitamins, and minerals) (Harvey 2006). The soybean-to-soybean meal conversion ratio is 1.362 : 1 (CBOT 2005). Between 1986 and 2005, the price of a ton of soybean meal averaged 75% the price of the volume of soybeans needed to produce the meal (authors' calculations based on USDA/ERS 1986-2005). Given these parameters, we can estimate the share of feed prices attributable to the cost of raw corn and soybeans converted to soybean meal.

Between 1997 and 2004, the cost of raw corn and soybeans converted to meal accounted for an average of 78% of the total cost of feed (authors' calculations based on USDA/ERS 1986-2005; USDA/ERS 1987-2005; USDA/ERS 2005). We can calculate the dollar value of that share per ton of feed, based on USDA/ERS data on the market price of broiler feed (USDA/ERS 1987-2005).[4]

Using our previously calculated cost-price margins, we adjust the dollar value of the corn and soybean meal portion of feed to determine the price that broiler producers would pay for a ton of feed if they paid the full cost of production for the corn and soybean meal components. The difference between the cost of a ton of feed at market price and the recalculated cost represents an estimate of the implicit subsidy to broiler producers from below-cost feed components.

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[3] The use of an average cost of production for corn and soybeans is well-justified, as there is surprisingly little variation in production cost by farm size. For example, ERS data for cost of corn production disaggregated by farm size (small, medium, large, and very large) for the ERS North Central region (Iowa, Missouri, Illinois, and Indiana) shows that large farms had the highest production costs (10% above average), and very large farms had the lowest (just 5% below average). Medium-sized and small farms' costs were within one percentage point of the regional average. It is therefore reasonable to use the average cost of production for feed components (USDA/ERS 2006).

[4] It is worth mentioning a complicating factor with respect to broiler feed market price data. Given that many, if not most, of the large-scale broiler companies purchase corn and soybean meal from the market and mill their own feed (Harvey 2006), the market price for broiler feed may not be fully representative of the average cost that broiler companies pay. As concentration has increased in the industry, cost data has increasingly become proprietary information, making price discovery difficult (MacDonald 2004; Cunningham 2006). To validate the accuracy of the USDA/ERS data on feed costs, we contacted a researcher from within the industry who shared feed cost data with us for the years 2000-2004. The numbers were comparable to USDA/ERS data, boosting our confidence in the USDA data set (Confidential Industry Contact 2006).

In the interest of being able to examine the relationship between major policy changes – specifically, the passage of the 1996 Farm Bill – and these trends, and because of limitations on the availability of government support data from the OECD, our data cover the time period 1986-2005. Our analysis will focus mainly on the post-1996 Farm Bill period (1997-2005), which is most relevant to the current policy environment, but we will use the pre-1996 Farm Bill period of 1986-1996 for comparison.

An Overview of the Data

We begin with a brief overview of the data on FCOP for corn and soybeans and briefly discuss production and yield trends (USDA/ERS 2005). As noted earlier, we calculate the total cost of production for corn and soybeans by adding together the FCOP estimates from USDA, and OECD estimates of government payments based on input use. Both are presented on a dollar per bushel basis. FCOP includes the sum of operating and allocated overhead costs (referred to by the USDA as "cash and economic" costs prior to 1995) for inputs provided by operators, landlords, and contractors (USDA/ERS 2005). For 1986 through 2004, FCOP estimates are based on producer surveys conducted every 3-8 years for each commodity as part of the Agricultural Resource Management Survey (ARMS). FCOP estimates for 2005 are from USDA's Cost of Production Forecasts, which are developed as part of the USDA Baseline Projections to help estimate projected net returns for major field crops (USDA/ERS 2006). We use databases from USDA's Economic Research Service to obtain estimates for yield, planted acreage, and production (yield x planted acreage) (USDA 2006).

In general, changes in the FCOP per bushel move counter to changes in total production of corn and soybeans: as total production increases, FCOP per bushel decreases. Often this is simply a function of climate or other exogenous factors, as higher or lower production levels reduce or increase per-bushel costs. Rising productivity, however, will also result in lower costs per bushel.

The estimate for government input subsidies come from the OECD Producer Support Estimate (OECD 2005). Only the category of payments based on input use is used, consistent with the IATP methodology described above. The specific payments included in the category of input subsidies are also described above. Because OECD data is available only through 2004, we use a 1997-2004 average for input subsidies for 2005.

Corn

Figure 4 presents FCOP data for corn from 1986-2005, including input subsides and land value component of FCOP. Figure 5 shows an index of the changes in planted acres, yield, and production for the same years.

Figure 4: Corn Cost of Production

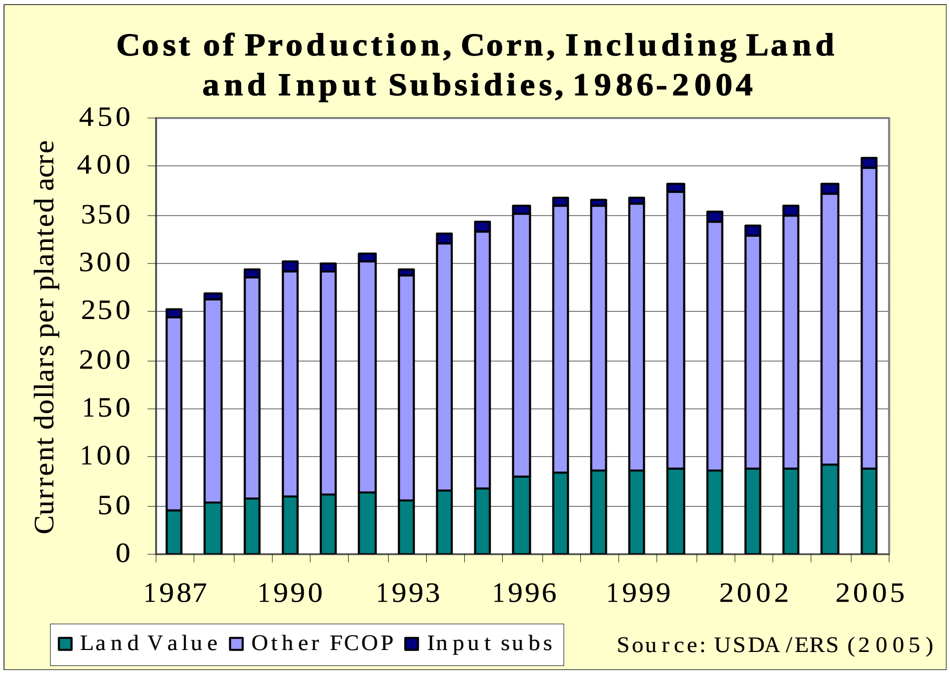


Figure 5: Index of Corn Acreage, Yield, and Production

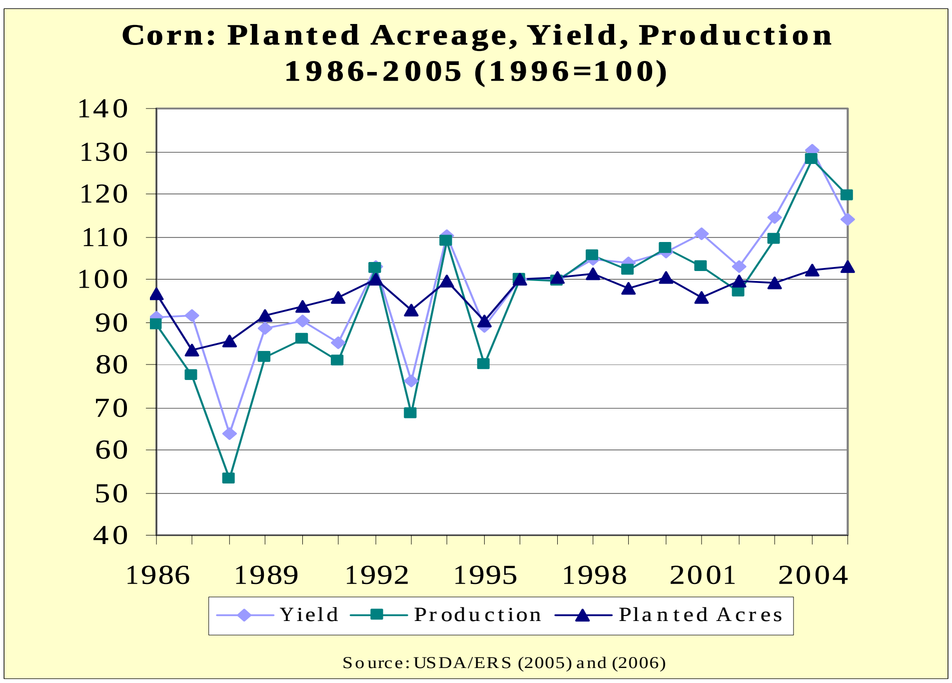


Figure 4 depicts rising farmer costs of production per planted acre, except between 2000 and 2002. Figure 5 shows an upward trend in corn yield during the period under study. Per bushel, then, we calculate that FCOP decreased overall by 21% between 1997 and 2004, paralleling the relative average increase in yields and planted acreage. Preliminary data from the USDA suggest that the FCOP/bushel rose back to 1997 levels in 2005, largely due to increased fuel prices. While minor feed grain acreage has dropped over the last fifteen years, U.S. corn plantings and yields have increased over the same period because of improved varieties and government policy changes, such as those enacted in 1996 that eliminated all remaining planted acreage restrictions for program crops (Westcott 1999). Government input subsidies, included in Figure 4, have fluctuated from $0.06/bu and $0.09/bu between 1996 and 2005. Land values, which make up an average of 22% of the FCOP, rise after 1996 and fall in 2001, 2003, and 2004, when market returns for corn were low. Compared to the pre-1996 period, farmer costs of production per acre, including land values, are higher, while government subsidies to inputs are similar on average. Planted acreage for corn has remained relatively constant since 1986, though with less fluctuation in the post-1996 Farm Bill period.

Curiously, Figure 4 shows a decline in FCOP per acre between 2000 and 2001 despite falling production. Following consultation with staff at the USDA/ERS, we determined that FCOP estimates for 2001-2004 were based on a survey conducted in 2001, while FCOP estimates for 1997-2000 were based on survey data collected in 1996. In short, a break in the data collection between 2000 and 2001 accounts for the apparent FCOP deviation observed in the graph (Foreman 2006).[5]

Since 1996, planted acres have remained relatively steady, but production has risen, dramatically in some years, as yields have increased. Much of the fluctuation is accounted for by climatic change, with drought conditions in 2001-2, and strong growing conditions in 2004.

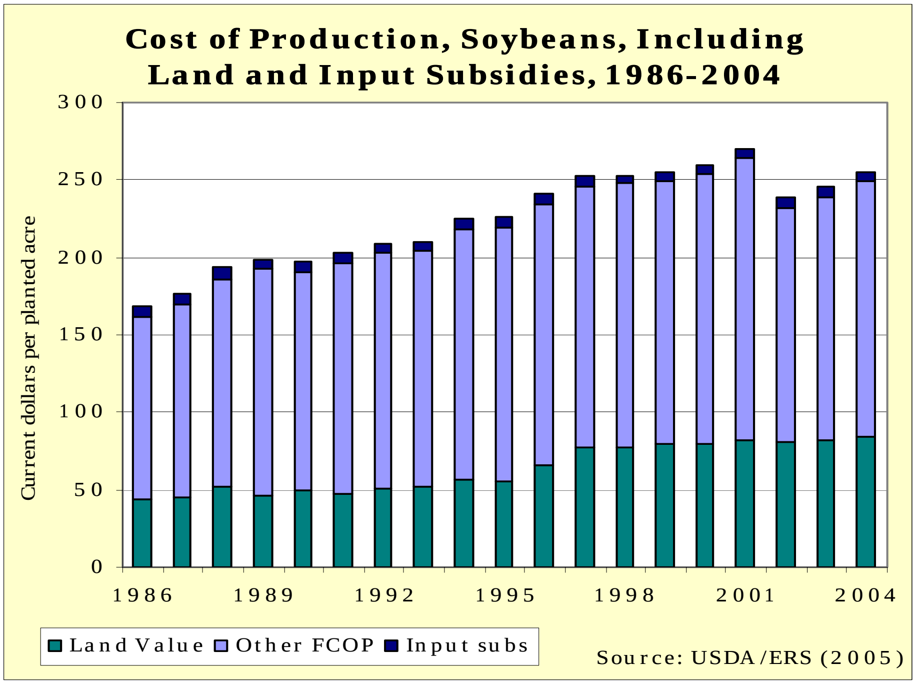
Soybeans

With the exception of 2001 to 2003, when soybean yields diminished due to drought and soybean aphid infestation (Ash 2006), U.S. soybean production has climbed steadily over the past ten years, reaching record high yields in 2004 (FAPRI 1999-2006). FCOP per acre increased steadily through 2001 and then again between 2002-2004, while FCOP per bushel fluctuated depending on yields and production levels. In the post-1996

[5] The drop in FCOP per acre between 2000 and 2001 raises some concerns about the USDA FCOP data points for the years 1997-2000 and 2002-2005, since the algorithm for calculating production costs was consistent for each year, using the 1996 and 2001 survey data as baselines. The drop between 2000 and 2001 suggests that the algorithm applied to the 1996 data did not accurately predict 2001 levels. According to the ERS, "Estimates made in the survey year should be regarded as the most reliable because they reflect both prices and technologies used on the commodity. The reliability of estimates in non-survey years likely varies for each commodity by the degree of technical and structural change that has occurred since the last survey" (USDA/ERS 2005). The change would not significantly affect the results. If we assume instead that the cost of corn production per acre actually declined at a steady rate from 1996 to 2001, and use these adjusted numbers to calculate a new cost-price margin for corn, we find the average cost-price margin for 1997-2001 declines by about 4 percentage points, from 29% to 25%. This finding would result in a slightly lower, but still quite large, implicit subsidy calculation.

Farm Bill period, per bushel FCOP ranged from a low of $5.50/bu in 2004, corresponding to the record high level of production, to a period high of $6.70/bu the year before when weather and pests impacted much of the crop. Land values, which account for an average of 29% of the FCOP estimate for soybeans, rose steadily after 1996, falling only in 2003 when market returns fell. Government input subsidies for soybeans varied from $0.15/bu and $0.22/bu between 1997 and 2004.

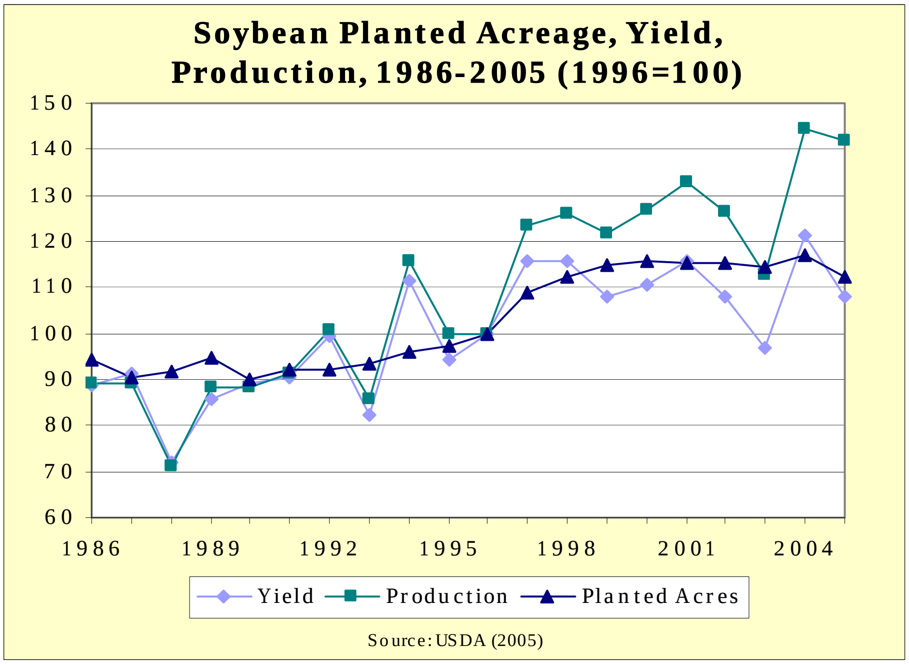
Figure 6: Soybean Cost of Production



We observe the same deviation from the typical production/FCOP relationship that we see for corn—FCOP and soybean production levels appear to have declined concurrently—in this case between 2001 and 2002. Again, after consulting with experts at the USDA/ERS, we learned that there was a break in data collection for these years; soybean farmers were surveyed in 2002 to establish a new base year for estimates, while the 2001 data was updated from a 1997 survey. According to the USDA/ERS, this explanation accounts for most of the difference we observe in FCOP between 2001 and 2002 (Livezey 2006).[6]

[6] See footnote 4; the same issue applies to soybean COP data for 1998-2001. If we assume that cost of soybean production actually declined at a steady rate between 1997 and 2002, our average cost-price margin for soybeans for 1998-2001 would fall by 2 percentage points, from 26% to 24%. Again, this would result in slightly lower implicit subsidies for those years, but our finding would still be large enough to raise serious concern about the gains to industrialized broiler companies from policies that result in low feed prices.

Figure 7: Soybean Acreage, Yield, and Production



Several factors have contributed to the increased soybean production visible in Figure 7, including new seed varieties, improved applications of fertilizers and pesticides, and farm policies, particularly the 1996 FAIR Act. Production was enhanced by excellent yields in 1996-1998, when an absence of freezing weather in the fall allowed late-planted fields to mature well into October. 1997 saw a bumper soybean harvest; farmers responded by planting more acres, increasing acreage by 6.3 million acres over the 64.2 million planted in 1996 (USDA/ERS 1986-2005; FAPRI 1999-2006).

Of some debate is the impact of herbicide-tolerant genetically modified seeds. Analysts have struggled, often unsuccessfully, to isolate the effects of GE adoption from other factors in yield studies (Lin 2001). Herbicide-tolerant soybeans were made commercially available in 1996, and since then have become the most widely adopted biotech crop in the U.S. Today, herbicide-tolerant soybeans account for 87% of total U.S. soybean acreage (Fernandez-Cornejo 2006). A study published in 2001 examining farm-level effects of adopting herbicide-tolerant soybeans found that adopters' yields in 1997 were 3% higher than for non-adaptors (Lin 2001). A more recent study, published in 2006, found that rapid adoption of herbicide-tolerant soybeans had little impact on net farm returns in 1997 and 1998 (Fernandez-Cornejo 2006). It is difficult to draw conclusions about the impact of herbicide-tolerant soybeans on yields and FCOP from data analyzed for one or two years. More research in this area is needed.

There is little debate, however, over whether or not the 1996 policy changes have had a significant impact on total soybean production since then. As mentioned earlier, the combination of increased planting flexibility beginning in 1990, the dismantling of supply controls, and the introduction of decoupled payments allowed farmers to shift land from other crops into soybeans when market prices for soybeans were favorable. The 2002 Farm Act allowed farmers to establish soybean base acres for the first time, providing less incentive to scale back production despite low prices (Ash 2006).

Corn and Soybean Price Trends

The acreage, yield and production trends outlined above had clear price impacts in both corn and soybean markets. USDA market price data for the North Central region show a sharp drop in prices for both corn and soybeans beginning in 1996 and lasting through 2001, due in part to the Asian financial crisis and in part to changes in production and yield. Soybean market prices fell from $6.91/bu in 1996 to $4.16/bu in 2001 (USDA/ERS 1986-2005; USDA/ERS 2005). By 1999, corn prices had plummeted to lows not seen since the mid-1980s, dropping from $2.79/bu in 1996 to $1.67/bu in 1999 (USDA/ERS 2005). A 2002-2003 drought squeezed corn supplies and brought prices up to $2.30/bu; many farmers moved out of soybeans and into corn in seek of higher returns, and record production brought corn prices back down to $2.10/bu in 2003. In contrast, soybean production fell, and market prices rebounded for the first time in six years, to $5.19/bu. By 2004, however, farmers chasing high returns had moved back into soybeans. Helped by record high yields from good weather, 2004 soybean production levels surged to a new high, dropping the market price to $5.58/bu. Overall market returns to soybean farmers fell, as the price drop more than offset the increase in yield. Strong domestic and international demand for corn in 2004, due in part to a decline in exports from China and the increased demand for corn-based ethanol in the United States, kept corn prices steady despite record levels of production.

Preliminary USDA estimates for 2005 soybean market prices show a continued drop, to $5.45/bu., as production continues at a high level (USDA 2006). Initial price estimates for corn show a decline as well, to around $1.90/bu (USDA 2006).

The price, acreage, and production trends illustrate an imperfection in agricultural markets that was exacerbated by the policy changes enacted in 1996. Rather than cutting back on planted acreage or production when prices are low, production generally moves in an opposite direction from market prices, increasing when prices drop. While farmers do generally adjust their planting decisions based on which crop will bring in the highest anticipated returns, the majority simply cycle between corn, soybeans, and hay—or just corn and soybeans—and overall planted acreage increases regardless of the market price.

V: Findings

Cost-Price Margins

Taking the difference between the true cost of production and the market price as a percentage, we find the percent below cost of production at which corn and soybeans are sold, otherwise known as the cost-price margin. Data and calculations are available in Appendix A.

Figure 8: Corn Cost-Price Margins

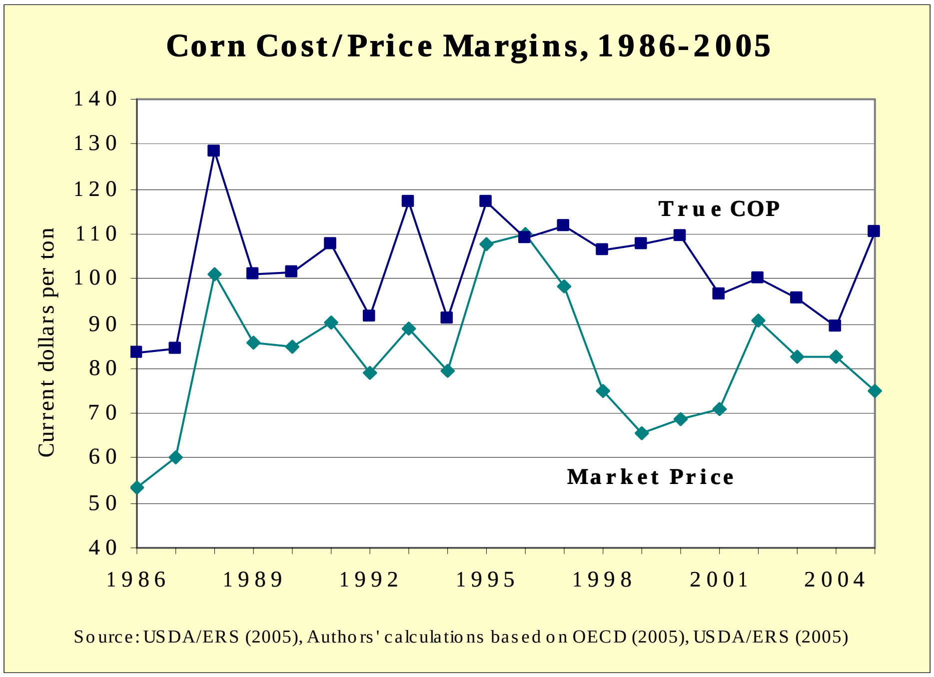
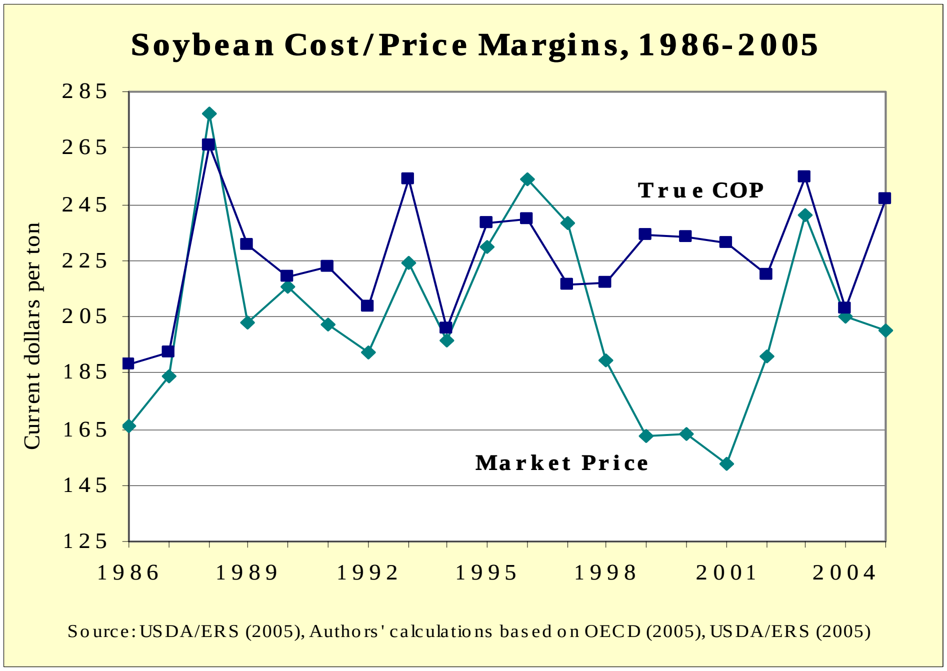


Figure 9: Soybean Cost-Price Margins



As Figure 8 shows, the market price was consistently below the true production cost of corn in almost every year from 1986-2005. In the eleven-year period before the 1996 policy reform, the average cost-price margin was 17%. After the reforms, cost-price margins widened to an average of 23% between 1997 and 2005.

For soybeans, Figure 9 shows lower cost-price margins than for corn, with prices above costs in three of the twenty years studied. Between 1986 and 1996, margins averaged 5%. After the 1996 reforms, margins tripled to an average of 15%.

Thus, our first finding is that prices have indeed been below true costs of production for both corn and soybeans since 1986. Moreover, we can confirm that margins for both commodities were significantly higher following the 1996 policy reforms.[7]

Implicit Subsidies to the Broiler Industry

Based on our cost-price margin findings, we can estimate the discount that industrial broiler producers receive when farm policies allow the prices of feed corn and soybeans to fall below their costs of production, so that industrial operations can purchase feed more cheaply than family farmers can produce it. Data and calculations are available in Appendix B. We refer to this discount as an "implicit subsidy"—not a direct subsidy from the government to industrial broiler producers, but a discount on operating costs that industrial producers receive from the price effects of federal farm policy. Stated differently, the implicit subsidy measures how much industrial broiler companies gain from purchasing feed under current policy conditions, compared with what they would pay for feed if federal farm policies were structured to ensure that feed prices reflected the cost of producing the feed components.

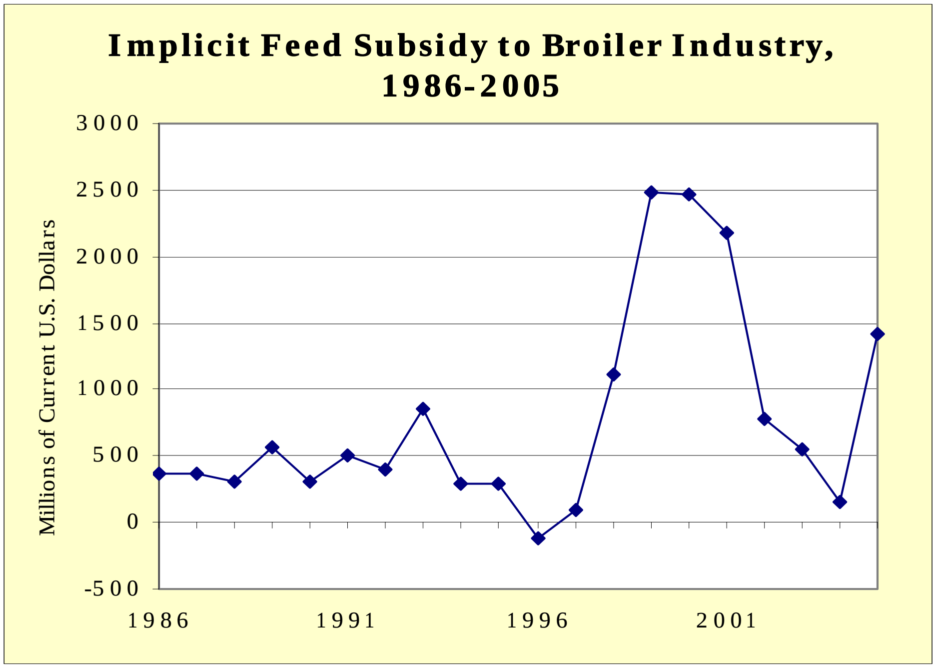
Figure 10 illustrates the implicit subsidy from below-cost feed between 1986 and 2005. We see a low implicit subsidy when corn and soybean prices rose, in 1996 and then again in 2002-2004 because of supply shocks from drought and other factors. From 1986 to 1996, the implicit subsidy to corporate broiler producers averaged $377 million per year, with feed prices an average of 10% below what they would have been if the corn and soybean meal components had been priced at full costs of production. Following the 1996 reforms, the implicit subsidy rose to $1.25 billion per year on average, an increase of over 230%. Feed prices were an average of 21% below cost of production during this period.[8]

[7] T-tests comparing cost-price margin data pre- and post-Farm Bill (1986-1996 and 1997-2005) confirmed a statistically significant difference between the two periods for the soybean margins (t-stat = -2.06, p<.05) but not for corn (t-stat = -1.11, p = .1). The legitimacy of any t-test in this case is questionable given the small sample size.

[8] A t-test comparing the feed price reduction percentages before and after the policy change (1986-1996 and 1997-2005) confirmed a significant difference (t-stat = -2.21, p<.05). The legitimacy of any t-test in this case is questionable given the small sample size.

The overall impact on broiler production costs from low-priced feed has been significant. Since feed costs average 60% of total production costs, between 1986 and 1996, broiler production costs were 6% lower than they would have been if industrial broiler companies were paying full cost of production for feed. Between 1997 and 2005, the implicit subsidy kept broiler production costs 13% lower.[9]

Figure 10: Implicit Subsidy to Broiler Industry



VI: Discussion

The Winners and Losers from U.S. Farm Policy

Our findings are clear. Below-cost feed has been a boon to the broiler industry, and the policy reforms in 1996 have significantly increased the implicit subsidy to the industry. The implicit subsidy in the post-Farm Bill period was over $850 million higher per year on average than in the pre-Farm Bill period. Consistent with previous findings on the impacts of agricultural policy change on commodity prices (Scott 1999; Ray 2003; Zulauf 2003), we conclude that the industrialized broiler industry is a major beneficiary of U.S. agriculture policies that have allowed the price of feed grains and soybeans to fall below, sometimes far below, production costs.[10]

[9] USDA data on the cost of broiler production per pound is only available for the years 1998-2002, so the five-year average of $0.25/lb is used for all other years analyzed

[10] Even the literature concluding that U.S. policy had a significant impact on commodity prices after 1996 acknowledge a number of other factors at play, including the Asian financial crisis, which reduced global demand, and yield increases from technological innovation and good weather. However, other forces at work during the same period had an upward effect on prices, including the 2002-2003 drought. On average, our findings show a relationship between policy change and commodity price volatility. The

These findings have implications, of course, for more than just broiler producers. Other industrial livestock operations that rely on processed feed made from corn and soybeans have also received implicit subsidies. Data on hog production suggests that industrial hog operations (defined by the USDA/ERS as housing over 5,000 head) spend 54-65% of production costs on feed (Tarter 2001; McBride and Key 2003) using a mixture that averages 80% corn and 17% soybean meal (VES 2000). Assuming that feed accounts for 60% of production costs for industrial hog operations, preliminary calculations suggest that a scenario in which industrial hog producers had to pay full cost of production for the corn and soybean meal used in hog feed would have increased industrial hog operators' total production costs by an average of 13% from 1997-2005. The implicit subsidy (again, a term we use to describe the discount to industrial firms from farm policies that allow feed market prices to fall below feed production costs) to industrial firms with over 5,000 hogs, which have captured a growing share of the pork market since 1997, grew from $81 million in 1997 to nearly $1 billion in 2005, with variation in the interim. The average implicit subsidy to industrial hog companies in the post-1996 Farm Bill period was $566.3 million per year.[11] It should be noted that an industrial hog operation is not the same as a hog CAFO (Confined Animal Feeding Operation); CAFOs are defined as operations housing over 1,000 animal units (equivalent to 2,500 hogs weighing over 55 lbs), and the category therefore includes many operations with fewer than 5,000 head of hogs (Environmental Protection Agency 2002). The implicit subsidy to hog CAFOs would thus be assumed to be larger, perhaps much larger, than the implicit subsidy to industrial operations.

Full-cost pricing of feed could have an important impact on an industry in which consolidation is well underway but is not yet complete. If industrial operations are getting a 13% discount on their operating costs due to U.S. agricultural policies that depress feed prices below production costs, they are enjoying a cost advantage over diversified hog farmers who grow crops and raise livestock in free-range environments. That is a very significant cost advantage, one that could well be providing the competitive edge that allows CAFO-based hog production to out-compete diversified farmers. If that is the case, then a policy change that resulted in the market price of feed

findings are bolstered by statistical analyses in the literature mentioned above. For example, Zulauf (Zulauf 2003) notes in the Review of Agricultural Economics: "Following enactment of the 1996 Farm Bill, corn and soybean implied volatilities covering the pre-harvest and storage seasons increased 16-23% between 1987-1995 and 1997-2001. The increase was statistically significant at the 90% confidence level."

[11] Authors' calculation based on a comparison of the market price for corn and soybeans (USDA/ERS 1986-2005; USDA/ERS 2005) to the estimated full cost of producing the commodities. Assumes that feed accounts for 60 % of industrial hog producers' production costs (Tarter 2001; McBride and Key 2003) and that the price of a ton of soybean meal is 75% the price of the volume of soybeans needed to produce it (USDA/ERS 1986-2005). A 1998 estimate of production costs for industrial hog producers of $0.44/lb (McBride and Key 2003) is used for all years 1997-2005. Total hog production for 1997-2005 from (USDA/ERS 2005). The percentage of national hog inventory on industrial-sized operations, defined as those housing over 5,000 hogs (USDA/NASS 2005), is used as a proxy for share of the pork market held by industrial firms. The inventory proxy likely underestimates the share due to inequities in market access between smaller and larger hog operations, and the enhanced distributional capacity of industrial, vertically integrated operations.

better reflecting the cost of producing the feed components could reduce the advantage that industrial operations currently receive over diversified, independent producers.

This is an important area for further research. The poultry industry is fully consolidated, but the hog and cattle industries are still in the midst of a process of vertical integration and concentration. If U.S. agricultural policies are feeding the industrialization of our livestock industries, policymakers and the public should be aware of it and recognize that corporate livestock firms are some of the real beneficiaries of policies that keep commodities prices low.

Losing Out: Taxpayers and Family Farmers

Taxpayers are one group that loses out in the current policy environment. Because subsidy levels rise when prices fall, the years when financial windfalls to the broiler industry from low-priced feed were the greatest were also the years when total government payments to farmers were at all-time highs. Overall, the cost of U.S. farm programs has doubled since the 1996 reforms. Total government subsidies to corn production rose from $2.5 billion in 1997 to $10 billion in 2000, and have averaged around $5 billion a year since then. Total soybean subsidies rose from $4 million in 1997 to almost $3 billion in 2000, and have averaged $2 billion a year since (USDA/FSA 2001; USDA/FSA 2004). Our research shows that these increased taxpayer expenditures, which have replaced higher market prices as a source of income support for farmers, benefit the purchasers of low-priced commodities, such as industrial livestock operations. A system in which farmers are not compensated for their production by market prices but instead by taxpayer subsidies shifts the burden of supporting farmers from agribusiness purchasers to taxpayers. The burden also shifts to the many farm families who must work off-farm jobs to stay in business when subsidies do not fully make up for low prices.

Our research does not address the question of how much farmers benefit from the full array of government subsidies discussed above. Rather, we consider only the relatively minor category of government subsidies for inputs as part of the total cost of production for corn and soybeans. We then compare those costs to market prices, and suggest that the difference is a loss to farmers: for each year since 1997, farmers have been compensated by the market at a level below what farmers and the government pay to produce the crops. Some readers will undoubtedly speculate that the massive subsidies noted above would offset the market loss, bringing farmers to profitability; indeed, U.S. farm policy debates often depict farmers as living well off the government dole. In reality, however, research suggests that farmers are another group losing out under current U.S. farm policy, despite the massive subsidy outlays.

Farm income data from the USDA/ERS suggests that subsidies often fail to bring farmers to profitability. When prices plummeted after the passage of the 1996 Farm Bill, government farm payments tripled; but despite the influx of taxpayer dollars, net farm income fell over the same period by an inflation-adjusted average of 15.5% (Ray 2003; USDA/ERS 2005; Wise 2005). Calculations by agricultural economists at the University of Tennessee suggest that even when subsidies are added to market income, returns for most program crops are well below USDA estimates of the total economic cost of production (Ray 2003). The majority of farm families have had to support their households with off-farm employment because farm income, payments included, cannot support them (Jones 2006). Subsidies attempt, but often fail, to make up for low prices.

While family farmers selling corn and soybeans on the market suffer from policies that depress the market prices of these crops, farm households growing grain and oilseed crops to feed their own livestock lose out for reasons touched on above. Diversified family farms pay full operating and ownership costs to produce the grains and oilseeds that they use as feed, although they may receive input subsidies from the government to offset a small portion of the direct cost of production. Taking corn as an example, between 1997 and 2005, government input subsidies offset approximately 2% of total corn production costs (authors' calculations based on OECD 2005; USDA/ERS 2005). Meanwhile, over the same period, industrial operations have been able to purchase corn from the market at an average of 23% below what the farmer and government pay to produce it. Confined feeding operations purchasing all of their feed from the market are thus at a cost advantage when compared to diversified operations that grow feed grains and oilseeds themselves, even those that receive government input subsidies.

This study also leaves to other researchers the task of determining the impact on consumers of a policy change that would increase the market prices of raw commodities, moving them more in line with production costs. The degree of consumer impact would depend on a variety factors. Research could examine the price response of a processed product, such as meat, to an increase in the cost of the raw commodity inputs; the extent to which agribusiness purchasers and processors pass on input price increases to consumers of value-added products, or use the input price increase to justify an increase in processed food prices; or possibilities for complementary policies that could support low-income consumers in accessing higher-priced food.

Land Values

As mentioned earlier, research suggests that the farmer cost of production estimates provided by the USDA are complicated by the inclusion of estimates for the value of agricultural land (Weersink 1999; Ryan 2001; Gardner 2002; Shaik 2005). While land values represent real costs to farmers—payments on mortgages, rental fees, taxes, insurance—they are inflated by government payments because payments raise returns, and land values are determined in part by expected future earnings from farming (Ryan 2001; Harl 2003). Land value estimates make up a significant percentage of USDA cost of production estimates—an average of 22% for corn and 29% for soybeans between 1986 and 2005—so the overvaluation of land could present a misleading picture of true production costs, making our cost-price margin findings less reliable.

We test this theory by reducing the costs of land in the previous calculations. Based on the conclusion of Shaik et al. (2005) that the inflation of land values generated by farm program payments between 1980 and 2004 was between 15% and 20%, and the finding of Ryan et al. (2001) that payments inflated land values by 19% on average after 1990 (Ryan 2001; Shaik 2005), we deflate the land value estimate in the USDA cost of production data by 20%.

Deflating land values by 20% brings the cost/price margin for corn down by an average of four percentage points between 1997 and 2005, from 23% to 19%. For soybeans, the margin shrinks by about six percentage points, from 15% to 9%. Broiler industry gains are reduced by an average of $333 million annually, or 26%, with the adjusted production cost estimates, to slightly less than $1 billion per year. Data and calculations for cost-price margins and the implicit feed subsidy using the adjusted FCOP are available in Appendices C and D.

Adjusting for the possible overvaluation of land in the FCOP, cost-price margins for corn and soybeans are smaller, but they are still large, as is the implicit subsidy to the broiler industry from below-cost feed, which averages almost $1 billion per year. The policy implications of this finding are important, since they suggest that even if land values were deflated by ending government farm subsidies, farmer production costs would still exceed market prices for corn and soy for most years, except those in which supply was particularly constrained. Price modeling by Ray, de la Torre Ugarte, et al. (2003) found that eliminating marketing loan, counter-cyclical, and direct government payments to farmers would decrease net farm income by 25-30%, but that prices for corn and soy would continue to decline slightly each year as farmers increased production to capture every available farm dollar (Ray 2003).

Looking Towards the Future

How well do our findings hold as a guide to the future? The policy environment leading up to the legislation of a new farm bill in 2007 is much the same as the latter period studied here. Still, averages can often be deceiving; within our findings, there is significant variation. Is our average a good indication of what we might expect in the future? The answer to this question hinges on market price trends for corn and soybeans and on trends in production costs for farmers.

Future production costs and planted acreage for corn and soybeans, and their future cost-price margins, will be determined in large part by new trends in alternative energy. Data from the USDA/ERS and FAPRI predict that higher prices for fuel, fertilizer, and other inputs will increase farmers' cost of production; at the same time, however, the development of alternative crop-based energy regimes could have significant impacts on total corn and soybean production levels. Both sources predict that corn will play a leading role in the new alternative energy movement, limiting the expansion of soybean production. According to a recent study by the USDA, if the current trends and new Renewable Fuel Standard (RFS) provision of the Energy Policy Act of 2005 continue, the share of ethanol in total corn disappearance will nearly double in the next ten years, from 12% in 2004/2005 to 23% in 2014/2015 (Baker 2006). In its Agricultural Outlook for 2006, FAPRI predicts that as early as 2007/2008, the use of corn to produce ethanol will exceed U.S. corn exports (FAPRI 1999-2006).

There is no better cure for chronic low prices caused by overproduction than new demand for agricultural products that comes from outside the food industry. The rising demand for bio-based fuels could offer an important respite from below-cost prices, particularly for corn.

Because of domestic ethanol production, USDA and FAPRI predict that corn prices will increase over time. The annual capacity of the U.S. ethanol sector stood at 4.4 billion gallons in February 2006, and is expected to reach 7 billion gallons by 2010 (Baker 2006). This trend is not expected to have a significant impact on corn prices until 2009/2010, however, and as our figures demonstrate below, a positive cost-price margin is expected to continue through that time. It stands to mention, however, that the projected price increase could change under a couple of scenarios. An unanticipated increase in demand for grain-fed livestock in China and elsewhere in the developing world could raise prices more than estimated here. However, prices could be lower than estimated if the United States changed its policy on the importation of Brazilian ethanol, or put significant investment in ethanol production from cellulosic biomass products such as switchgrass or mill residues. Market prices for corn could also decline if corn production in South America and China increased global supply. If fertilizer and fuel costs continue to rise, corn—an energy-intensive crop—could begin to look much less attractive as an alternative energy source.

Finally, prices could decline if significant acreage were taken out of the Conservation Reserve Program and put back into corn or soybean production. Modeling by the University of Tennessee provides a window into this scenario: the authors estimate that if CRP were eliminated entirely, 37% of currently fallowed land would come back into agricultural production. Corn prices in 2015 would be $0.31/bu below USDA estimates, or $2.29 a bushel. This price is higher than the $1.90/bu farmers received in 2005, but lower than the ten-year high of $2.79/bu they saw in 1996. The model shows 2015 soybean prices $0.90/bu lower than USDA estimates, at $5.20 a bushel. This is significantly lower than the already low $5.45/bu farmers received in 2005 (de la Torre Ugarte 2006). If this scenario plays out even in part, FAPRI estimates of significant increases in corn and soybean prices will prove unrealistic, and our cost-price margins will widen.

Increased ethanol production could impact feed prices for industrial broiler companies in at least two ways. First, a rapid rise in ethanol production could raise corn market prices, in turn encouraging producers to shift from planting soybeans to corn and reducing soybean planted acreage. Such a change may result in higher market prices for broiler and other livestock feed. However, for hogs and cattle, and to a limited extent for broilers, the feed price increase may be tempered by a second trend. The production of distillers' dried grains with solubles (DDGS), a co-product of ethanol production and a mid-protein feed, is expected to increase, and will likely displace some of the corn and soybean meal used in animal feed, reducing demand for these commodities. DDGS is already substituting for a portion of soybean meal and corn in cattle feed, and is making its way into hog and poultry rations (Baker 2006).

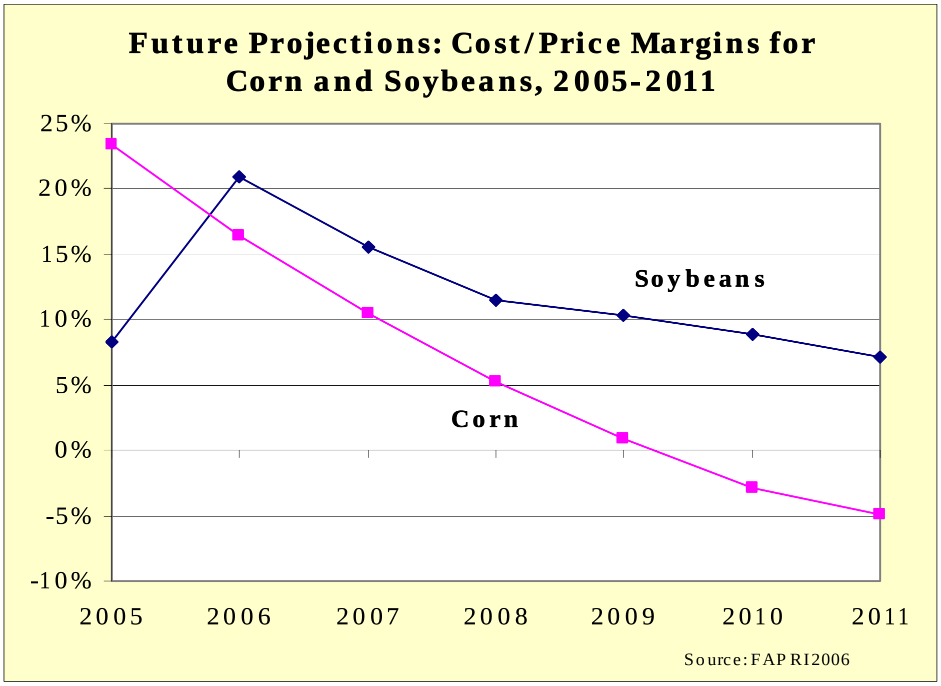
Though demand for soybean oil, the other major co-product of soybean crushing, may grow, the long term prediction is that soybean expansion for domestic non-food use will be limited because of competition from corn, while soybean expansion for the export market will be limited because of competition with South America (Ash 2006). While one might expect higher soybean prices to result from the reduction of planted acreage, FAPRI price projections suggest that if current commodity policies are maintained over time, the average market price for soybeans is still expected to remain at an average of 9% below the cost of production through 2011 (FAPRI 1999-2006). Soybean meal is generally the greatest expense in a ton of feed, so as long as it continues to make up a portion of feed for broilers, the broiler industry will continue to reap gains from the projected scenario.

To estimate the future costs of producing corn and soybean meal, as well as their market price, and potential gains to the broiler industry for 2005 through 2011, we relied on data from the FAPRI Agricultural Outlook 2006 (FAPRI 1999-2006). This data source provided us with projections for planted area, yield, production, and market price for corn and soybeans, as well as projected production of broilers. We assume that the FCOP per planted acre for corn will remain relatively steady, and thus used a 1997-2004 average of $356.43 per acre for the future FCOP. This assumption may return a conservative cost-price margin estimate because FCOP per acre generally increases over time, as shown earlier in Figures 4 and 6. We estimate government input subsidies for corn to be $0.07 per bushel, the average for the 1997-2004 period. This assumption appears sound, given that input subsidies averaged around $0.07/bu over the 19-year period 1986-2005. Under the same assumptions, we calculate the FCOP for soybeans to be $247.75 per acre and input subsidies to be $0.17 per bushel, both averages from 1997-2004. It should be noted that our calculations do not account for any changes to the feed mixture that could take place if DDGS use increases across the livestock industry. Data and calculations are available in Appendix D.

Figure 11 illustrates the projected trend for the total cost of producing corn and the cost-price margin from 2006 to 2011. Based on projections of increased ethanol production from U.S. corn over the next ten years, we can conclude that the negative margin starting in 2010 accounts for higher corn prices due to increased domestic demand. However, the average margin over the period is still positive, at 4%.

As Figure 11 illustrates, cost-price margins are large for soybeans through 2007, likely due to surplus supplies in the U.S. and South America. Under the assumption that U.S. ethanol production from corn continues to grow, we conclude that the shrinking cost-price margins for soybeans between 2008 and 2011 is at least partially attributable to the conversion of land from soybeans to corn, but is offset somewhat by global supply increases from South America. The average margin is positive throughout the period, at 12%.

Figure 11: Projections of Future Cost-Price Margins for Corn and Soybeans



When we substitute the true cost of producing corn and soybean meal into the feed cost calculations, we find that feed costs would increase by 7% on average between 2006 and 2011 if the market price reflected the true cost of production. Total broiler production costs would increase by an average of 4%. Assuming, then, that future agriculture policies continue to allow feed market prices to fall below production costs, total gains to the broiler industry from low-cost feed will average $419 million dollars a year, significantly smaller than the average of $1.25 billion that we found for the 1997-2005 period, but still larger than the 1986-96 average of $377 million. Data for the future projections can be found in Appendix E.

As mentioned above, industry gains will be reduced by narrowing cost-price margins, which are caused by rising corn prices due to ethanol production and declining planted acreage in soybeans. Again, however, the gains could be much larger than in our projected scenario if U.S. ethanol import policies change, if land currently enrolled in the Conservation Reserve Program is put back into agricultural production, if fuel and fertilizer costs continue to rise, or if more intensive production in Brazil, Argentina, and China causes world grain and oilseed supplies to increase.

A related topic, but one we will only mention in passing here, is the role of U.S. subsidies to the ethanol industry in further shaping the U.S. livestock production system. On the one hand, increased use of corn for ethanol may put pressure on feed corn supplies, driving up prices. On the other hand, because ethanol production creates the co-product DDGS, which can be used as a high-protein animal feed component, livestock operations able to purchase DDGS may benefit to a significant degree from U.S. policies that encourage and subsidize ethanol production.

VII: Conclusion

We have demonstrated that below-cost corn and soybeans have been a boon to the corporate broiler industry and that the financial benefits of U.S. policies that encourage high levels of production and low prices have increased with the 1996 policy reforms. Those benefits are not small, averaging $1.25 billion per year in the post-1996 period. Though rising demand for corn-based ethanol may push corn prices up and narrow cost-price margins in coming years, there is no indication that feed prices will naturally approach their true costs of production.

It is outside the scope of this project to discuss the various policy proposals that could secure farmer and rancher livelihoods and reduce the burden on taxpayers from U.S. farm payments. Such policies would in any case better balance supply and demand so prices could rise to above production costs. It stands to mention that policy changes that raise the market prices of corn and soybeans would negatively affect not just the agribusiness corporations who use U.S. farm products as a major input, but also small and mid-sized farmers and ranchers who purchase corn and soybeans from the market. However, those farm and ranch households selling corn and soybeans, or diversified farmers and ranchers who feed their own grains or soybeans to livestock, would benefit from such policy changes.

It is incumbent upon agricultural economists to analyze current U.S. farm policies in such a way as to paint an accurate picture of their structural and economic impacts. Such an analysis is especially important for those sub-sectors of the livestock industry, such as beef cattle and hogs, that are moving toward but have not yet reached full integration and industrialization. This study helps lay the groundwork for such research. Other analytical techniques may ultimately prove more accurate. Regardless, it is clear that the development of sensible proposals for farm policy reform hinges on a thorough understanding of the impacts of these policies, and on recognizing the true winners and losers under the current system.

As policymakers turn their attention to the 2007 Farm Bill, they would do well to examine the ways in which agribusiness firms in general, and industrial livestock operations in particular, benefit from policies ostensibly designed to support family farmers. As this study suggests, most diversified independent family farmers would be better served by policies that ensure market prices in excess of production costs. To the extent such policies reduce the current cost advantages enjoyed by industrial animal factories, they will further the stated goals of U.S. agricultural policy, and will perhaps help reverse the trend toward concentrated industrial hog and beef cattle production.

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Appendix A: Cost-Price Margins

Table 1: Cost-Price Margin, Corn, 1986-1996

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average
FCOP (1)	$/Bu	2.05	2.06	3.16	2.48	2.49	2.65	2.26	2.90	2.25	2.88	2.70	2.53
Input Subsidies (2)	$/Bu	0.07	0.08	0.10	0.09	0.08	0.09	0.07	0.08	0.07	0.10	0.08	0.08
Full Cost (3)	$/Bu	2.12	2.14	3.26	2.57	2.57	2.74	2.33	2.98	2.31	2.97	2.77	2.61
Avg Mkt Price (4)	$/Bu	1.36	1.53	2.56	2.18	2.16	2.29	2.01	2.26	2.02	2.74	2.79	2.17
Cost/Price Margin (5)	%	36%	28%	21%	15%	16%	16%	14%	24%	13%	8%	-1%	17%

Table 2: Cost-Price Margin, Corn, 1997-2005

		1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
FCOP (1)	$/Bu	2.77	2.64	2.68	2.72	2.39	2.46	2.35	2.20	2.74	2.55
Input Subsidies (2)	$/Bu	0.07	0.06	0.06	0.06	0.07	0.08	0.08	0.06	0.07	0.07
Full Cost (3)	$/Bu	2.84	2.70	2.74	2.78	2.46	2.54	2.43	2.26	2.81	2.62
Avg Mkt Price (4)	$/Bu	2.50	1.91	1.67	2.00	1.80	2.30	2.10	2.10	1.90	2.00
Cost/Price Margin (5)	%	12%	29%	39%	37%	27%	9%	13%	7%	32%	23%

(1) The Farmer Cost of Production as reported by the USDA. Source: ERS Historic and Recent cost and returns, http://www.ers.usda.gov/data/costsandreturns/testpick.htm
(2) Includes only those government subsidies to corn categorized by the OECD as based on input use. Source: OECD, Producer and Consumer Support Estimates, http://www.oecd.org/document/58/0,2340,en_2649_33773_32264698_119656_1_1_1,00.html
(3) FCOP plus input subsidies.
(4) Market Year Average Price for the USDA North Central Region. Source: USDA/ERS Feed Grains Database, http://www.ers.usda.gov/data/feedgrains/
(5) Calculated as (Full cost – market price) / market price.

Table 3: Cost-Price Margin, Soybeans, 1986-1996

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average
FCOP (1)	$/Bu	4.89	5.00	6.94	6.05	5.76	5.87	5.51	6.71	5.29	6.30	6.30	5.87
Input Subsidies (2)	$/Bu	0.22	0.24	0.29	0.21	0.20	0.20	0.17	0.20	0.16	0.20	0.22	0.21
Full Cost (3)	$/Bu	5.11	5.23	7.23	6.27	5.96	6.07	5.69	6.91	5.45	6.49	6.52	6.08
Avg Mkt Price (4)	$/Bu	4.52	5.00	7.54	5.52	5.87	5.50	5.24	6.09	5.34	6.25	6.91	5.80
Cost/Price Margin (5)	%	12%	4%	-4%	12%	1%	9%	8%	12%	2%	4%	-6%	5%

Table 4: Cost-Price Margin, Soybeans, 1997-2005

		1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
FCOP (1)	$/Bu	5.72	5.76	6.23	6.20	6.14	5.80	6.70	5.50	6.54	6.06
Input Subsidies (2)	$/Bu	0.18	0.15	0.15	0.15	0.15	0.19	0.23	0.16	0.17	0.17
Full Cost (3)	$/Bu	5.89	5.91	6.38	6.35	6.28	5.99	6.93	5.66	6.71	6.23
Avg Mkt Price (4)	$/Bu	6.49	5.16	4.43	4.44	4.16	5.19	6.57	5.58	5.45	5.27
Cost/Price Margin (5)	%	-10%	13%	31%	30%	34%	13%	5%	1%	19%	15%

(1) The Farmer Cost of Production as reported by the USDA. Source: ERS Historic and Recent cost and returns, http://www.ers.usda.gov/data/costsandreturns/testpick.htm
(2) Includes only those government subsidies to corn categorized by the OECD as based on input use. Source: OECD, Producer and Consumer Support Estimates, http://www.oecd.org/document/58/0,2340,en_2649_33773_32264698_119656_1_1_1,00.html
(3) FCOP plus input subsidies.
(4) Market Year Average Price from the USDA North Central Region. Source: USDA/ERS Oil Crops Yearbook, 1987-2005, http://usda.mannlib.cornell.edu/data-sets/crops/89002/
(5) Calculated as (Full cost – market price) / market price.

Table 5: T-Tests: Cost-Price Margins for Corn and Soybeans Over Two Periods (1986-1996 and 1997-2005)

	1986-1996		**1997-2005**			
	Mean	**SD**	**Mean**	**SD**	**t**	**p value**
Corn	0.17	0.09	0.22	0.12	-1.11	0.13
Soybeans	0.05	0.06	0.15	0.15	-2.07*	0.02

Appendix B: Implicit Subsidies to the Broiler Industry

Table 6: Implicit Subsidies to the Broiler Industry, 1986-1996

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average
Feed avg. mkt. price (1)	$/ton	187.30	143.10	148.40	103.20	131.00	126.70	125.40	131.40	136.50	138.50	174.40	
Corn/soy price portion (2)	$/ton	74.54	83.06	131.22	103.29	106.10	104.70	96.65	110.53	97.82	123.37	130.74	
Corn & soy full price (3)	$/ton	98.10	99.64	144.79	119.43	116.67	121.58	108.27	135.14	105.84	131.17	126.70	
Change in feed cost (4)	%	13%	12%	9%	16%	8%	13%	9%	19%	6%	6%	-2%	10%
Change in total prod. cost (5)	%	8%	7%	5%	9%	5%	8%	6%	11%	4%	3%	-1%	6%
Industry underpays (6)	$/lb.	0.02	0.02	0.01	0.02	0.01	0.02	0.01	0.03	0.01	0.01	-0.003	
Broiler Production (7)	Millions of lbs.	19,661	21,523	22,465	23,979	25,631	27,203	28,829	30,618	32,529	34,222	36,479	
Implicit industry subsidy	Millions US$	$371	$374	$308	$562	$310	$512	$401	$860	$287	$289	-$127	$377

Table 7: Implicit Subsidies to the Broiler Industry, 1997-2005

		1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
Feed avg. mkt. price (1)	$/ton	157.80	128.60	103.10	104.70	101.30	113.50	132.10	157.20	122.90	
Corn/soy price portion (2)	$/ton	119.9	93.53	81.02	83.00	81.55	103.03	111.25	101.96	96.02	
Corn & soy full price (3)	$/ton	122.37	119.26	124.46	125.29	116.99	116.17	122.36	106.57	129.22	
Change in feed cost (4)	%	2%	20%	42%	40%	35%	12%	8%	3%	27%	21%
Change in total prod. cost (5)	%	1%	12%	25%	24%	21%	7%	5%	2%	16%	13%
Industry underpays (6)	$/lb.	0.002	0.03	0.06	0.06	0.05	0.02	0.01	0.004	0.04	
Broiler Production (7)	Millions of lbs.	37,541	38,554	40,829	40,829	41,626	41,452	43,958	35,200	34,915	
Implicit industry subsidy	Millions US$	$86	$1,110	$2,477	$2,463	$2,184	$778	$555	$155	$1,415	$1,247

(1) Broiler feed market price data from USDA/ERS Poultry Yearbook, 1987-2005, http://usda.mannlib.cornell.edu/data-sets/livestock/89007/.
(2) The portion of the price of a ton of feed that is attributable to corn and soybean meal, based on the market prices of corn and soybeans. Assumes that the soybean-to-soybean meal conversion ratio is 1.362 : 1 (Chicago Board of Trade 2005), and that 1 ton of broiler feed = 0.6 ton corn, 0.25 ton soybean meal, and 0.15 ton other (USDA/ERS, 2006). We assume that the price of a ton of soybean meal is 75% the price of the volume of soybeans needed to produce it, based on a cost comparison of 1.362 short tons of soybeans to 1 short ton of soybean meal (USDA/ERS 1986-2005).
(3) The portion of the price of a ton of feed that is attributable to corn and soybean meal, if the crops were priced at their full cost of production (FCOP + input subsidy). The same assumptions hold as above (2).
(4) Calculated as: (Full cost of the corn and soybean portion of feed – the market price of corn and soybean portion) / Market price of corn and soybean portion.
(5) Assumes that feed costs = 60% of broiler production costs (USDA/ERS, 2002).
(6) Given the cost-price margin of the corn and soybean portion of broiler feed, this represents the dollar amount per pound that the industry underpays for feed. The ERS only provides data on the cost of production per pound for broilers for the years 1998-2002. Therefore, the 1998-2002 average of $0.25/lb has been used for all other years. Source: USDA/ERS Poultry Yearbook, 1987-2005
(7) Source: USDA/ERS Poultry Yearbook, 1987-2005

Table 8: T-Test: % Change in Feed Costs from Paying Full COP for Feed Components Over Two Periods (1986-1996 and 1997-2005)

	Mean	SD	t	p value
1986-1996	0.09	0.06		
1997-2005	0.2	0.16	-2.21*	0.02

Appendix C: Cost-Price Margins, Adjusted Methodology to Account for Overvaluation of Land

Table 9: Cost-Price Margin, Corn, Adjusted for the Overvaluation of Land (1986-1996)

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average
Original FCOP (1)	$/Bu	2.05	2.06	3.16	2.48	2.49	2.65	2.26	2.90	2.25	2.88	2.70	2.53
USDA Land est. (2)	$/Bu	0.35	0.37	0.63	0.50	0.51	0.56	0.48	0.55	0.46	0.58	0.62	0.51
Adjusted FCOP (3)	$/Bu	1.98	1.98	3.03	2.38	2.39	2.54	2.16	2.78	2.15	2.76	2.57	2.43
Input Subsidies (4)	$/Bu	0.07	0.08	0.10	0.09	0.08	0.09	0.07	0.08	0.07	0.10	0.08	0.08
Full Cost (5)	$/Bu	2.05	2.06	3.13	2.47	2.47	2.62	2.23	2.87	2.22	2.86	2.65	2.51
Avg Mkt Price (6)	$/Bu	1.36	1.53	2.56	2.18	2.16	2.29	2.01	2.26	2.02	2.74	2.79	2.17
Cost/Price Margin (7)	%	34%	26%	18%	12%	13%	13%	10%	21%	9%	4%	-5%	14%

Table 10: Cost-Price Margin, Corn, Adjusted for the Overvaluation of Land (1997-2005)

		1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
Original FCOP (1)	$/Bu	2.77	2.64	2.68	2.72	2.39	2.46	2.35	2.20	2.74	2.55
USDA Land est. (2)	$/Bu	0.65	0.63	0.64	0.65	0.60	0.65	0.60	0.55	0.65	0.62
Adjusted FCOP (3)	$/Bu	2.64	2.52	2.55	2.59	2.27	2.33	2.23	2.09	2.61	2.42
Input Subsidies (4)	$/Bu	0.07	0.06	0.06	0.06	0.07	0.08	0.08	0.06	0.07	0.07
Full Cost (5)	$/Bu	2.71	2.58	2.61	2.65	2.34	2.41	2.31	2.15	2.68	2.49
Avg Mkt Price (6)	$/Bu	2.50	1.91	1.67	2.00	1.80	2.30	2.10	2.10	1.90	2.00
Cost/Price Margin (7)	%	8%	26%	36%	34%	23%	5%	9%	3%	29%	19%

(1) The Farmer Cost of Production as reported by the USDA. Source: ERS Historic and Recent cost and returns, http://www.ers.usda.gov/data/costsandreturns/testpick.htm
(2) USDA estimate for the value of land.
(3) Original FCOP is adjusted to account for the overvaluation of land by deflating the land value estimate by 20%.
(4) Includes only those government subsidies to corn categorized by the OECD as based on input use. Source: OECD, Producer and Consumer Support Estimates, http://www.oecd.org/document/58/0,2340,en_2649_33773_32264698_119656_1_1_1,00.html
(5) Adjusted FCOP plus input subsidies.
(6) Market Year Average Price for the USDA North Central Region. Source: USDA/ERS Feed Grains Database, http://www.ers.usda.gov/data/feedgrains/
(7) Calculated as (Full cost – market price) / market price.

Table 11: Cost-Price Margin, Soybeans, Adjusted for the Overvaluation of Land (1986-1996)

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average
Original FCOP (1)	$/Bu	4.89	5.00	6.94	6.05	5.76	5.87	5.51	6.71	5.29	6.30	6.30	5.87
USDA Land est. (2)	$/Bu	1.32	1.35	1.95	1.47	1.51	1.41	1.38	1.69	1.36	1.58	1.77	1.53
Adjusted FCOP (3)	$/Bu	4.63	4.73	6.55	5.76	5.45	5.59	5.24	6.37	5.02	5.98	5.95	5.57
Input Subsidies (4)	$/Bu	0.22	0.24	0.29	0.21	0.20	0.20	0.17	0.20	0.16	0.20	0.22	0.21
Full Cost (5)	$/Bu	4.85	4.96	6.84	5.97	5.66	5.79	5.41	6.57	5.18	6.17	6.17	5.78
Avg Mkt Price (6)	$/Bu	4.52	5.00	7.54	5.52	5.87	5.50	5.24	6.09	5.34	6.25	6.91	5.80
Cost/Price Margin (7)	%	7%	-1%	-10%	8%	-4%	5%	3%	7%	-3%	-1%	-12%	0%

Table 12: Cost-Price Margin, Soybeans, Adjusted for the Overvaluation of Land (1997-2005)

		1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
Original FCOP (1)	$/Bu	5.72	5.76	6.23	6.20	6.14	5.80	6.70	5.50	6.54	6.06
USDA Land est. (2)	$/Bu	1.78	1.81	1.99	1.95	1.91	2.02	2.28	1.86	2.15	1.97
Adjusted FCOP (3)	$/Bu	5.36	5.40	5.83	5.81	5.76	5.40	6.17	5.16	6.11	5.66
Input Subsidies (4)	$/Bu	0.18	0.15	0.15	0.15	0.15	0.19	0.23	0.16	0.17	0.17
Full Cost (5)	$/Bu	5.54	5.55	5.98	5.96	5.91	5.58	6.40	5.32	6.28	5.83
Avg Mkt Price (6)	$/Bu	6.49	5.16	4.43	4.44	4.16	5.19	6.57	5.58	5.45	5.27
Cost/Price Margin (7)	%	-17%	7%	26%	26%	30%	7%	-3%	-5%	13%	9%

(1) The Farmer Cost of Production as reported by the USDA. Source: ERS Historic and Recent cost and returns, http://www.ers.usda.gov/data/costsandreturns/testpick.htm
(2) USDA estimate for the value of land.
(3) Original FCOP is adjusted to account for the overvaluation of land by deflating the land value estimate by 20%.
(4) Includes only those government subsidies to corn categorized by the OECD as based on input use. Source: OECD, Producer and Consumer Support Estimates, http://www.oecd.org/document/58/0,2340,en_2649_33773_32264698_119656_1_1_1,00.html
(5) Adjusted FCOP plus input subsidies.
(6) Market Year Average Price for the USDA North Central Region. Source: USDA/ERS Oil Crops Yearbook, 1987-2005, http://usda.mannlib.cornell.edu/data-sets/crops/89002/
(7) Calculated as (Full cost – market price) / market price.

Appendix D: Implicit Subsidies to the Broiler Industry, Adjusted for the Overvaluation of Land

Table 13: Implicit Subsidies to the Broiler Industry, Adjusted for the Overvaluation of Land (1986-1996)

		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Average
Feed avg mkt price (1)	$/ton	187.30	143.10	148.40	103.20	131.00	126.70	125.40	131.40	136.50	138.50	174.40	
Corn/soy price portion (2)	$/ton	74.54	83.06	131.22	103.29	106.10	105.70	96.65	110.53	97.82	123.37	130.74	
Corn/soy true price (3)	$/ton	93.97	95.35	138.13	114.29	111.44	116.29	103.42	129.34	101.09	125.45	120.42	
Change in feed cost (4)	%	10%	9%	5%	11%	4%	8%	5%	14%	2%	2%	-6%	6%
Change in tot. prod. cost (5)	%	6%	5%	3%	6%	2%	5%	3%	9%	1%	1%	-4%	4%
Industry underpays (6)	$/lb.	0.016	0.013	0.007	0.016	0.006	0.013	0.008	0.021	0.004	0.002	-0.009	
Broiler Production (7)	Millions of lbs.	19,661	21,523	22,465	23,979	25,631	27,203	28,829	30,618	32,529	34,222	36,471	
Implicit industry subsidy	Millions of US$	$306	$277	$157	$384	$157	$341	$233	$657	$117	$77	-$324	$217

Table 14: Implicit Subsidies to the Broiler Industry, Adjusted for the Overvaluation of Land (1997-2005)

		1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
Feed avg mkt price (1)	$/ton	157.80	128.60	103.10	104.70	101.30	113.50	132.10	157.20	122.90	
Corn/soy price portion (2)	$/ton	119.95	93.53	81.02	83.00	81.55	103.03	111.25	101.96	96.02	
Corn/soy true price (3)	$/ton	115.94	112.87	117.68	118.56	110.63	109.30	114.55	100.80	122.12	
Change in feed cost (4)	%	-3%	15%	36%	34%	29%	6%	2%	-1%	21%	15%
Change in tot. prod. cost (5)	%	-2%	9%	21%	20%	17%	3%	1%	0%	13%	9%
Industry underpays (6)	$/lb.	-0.004	0.02	0.05	0.05	0.04	0.01	0.004	-0.001	0.03	
Broiler Production (7)	Millions of lbs.	37,540.8	38,553.6	40,829.8	40,829	41,626.1	41,452.4	43,958	35,200	34,915	
Implicit industry subsidy	Millions of US$	-$143	$835	$2,090	$2,071	$1,782	$371	$165	-$39	$1,112	$917

(1) Broiler feed market price data from USDA/ERS Poultry Yearbook, 1987-2005, http://usda.mannlib.cornell.edu/data-sets/livestock/89007/
(2) The portion of the price of a ton of feed that is attributable to corn and soybean meal, based on the market prices of corn and soybeans. Assumes that the soybean-to-soybean meal conversion ratio is 1.362 : 1 (Chicago Board of Trade 2005), and that 1 ton of broiler feed = 0.6 ton corn, 0.25 ton soybean meal, and 0.15 ton other (USDA/ERS, 2006). We assume that the price of a ton of soybean meal is 75% the price of the volume of soybeans needed to produce it, based on a cost comparison of 1.362 short tons of soybeans to 1 short ton of soybean meal (USDA/ERS 1986-2005).
(3) The portion of the price of a ton of feed that is attributable to corn and soybean meal, if the crops were priced at their full cost of production (FCOP + input subsidy). The same assumptions hold as above (2).
(4) Calculated as: (Full cost of the corn and soybean portion of feed – the market price of corn and soybean portion) / Market price of corn and soybean portion.
(5) Assumes that feed costs = 60% of broiler production costs (USDA/ERS, 2002).
(6) Given the cost-price margin of the corn and soybean portion of broiler feed, this represents the dollar amount per pound that the industry underpays for feed. The ERS only provides data on the cost of production per pound for broilers for the years 1998-2002. Therefore, the 1998-2002 average of $0.25/lb has been used for all other years. Source: USDA/ERS Poultry Yearbook, 1987-2005
(7) Source: USDA/ERS Poultry Yearbook, 1987-2005

Appendix E: Future Scenarios

Table 15: Corn Cost-Price Margins, 2006-2011

		2006	2007	2008	2009	2010	2011	Average
FCOP (1)	$/Bu	2.42	2.39	2.36	2.33	2.30	2.27	2.35
Input Subsidies (2)	$/Bu	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Full Cost (3)	$/Bu	2.49	2.46	2.43	2.40	2.37	2.34	2.42
Mkt Year Average Price (4)	$/Bu	2.08	2.20	2.30	2.38	2.44	2.46	2.31
Cost-Price Margin (5)	%	16%	11%	5%	1%	-3%	-5%	4%

(1) Farmer Cost of Production. Planted acreage and yield projections from FAPRI Agricultural Outlook 2006. We assume FCOP/acre = $356.43 (97-04 average). This likely yields conservative results, as FCOP/acre historically rises over time.
(2) We assume input subsidies = $0.07/bu (97-04 average).
(3) FCOP + input subsidies.
(4) Source: FAPRI Agricultural Outlook 2006.
(5) Calculated as (Full cost – market price) / Market price.

Table 16: Soybean Cost-Price Margins, 2006-2011

		2006	2007	2008	2009	2010	2011	Average
FCOP (1)	$/Bu	6.10	6.04	5.98	5.94	5.88	5.83	5.96
Input Subsidies (2)	$/Bu	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Full Cost (3)	$/Bu	6.27	6.21	6.15	6.11	6.05	6.00	6.13
Mkt Year Average Price (4)	$/Bu	4.96	5.25	5.45	5.48	5.52	5.57	5.37
Cost-Price Margin (5)	%	21%	15%	11%	10%	9%	7%	12%

(1) Farmer Cost of Production. Planted acreage and yield projections from FAPRI Agricultural Outlook 2006. We assume FCOP/acre = $247.75 (97-04 average). This likely yields conservative results, as FCOP/acre historically rises over time.
(2) We assume input subsidies = $0.17/bu (97-04 average).
(3) FCOP + input subsidies.
(4) Source: FAPRI Agricultural Outlook 2006.
(5) Calculated as (Full cost – market price) / Market price.

Table 17: Implicit Subsidies to the Broiler Industry, 2006-2011

		2006	2007	2008	2009	2010	2011	Average
Constructed feed mkt price (1)	$/ton	122.66	129.78	135.21	138.00	140.30	141.50	
Corn/soy price portion (2)	$/ton	95.67	101.23	105.47	107.64	109.43	110.37	
Corn/soy true price	$/ton	117.66	116.38	115.12	114.06	112.86	111.68	
Change in feed cost	%	18%	12%	7%	5%	2%	1%	7%
Change in tot. prod. cost (3)	%	11%	7%	4%	3%	1%	1%	4%
Industry underpays (4)	$/lb.	0.03	0.02	0.01	0.01	0.004	0.001	
Broiler Production (5)	Millions of lbs.	36,098	37,194	38,320	39,330	40,207	41,002	
Implicit industry subsidy	Millions of US$	$971	$651	$410	$275	$147	$56	$418

(1) Broiler feed market price constructed on the assumption that the corn and soybean meal portions of feed account for 78% of the cost of feed (1986-2005 average, using calculated prices for the corn and soybean meal portions of feed, compared to the broiler feed market price). Therefore, feed price = 1.22 * the corn/soy portion of the feed. We assume that 1 ton feed= .6 ton corn, .25 ton soy meal, .15 ton other (USDA/ERS 2006); that the soybean-to-soybean meal conversion ratio is 1.362 : 1 (CBOT 2005); and that the price of a ton of soybean meal is 75% the price of the volume of soybeans needed to produce it (authors' calculations based on meal and bean price data from USDA/ERS 1986-2005).
(2) Soy and corn market price projections from FAPRI Agricultural Outlook 2006.
(3) We assume that feed costs = 60% of broiler production costs (USDA/ERS 2002).
(4) Cost of broiler production assumed to be $0.25/lb (1998-2002 average). USDA/ERS Poultry Yearbooks, 1998-2002.
(5) Broiler production projections from FAPRI Agricultural Outlook 2006.

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