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Concentration in Agribusiness

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Three developments drive concerns over concentration in agribusiness. First, farmers face declining numbers of buyers in such key commodity processing industries as meatpacking and grain and oilseed processing. Second, contracts are replacing cash markets as a means for organizing the marketing of farm products. While production and marketing contracts can limit producer risks, reduce processing costs, and introduce effective incentives for quality control, they may also introduce unexpected risks for producers, allow processors in highly concentrated markets to practice price discrimination, and their growth may reduce the effectiveness of spot markets. The third development is the expansion of biotechnology in input markets, where disputes over the exchange of intellectual property can lead to sharply increased concentration in input markets.

Introduction

Concentration has become an important issue in agriculture, reflecting a broad based set of concerns over processor market power and marketing methods, over changes in the size of farm enterprises, as well as their production methods and business organization, and over the resultant impacts on rural land use and rural communities. The concerns have appeared in Congressional hearings on the topic, conferences, and numerous media reports, and were succinctly captured in a March 1999 letter from 23 farm state senators to President Clinton, calling for greater antitrust scrutiny of food and agricultural industries. This paper describes three of the key developments that drive those concerns: declining numbers of buyers of agricultural commodities, changes in methods of exchange between growers and buyers, and the emerging influence of biotechnology, particularly in input markets but with likely impacts throughout the food marketing system. It will then focus on one concern, by discussing the linkage between concentration and processor market power.

Buyer Concentration

Table 1 highlights recent concentration trends in meatpacking, one of the sectors that have attracted the most attention. The top columns show trends in four firm concentration (CR4)--the share of the market

held by the four largest firms in the market. In this case, the market is the procurement market for animals, so the data show the share of all hogs slaughtered by the four largest hog packers, and the share of all steers and heifers slaughtered by the four largest steer and heifer packers (steers and heifers are a better market definition than all cattle, both because plants specialize in steers and heifers and because the animals produce different meat products).

CR4 in steers and heifers is quite high—four firms account for nearly 80% of all slaughter. Average CR4 across all U.S. manufacturing industries is closer to 40, and 80 is generally considered to be highly concentrated. Moreover, because cattle usually aren't shipped far for slaughter, many producers may only see buyers from two or three nearby packers; that is, local market concentration may be higher. The other striking element about steer and heifer slaughter is the dramatic increase in CR4, from 36 in 1980 to 72 in 1990, with a further increase to 78 in the last year of our data, 1997. No other manufacturing industry shows as dramatic an increase in any 10 year period since the U.S. Census Bureau began regularly publishing concentration data in 1947.

Hog slaughter is not as concentrated as steer and heifer slaughter—the top four hog packers handled 54% of slaughter in 1997. But CR4 in hog slaughter has also increased sharply, from 32 just twelve years earlier, and it continues to increase. As in other livestock industries, hogs don't travel far to market, and as a result many producers may have more limited local options, selling to buyers from only two or three packers.

The lower panel of table 1 provides data on the size of packing plants, information that may account for some of the CR4 increase, but that also creates some separate concerns about agribusiness concentration. The panel shows that slaughter has shifted sharply toward large plants (defined as at least 1 million head annually in hogs, and at least five hundred thousand head annually in steer and heifer slaughter). In 1980, 63% of all hog slaughter occurred in large plants, but that share increased to 88% by 1997. The shift in steers and heifers was especially striking; less than a quarter of slaughter occurred in large plants in 1980, but large plants accounted for over 80% of slaughter just fifteen years later. Moreover, the typical size of large plants grew sharply in each industry.

The shifts in plant size suggest that there are economies of scale in slaughter, and that scale economies and the resultant shift to large plants accounts for part of the increase in concentration. Indeed, that is the finding of a forthcoming ERS analysis of scale economies and concentration in meatpacking (MacDonald, et, al, 2000). If true, that would suggest that larger slaughter plants realize lower costs, and that that increasing meatpacker concentration may therefore have led to lower meat prices for consumers. But enormous slaughter plants (2,000 to 3,000 workers) sometimes impose significant new social costs on rural communities in the form of sharp changes in community social structures and increased educational and social service commitments to service plant work forces.

Meatpacking represents the most striking example of increased concentration in agribusiness, but the pattern is also more widespread than would be suggested by an emphasis on meatpacking alone. Table 2 describes recent changes in concentration in grain and oilseed milling industries, again using four firm concentration ratios (here derived from U.S. Census Bureau data on product shipments in the several

industries). Several patterns stand out. First, CR4 is quite high in these industries, and the measures have generally grown through time. Second, the same large agribusiness firms are the leaders in each industry, and are active in other related businesses (such as grain merchandising or livestock feeding). Increasingly, farmers deal with a common small set of very large agribusiness corporations in a variety of different contexts. Third, and not shown in the table, scale economies don't seem to easily account for changes in concentration in these industries--they don't show the same sharp changes in plant sizes that we see in livestock slaughter, and mergers among existing firms and plants appears to be more important.

These aren't the only agribusiness sectors showing increased concentration. Recent mergers have reduced the number of independent railroads, important in grain and fertilizer shipments, to two or sometimes three in most parts of the country. Census Bureau data show increased concentration in some traditional input industries like agricultural chemicals. Finally, recent and likely future mergers among supermarket chains, which may not greatly alter the number of stores that consumers generally have available to shop at, may still sharply reduce the number of different chains competing to buy produce from agricultural shippers. In short, farmers do face significant reductions in the number of competing buyers across a wide range of markets.

Contracts

For many farmers, the increasing usage of contracts as a method of market exchange exacerbates some concerns with concentration. Agricultural contracts are arrangements under which farmers agree to deliver products of a specified quality and quantity to a contractor at specified times. Contracts also specify a payments agreement (an actual price or fee, or sometimes a pricing formula). Contracts generally stipulate who owns the product, who pays for specific inputs, and who bears various risks.

Table 3 provides some recent evidence on the use of contracts, using USDA's 1997 Agricultural Resource Use Study (ARMS) data. ERS has used other data from the survey to classify farms enterprises into several types, and the table focuses on family-owned farms for whom farming is the principal occupation (excluding farms owned by nonfarm corporations and farms operated by part time or largely retired families). The table divides those farms into small (less than \$250,000 in annual farm sales), very large (more than \$500,000 in sales), and large.

The table shows that nearly one third of all farm sales were covered by production or marketing contracts in 1997, and that coverage is closely related to farm size--nearly two third of the very largest farms had contracts, and 44% of those farms' sales was covered by contracts. In contrast, only 16% of small farms had contracts, and contracts in turn covered only 20.9% of their production. Contract use varies with commodity, being especially prevalent in hogs, poultry, cotton, and some fruits and vegetables.

Contracts can provide a variety of benefits to farmers, processors, and consumers. They may allow farmers to reduce price risks, transferring the risks to processors, who often are better positioned to

bear such risks. In some cases, holding a contract may make it easier for a farmer to acquire debt financing. Contracting may allow processors to schedule a steady flow of the agricultural commodity through plants, thereby improving capacity utilization and reducing processing costs. Some contracts can provide incentives to produce higher and more consistent levels of product quality, thereby increasing consumer demand.

But reliance on contracting may also introduce new costs, for contract users and for farmers who don't use contracts. Poorly understood or designed contracts may actually create new risks for farmers under contract. Increased use of contracts for some commodities may reduce cash market volumes enough to significantly increase cash market volatility (increasing price risks for noncontracting farmers); publicly reported cash market prices may also then become less reliable guides to market developments.

In concentrated markets with only a few buyers, farmers worry that buyers may be able to use contracts as a tool of price discrimination, thereby exploiting the potential market power created by concentration. Contracting farmers worry that concentrated buyers may be able to manipulate thin cash market prices, which frequently form the basis for contract settlements. In short, contracts may combine with buyer concentration to allow buyers to exploit market power. Market power concerns are exacerbated, for many farmers, by the close linkages between contract utilization and farm size (table 3). Note that over 83% of small farms in table 3 do not have contracts, and that this group alone accounts for over two thirds of all full time family farms in the table. For many of these producers, contracting is a tool used by much larger farm enterprises, and is therefore associated with consolidation into larger farms, cost pressures on smaller producers, and with dwindling farm communities.

Biotechnology

Agricultural biotechnology refers to the process whereby the genetic structure of a plant can be altered by physically inserting genes with desired characteristics. Developments in biotechnology are likely to have many far reaching impacts on agricultural production and on food processing and consumption, but I will focus my remarks here only on the effects on concentration in agricultural supply sectors, and principally on seed providers.

As biotechnology has spread through the seed industry, a striking reorganization of firms and industry structure has taken place. Table 4 outlines several striking features of the reorganization. First, large diversified firms, with backgrounds in agricultural chemicals (DuPont, Dow, Monsanto) or in pharmaceuticals (Novartis, Aventis) made large investments in the industry through a series of acquisitions of seed companies and small biotechnology research firms (trait developers). Second, seeds have become a concentrated market (some crops more than others), with a small set of large firms active across many crop categories. What the table doesn't show is the uncertainty that attends attempts to predict future market structures in biotechnology-based industries. Many of the firms listed in table 4 have their agricultural divisions up for sale, and several of the mergers underlying the table have come undone. The best prediction that can be made is that there are likely to be many sales,

divestitures, and reorganizations of biotechnology firms in the near future, but the eventual organization of the industry is up for grabs.

Why is reorganization occurring? Biotechnology research is complex and increasingly expensive. There may be economies of scale in some parts of the research effort--that is, large firms may be more effective at developing and marketing new seeds. But research effort is only part of the story. The outcome of the research process is a new trait. Traits must still be combined with existing seed types that contain other desired characteristics. Research firms and existing seed companies could, and often do, reach agreements on transferring knowledge and research traits among themselves, but those "market arrangements" often don't work smoothly, and as a result seed firms often ally or merge with research firms. Moreover, the newly developed seeds often create complementarities with agricultural chemicals--seeds may reduce the need for herbicides or pesticides, or they may alter the mix of specific ag chemicals that a farmer needs. Because a farmer's chemical and seed decisions are often now made jointly, and because ag chemical companies possess strong research organizations and extensive marketing organizations, we also see mergers and alliances among chemical firms, research firms, and seed firms.

Biotechnology reorganizations are not driven by clear economies of scale in production, as in livestock slaughter. Rather the shifting set of mergers and alliance reflects a search for the most effective ways to develop and to exploit biotech research. Because the end of that search--the best way to develop and exploit--isn't clear, we can expect to see continued reshuffling.

Should Concentration Concern Farmers?

I'll emphasize one aspect of concentration--the potential for market power that will either lower the prices that farmers receive for their products or raise the costs that they pay for inputs. One thing we know from the economics of industrial organization is that concentration alone is not a precise guide to the existence and exercise of market power. Other factors, such as the ease of entry into a market, the nature of the product, and the alternative options available to farmers, combine with concentration to determine whether firms have market power.

There are clear instances of agribusiness firms exercising extensive market power. For example, the four producers of lysine, a key ingredient in animal feed, were able to raise prices by amounts ranging from 40-70% during the period when they were conspiring to fix prices (Connor, 1997). Other cases of international price-fixing cartels have arisen in recent years, including one in vitamins that are also key feed ingredients. On the consumer side of the food sector, the results of the government's attempts to induce competition among the three makers of infant formula are just as striking; the federal Women, Infants, and Children (WIC) program, which purchases about half of the infant formula consumed in the United States, pays wholesale prices for formula that are one fifth the wholesale price offered to non-WIC buyers (GAO, 1998). Assuming that the government receives the competitive price, prices in the non-WIC market reflect enormous market power. These cases should give pause to anyone who thinks that cartels are inherently unstable or that competition can have only small effects on prices.

But increasing concentration doesn't necessarily imply sharp increases in market power. Consider figure 1, which plots ERS data on farm to wholesale price spreads for choice beef from 1970 through 1997. The price spread is the difference between the price received by packers for beef and byproducts and the price paid by packers for the animals; it includes costs of slaughter and processing, transportation expenses for moving animals from feedlot to packing plant, and packer profits. The nominal spread in figure 1 is the actual price difference in current dollars, while the real spread has been deflated by an index of packer input prices that I developed (Packers faced inflation in the 1970's in the price of all inputs, like other manufacturers. But during the 1980's, packers' inflation experience diverged from other manufacturers, as packer production worker wages, which account for about 1/3 of slaughter costs, fell. Because of this, we need to use a specific packer deflation measure to get at real costs).

The nominal spread rose during the 1970's, but by a little less than the rate of inflation in packer input prices; as a result the real spread fell, reflecting productivity growth in packing plants. Now notice the trend during the period of rapid concentration increase, in the 1980's: nominal spreads trended down slightly during the period, and the trend matched the real spread, because input prices were unchanged, on average (increases in other input prices largely offset declines in production worker wages). During the 1990's, spreads fluctuated much more widely, but showed no long term increase. The figure tells a strong story: if large increases in concentration had large effects on packer pricing and profits, it doesn't show up in the price spread statistics.

But I've left one cautionary number out of the figure--the data are ended in 1997 because that's as far as my input price series goes. But in 1999, the nominal spread rose dramatically to 30.5 cents, 45% higher than the 1997 value. That's mostly profit--although I don't yet have input prices, I'm sure they won't rise much. 1999 was an unusual year, in a lot of ways. The question for the future is whether intense packer competition will erode that spread, driving it back to previous levels, or whether we've entered a new era in which packers recognize that they're highly concentrated, and manage to refrain from competing with one another.

References

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Table 1: Structural Change in Meatpacking

	1980	1985	1990	1995	1997
<u>Four Firm Concentration</u>					
Hogs	34	32	40	46	54
Steers and heifers	36	50	72	79	78
<u>Large Plants Only</u>					
Hogs--At least 1 million head					
Number of Plants	41	34	31	31	31
Share of Slaughter (%)	63	67	79	86	88
Average Size (m.head)	1.43	1.59	2.05	2.56	2.51
Steers/heifers--At least 500,000 head					
Number of Plants	8	17	18	22	22
Share of Slaughter (%)	24	53	66	81	80
Average Size (m.head)	0.73	0.85	0.95	1.01	1.02

Source: USDA/GIPSA

Notes: Large hog plants slaughter at least 1 million head, while large steer and heifer plants slaughter at least 500,000 head.

Table 2: Concentration in Grain and Oilseed Processing

Industry	Leading Firms	Four Firm Concentration			
		1977	1987	1992	1997*
Flour Milling	ADM, Conagra, Cargill, Cereal Food	33	44	56	62
Wet Corn Milling	ADM, Cargill, Staley, CPC	63	74	73	74
Soybean Milling	ADM, Cargill, Bunge, AGP	54	71	71	83
Cottonseed Milling	Anderson Clayton	45	43	62	
Malting	Conagra, Cargill, ADM, breweries	59	64	65	

Sources: 1977-92 concentration data from Census of Manufactures. Identities of leading firms, and 1997 concentration estimates, are from trade publications.

Table 3: Contracting Among Family Farms, 1997

Farm size category	Number of farms	Farms with contracts (%)	Total value of production (\$ million)	Share of production covered by contract (%)
Small	574,908	16.4	55,222	20.9
Large	79,240	47.2	30,231	27.8
Very Large	45,804	62.9	59,583	44.3
All	699,952	22.9	145,036	32.0

Source: 1997 USDA Agricultural Resource Management Survey. Definitions are based on ERS farm typology; table includes only family owned farms for whom farming is principal occupation.

Table 4: Biotechnology and Seed Industry Consolidation

A. Life science companies in seeds, and number of 1995-98 seed industry acquisitions		
U.S. Based: Dow Chemical (10), Dupont (5), Monsanto (22)		
Foreign-Based: Astra-Zeneca (7), Aventis (18), Novartis (6)		
B. Four firm concentration ratios, by crop		
<u>Crop</u>	<u>Largest Companies</u>	<u>CR4</u>
Corn	DuPont/Pioneer, Monsanto, Novartis, Dow	69
Soybeans ¹	Monsanto, Pioneer, Novartis, Dow	47
Wheat	Monsanto, Pioneer, Novartis, Dow	36
Cotton ²	Monsanto	87

Sources: Unpublished ERS report, by John L. King and Kenneth S. Krupa

Notes: (1) About 25% of soybeans are farmer saved, not newly purchased. (2) Monsanto alone accounted for 87% of cotton seed sales, when combined with Delta & Pine Land.

Figure 1: Choice Beef Farm-Wholesale Price Spreads

