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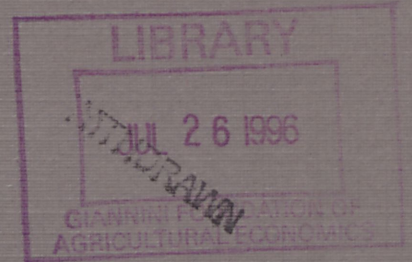
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Food



**Organization**  
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**CONCENTRATION CHANGE IN THE SELECTED  
FOOD MANUFACTURING INDUSTRIES:  
THE INFLUENCE OF MERGERS V.  
INTERNAL GROWTH**

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OP-19

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**Note:** The authors are Professor and Research Assistant at the University of Wisconsin-Madison. The helpful comments of Willard Mueller, Richard Rogers and Dennis Henderson are gratefully acknowledged.



## I. Introduction

Economists have long had an interest in the concentration of industries. In part, this is because industry concentration is often considered as a proxy for the level of market power. This view has been challenged by revisionist interpretations and theories during the last two decades. Although a significant positive relationship has been found between concentration and profits in the vast majority of empirical studies (Weiss 1974), the "new learning" of the 1970s challenged mainstream interpretations that this was due to market power in concentrated industries. Concentrated industries could produce higher profits because of superior efficiency, not higher prices.

Responding to the superior efficiency hypothesis of the Chicago School, Weiss sought to avoid the influence of firm costs altogether by focusing on concentration-price relationships, not concentration-profits. After reviewing approximately 75 price studies and 120 data sets, Weiss, (1989) concludes: "Our evidence that concentration is correlated with price is overwhelming" (p. 283).

Yet another rationalization for increased concentration is the strategic trade policy suggested by Brander and Spencer's analysis. However, Krugman (1989) and Michael Porter (1990) refute the Brander-Spencer contention. Indeed the reverse is true: competition, not concentration, enhances performance in international markets. In his review of the literature on international competition, Henderson (1990) concluded: "The available evidence, both theoretical and empirical, strongly supports the conclusion that seller concentration and market power are negatively related to global, as well as domestic market performance and economic welfare."

Thus, in spite of the theory of contestable markets, the superior efficiency hypothesis, and proposals for strategic trade policy, market concentration continues to occupy a central position in explaining industry competitive behavior. And, as long as this is the case, it leads to interest in explaining the causes of industry concentration. Is industry concentration largely a function of technology and economies of size, or are other factors at work? Can we have faith in Demsetz's (1979) admonition that market structures resulting from unrestrained competition are efficient market structures?

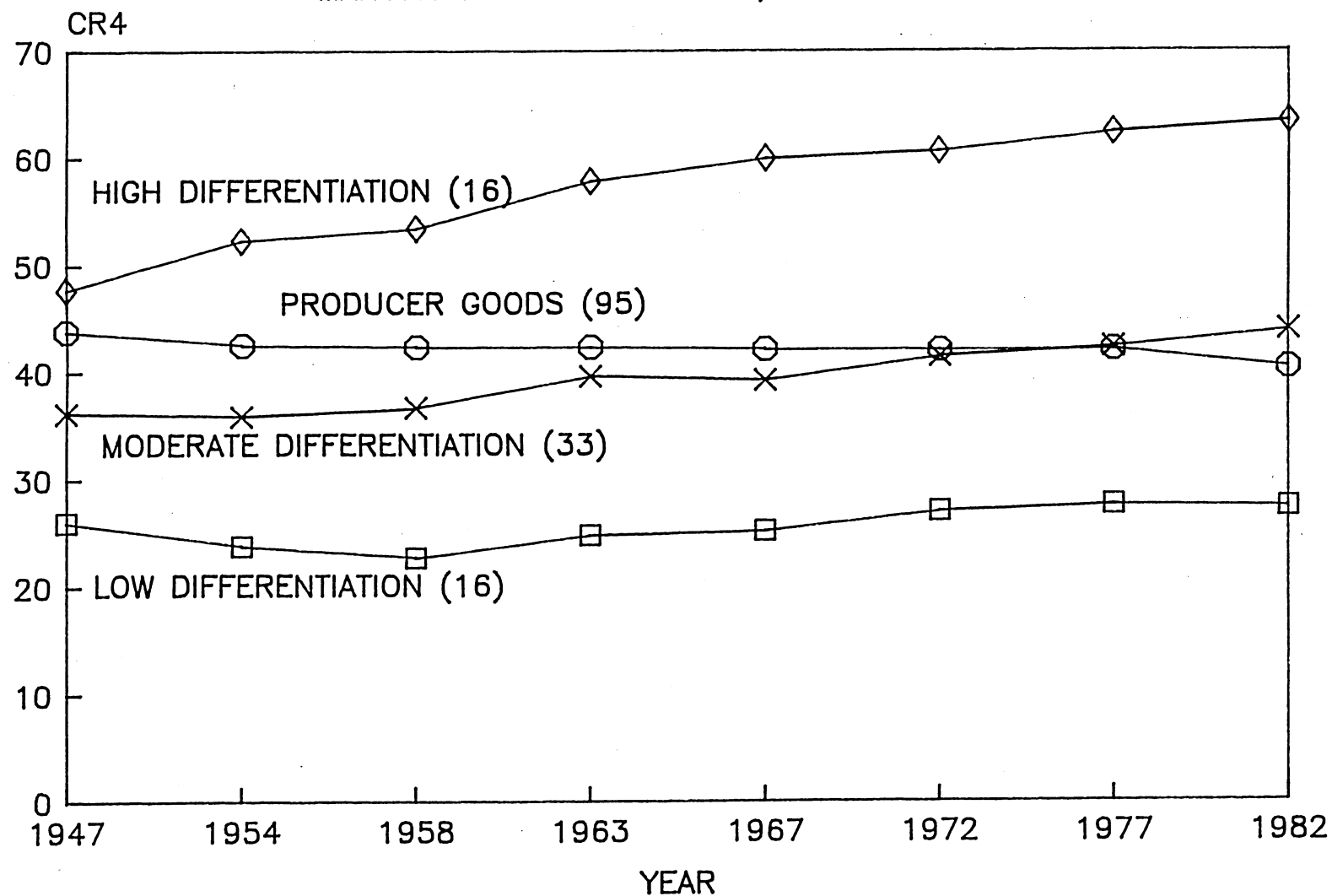
In a series of studies, Mueller (1967), Mueller and Hamm (1974), and Mueller and Rogers (1980, 1984) examined concentration changes in U.S. manufacturing industries during 1947 to 1977. Although the studies found average concentration had remained surprisingly stable over this 30 year period, major differences in trends were apparent when producer good and consumer good industries were examined separately, and when the degree of product differentiation was used to classify consumer goods (Figure 1). Ninety-five producer good product classes actually declined slightly in CR4. Television advertising was found to be closely linked to increasing concentration in consumer goods industries.

While the trends in Figure 1 were cause for some concern about the level and trend in concentration of moderate to heavily advertised product classes, it also provided some reassurance that technological determinants were not propelling the U.S. economy toward high levels of concentration. If that were the case, one would expect it to show up in the concentration trends of producer good industries.

The foregoing was based upon an analysis of all manufacturing



FIGURE 1. UNWEIGHTED AVERAGE FOUR-FIRM CONCENTRATION RATIOS  
 BY DEGREE OF PRODUCT DIFFERENTIATION FOR 165 U.S.  
 MANUFACTURING INDUSTRIES, 1947-1982.



SOURCE: MUELLER AND ROGERS, 1984; MUELLER, 1988.

industries. Rogers found similar trends and causal relationships in food manufacturing industries up until 1977 (Connor et al, p. 108-113). With the advent of the 1980s, the 30 year pattern went asunder. From 1977 to 1982, producer good product classes in food manufacturing jumped from an average CR4 of 43 to 50. The CR4 of consumer good product classes with low advertising increased by 6 points, while medium and highly advertised product classes increased by only 1 percentage point. Given the relaxation in antitrust enforcement during the 1980s, mergers immediately come to mind as a possible explanation for this abrupt change in concentration trends. Technological scale determinants change slowly, not suddenly.

This paper seeks to explain this sudden change in concentration by examining six food manufacturing industries that are either producer goods or consumer goods with low advertising. Data on the flour milling, corn wet milling, soybean crushing, cottonseed crushing, beef packing, and broiler processing industries were gathered. Concentration figures were developed for varying periods since 1977. Four-firm concentration ratios were constructed mainly based on the processing capacities of each firm. In most industries, capacity figures were more readily available than sales figures.

It is hypothesized that mergers and acquisitions played a major role in increasing concentration of these industries. In order to test this hypothesis, this paper examines the change in plant ownership and firm capacity shares that resulted from mergers and acquisitions.

## II. The Measurement of Concentration and the Trend of Its Change in the Food Manufacturing Industries

The concentration ratio is a widely used indicator of the number and size distribution of firms in a market. It is the percent of market sales (or



some other measure of size, such as assets, capacity, employment or value added) accounted for by an absolute number of the largest firms in the market - for example, the 4, 8, or 20 largest firms (Greer, 1984).

In calculating a concentration ratio, the definition of a "market" or "industry" is important. The U.S. Bureau of the Census classifies plants and firms by the Standard Industrial Classification code (SIC). Since the SIC classification gives heavy weight to the similarity of production processes as well as to the similarity of product uses, "industries" (4 digit) and "product classes" (5 digit) in the Census of Manufactures are sometimes broader or narrower than the relevant market. For example, foods produced with the same technology may be poor substitutes; conversely, foods with very different processing technologies and dissimilar inputs may be considered as close substitutes by customers. Census 4 digit industries are typically so broad that they include some noncompeting products. In general, Census 5 digit product classes are more consistent with the economic concepts of a relevant product market.

The 4, 8, 20 and 50 firm concentration ratios are published by the Bureau of Census. Those ratios are calculated from the shipment values of each industry or each product class. The 1982 Census is the latest one for which concentration ratios are available. According to Rogers, the four firm concentration ratio of 65 comparable food and tobacco product classes increased from 47.1 in 1958 to 53.8 in 1982 (Table 1). Until the late 1970's, concentration increases occurred only in the consumer goods product classes with medium or high levels of advertising (fourth and fifth columns of the table). Concentration increases appeared to be driven by advertising-created product differentiation. This conclusion was confirmed by the econometric

Table 1. Average Unweighted Four-Firm Concentration Ratios by Degree of Advertising Intensity, 65 U.S. Food and Tobacco Product Classes, 1958 to 1982.

Year	All Product Classes N=65	Producer Goods Product Classes (A/S=0) N=18	Consumer Goods Product Classes		
			Low Advertising (A/S=0 to 1%) N=17	Medium Advertising (A/S=1 to 3%) N=16	High Advertising (A/S > 3%) N=14
1982	53.8%	50.2%	43.7%	58.9%	64.7%
1977	49.8	43.0	37.7	58.1	63.7
1967	47.7	44.7	36.8	53.9	57.6
1958	47.1	46.4	37.3	52.1	53.9
Change					
1958-77	+2.7	-3.4	+0.4	+6.0	+9.8
1977-82	+4.0	+7.2	+6.0	+0.8	+1.0

Source: Bureau of Census, Census of Manufactures for various years. Data tabulated by Richard T. Rogers, Department of Agricultural Economics, University of Massachusetts.

Note : The advertising-to-sales ratio is constructed for each product class using advertising expenditures in eight measured media for 1967 and the 1967 value of shipments.

analysis of Mueller and Rogers (1980, 1984) which found a positive relationship between changes in market concentration and advertising. However, this pattern changed after 1977. Producer goods industries and consumer goods industries with low advertising (second and third columns), which historically have been characterized by modest and stable levels of four-firm concentration, increased sharply in concentration. There were 14 product classes in which CR4 increased 10 points or more during the period of 1977 - 1982. Among them, all product classes except one were either producer goods or consumer goods with low advertising. The industries to which these product classes belonged were meat packing (4 product classes), broiler processing (1), flour milling (3), wet corn milling (1), and cottonseed and vegetable oil mills (4).



Although the concentration ratios are published for product classes (SIC 5 digit codes) by the Census, it is often difficult to determine the impact of mergers at the five digit level. Data on 5 digit value of shipments for each firm are generally not available. Capacity data are often available only at the 4 digit industry level. In this paper, concentration ratios based upon production capacity were developed to supplement Census concentration ratios. Data on production capacities are readily available in trade publications and company annual reports. It is assumed that, over time, each firm's capacity is closely related to its sales market share.

### III. Case Studies of Six Industries

#### Flour Milling Industry

The flour milling industry (SIC 2041) has undergone extensive structural change in recent years. Four-firm concentration ratio of SIC 2041, "Flour and other grain mill products" increased from 33 in 1977 to 40 in 1982. At the product class level, CR4 in 20411 changed from 38 to 48 and CR4 in 20412 increased from 39 to 50 during the same period (Table 2).

Plant numbers declined but total milling capacity increased during 1978 - 1988. Total number of mills of hard, soft, and whole wheat flour fell from 256 in 1978 to 207 in 1988, a decline of about 20 percent (Harwood, 1988). However, total U.S. flour milling capacity increased from 1,099,600 cwt per day in 1978 to 1,174,200 cwt in 1983 and then declined slightly to 1,163,000 cwt in 1988.

The concentration ratio of the flour milling industry has increased substantially as the largest milling firms have expanded their holdings. The CR4's for several years, based upon daily milling capacities, are shown in Table 3. In 1988, the top four companies owned 60.6 % of total milling

Table 2. Product Classes of the Flour Milling Industry that Increased in Concentration by 10 Points or More, 1977-1982.

SIC Code	Class of Product	1982 Shipment value (million dollars)	CR4		
			1977	1982	change
2041-	FLOUR AND OTHER GRAIN MILL PRODUCTS	4871.6	33	40	+7
20411	Wheat flour, except flour mixes	3102.3 (63.7%) <sup>a</sup>	38	48	+10
20412	Wheat mill products other than flour	478.5 (9.8%)	39	50	+11

Source: 1982 Census of Manufactures

a/ Percentages of total industry shipment value.

capacity, a sharp increase from 36.3 % in 1978. In order to examine the cause of concentration change, the CR4 without acquisitions was calculated (for more details, see Appendix A). The CR4 without acquisitions was based upon the capacity shares of original and newly built plants. CR4 without acquisitions would have remained virtually constant from 1978 to 1988. Thus, internal firm expansion was not the source of concentration increase during this period.

The ownership of many flour milling plants changed during this period. Pillsbury ranked as the largest flour miller in 1978. ConAgra took over this position in 1983. In 1988, the top four firms were ConAgra (23.2 %), Archer Daniels Midland (ADM, 15.0 %), Cargill (12.1 %), and Pillsbury (10.3%).

The number one company, ConAgra, acquired Peavey (98,500 cwt) in 1982, Standard Milling (16,300 cwt) in 1983, Sunshine Biscuits (10,000 cwt) in 1987, and International Multifood (80,300 cwt) in 1988. Between 1978 and 1988,

Table 3. Top Four Firms and Four-firm Concentration Ratio of the Flour Milling Industry, With and Without Acquisitions, 1978-1988.

	1978	1983	1988
Rank 1	Pillsbury (10.1) <sup>a</sup>	ConAgra (18.4)	ConAgra (23.2)
2	Peavey ( 9.0)	Cargill (11.4)	ADM (15.0)
3	ADM ( 8.7)	ADM (10.5)	Cargill (12.1)
4	ConAgra ( 8.5)	Pillsbury (10.3)	Pillsbury (10.3)
Actual CR4 <sup>b</sup>	36.3	50.6	60.6
CR4 without acquisitions <sup>c</sup>	36.3	37.2	38.6

a/ Percentages of total industry capacity based upon data from the Milling Directory.

b/ Four firm concentration ratio constructed based upon the actual capacity in each year of the top four firms and the total industry.

c/ Four-firm concentration ratio constructed based upon the capacity held by the top four firms in each year from originally owned or newly built plants.

ConAgra's daily milling capacity increased from 93,000 cwt (8.5% of the total industry capacity) to 270,000 (23.2%) cwt. ADM, which was the second ranked miller in 1988, acquired Centennial Mills (24,000 cwt) in 1978 and expanded its capacity of originally owned plants to 150,700 cwt in 1988. ADM's daily capacity increased from 96,000 cwt (8.7%) in 1978 to 174,700 cwt (15.0%) in 1988. The third largest company, Cargill, bought Seaboard Allied Milling (91,000 cwt) in 1981. Cargill's original capacity in 1978 was 46,000 cwt (4.2%) but it increased to 141,000 cwt (12.1%) in 1988. Most of Cargill's capacity came from the acquisitions. The fourth company, Pillsbury, purchased Tennant and Hoyt Co. (11,000 cwt) in 1987. Unlike the other top firms, Pillsbury's share of industry capacity remained about the same. Its daily

capacity increased only 8,100 cwt, from 111,600 cwt (10.1%) in 1978 to 119,700 cwt (10.3%) in 1988.

#### Soybean Crushing Industry

The soybean crushing industry is also in a phase of structural change. The soybean crushing industry ("Soybean oil mill products", SIC 2075) is composed of "Soybean oil (SIC 20751)" and "Soybean cake, meal, and other byproducts (SIC 20752)" product classes. These are producer goods product classes. Census CR4 for 2075 changed from 50 in 1977 to 56 in 1982. The CR4's in the product classes increased by a similar amount (Table 4).

Total plant numbers and total crushing capacity decreased concurrently during this period. According to the American Soybean Association's Soya Bluebook, total plant numbers in this industry decreased from 118 in 1977 to

Table 4. Product Classes of the Soybean Oil Crushing Industry, 1977-1982.

SIC Code	Class of Product	1982 Shipment value (million dollars)	CR4		
			1977	1982	change
2075-	SOYBEAN OIL MILL PRODUCTS	7257.4	50	56	+6
20751	Soybean Oil	2375.4 (32.7%) <sup>a</sup>	53	59	+6
20752	Soybean cake, meal and other byproducts	4836.2 (66.6%)	49	56	+7

Source: 1982 Census of Manufactures

<sup>a</sup>/ Percentages of total industry shipment value.



100 in 1982 and to 76 in 1988. Total crushing capacity also decreased from 127,229 tons in 1977 to 126,664 tons in 1982 and to 108,159 tons in 1988 (a decline of 10% in 11 years).

Although total crushing capacity of this industry declined, concentration of the industry increased primarily because of mergers and acquisitions. Four-firm concentration ratios, which were computed from daily crushing capacities, are presented in Table 5. Without acquisitions, we estimate CR4 would have increased slightly from 46.4 in 1977 to 49.8 in 1988. With acquisitions, CR4 increased from 46.4 in 1977 to 50.9 in 1982 and to 76.4 in 1988, a sharp increase in only 11 years.

Table 5. Top Four Firms and Four-firm Concentration Ratio of Soybean Crushing Industry, With and Without Acquisitions, 1977-1988.

	1977	1982	1988
Rank 1	Cargill (15.1) <sup>a</sup>	ADM (17.8)	ADM (29.6)
2	ADM (14.6)	Cargill (15.8)	Cargill (21.9)
3	Central Soya ( 9.9)	Central Soya ( 9.7)	Bunge (12.8)
4	Ralston Purina ( 6.8)	Bunge ( 7.6)	Ag Processing (12.1)
Actual CR4 <sup>b</sup>	46.4	50.9	76.4
CR4 without acquisitions <sup>c</sup>	46.4	46.8	48.9

a/ Percentages of total industry capacity based upon data from the directory of soybean meal and oil processors in the Soya Bluebook.

b/ Four-firm concentration ratio constructed based upon the actual capacity in each year of the top four firms and the total industry.

c/ Four-firm concentration ratio constructed based upon the capacity held by the top four firms in each year from originally owned or newly built plants.

The rank of the top four firms and their capacity shares have changed due to mergers and acquisitions. ADM and Cargill held the top two positions from 1977 to 1988, but the number three and the number four positions were held by four different firms over this period. In 1988, ADM (29.6 %), Cargill (21.9%), Bunge (12.8%), and Ag Processing (12.1%) were the largest four firms in the soybean crushing industry.

The largest crusher, ADM, acquired three plants (3,140 tons) from Buckeye Cellulose Corp. and one plant (900 tons) from Planters Mfg Co. in 1982. In 1985, it bought five soybean crushing plants (6,975 tons) from A. E. Staley (which had acquired MFA Grain Mkt (long-term lease) in 1983) and one plant (2,400 tons) from Continental Grain. In 1987, it added one plant (2,000 tons) from Gold Kist. As a result of these acquisitions, ADM's daily crushing capacity increased from 18,590 tons (14.6% of the total industry capacity) in 1977 to 32,035 tons (29.6%) in 1988. The second largest firm, Cargill, acquired one plant (300 tons) from Hartville Oil in 1982, one plant (1,500 tons) from Anderson Clayton in 1983, and five plants (6,300 tons) from Ralston Purina in 1985. Between 1977 and 1988, the daily crushing capacity of Cargill increased from 19,190 tons (15.1%) to 23,700 tons (21.9%). The third firm, Bunge, acquired two plants (2,800 tons) from Cook Industry Inc. in 1978, one plant (2,500 tons) from Gold Kist in 1983, and two plants (1,800 tons) from Anderson Clayton in 1984. Bunge's capacity increased from 6,550 tons (5.1%) in 1977 to 13,850 tons (12.8%) in 1988. Ag Processing, which was formed as a co-op in 1983, merged three plants (4,400 tons) of Farmland Inc., one plant (4,200 tons) of Boone Valley Co-op, and two plants (2,500 tons) of Land O'Lakes. In 1986, it acquired two plants (2,000 tons) from American Grain. The total daily capacity of Ag Processing was 13,100 tons (12.1%) in 1988.

### Corn Wet Milling Industry

Corn wet milling (SIC 2046) increased in CR4 from 61 in 1977 to 73 in 1982 (Table 6). In 1982, product classes were identified for the first time by Census. The main product classes are "Corn sweeteners (20461)," "Manufactured starch (20462)," "Corn oil (20463)," and "Wet process corn byproducts (20464)." Corn sweeteners are widely used in soft drinks, dairy products, catsup, confections, bread, canned fruits, and beer. In particular, the demand for corn syrup has sharply increased since the development of High Fructose Corn Syrup (HFCS), a product sweet enough to compete with sugar in processed foods. The leading soft drinks, such as Coke and Pepsi, started to use 55% HFCS in the 1980's.

Table 6. Product Classes of the Wet Corn Milling Industry, 1977-1982.

SIC Code	Class of Product	1982 Shipment value (million dollars)	CR4		
			1977	1982	change
2046-	WET CORN MILLING	3105.7	61	73	+12
20461	Corn sweeteners	1610.4 (51.9%) <sup>a</sup>	n.a.	84	
20462	Manufactured starch	655.1 (21.1%)	n.a.	62	
20463	Corn oil	234.9 (7.6%)	n.a.	83	
20464	Wet process corn byproducts	577.7 (18.6%)	n.a.	77	

Source: 1982 Census of Manufactures

a/ Percentages of total industry shipment value.

The grinding capacities for each firm were estimated based upon data from the Milling Directory and company annual reports. According to these estimates, total plant numbers increased from 19 in 1977 to 22 in 1982 and to 23 in 1988. Total 24 hour grinding capacity of the industry increased from 1,344 thousand bushels in 1977 to 2,071 thousand bushels in 1982 and 2,337 thousand bushels in 1988.

In spite of increasing demand and growing capacity, the industry increased in concentration. The change in concentration of this industry can

Table 7. Top Four Firms and Four-firm Concentration Ratio of the Wet Corn Milling Industry, With and Without Acquisitions, 1977-1988.

	1977		1982		1988	
Rank 1	CPC	(18.9) <sup>a</sup>	ADM	(26.1)	ADM	(27.8)
2	Staley	(18.6)	Staley	(18.3)	Staley	(20.1)
3	Cargill	(14.9)	CPC	(17.9)	Cargill	(16.9)
4	Clinton Corn	(10.4)	Cargill	(14.5)	CPC	(13.4)
Actual CR4 <sup>b</sup>		62.8		76.8		78.2
CR4 without acquisitions <sup>c</sup>		62.8		70.1		70.7

a/ Percentages of total industry capacity based on data from the Milling Directory.

b/ Four-firm concentration ratio constructed based upon the actual capacity in each year of the top four firms and the total industry.

c/ Four-firm concentration ratio constructed based upon the capacity held by the top four firms in each year from originally owned or newly built plants.



be explained by both acquisitions and the capacity expansion of incumbent firms. The CR4 of grinding capacity increased from 62.8 in 1977 to 76.8 in 1982 and to 78.2 in 1988 (Table 7). Without mergers and acquisitions, we estimate CR4 would have increased from 62.8 to 70.1 and 70.7. Mergers and acquisitions accounted for about half of total CR4 change from 1977 to 1988 and the internal capacity expansion of the largest four refiners explained the other half.

The current top four firms are ADM (27.8%), A. E. Staley (20.1%), Cargill (16.9%), and CPC (13.4%). In 1977, the largest four firms were CPC, A. E. Staley, Cargill, and Clinton Corn. ADM rose to the industry's leading position through constructing new plants, acquiring existing plants, and expanding capacity. ADM, whose grinding capacity was 80 thousand bushels, had too small a share (5.9%) to be included in the largest four processors in 1977. However, ADM constructed a new plant at Decatur, Illinois and expanded the capacity of its existing plants. In 1982, ADM entered into the long-term lease of 2 plants (140 thousand bushels) from Nabisco Brands. As a result, its total grinding capacity increased to 540 thousand bushels (26.1%) in 1982. By 1988, ADM's total capacity had expanded to 650 thousand bushels (27.8%). A. E. Staley, the second largest processor, expanded the grinding capacity and acquired one plant (35 thousand bushels) from the Anheuser Busch in 1985. Staley's total processing capacity increased from 250 thousand bushels (18.6%) in 1977 to 380 thousand bushels (18.3%) in 1982 and 470 thousand bushels (20.1%) in 1988. The third firm, Cargill, expanded its capacity continuously from 200 thousand bushels (14.9%) in 1977 to 300 thousand bushels (14.5%) in 1982 and 395 thousand bushels (16.9%) in later years. CPC was the largest corn refiner in 1977 but its share of the total industry's capacity declined

over the 11 years examined. The company shut down old plants located at Corpus Christi, Texas, North Kansas City, Missouri and Pekin, Illinois and replaced those with the new plants at Stockton, California and Winston-Salem, North Carolina. Its total grinding capacity increased from 254 thousand bushels in 1977 to 312 thousand bushels in 1988 but its share of industry capacity dropped from 18.9% to 13.4%.

#### Cottonseed Oil Milling Industry

The cottonseed oil milling industry (SIC 2074) is a producer goods industry with relatively low concentration. The industry is made up of four product classes: Cottonseed oil, crude (20741), Cottonseed oil, once refined (20742), Cotton linters (20743), and Cotton cake and meal and other byproducts

Table 8. Product Classes of the Cottonseed Oil Mills, 1977-1982.

SIC Code	Class of Product	1982 Shipment value (million dollars)	CR4		
			1977	1982	change
2074-	COTTONSEED OIL MILL PRODUCTS	812.2	42	50	+8
20741	Cottonseed oil, crude	150.2 (18.5%) <sup>a</sup>	41	59	+18
20742	Cottonseed oil, once-refined	219.7 (27.0%)	54	60	+6
20743	Cotton linters	70.0 (8.6%)	44	47	+3
29744	Cottonseed cake and meal and other byproducts	360.1 (44.3%)	42	52	+10

Source: 1982 Census of Manufactures

a/ Percentages of total industry shipment value.

(20744). Among them, 20744 and 20742 accounted for 71% of industry shipments.

Historically, concentration has been relatively low and stable at both the four and five digit levels. However, from 1977 to 1982, four-firm concentration increased sharply (Table 8).

According to the National Cottonseed Products Association, the total number of mills fell from 90 in 1977 to 57 in 1982 and 52 in 1988. Total milling capacity of the industry declined from 20,505 tons in 1977 to 18,425 in 1982 and to 14,405 in 1988 (29.7% decline in 11 years).

As shown in Table 9, the share of industry capacity accounted for by

Table 9. Top Four Firms and Four-firm Concentration Ratio of the Cottonseed Oil Milling Industry, With and Without Acquisitions, 1972-1988.

	1977	1982	1988
Rank 1	Anderson Clayton (10.6) <sup>a</sup>	ADM (17.6)	ADM (24.9)
2	Buckeye Cellulose ( 9.2)	Anderson Clayton (11.8)	Plains Coop ( 8.3)
3	Ranchers Cotton Oil ( 7.8)	Ranchers Cotton Oil ( 8.7)	Paymaster Oil Mill ( 6.9)
4	Plains Coop ( 5.9)	Plains Coop ( 6.5)	Western Cotton Service ( 5.2)
Actual CR4 <sup>b</sup>	33.4	44.5	45.4
CR4 without acquisitions <sup>c</sup>	33.4	37.2	41.4

a/ Percentages of total industry capacity based upon capacity estimates from USDA.

b/ Four-firm concentration ratio constructed based upon the actual capacity in each year of the top four firms and the total industry.

c/ Four-firm concentration ratio constructed based upon the capacity held by the top four firms in each year from originally owned or newly built plants.

the largest four firms increased from 33 percent in 1977 to 45 percent in 1988. Absent acquisitions, the CR4 in 1988 would have been 41. The increase of the CR4 without acquisitions can be explained by the sharp decline in the total milling capacity of the industry. Thus, acquisitions accounted for only one-third of the increase in concentration.

The top four cottonseed oil mills in 1988 were the Southern Cotton Oil (ADM, 24.9%), Plains Cooperative (8.3%), Paymaster Oil Mill (a division of International Protein Corporation, 6.9%) and Western Cotton Service (a division of Julian Corporation, 5.2%). Of these, only Plains Coop. ranked among the top four firms in 1977.

Most of acquisitions in this industry were done by ADM. Southern Cotton Oil (ADM) acquired 6 cottonseed milling companies (8 plants, 3,140 tons) in the period 1977 - 1988. It acquired one plant (250 tons) from Lubbock Cotton Oil (Texas), one plant (350 tons) from Sweetwater Cotton Oil (Texas) and three plants (1,620 tons) from Buckeye Cellulose Corporation in 1981. One plant (400 tons) from Planters Manufacturing was merged in 1982. From 1977 to 1982, its capacity increased from 1,135 tons to 3,235 tons and its share increased to 17.6%. It acquired Quanah Cotton Oil (320 tons) and Plainview Oil Mill (200 tons) in 1985. With these acquisitions, its total capacity increased to 3,585 tons in 1988 and its share increased to 24.9%.

Anderson Clayton was once the largest cottonseed processor in the U.S. From 1977 to 1982, its capacity share exceeded 10 percent. The company restructured its cottonseed operation into Western Cotton Service and Paymaster Oil Mill in 1983. These two divisions were divested separately to other firms. Anderson Clayton itself was acquired by Quaker Oats in 1986. The three plants (1,000 tons) from Paymaster Oil Mill were acquired by

International Protein Corporation in 1988 and the two plants (750 tons) from Western Cotton Service were merged with Julian Corporation in 1987. Both of these former division of Anderson Clayton ranked among the top firms in 1988.

Cooperatives account for a large share of the total U.S. cottonseed crush. The share was 37% in the 1977-1978 and it increased to over 40% in 1980's. In 1988, cooperative share was 45%. Plains Cooperative Oil Mill took the largest share among the cooperatives. Its daily milling capacity was 1,200 tons in 1988, equivalent to 8.3% of the industry's total capacity. Yazoo Valley Cotton Oil, Producers Cooperative Oil Mill and Osceola Products Co. are also cooperative crushers but with shares too small to be among the top four firms.

#### Beef Packing Industry

In recent years, the beef packing industry has undergone substantial restructuring. "Old line" packers like Armour, Swift, and Morrell either disappeared or were substantially reorganized. A large number of plants were closed. The "Big 3" that now dominates the industry are all "new breed" packers. In part, because of mergers and acquisitions, concentration increased sharply during the 1980's.

Among 14 food manufacturing product classes in which CR4 increased over 10 points during 1977-1982, 4 belonged to SIC 2011, "Meat packing plant products." These four product classes were beef, veal, canned meat, and hides and pelts (Table 10).

The beef packing industry examined here does not match exactly the SIC 20111 product class defined by the Census. Here, beef packing is confined to steer and heifer slaughter. Cow and bull slaughter, which is included in the Census product class, is omitted from our data since we believe it is in a



Table 10. Product Classes of the Meat Packing Industry that Increased in Concentration by 10 Points or more, 1977-1982.

SIC Code	Class of Product	1982 Shipment value (million dollars)	CR4		
			1977	1982	change
2011-	MEAT PACKING PLANTS PRODUCTS	40,522.6	21	27	+6
20111	Beef, not canned or made into sausage	20,606.7 (50.9%) <sup>a</sup>	25	44	+19
20112	Veal, not canned made into sausage	362.1 (0.9%)	32	55	+23
20118 (20138)	Canned meat, except animal and baby foods, 20 % or more meat.	1548.6 (3.5%)	36	53	+17
20119	Hides, skins, and pelts	867.1 (2.1%)	23	38	+15

Source: 1982 Census of Manufactures.

a/ Percentages of total industry shipment value.

separate product market. Plants slaughtering cows and bulls are mainly located in dairy production areas and sell most of their products as trimmings and ground beef. The beef supplied to supermarkets and better restaurants largely comes from steer and heifer slaughterers.

According to the USDA Packers and Stockyards Administration (P & SA), the concentration ratio of steer and heifer slaughtering increased sharply during the period of 1977-1988. The CR4 increased from 29.1 in 1977 to 45.0 in 1982 and to 69.7 in 1988. The total number of beef packing plants declined from 692 in 1977 to 374 in 1988 but the number of large-scale plants

Table 11. Top Four Firms and Four-firm Concentration Ratio of the Beef Packing Industry, With and Without Acquisitions, 1977-1988.

		1977		1982		1988	
Rank	1	IBP	(13.0) <sup>a</sup>	IBP	(20.9)	IBP	(27.0)
	2	Swift	( 6.9)	Excel	(12.1)	ConAgra	(21.1)
	3	MBPXL	( 4.9)	SIPCO	( 6.3)	Excel	(17.1)
	4	Spencer	( 4.3)	Spencer	( 5.6)	Beef America	( 4.5)
Actual CR4 <sup>b</sup>			29.1		45.0		69.7
CR4 without acquisitions <sup>c</sup>			29.1		44.5		50.3

a/ Shares are based upon actual slaughter number in 1977 and upon estimated capacities in 1982 and 1988.

b/ Four-firm concentration ratio constructed based upon the actual capacity in each year of the top four firms and the total industry.

c/ Four-firm concentration ratio constructed based upon the capacity held by the top four firms in each year from originally owned or newly built plants.

increased. Most of the large packing plants are owned by the leading packers (Feedstuffs, January 23, 1989 and January 22, 1990).

Estimates of the four-firm concentration ratio with or without mergers are compared in the Table 11. Capacity figures were collected from various sources (see Appendix A). Current capacity figures were applied to previous years because reliable data on past capacities are not available. Without mergers, we estimate concentration would have increased from 29 in 1977 to 44.5 in 1982, whereas the actual CR4 in 1982 was 45.0 according to P & SA. Thus, the concentration increase during this period was mainly due to a decline of total industry capacity and internal expansion by the leading

firms. However, the 19 point increase in CR4 from 1982 to 1988 was almost totally driven by mergers and acquisitions. Absent mergers and acquisitions, the CR4 in 1988 would have been 50.3 instead of the actual 69.7.

IBP continued to hold the number one position for the whole period. In 1988, the current four largest packers were IBP (27.0%), ConAgra (21.1%), Excel (17.1%), and Beef America (4.5%).

Incorporated as Iowa Beef Packers in 1960, IBP steadily increased its market share from zero in 1960 to its dominant position today. It was acquired by Occidental Petroleum Corporation in 1981. The daily slaughtering capacity of IBP increased from 13.0% of total industry capacity in 1977 to 20.9% in 1982 and 27.0% in 1988. This was largely the result of the construction of one new plant and capacity expansion of existing plants. In 1980, it opened a large plant at Holcomb, Kansas (original capacity; 4,000 head/day) and expanded capacity of several plants. During 1977-1988, IBP acquired only one plant at Joslin, Illinois (3,100 head/day) from Illini Beef Packers (1982). The company is currently building a new plant in central Nebraska.

Swift was the largest beef packer in 1960's but its rank dropped to second in 1977 and third in 1982. Swift had a 6.9% market share in 1977. In 1981, the fresh meat portion of Swift and Company, was reorganized as the Swift Independent Packing Company (SIPCO) and spun off by Esmark as an independent company. SIPCO was combined with Val-Agri in 1986 and the combined company was acquired by ConAgra in 1987.

ConAgra first entered the beef packing industry through the acquisition of the Nampa, Idaho plant from Armour Food Company in 1983. In 1985, it acquired Northern States Beef. In 1987, ConAgra acquired E.A. Miller, Monfort

of Colorado, and 50% interest of SIPCO/Val-Agri with an option to buy the remaining 50% in 1990. Monfort of Colorado was the number five packer when acquired by ConAgra. With these mergers and acquisitions, ConAgra held 21.1% of total industry capacity and ranked as the second largest beef packer. ConAgra is remodelling a large plant at Amarillo, Texas (6,500 head/day) and has closed several plants. ConAgra is clearly one of the main player in restructuring the beef packing industry.

Excel (a subsidiary of Cargill) ranked third in 1988. It operated 7 plants that represented 17.1% of total industry capacity. Excel is the successor of MBPXL which was organized as a combination of Missouri Beef Packers and Kansas Beef Industry. MBPXL was the third largest beef packer in 1977 with a 4.9% market share. Cargill acquired MBPXL in 1979 and changed the company name to Excel in 1982. Excel acquired two large packers in 1987: Spencer Beef and Sterling Beef. The acquisition of Spencer Beef from Land O'Lakes in 1983 was blocked by the lower courts. After that decision was overturned by the U.S. Supreme Court in 1986, Excel completed the acquisition. With these mergers and acquisitions, Excel's capacity share in the industry increased from 12.1% in 1982 to 17.1% in 1988.

Beef America was the fourth largest beef packer in 1988. Dubuque Packing and Beef Nebraska were merged to form Beef America in 1988. It had 5 plants with 4.5% of the industry capacity.

#### Broiler Processing Industry

The broiler processing industry is a consumer goods industry with low levels of advertising. Concentration of the industry was the lowest among the six industries included in this study. However, mergers and acquisitions in recent years have sharply increased concentration.

The broiler processing industry could be matched with the combined product class of "Young chickens, including frozen, slaughtered in same establishment (SIC 20161)" and "Young chickens (frozen) including broiler, fryer, roasters, and capons (SIC 20171)." The CR4 of this combined product class increased from 22 in 1977 to 32 in 1982.

Slaughtering figures for individual processors were obtained from Broiler Industry magazine and total annual industry slaughtering figures were taken from Poultry Slaughter (USDA). Using these data, we estimate CR4 increased from 20.6 in 1977 to 30.3 in 1982 and to 38.8 in 1988 (Table 12).

Table 12. Top Four Firms and Four-firm Concentration Ratio of the Broiler Processing Industry, With and Without Acquisitions, 1977-1988.

	1977	1982	1988
Rank 1	Holly Farms (6.0) <sup>a</sup>	ConAgra (10.9)	Tyson (13.6)
2	Gold Kist (5.3)	Gold Kist (7.7)	ConAgra (9.8)
3	Valmac (5.3)	Holly Farms(6.7)	Gold Kist (8.7)
4	Tyson (4.1)	Perdue (4.9)	Holly Farms(6.8)
Actual CR4 <sup>b</sup>	20.6	30.3	38.8
CR4 without acquisitions <sup>c</sup>	20.6	23.0	24.6

a/ Percentages of total industry slaughter head based upon data from the Broiler Industry and the Poultry Slaughter.

b/ Four-firm concentration ratio constructed based upon the actual slaughter in each year by the top four firms and the total industry.

c/ Four-firm concentration ratio constructed based upon the slaughter by the top four firms in each year from originally owned or newly built plants.



Without mergers, the CR4 would have been 23.0 in 1982 and 24.6 in 1988. From this comparison, we conclude nearly 80 percent of the CR4 change from 1977 to 1988 was due to mergers and acquisitions.

The four largest broiler processors in 1988 were Tyson (13.6%), ConAgra (9.8%), Gold Kist (8.7%), and Holly Farms (6.8%). Holly Farms and Gold Kist held the first and second position in 1977 but their rank dropped because Tyson and ConAgra grew faster through mergers and acquisitions.

Tyson was a very aggressive player in mergers and acquisitions. It was the fourth processor with 2.75 million head slaughtered per week (HSW) and 4.1% of total industry slaughter in 1977 and the fifth with 3.7 million HSW (4.5%) in 1982. Tyson acquired Valmac Industries (3.8 million HSW) in 1984 and Lane Processing (3.9 million HSW) in 1986. Tyson also built a large complex at Berman, Arkansas in 1986. By 1988, Tyson was the largest broiler processors in the United States with 13.9 million HSW (13.6%). In addition, Tyson outbid ConAgra in acquiring Holly Farms, the nation's fourth largest processor. With this, Tyson's share jumped to 21.8% in 1989. Tyson owned 43 processing and further processing plants and employed 40,000 people in the poultry division.

ConAgra was the second largest firm with 10.0 million HSW in 1988, but it ranked only 10th in 1977. ConAgra acquired Banquet Foods (1.3 million HSW) in 1980 and Country Pride (4.2 million HSW) in 1982. Country Pride itself had acquired Bayshore Foods in 1978. With these mergers, ConAgra ranked first with 8.9 million HSW (10.9%) in 1982.

Gold Kist, an agricultural cooperative, was one of the top four processors for the whole period. Its slaughter number increased from 3.5 million (5.3%) in 1977 to 6.3 million (7.7%) in 1982 and to 8.86 million

(8.7%) in 1988. Perdue, the fifth largest processor with 6.5 million HSW (6.0%) in 1988, acquired Golden Pride (0.8 million HSW) in 1979 and White Poultry (0.4 million HSW) in 1985.

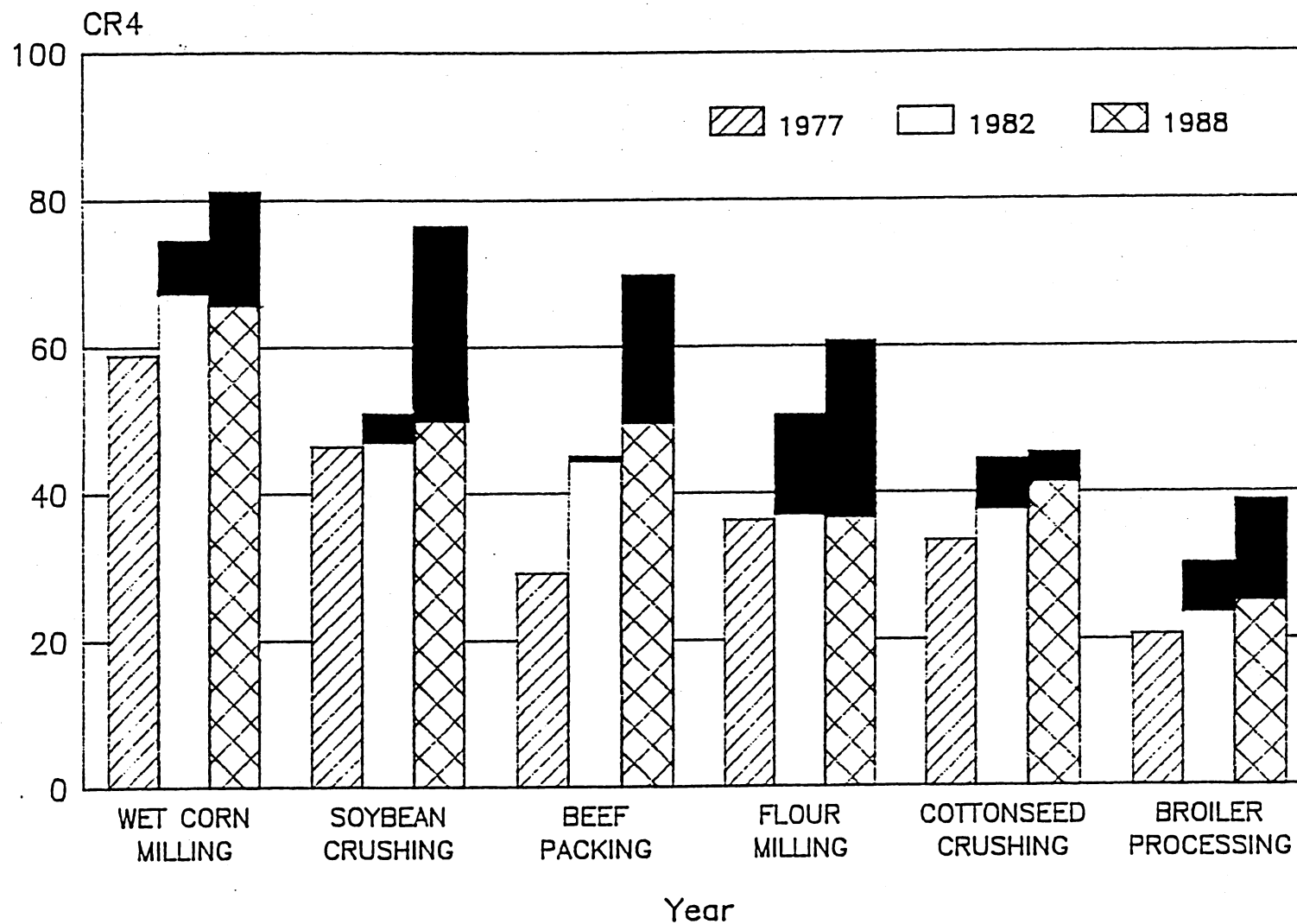
Holly Farms was number one in the industry in 1977 with 4.0 million HSW (6.0%). Acquiring Victor Weaver (0.8 million HSW) in 1987, Holly Farms Foods ranked fourth with 6.9 million HSW (6.8%) in 1988. It was acquired by Tyson in 1989. The Tyson-Holly Farms merger increased the industry CR4 to about 46 in 1989.

#### IV. Conclusions

This paper has examined changes in the national concentration of the flour milling, soybean crushing, corn wet milling, cottonseed oil milling, beef packing, and broiler processing industries. As either producer goods industries or consumer goods industries with low levels of advertising, these industries were characterized by low and stable levels of concentration until the late 1970's. However, four-firm concentration ratios in all six industries increased sharply during the period 1977-1988. National four-firm concentration ratios constructed from production capacities increased from 36.3 to 60.6 in the flour milling industry, from 46.4 to 76.4 in the soybean crushing industry, from 62.8 to 78.2 in the corn wet milling industry, from 33.4 to 45.3 in the cottonseed oil milling industry, from 29.1 to 69.7 in the beef packing industry, and from 20.6 to 38.8 in the broiler processing industry (Figure 2).

These changes imply a decline in the effectiveness of competition. In 1977, five of the six industries had four-firm concentration ratios below 50, which Leonard Weiss identifies as the threshold level of concentration below which there is little effect on performance. By 1988, only two industries

FIGURE 2. FOUR-FIRM CONCENTRATION RATIO OF THE SELECTED FOOD MANUFACTURING INDUSTRIES, 1977-1988.



NOTE: SOLID FILL AREA IS INCREASE IN CR4 DUE TO MERGERS

remained below  $CR_4 = 50$ ; four of the six had a  $CR_4$  over 60. These four industries would be characterized as tight oligopolies, in which some form of collusion or dominant firm behavior is increasingly likely. However, we hasten to add that we did not examine the changes in competitive behavior that occurred as these industries increased in concentration. Some of the industries, such as corn wet milling, may have relatively limited control over either the price of primary inputs (e.g., corn) or the price of outputs. Several products of corn wet milling have close substitutes (e.g., high fructose corn syrup-sugar; corn oil-soybean oil; ethanol-gasoline). A monopoly in any of these products is still likely to be of value--but to a lesser degree than where close substitutes are unavailable.

In other cases, foreign competition may limit the market power of U.S. firms. South American soybean crushers have provided strong international competition for U.S. crushers. In these examples, the relevant geographic or product market is either broader or narrower than the U.S. census classification. A more rigorous analysis of the behavioral consequences of increased concentration would need to address such issues.

The change in the concentration of these industries is mainly due to the merger component of growth. Absent mergers and acquisitions, the four-firm concentration ratios would have changed little in most industries. This implies that technical causes, such as new technology and economies of scale, were minor contributors to increases in concentration. This is consistent with studies showing small economies of scale in food manufacturing industries (Connor et. al, 1985). In the food manufacturing industries examined here, most mergers and acquisitions occurred in the 1980's, a decade in which an enormous wave of mergers affected every part of the U.S. economy in response

to the relaxed enforcement of the antitrust laws. Certain companies were major players in the merger mania. Archer Daniels Midland (ADM), Cargill, and ConAgra were major participants in mergers that affected the six industries. ADM used mergers to become the leading firm in soybean, cottonseed, and corn wet milling. ConAgra employed mergers to become the number one or two in flour milling, beef packing, broiler processing. Cargill was a major participant in mergers in flour milling, soybean milling and beef packing (Table 13).

As a result of the mergers during 1977 - 1988, ADM, Cargill, and ConAgra have become enormous commodity conglomerates with strong positions in most of the industries in which they are involved. ConAgra, for example, in addition to being the nation's number one flour miller and number two broiler processor and beef packer, is also the number one lamb slaughterer, the number two hog slaughterer, a leading processor/distribution of branded processed meats (Armour and Swift brands) and turkeys, and also has shrimp and catfish operations. From one end of the retail meat case to the other, ConAgra has

Table 13. Major Players in Mergers Affecting Six Selected Industries.

Company Name	Flour Milling	Soybean Crushing	Cottonseed Milling	Wet Corn Milling	Beef Packing	Broiler Processing
ADM		X	X	X		
Cargill	X	X			X	
ConAgra	X				X	X
Bunge		X				
Tyson						X

a presence. ConAgra has developed these positions very quickly through a series of mergers.

The main purpose of this study was to examine the causes of increased concentration in six selected industries. In their 1984 article, Mueller and Rogers (1984) concluded that increasing concentration in food manufacturing product classes from 1958 to 1977 was largely a function of advertising in electronic media, and that economies of scale and the requisites of new technology do not require high levels of concentration in most cases.

The latter conclusion still appears valid. However, the merger mania of the 1980's must now be added as a major cause of increased concentration since 1977.

#### V. Policy Implications

The Celler-Kefauver Act of 1950 amended Section 7 of the Clayton Act to make illegal mergers in which the effect "may be substantially to lessen competition, or to tend to create a monopoly." The objective of amended Section 7 is to prevent merger-induced structural changes that are far short of a monopoly. The law was designed to forestall anticompetitive mergers in their incipiency. Hence the language "may substantially lessen" is anticipatory in character and allows challenging mergers before adverse consequences have occurred.

The Department of Justice in 1982 and 1984 revised the merger guidelines from previous administrations. The 1984 guidelines establish three categories of enforcement, depending on the post-merger Herfindahl Index (HHI) in the relevant product and geographic markets.

- a. Post-merger HHI below 1000--unconcentrated markets. Mergers will not be challenged.

- b. Post-merger HHI between 1000 and 1800--Mergers that increase HHI by 100 points or more are likely to be challenged.
- c. Post-merger HHI above 1800--Mergers that increase HHI by 50 points or more are likely to be challenged.

We examined the mergers in the six case industries to determine if they violated the DOJ guidelines. To do so, we assumed the industries as we defined them were the relevant product market, and that the relevant geographic market in all cases was national. We recognize that these assumptions are clearly not appropriate in some cases. For example, the relevant procurement markets for beef packers and broiler processors are local, not national. And soybean processors and corn wet millers operate in more than one product market and in geographic markets that are often international. The relevant product market in some cases is broader than the industries examined (soybean oil, cottonseed oil, corn oil and other vegetable oils are probably all in the same product market). In other cases, product markets are narrower than the industries examined (e.g., flour in consumer packages).

In addition, since we did not have sufficient data to calculate a full Herfindahl Index, we used the four-firm HHI as a proxy. The result of the above assumptions and procedures is to bias our estimates to an unknown degree. In some cases our Herfindahl values likely overstate the Herfindahl for the relevant geographic and product market; in other cases we probably understate the correct value. Thus, some mergers that did not violate the DOJ guidelines by our estimates may, in fact, have been violations given more accurate data, and vice versa. We also make no attempt to determine if some of these mergers involved failing firms, in which case they might be permitted



even though violating the guidelines. Given these caveats, we still believe our assessment provides a rough approximation of the number of mergers that violated DOJ guidelines.

By our estimates, there were seven mergers that violated the Department of Justice merger guidelines in the six case industries (Table 14). All seven occurred between 1982 and 1988.

Table 14. Mergers which Violated the Department of Justice Merger Guidelines in the Six Case Industries, 1977-1988.

Industry	Merger	Post-merger HHI <sub>4</sub>	Increase in HHI <sup>a</sup>
Flour Milling	ConAgra acq. of Int'l Multifood (1988)	1016	225
Soybean Oil Milling	ADM acq. of 5 A.E. Staley plants (Jan. '85)	1157	228
	Cargill acq. of 5 Purina plants (Feb. '85)	1368	215
	ADM acq. of 1 Continental Grain plant (1985)	1477	105
	ADM acq. of 1 Gold Kist plant (1987)	1596	100
Wet Corn Milling	ADM acq. of 2 Clinton Corn plants (1982)	1547	262
Beef Packing	ConAgra acq. of SIPCO- ValAgri (Sept. 1987)	1432	211

a/ Increase in HHI is calculated using DOJ formula.

Increase =  $(a+b)^2 - (a^2+b^2)$  where (a) and (b) are pre-merger market shares of two firms

The above picture is consistent with the beliefs of many: The antitrust laws were not enforced vigorously during the 1980s. This clearly was the case for Section 7 of the Clayton Act. Mergers that would have been challenged

under previous administrations were allowed during the Reagan years. The merger guidelines that were published in 1982 and 1984 were considered a relaxation of previous standards. However, even these relaxed standards were not enforced in the six industries examined in this paper.

References

- American Soybean Association, Soya Blue Book, 1977 - 1988.
- Brander, James A. and Barbara J. Spencer. "International R&D Rivalry and Industrial Strategy," Review of Economic Studies, Volume 50 (1983), pp. 707-22.
- Broiler Industry, 1977-1990.
- Committee on Small Business, U.S. House of Representatives, Small Business Problems in the Marketing of Meat and Other Commodities, U.S. Government Printing Office, Part 4 - Changing Structure of the Beef Packing Industry, 1979.
- Connor, John M. et al., The Food Manufacturing Industries - Structure, Strategies, Performance, and Policies, Lexington books, 1985.
- Connor, John M. and Geithman, Frederick E., "Mergers in the Food Industries: Trends, Motives, and Policies," Agribusiness, Vol. 4(4), 1988, pp. 331 - 346.
- Demsetz, H., "The Trust Behind Antitrust," Industrial Concentration and the Market System, American Bar Association Press, Chicago, IL, 1979.
- Feedstuffs, January 23, 1989 and January 22, 1990.
- Food Institute Report, August 11, 1984, October 17, 1987, May 28, 1988, and January 21, 1989.
- Greer, Douglas F., Industrial Organization and Public Policy, Second Edition, MacMillan Publishing Company, New York, 1984.
- Harwood, Joy et al., "Structural Change in the U.S. Wheat Milling Industry", USDA, ERS, Wheat - Situation and Outlook Report, 1988.
- Henderson, Dennis R., "Implications of Globalization for Industrial Structure Policy: Lessons from the Food Industries," presented at National Public Policy Education Conf., Park City, Utah, Sept. 17-20, 1990.
- Krugman, Paul R. "Industrial Organization and International Trade," Ch. 20 in Handbook of Industrial Organization, R. Schmalensee et al., eds. Amsterdam: North-Holland, 1989.
- Marion, Bruce W. et al., The Organization and Performance of the U.S. Food System, Lexington Books, 1986.
- Marion, Bruce W., "Restructuring of Meat Packing Industries; Implication for Farmers and Consumers (Unpublished)," Testimony presented at hearings held by the House Agricultural Committee of the Iowa State Legislature, 1988.

Meat and Poultry, January 1987, January 1988, and January 1989.

Milling and Baking News, Milling Directory - Buyer's Guide, Sosland Publishing Company, Kansas City, 1989.

Mueller, Willard F., "Concentration and Merger Activity Since World War II," Select Committee on Small Business, United States Senate, March 15, 1967.

Mueller, Willard F. and Hamm, Larry G., "Trends in Industrial Market Structure, 1947 to 1970," Review of Economics and Statistics, Vol. 66, 1974

Mueller, Willard F. and Rogers, Richard T., "The Role of Advertising in Changing Concentration of Manufacturing Industries," Review of Economics and Statistics, Vol. LXII (1), February, 1980.

Mueller, Willard F. and Rogers, Richard T., "Changes in Market Concentration of Manufacturing Industries, 1947 - 1977," Review of Industrial Organization, 1984.

Mueller, Willard F., "An Overview of the Competitive Organization and Performance of the Food Manufacturing Industries", Prepared Statement for Hearings on Mergers and Concentration: The Food Industries, Subcommittee on Monopolies and Commercial Law of Committee on Judiciary, House of Representatives, May 11, 1988.

Nelson, Kenneth E., Issues and Developments in the U.S. Meatpacking Industry, USDA, ERS, 1985.

Porter, Michael E., The Competitive Advantage of Nations. New York: The Free Press, 1990(B).

Rose, John W., "Firm Histories - Meat Packing Industry; ConAgra, Excel, and IBP (Mimeo)," 1989.

Shepherd, William G., "Causes of Increased Competition in the U.S. Economy, 1939 - 1980," Review of Economics and Statistics, Vol. LXIV(4), 1982.

The Food Institute, Food Business - Mergers and Acquisitions, 1978 - 1988.

The National Cottonseed Products Association, The International Greenbook of Cottonseed and Other Vegetable Oil Products, 1986 - 1987, The Cotton Gin and Oil Mill Press, Dallas, 1987.

The National Cottonseed Products Association, Directory of Manufactures and Suppliers of Cottonseed Products, 1977-1989.

U.S. Department of Agriculture, Economic Research Service, Food Marketing Review, 1989.

- U.S. Department of Agriculture, Packers and Stockyard Administration, Packers and Stockyards Statistical Report, 1987 (and Previous issues).
- U.S. Department of Agriculture, Statistical Reporting Service, Poultry Slaughter, 1978-1990.
- U.S. Department of Commerce, Bureau of the Census, 1982 Census of Manufactures, Washington, D.C.
- Weiss, Leonard, "The Concentration-Profit Relationships and Antitrust," Industrial Concentration: The New Learning, Edited by Harvey J. Goldschmid, Boston, 1974.
- Weiss, Leonard, Concentration and Price, The MIT Press, 1989.

#### Appendix A: Construction of CR4 and Source of Data.

In all industries but the broiler processing industry, the four-firm concentration ratios were constructed based upon each firm's processing capacity. In order to investigate the cause of changes in concentration, we need to decompose changes in the four-firm concentration ratio into those caused by mergers and acquisitions or those by internal expansions of the firm. In this regard, two four-firm concentration ratios were constructed; the actual CR4 and the CR4 without mergers and acquisitions. The actual CR4 was constructed based upon the capacities of the plants currently held. In contrast, the CR4 without acquisitions was calculated on the assumption that mergers and acquisitions did not take place. That is to say, the ratio was constructed based upon the capacities of plants originally owned or built. It allows only changes in processing capacity due to internal expansion or contraction.

The construction of the CR4 was made possible by identifying the capacity and ownership of individual plants. The data and information sources used are as follows:

##### Flour milling industry

The main sources of capacity figures and merger records were Joy L. Harwood et. al, "Structural Change in the U.S. Wheat Milling Industry" in USDA, ERS, Wheat - Situation and Outlook Report, 1988 and Milling and Baking News, the Milling Directory, 1989.

### Soybean crushing industry

The ownership and capacity of each plant was identified over the period based on the directory of soybean meal and oil processors in American Soybean Association, Soya Blue Book. Since the capacity figures are not available for every year, the daily crushing capacities (metric tons) for plants in 1983 were applied to all years.

### Wet corn milling industry

The directory of U.S. corn refiners in Milling and Baking News, Milling Directory and company annual reports were used to figure out changes in the ownership and milling capacity of individual plant. The capacity is 24 hour grinding capacity (bushels). Since the capacity figures for CPC were not available, the average plant size of the industry was used as an estimate of CPC capacity per plant.

### Cottonseed oil mills

The major source for plant identification is the National Cottonseed Products Association, Directory of Manufacturers and Suppliers of Cottonseed Products. Daily milling capacity (metric ton) of each plant was quoted from the estimates by Bruce J. Reynolds, USDA, Agricultural Cooperative Service.

### Beef packing industry

The share of steer and heifer slaughter accounted for by the largest four packers was provided by the Packers and Stockyard Administration, USDA (Unpublished). The actual slaughter figures of individual firms were available only for 1977 by Committee on Small Business, House of Representatives, Small Business Problems in the Marketing of Meat and Other Commodities (Part 4 - Changing Structure



of the Beef Packing Industry), 1979. Data for the recent capacity of individual plants of the leading packers were found in the Food Institute Report, October 17, 1987, Meat and Poultry, January, 1988, and John Rose, "Firm Histories - Meat Packing Industry (Mimeo)," 1989.

#### Broiler processing industry

The CR4 was constructed from the estimated slaughter figures published in Broiler Industry magazine. Weekly slaughter data for individual firms were converted to annual data on the assumption that a year is equivalent to 50 weeks. Total annual industry slaughter was taken from USDA, Statistical Reporting Service, Poultry Slaughter.

Appendix B: Individual Company Market Share Estimates, Six Selected Industries.

Appendix Table I. Daily Flour Milling Capacities of the Leading Milling Companies, 1978-1988.

		(1,000 cwt)		
		1978	1983	1988
ConAgra	A	93.0	118.0	64.9
	B	93.0	216.5	270.0
	(%)	(8.5)	(18.4)	(23.2)
	rank	4	1	1
	acquisitions:	Peavey (98.5) in 1982 Standard Milling (16.3) in 1983 Sunshine Biscuits (10.0) in 1987 International Multifood (80.3) in 1988		
ADM	A	96.0	99.0	150.7
	B	96.0	123.0	174.7
	(%)	(8.7)	(10.5)	(15.0)
	rank	3	3	2
	acquisitions:	Centennial Mills (24.0) in 1978		
Cargill	A	46.0	43.0	50.1
	B	46.0	134.0	141.1
	(%)	(4.2)	(11.4)	(12.1)
	rank	9	2	3
	acquisitions:	Seaboard Allied Milling (91.0) in 1981		
Pillsbury	A	111.6	121.4	108.7
	B	111.6	121.4	119.7
	(%)	(10.1)	(10.3)	(10.3)
	rank	1	4	4
	acquisitions:	Tennant & Hoyt Co. (11.0) in 1987		
International Multifood	A	71.9	78.1	(ConAgra)
	B	71.9	78.1	
	(%)	(6.5)	(6.7)	
	rank	6	5	
Dixie-portland Flour Mills	A	47.0	51.0	55.0
	B	47.0	51.0	55.0
	(%)	(4.3)	(4.3)	(4.7)
	rank	8	7	8

		1978	1983	1988
Seaboard Allied Milling Corp.	A	91.0	( Cargill )	
	B	91.0		
	(%)	(8.3)		
	rank	5		
Peavey Co.	A	98.5	( ConAgra )	
	B	98.5		
	(%)	(9.0)		
	rank	2		
General Mills	A	55.1	55.1	63.8
	B	55.1	55.1	63.8
	(%)	(5.0)	(4.7)	(5.5)
	rank	7	6	6
RJR Nabisco	A	44.5	43.0	28.0
	B	44.5	43.0	28.0
	(%)	(4.0)	(3.7)	(2.4)
	rank	10	8	9
Cereal Food Proc. Inc.	A	21.9	31.3	68.3
	B	21.9	31.3	68.3
	(%)	(2.0)	(2.7)	(5.9)
	rank			5
Bay State Milling Co.	A	34.9	34.0	58.4
	B	34.9	34.0	58.4
	(%)	(3.2)	(2.9)	(5.0)
	rank			7
Total Capacity		1099.6	1174.2	1163.0
Actual CR4		36.3	50.6	60.6
CR4 Without Acquisitions		36.3	37.2	38.6

A: original capacity without acquisitions.  
 B: actual capacity.

Source: Joy L. Harwood et. al, "Structural Change in the U.S. wheat Milling Industry", USDA, Wheat: Situation and Outlook Report, November, 1988.  
 Milling and Baking News, Milling Directory.

Appendix Table II. Plant Numbers and Daily Crushing Capacities of the Leading Soybean Crushers, 1977-1988.

							(tons)
		1977		1982		1988	
		plant#	capa.	plant#	capa.	plant#	capa.
ADM	A	13	18,590	11	17,990	9	17,340
	B	13	18,590	15	22,030	18	32,035
	(%)		(14.6)		(17.8)		(29.6)
	rank		2		1		1
	acquisitions:		Buckeye Cellulose		3 Plants	3140 t in 1982	
			Planters Mfg. Co.		1 Plant	900 t in 1982	
			A.E.Staley		5 Plants	6975 t in 1985	
			Continental Grain		1 Plant	2400 t in 1985	
			Gold Kist		1 plant	2000 t in 1987	
	Cargill	A	13	19,190	13	19,190	9
B		13	19,190	14	19,490	15	23,700
(%)			(15.1)		(15.8)		(21.9)
rank			1		2		2
acquisitions:		Hartville Oil		1 Plant	300 t in 1982		
		Anderson Clayton		1 Plant	1500 t in 1983		
		Ralston Purina		5 Plants	6300 t in 1985		
Bunge	A	3	6,550	3	6,550	3	6,550
	B	3	6,550	5	9,350	8	13,850
	(%)		(5.1)		(7.6)		(12.8)
	rank		7		4		3
	acquisitions:		Cook Ind. Inc.		2 Plants	2800 t in 1978	
		Gold Kist		1 Plant	2500 t in 1983		
		Anderson Clayton		2 plants	2200 t in 1984		
Central Soya	A	11	12,640	9	12,040	7	11,440
	B	11	12,640	9	12,040	7	11,440
	(%)		(9.9)		(9.7)		(10.6)
	rank		3		3		5
Ag Processing	A	-	-	-	-	-	-
	B	-	-	-	-	8	13,100
	(%)						(12.1)
	rank						4
	acquisitions:		Farm land Inc.		3 Plant	4400 t in 1984	
		Boone Valley Coop.		1 Plant	4200 t in 1984		
		Land O'Lakes		2 Plants	2500 t in 1984		
		American Grain		2 Plants	2000 t in 1986		
Anderson Clayton	A	4	4,000	4	4,000	(Cargill and	
	B	4	4,000	4	4,000	Bunge )	
	(%)		(3.1)		(3.2)		

	1977		1982		1988	
	plant#	capa.	plant#	capa.	plant#	capa.
A.E. Staley	A 4	7,975	4	7,975		
	B 4	7,975	4	7,975	( A D M )	
	(%)	(6.3)		(6.4)		
	rank					
	acquisitions: Long-term lease of MFA Grain Mkt 1 plant (1500t) in 1983					
	A 6	8,700	6	8,700		
Ralston Purina	B 6	8,700	6	8,700	( Cargill )	
	(%)	(6.8)		(7.0)		
	rank	4				
Total	118	127,229	100	123,664	76	108,159
Actual CR4		46.4		50.9		76.4
CR4 Without Acquisitions		46.4		46.8		49.8

A: original capacity without acquisition.

B: actual capacity.

Source: American Soybean Association, Soya Bluebook, 1977 - 1988.

Appendix Table III. Plant Numbers and Capacities of the Leading Corn Refiners, 1977-1988.

		(bushels)					
		1977		1982		1988	
		plant#	capa. <sup>a</sup>	plant#	capa.	plant#	capa.
ADM	A	1	80,000	2	400,000	2	510,000
	B	1	80,000	4	540,000	4	650,000
	(%)		(5.9)		(26.1)		(27.8)
	rank				1		1
acquisitions: Long-term lease of Clinton Corn (Nabisco Brands) 2 plants 140,000 bus in 1982							
Staley	A	3	250,000	4	380,000	5	435,000
	B	3	250,000	4	380,000	5	470,000
	(%)		(18.6)		(18.3)		(20.1)
	rank		2		2		2
acquisitions: Anheuser Busch 1 plant 35,000 bus in 1985							
CPC <sup>b</sup>	A	4	254,000	4	371,000	3	312,000
	B	4	254,000	4	371,000	3	312,000
	(%)		(18.9)		(17.9)		(13.4)
	rank		1		3		4
Cargill	A	3	200,000	3	300,000	4	395,000
	B	3	200,000	3	300,000	4	395,000
	(%)		(14.9)		(14.5)		(16.9)
	rank		3		4		3
American Maize (American Fructose corp)	A	1	80,000	2	140,000	2	140,000
	B	1	80,000	2	140,000	3	175,000
	(%)		(6.0)		(6.8)		(7.5)
	rank						
acquisitions: Dimmit corn division of Amstar in 1984 (Dimmit, TX) 35,000 bus							
Grain Processing		1	110,000	1	110,000	1	110,000
	(%)		(8.2)		(5.3)		(4.7)
rank							
National Starch (Unilever)		1	65,000	1	65,000	2	125,000
	(%)		(4.8)		(3.2)		(5.3)
rank							

	1977		1982			1988	
	plant#	capa.	plant	capa.	plant	capa.	
Clinton Corn (%) rank	2	140,000 (10.4) 4	(	A D	M	.	)
Hubinger (H. J. (%) Heinz)	1	100,000 (7.4)	1	100,000 (4.8)	1	100,000 (4.3)	
Anheuser Busch (%)	1	30,000 (2.2)	1	30,000 (1.4)	(	Staley	)
Amstar (%)	1	35,000 (2.6)	1	35,000 (1.7)	(	American Maize)	)
Total	19	1,344,000	22	2,071,000	23	2,337,000	
Actual CR4		62.8		76.8		78.2	
CR4 Without Acquisitions		62.8		70.1		70.7	

a/ 24 hour grinding capacity.

b/ Capacities are estimated based on the industry's average plant size.

A: original capacity without acquisitions.

B: actual capacity.

Source: Milling Directories, 1977, 1982, and 1988.  
Company annual reports.

Appendix Table IV. Plant Numbers and Capacities of the Leading Cottonseed Oil Mills, 1977-1988.

		(tons)					
		1977		1982		1988	
		plant#	capa.	plant#	capa.	plant#	capa.
ADM	A	6	1,135	4	615	4	615
	B	6	1,135	9	3,235	10	3,585
	(%)		(5.5)		(17.6)		(24.9)
	rank				1		1
acquisitions: Lubbock Cotton Oil (TX) 1 plant (250) in 1981							
Sweetwater Cotton Oil (TX) 1 plant (350) in 1981							
Buckeye Cellulose Corp. 3 plants (1620)							
(Montgomery, N. Little Rock, Memphis) in 1981							
Planters Mfg (Clarksdale, MS) 1 plant (400)							
in 1982							
Plainview Oil Mill (Plainview, TX) 1 plant							
(200) in 1985							
Quannah Cotton Oil (TX) 1 plant (320) in 1985							
Plains Coop		1	1,200	1	1,200	1	1,200
	(%)		(5.9)		(6.5)		(8.3)
	rank		4		4		2
Anderson Clayton		7	2,170	7	2,170	( Paymaster and	
	(%)		(10.6)		(11.8)	Western Cotton	
	rank		1		2	Serv.)	
Paymaster Oil Mill			-		-	3	1,000
(Itnl Protein	(%)						(6.9)
Corp)	rank						3
acquisitions: Anderson Clayton 3 plants (1000) in 1988							
Western Cotton Serv.			-		-	2	750
(Julian Corp)	(%)						(5.2)
	rank						4
acquisitions: Anderson Clayton 2 plants (750) in 1987							
Ranchers Cotton Oil		2	1,600	2	1,600	1	600
	(%)		(7.8)		(8.7)		(4.2)
	rank		3		3		
Buckeye Oilseed							
(Proctor & Gamble)		1	220	1	220	2	400
	(%)		(1.1)		(1.2)		(2.8)
	rank						
acquisitions: Levelland Vegetable Oil 1 plant (180)							
in 1982							



	1977		1982		1988	
	plant#	capa.	plant#	capa.	plant#	capa.
Buckeye Cellulose	5	1,880 (9.2) 2	(	ADM	)	
Producers Cotton Oil (%) rank	2	670 (3.3)	2	670 (3.6)	1	550 (3.8)
Yazoo Valley Cotton Oil (%) rank	2	630 (3.1)	1	500 (2.7)	1	500 (3.5)
Producers Coop Oil Mill (%) rank	1	500 (2.4)	1	500 (2.7)	1	500 (3.5)
Osceola (%) rank	2	330 (1.6)	2	330 (1.8)	3	720 (5.0)
Total	90	20,505	57	18,425	52	14,405
Actual CR4		33.4		44.5		45.4
CR4 Without		33.4		37.2		41.4

A: original capacity without acquisitions.

B: actual capacity.

Source: Directories of Manufacturers and Supplier of Cottonseed Products, 1977-1989.

Capacity estimates are from the USDA.

Appendix Table V. Annual Slaughter and Daily Packing Capacities of the Leading Beef Packers (Steer and Heifer), 1977 - 1988.

		1977 <sup>a</sup>	1982		1988	
		annual slaughter (head/year)	plant# (head/day)	capa. (head/day)	plant# (head/day)	capa. (head/day)
IBP	A	3,741,387	10	22,765	9	27,064
	B		11	25,865	10	30,164
	(%)	(13.0)		(20.9)		(27.0)
	rank	1		1		1
	acquisitions: Illini Beef Packer (IL) 1 plant (3,100) in 1982					
ConAgra	A	-		-		-
	B				8	23,600
	(%)					(21.1)
	rank					2
	acquisitions: Armour Food (Idaho) 1 plant (850) in 1983 Northern States Beef (NE) 1 plant (950) in 1985 E.A. Miller (Utah) 1 plant (1,600) in 1987 Monfort of Colorado 2 plants (10,000) in 1987 SIPCO/Val-Agri 6 plants (10,200) in 1987					
Excel	A	1,407,192	5	14,975	4	11,975
	B		5	14,975	7	19,175
	(%)	(4.9)		(12.1)		(17.1)
	rank	3		2		3
	acquisitions: Sterling Beef 2 plants (4,000) in 1987 Spencer Beef 1 plant (3,200) in 1987					
Beef America	A	-		-		-
	B				5	5,000
	(%)					(4.5)
	rank					4
	acquisitions: Dubuque Packing 4 plants (4,000) in 1988 Beef Nebraska 1 plant (1,000) in 1988					
National Beef Packing	A	564,830	1	4,800	1	4,800
	B		1	4,800	1	4,800
	(%)	(2.0)		(3.9)		(4.3)
Swift	A	1,988,245	4	10,287		
	B		3	7,787		(ConAgra)
	(%)	(6.9)		(6.3)		
	rank	2		3		

		1977 annual slaughter (head/year)	1982 plant# (head/day)	1988 capa. (head/day)	1988 plant# (head/day)	capa.
Val-Agri	A	-	-	-		
	B	-	1	3,200	(ConAgra)	
	(%)			(2.6)		
	acquisitions: Farmland Foods 1 plant (3,200) in 1981					
Monfort	A	525,408	1	2,500		
	B		2	5,000	(ConAgra)	
	(%)	(1.8)		(4.0)		
	acquisitions: Swift 1 plant (Grand Island,NE; 2,500) in 1979					
E.A. Miller	A	-	1	1,600		
	B		1	1,600	(ConAgra)	
	(%)			(1.3)		
Spencer Beef	A	1,231,524	3	6,950		
	B		3	6,950	(Excel)	
	(%)	(4.3)		(5.6)		
	rank	4		4		
Sterling Beef	A	-	1	2,000		
	B		2	4,000	(Excel)	
	(%)			(3.2)		
	acquisitions : Morgan Colorado 1 plant (2000) in 1980					
Dubuque	A	995,351	4	4,000		
	B		4	4,000	(Beef America)	
	(%)	(3.5)		(3.2)		
John Morrel	A	994,523	2	3,500	1	1,750
	B		2	3,500	1	1,750
	(%)	(3.5)		(2.8)		(1.6)
	rank					
<hr/>						
Total		28,676,283		123,527		111,821
Actual CR4		29.1		45.0		69.7
CR4 Without Acquisitions		29.1		44.5		50.3

a/ Annual slaughter head of steer and heifer.

A: original capacity without acquisitions.

B: actual capacity.

Source: Food Institute Report, Oct. 17, 1987 (daily capacities for IBP)  
Meat and Poultry, Jan., 1988 (daily capacities for the leading beef packers)  
John W. Rose, Firm Histories - Meat Packing Industry (Unpublished) (daily capacities for ConAgra, IBP, and Excel)  
M.D. Faminow et al., Economic Analysis of the Location of Fed Cattle Slaughtering and Processing in the United States, p.41 (annual capacities for several slaughtering plants)  
Committee on Small Business, U.S. House of Representatives, Small Business Problems in the Marketing of Meat and Other Commodities (Part 4) (annual slaughter of the 50 largest beef packers).

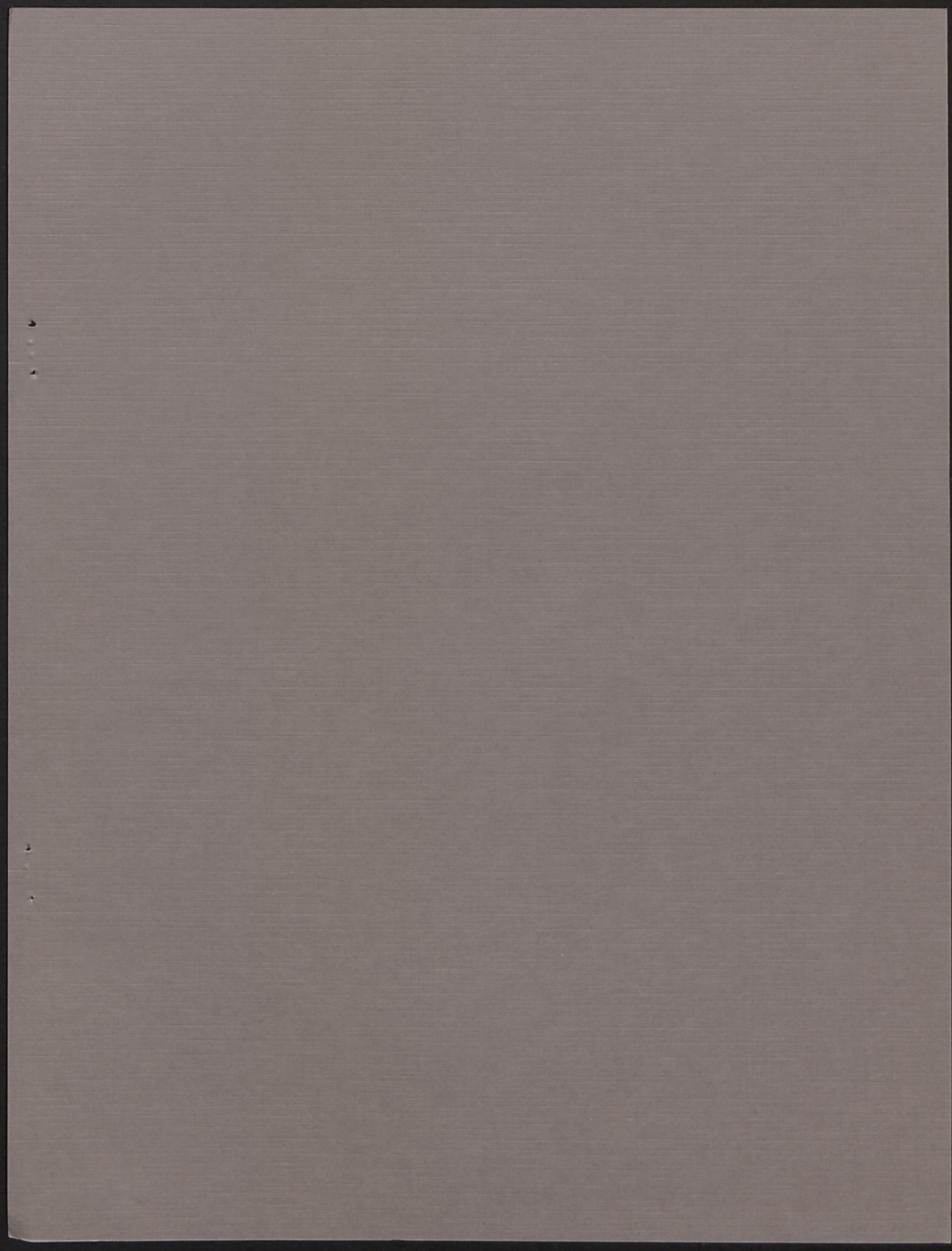
Appendix Table VI. Weekly Slaughter Head by the Leading Broiler Processors, 1977 - 1988.

		(Million head/week)			
		1977	1982	1988	1989
Tyson Foods	A	2.75	3.7	5.0	5.7
	B	2.75	3.7	13.9	23.9
	(%)	(4.1)	(4.5)	(13.6)	(21.8)
	rank	4	5	1	1
	acquisitions: Valmac Industries (3.8) in 1984 Lane Processing (3.9) in 1986 Holly Farms Foods (6.9) in 1989				
ConAgra	A	1.75	3.2	3.6	3.8
	B	1.75	8.9	10.0	10.5
	(%)	(2.6)	(10.9)	(9.8)	(9.6)
	rank	10	1	2	2
	acquisitions: Banquet Foods (1.3) in 1980 Country Pride (4.2) in 1982				
Gold Kist	A	3.5	6.3	8.86	9.1
	B	3.5	6.3	8.86	9.1
	(%)	(5.3)	(7.7)	(8.7)	(8.3)
	rank	2	2	3	3
Perdue	A	2.5	3.23	5.24	5.66
	B	2.5	4.0	6.5	7.02
	(%)	(3.8)	(4.9)	(6.4)	(6.4)
	rank	6	4	5	4
	acquisitions: Golden Pride (0.8) in 1979 White Poultry (0.4) in 1985				
Holly Farms Food	A	4.0	5.48	6.0	(Tyson)
	B	4.0	5.48	6.9	
	(%)	(6.0)	(6.7)	(6.8)	
	rank	1	3	4	
	acquisitions: Victor Weaver (0.8) in 1987				
Pilgrim Pride	A	0.6	2.5	4.24	4.37
	B	0.6	2.5	4.85	5.0
	(%)	(0.9)	(3.1)	(4.7)	(4.6)
	rank	26	9	6	5
	acquisitions: Plus-Tex (0.4) in 1985				

		1977	1982	1988	1989
Valmac Ind.	A	3.5	3.2	(	Tyson )
	B	3.5	3.2		
	(%)	(5.3)	(3.9)		
	rank	3	7		
<hr/>					
Total		66.6	81.4	102.2	109.8
Actual CR4		20.6	30.3	38.8	46.0
CR4 Without Acquisitions		20.6	23.0	24.6	24.1

A: original capacity without acquisitions.  
 B: actual capacity.

Source: Broiler Industry and USDA, Poultry Slaughter.





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