CHAPTER 6

DATA FOR EMPIRICAL ANALYSES
OF FSA AUCTIONS

Introduction

FSA amasses data while administering auctions, data that can be used to investigate the factors driving bids and to compare FSA bids with private sector prices for comparable items, as a step in evaluating auction strategy. To perform that evaluation, FSA provided ERS with auction records for five commodity categories—all-purpose flour, bakery flour, pasta products, vegetable oil, and peanut butter—for the 5 years covering January 1992 through December 1996.

This initial analysis focused on just five commodity categories because that seemed like a manageable number for a new project. The records were not kept in electronic format, but in paper archives, and included separate records for approximately 2,000 to 6,000 auctions for each commodity category. Coding the records into electronic format was a major task, and limited our original commodity coverage.

The five chosen were important FSA commodities that were closely linked to related agricultural commodities (wheat, peanuts, and soybean and cottonseed oils) with reliable data on prices. The major omitted category, cheese, is a large category undergoing substantial changes in agricultural commodity pricing. ERS will investigate cheese auctions in later analyses.

Data Sources and Definitions of Variables

Auction Records

Much of the data are derived from records ("PPCR30 forms") generated by FSA during the bidding process. Each record refers to an auction of a specific commodity on a specific date for delivery to a warehouse within a State (or to a plant for further processing) during a specified 2-week time window, generally 5-8 weeks after the auction (see table 4-1).

Each record specifies the commodity up for bid, with a precise description of package size and distinguishing product characteristics. It specifies the quantity up for bid (usually between one and five truckloads, but specified in pounds), as well as the place and the State to which the product is to be delivered. Separate bidder codes identify each bidder, the bidder's price, whether a bidder is a qualified small business, and the "constructed price" developed by FSA prior to the auction. The file also identifies the date of the auction and the month and 2-week time window (first or second half of a month) for delivery.

Most of our discussion in this report emphasizes the lowest bid in FSA auctions, which also is usually, but not always, the winning bid (see chapters 2 and 4 for an overview of the process and the determination of winning bids). Some analyses investigate a dataset consist-

ing of all bids in a commodity category, although we can say that the general factors driving low bids also drive other bids. In the sections that follow, we discuss the explanatory variables that we think account for fluctuations in bids.

Specific Agricultural Price Measures

We expected that FSA bids would be closely linked to price movements in related underlying agricultural commodities. Moreover, key agricultural prices showed a strong pattern during the period: wheat and oilseed prices rose sharply from 1992 through 1995, before abating somewhat in late 1996. To analyze that linkage, we obtained monthly USDA price data for key commodities. We generally developed price series for three variables: the average cash price in the month of delivery, the change in the average cash price between the delivery month and the following month, and the change in the average cash price between the delivery month and the prior month. By using these measures, we can distinguish the effects of longrun shifts in price from shortrun shocks. That distinction turns out to be useful (chapter 7) because it appears that month-to-month price fluctuations have little or no effect on FSA prices, while longer run shifts have large effects.

All-purpose flour uses a variety of different wheats. In our statistical analysis, we found that one wheat price series fit the data best, and that other price series added no additional explanatory power to our models. Consequently, we relied on the series for No. 2 Soft Red Winter Wheat (St. Louis). For bakery flour, we found that a different series fit the data best, so we relied on prices for No. 1 Hard Red Winter Wheat, Ordinary Protein (Kansas City). Pasta uses durum wheat, so we relied on the price series for No. 1 Hard Amber Durum (Minneapolis). All three monthly wheat price series are reported in the *1997 Wheat Yearbook* (ERS/USDA).

In contrast to flour and pasta, we found that two agricultural price series were important in explaining FSA vegetable oil bids. Soybean oil is the primary ingredient, but cottonseed oil is also important and statistically relevant. We consequently used wholesale prices for Crude Soybean Oil (Decatur) and the Crude Cottonseed Oil (Mississippi Valley points), as reported in the *Oil Crops Yearbook* (ERS/USDA).

Peanut butter presented more of a challenge. Peanut

butter is purchased throughout the year, so we have FSA monthly prices for the product, but peanuts are marketed only in part of the year, so peanut prices are generally available for the period from August through January. We tried several approaches to handle months outside of the marketing year. First, we dispensed with monthly peanut price data and used average annual (marketing year) prices for each month, but found that they fit the data poorly. We then used monthly data, and assigned the price for January (the last observed price) to the remaining months before a new marketing year. Finally, the best specification used that second approach, but allowed the regression coefficient on the January price to vary by month during the rest of the year. In other words, the third approach added interaction terms between the assigned monthly price and the month. Monthly peanut prices were also taken from the *Oil Crops Yearbook.*

Specific Measures of Purchase Scale

Chapter 3 showed that FSA commodity purchases declined sharply during the 1992-96 period. We wanted to assess the effect of that decline, if any, on prices. To do that, we used the PPCR30 records and calculated monthly sums of FSA purchases; we refer to that measure as the monthly "FSA volume" in a commodity category.

FSA volumes are not the only "volume effect" worthy of study. FSA also purchases quantities of commodities for delivery overseas, and these vary widely from month to month. We wanted to know whether FSA foreign purchase volumes affect domestic purchase prices. We obtained data on monthly commodity volume in international (PL480) auctions for flour and vegetable oil products, and designated these as "PL480 volume." We matched PL480 volumes to the delivery months of FSA domestic auctions, but our analysis is limited by an important problem of timing. Our domestic volumes measure the amount to be delivered in any month, but the PL480 variable measures the amount that is contracted for in any month—and contracting occurs some time before delivery. As a result, the two volume measures may not match up appropriately.

The amount of a product to be delivered to any specific domestic location in any particular auction also varies in the data; generally, from one to five truckloads are up for bid for delivery to a particular location in a particular time window. We wanted to know whether these

Table 6-1--Product characteristics and their share of commodity category auctions

Commodity & characteristic[1]	Auction share	Commodity & characteristic	Auction share
	Percent		*Percent*
All-purpose flour (5,727)		**Bakery flour** (1,712)	
5-lb. bag	34.47	50-lb. bag	9.58
10-lb. bag	46.20	100-lb. bag	13.64
50-lb. bag	19.20	Bulk	76.78
100-lb. bag	0.13	Unbleached	33.85
Unbleached	1.83	Bleached	66.15
Bleached	98.17	Hearth	13.30
Pasta (4,781)		**Shortening & vegetable oil** (7,153)	
Spaghetti, 2-lb. box	12.38	Shortening, 3-lb. can	24.60
Spaghetti, 20-lb. carton	25.37	Shortening, 50-lb. cube	3.86
Macaroni, 1-lb. box	17.71	Shortening, 1-gal. can	11.17
Macaroni, 20-lb. carton	24.05	Vegetable oil, 48 oz. bottle	1.54
Rotini, 20-lb. carton	20.49	Vegetable oil, Bulk	7.95
		Vegetable oil, 1-gal. bottle	50.88
Peanut butter (5,243)			
Smooth, 2-lb. can	66.53		
Smooth, # 10 can	33.28		
Reduced fat, smooth, # 10	0.19		

[1]Numbers in parentheses are the total number of auctions analyzed in each commodity category.

variations in auction quantity (designated in our tables as "truckloads in order") have any effect on prices, and so we retained this variable directly from the PPCR30 records. Finally, inspection of the data reveals that there are large and persistent product flows to some locations, but other locations receive only small and sporadic deliveries. We suspected that remote locations that rarely received deliveries might be bid at higher prices. To investigate that possibility, we calculated the total number of auctions for a location in the 1992-96 period from the PPCR30 records, and designated that variable as "total orders at location."

Measures of Product Characteristics

Each of the five commodity categories contains a variety of specific products distinguished by package size and by product characteristics. These factors can have important effects on costs and prices, and need to be controlled for in analyses. All of our measures were taken directly from the PPCR30 forms.

We dropped some very rare commodity types and package sizes from the analysis. In addition, we dropped some auctions with incomplete or inaccurate data, and

those with delivery destinations outside the 48 contiguous United States. Table 6-1 lists the package sizes and product characteristics for the products retained for each commodity category, as well as the share of each in the commodity category auctions that were retained for the analysis. Numbers in parentheses are the total number of auctions retained for analysis in each commodity category.

Measures of Competition

We used the PPCR30 forms to determine the number of bidders in each auction. Because we thought it likely that the effect of an additional competitor on price would depend on the number of existing bidders, we did not simply use the number of bidders as an explanatory variable (MacDonald, 1987). Instead, we defined a series of categorical variables, each of which takes a value of zero or one. If an auction had a single bidder, a variable defined as "one bidder" would take on a value of one, while other bidder variables would be zero. If an auction had two bidders, the variable "two bidders" would be set equal to one, and others set to zero; similar variables were specified for each level of competition. Tables 6-3 through 6-7 (discussed below) summarize bidder numbers across the different commodity groups and over time.

Seasonal and Locational Effects

FSA prices clearly vary with the location to which a product is delivered. For example, to deliver bakery flour to Vermont, either wheat or flour will have to be shipped there, incurring greater transport costs than if an order of flour were to be delivered to a client in Kansas. To account for location, we entered separate State effects. When State effects are entered, the coefficients on other variables show how prices vary from the State-specific means as other variables vary from their State-specific means; the State coefficients then show how mean prices vary from State to State.

Similarly, FSA prices and orders show clear seasonal variations. Because our analyses control for underlying

Table 6-2--Monthly variation in FSA auctions, by commodity category

	Monthly share of auctions, by commodity category				
Delivery month	All purpose flour	Bakery flour	Pasta	Vegetable oil	Peanut butter
	Percent				
January	7.75	17.32	11.92	11.46	11.12
February	15.19	15.32	9.13	9.65	9.46
March	10.84	12.11	7.34	5.11	8.18
April	7.62	13.05	5.69	5.11	7.74
May	6.46	8.87	5.96	3.12	7.84
June	8.01	8.02	5.56	4.49	7.13
July	8.89	1.41	9.12	6.77	8.70
August	13.02	1.80	11.61	13.92	10.65
September	9.16	8.26	14.26	13.34	10.19
October	3.17	4.96	6.53	9.01	4.88
November	4.13	4.41	6.44	11.01	7.15
December	5.76	4.47	6.44	7.01	6.96

Table 6-3: All-purpose flour auctions, volume and bidders

	1992	1993	1994	1995	1996
	Tons				
Volume	85,772	35,273	21,600	27,130	17,950
	Number				
Auctions	2,518	1,087	742	809	561
	Percent of annual volume				
Number of bidders					
1	1.3	15.6	1.4	13.2	3.7
2	9.8	20.9	28.7	25.6	14.9
3	15.3	33.6	33.4	26.3	25.3
4	20.6	13.6	21.7	22.5	33.8
5	24.7	8.1	5.9	11.0	20.0
6	16.7	5.1	8.9	1.4	1.7
7 or more	11.4	3.1	0.0	0.1	0.6

Table 6-4: Bakery flour auctions, volume and bidders

	1992	1993	1994	1995	1996
	Tons				
Volume	35,434	12,735	11,814	9,420	5,286
	Number				
Auctions	722	342	264	231	141
	Percent of annual volume				
Number of bidders					
1	27.8	13.8	62.9	12.6	19.6
2	33.7	45.3	27.1	35.6	23.9
3	31.8	16.3	4.1	30.3	40.7
4	5.5	4.6	5.9	12.2	14.0
5	0.9	0.0	0.0	9.3	1.7
6	0.4	0.0	0.0	0.0	0.0

Table 6-5: Pasta auctions, volume and bidders

	1992	1993	1994	1995	1996
	Tons				
Volume	21,360	20,908	15,288	18,252	13,741
	Number				
Auctions	1,076	1,047	784	893	688
	Percent of annual volume				
Number of bidders					
1	25.4	33.1	12.7	4.2	19.9
2	35.1	26.0	28.5	26.3	39.3
3	25.8	24.2	36.0	32.7	29.2
4	9.2	12.4	15.6	18.3	8.4
5	4.3	3.1	6.0	11.8	2.8
6 or more	0.2	1.1	1.2	6.7	0.6

Table 6-6: Vegetable oil auctions, volume and bidders

	1992	1993	1994	1995	1996
	Tons				
Volume	44,385	43,550	40,182	23,618	20,071
	Number				
Auctions	1,821	1,727	1,650	1,022	857
	Percent of annual volume				
Number of bidders					
1	10.3	18.6	12.8	2.2	4.2
2	52.1	43.9	39.5	53.4	74.2
3	23.4	26.5	38.9	31.9	17.3
4	12.6	7.6	6.3	9.6	3.3
5	1.5	3.1	2.3	2.7	1.0
6	0.1	0.3	0.1	0.2	0.0

Table 6-7: Peanut butter auctions, volume and bidders

	1992	1993	1994	1995	1996
	Tons				
Volume	38,200	29,917	22,621	14,121	8,877
	Number				
Auctions	1,711	1,348	1,046	637	427
	Percent of annual volume				
Number of bidders					
2	0.4	0.2	0.2	1.6	1.7
3	9.0	6.4	0.0	0.3	0.6
4	32.1	29.1	7.4	3.4	16.2
5	52.7	48.9	23.5	30.4	47.1
6	5.6	15.5	47.8	47.1	34.5
7	0.2	0.0	21.0	17.0	0.0

commodity prices, seasonal variation in FSA prices reflects variations in marketing margins through the year. To control for the phenomenon, we enter separate variables for each month in our analysis. Table 6-2 shows how orders vary by month for each commodity category. With 12 months, an "average" month ought to handle about 8.3 percent of a category's auctions.

Some Basic Data Patterns

Volume and Competition

Tables 6-3 through 6-7 provide summary information on commodity volumes and bidder numbers for each commodity by year. Consider, for example, all-purpose flour, in table 6-3.

Awards totaling 85,772 tons (just under 4,000 truck-loads) were put up for auction in 1992 in 2,518 auctions. In that year, 1.3 percent of that volume (or about 1,115 tons) was offered in auctions that attracted only a single bidder, while another 9.8 percent was offered in auctions that attracted two bidders. In that year, it was far more typical for all-purpose flour auctions to attract four (20.6 percent of volume) or five (24.7 percent of volume) bidders.

Volumes dropped by nearly 80 percent over the next 4 years, as CCC stocks fell. There was also a clear shift in bidder numbers; most auctions in 1993-95 attracted three or fewer bidders, in contrast to the generally greater participation in 1992 auctions. But bidder numbers rose again at the end of the period, in 1996, as more auctions attracted four and five bidders.

The other four commodity groups show similar trends in purchase volumes. Bakery flour and peanut butter each showed 1992-96 declines of more than 75 percent in volume and number of auctions, while vegetable oil fell by more than half and pasta by more than a third. Typical bidder numbers vary across commodity groups and over time. Bakery flour and vegetable oil auctions typically attract relatively few bidders. Until 1994, more than half of all bakery flour auctions attracted only one or two bidders, while that same pattern held in all years for vegetable oil. By contrast, more than half of all pasta auctions attracted at least three bidders after 1992, and peanut butter auctions rarely attracted fewer than four bidders.

Price Trends

Table 6-8 displays broad trends in average FSA prices across the five commodity groups during the 1992-96 period. Prices are not comparable across commodities because they are quoted in different units (dollars per hundredweight, cents per gallon), but they show some interesting temporal patterns. The three wheat-based commodities show sharp increases over time, about 18-25 percent between 1992 and 1996. Low bids in vegetable oil auctions rose by about one-third between 1992 and 1994, before dropping off somewhat in the next 2 years, while peanut butter bids fell (15 percent) between 1992 and 1995 before rising in 1996.

The trends in low bids could reflect the effects of changes in competition, the geographic distribution of auctions, or the mix of products and package sizes purchased, but those factors really have only very minor effects on the broad trends. The major factor driving broad temporal movements in FSA prices is underlying agricultural commodity prices: wheat prices rose sharply through the period, soybean and cottonseed oil prices rose and then fell somewhat, and peanut prices generally fell.

Table 6-8: Price trends in FSA auctions

Commodity group	1992	1993	1994	1995	1996
	Mean low bids in FSA auctions (dollars)				
All-purpose flour	13.08	12.27	13.35	15.08	16.60
Bakery flour	12.27	12.50	14.02	14.81	16.81
Pasta	27.46	26.27	29.77	30.36	32.24
Vegetable oil	32.27	36.64	42.59	42.21	39.50
Peanut butter	83.07	78.07	74.62	70.93	78.82
	Mean ratio of low bid to FSA constructed price				
All-purpose flour	.812	.803	.815	.833	.859
Bakery flour	.859	.861	.867	.881	.897
Pasta	.892	.891	.902	.898	.913
Vegetable oil	.760	.783	.823	.808	.762
Peanut butter	.895	.886	.881	.876	.888
	Mean ratio of low bid to second lowest bid				
All-purpose flour	.963	.947	.935	.939	.955
Bakery flour	.947	.945	.929	.936	.946
Pasta	.937	.942	.953	.947	.956
Vegetable oil	.974	.978	.972	.977	.975
Peanut butter	.985	.981	.982	.976	.978

FSA develops a "constructed" price for comparison purposes for each auction. The constructed price is used as a forecast tool to develop expectations about likely bid ranges, and it can also be used as a decision tool in that FSA may cancel auctions in which the low bid exceeds the constructed price. The middle panel in table 6-8 shows annual average ratios of low bids to constructed prices. Two factors stand out. First, the ratios clearly vary systematically, and by quite a bit, across commodity categories. Pasta ratios are always the highest, around 0.90, while vegetable oil ratios are generally the lowest, around 0.80. Second, the ratios seem to move up, sometimes sharply, as commodity prices rise. That pattern raises the question of whether FSA proper-

ly accounts for the effects of changes in agricultural prices when calculating constructed prices; there is some evidence in this pattern that the agency underestimates the sensitivity of bid prices to agricultural prices.

Finally, the bottom panel reports average ratios of low bids to the second lowest bid in FSA auctions (clearly, this ratio can only be calculated when there are at least two bidders). That ratio shows no particular time pattern, suggesting that all bids rise in unison as agricultural prices rise. They also show some distinctive difference across commodity groups. Peanut butter low bidders beat the number two bidder by only about 2 percent, for example, while, on average, low bidders in pasta are 5-7 percent below the second lowest bidder.