

The U.S. Sheep Industry

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Introduction

Concern arose over conditions in the U.S. sheep industry in 1988 because lamb prices were much lower during the usual late spring price peaks than in 1987. At the same time, a shipment of live lambs from New Zealand entered U.S. marketing channels. These events led to questions about the influence of imports on conditions in the U.S. sheep industry. In this report, we assess the state of the U.S. sheep industry. We respond to section 4508 of the Omnibus Trade and Competitiveness Act of 1988 which requires the Secretary of Agriculture to submit a report to Congress on the market for lamb meat products. As required by the act, we discuss the following conditions:

- o Production of lamb and lamb products.
- o Costs and returns in the sheep industry.
- o Demand and marketing trends for lamb.
- o Imports of both live lambs and lamb meat products.

We take a broad view of the sheep industry, emphasizing long-term trends, costs and receipts to stock sheep and lamb feeding enterprises, livestock cycles, and seasonal price patterns. Such a perspective helps distinguish the basic forces influencing conditions in the industry from one-time events that, while temporarily disruptive, are not likely to recur. We focus on the reasons for the decline in the sheep inventory, as opposed to the subsequent decline in slaughter facilities.

We conclude that imports have been countercyclical, but declining along with domestic inventories and production; that returns have generally been higher than in the competing cow-calf industries; and that the major challenge to the U.S. sheep industry is to expand consumption of a relatively expensive red meat. The issue of red meat consumption goes beyond lamb, as poultry is capturing market shares from all red meats through lower relative prices.

Sheep Production Practices

The sheep industry has developed two distinctive enterprises: stock sheep production and lamb feeding. Stock sheep producers manage grazing flocks on pasture and range forage; these producers frequently use arid land with few alternative uses.

Stock sheep producers sell lambs that are either slaughtered or placed in feedlots. In 1987, 31 percent of the stock sheep receipts came from slaughter lambs and 33 percent from feeder lambs. Wool, an important coproduct, accounted for 27 percent of stock sheep receipts, and cull ewes accounted for the remainder.

Feeder lambs are raised on forage until they reach around 80 pounds and then are usually placed in a dry lot for grain feeding. Feedlot-finished lambs have grown as a percentage of lambs slaughtered, due to the cost efficiency of grain feeding versus range finishing.

Stock Sheep

Stock sheep, mature ewes and rams, and their intended replacements in the breeding flock are the productive capital of the sheep industry.

Inventory Trends

Inventory data on stock sheep began in 1867 when there were approximately 45 million head (fig. 1). From 1867 to 1942, the number of stock sheep varied from a peak of 51 million head in 1884 to a low of 33 million in 1923. The inventory peaked a second time in 1942 at 49 million head. Producers liquidated their herds during 1942-50, and stock sheep numbers declined an unprecedented 47 percent. Inventories then remained stable during the 1950's. During a liquidation in the 1960's, inventories dropped another 40 percent, to 17 million head. The decline continued through the 1970's, reaching a low of 10.8 million head in 1979.

As the inventory now begins to stabilize, it appears to be re-entering a typical livestock cycle, which had been masked by the long-term downward trend in the sheep industry. The sheep inventory began to expand after 1979 and reached a peak in 1982 of 11.4 million head (fig. 2). Then, primarily because of a drought that reduced the carrying capacity of ranges in the main producing areas during 1982-84, the inventory declined until 1986 when it reached a low of 8.5 million head. Another reversal occurred in 1986 and sheep inventories climbed to 9.2 million head by January 1, 1989. Inventories appear to be expanding in response to increased returns. The stock sheep inventory is expected to stay in the 8- to 10-million-head range over the next few years.

Regional Location

The ability of sheep to forage in an arid environment has determined the regional distribution of sheep in the United States. Sheep production is primarily located in the 17 Western States where few or no alternative enterprises are available (fig. 3).

Figure 1

U.S. sheep inventory

Million head

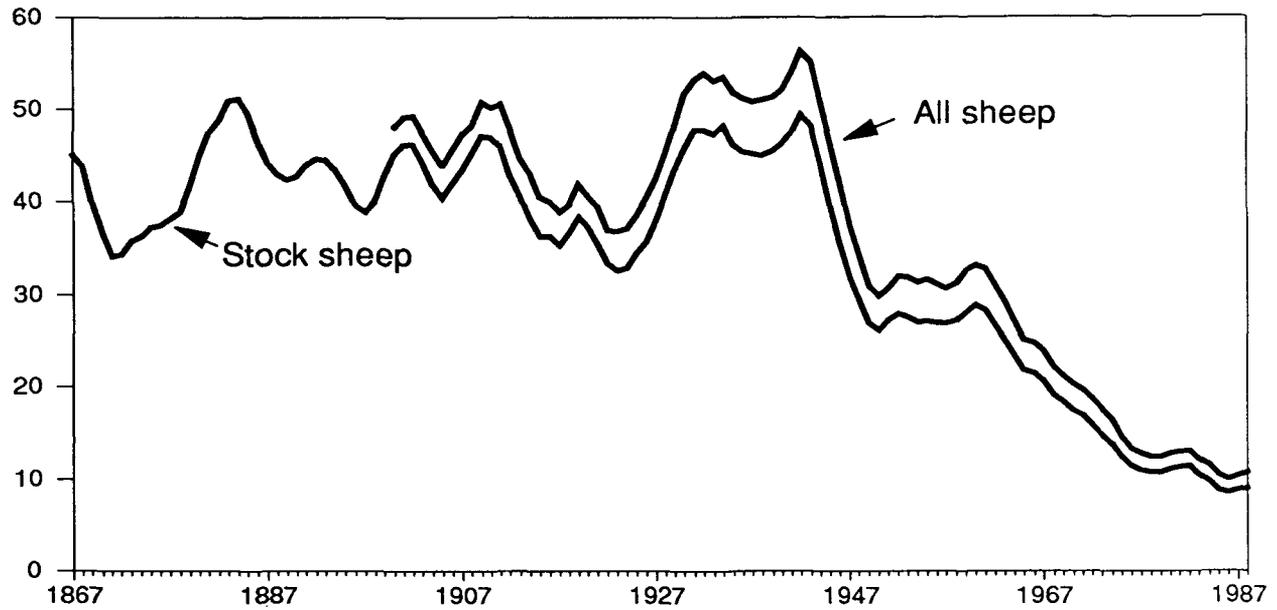
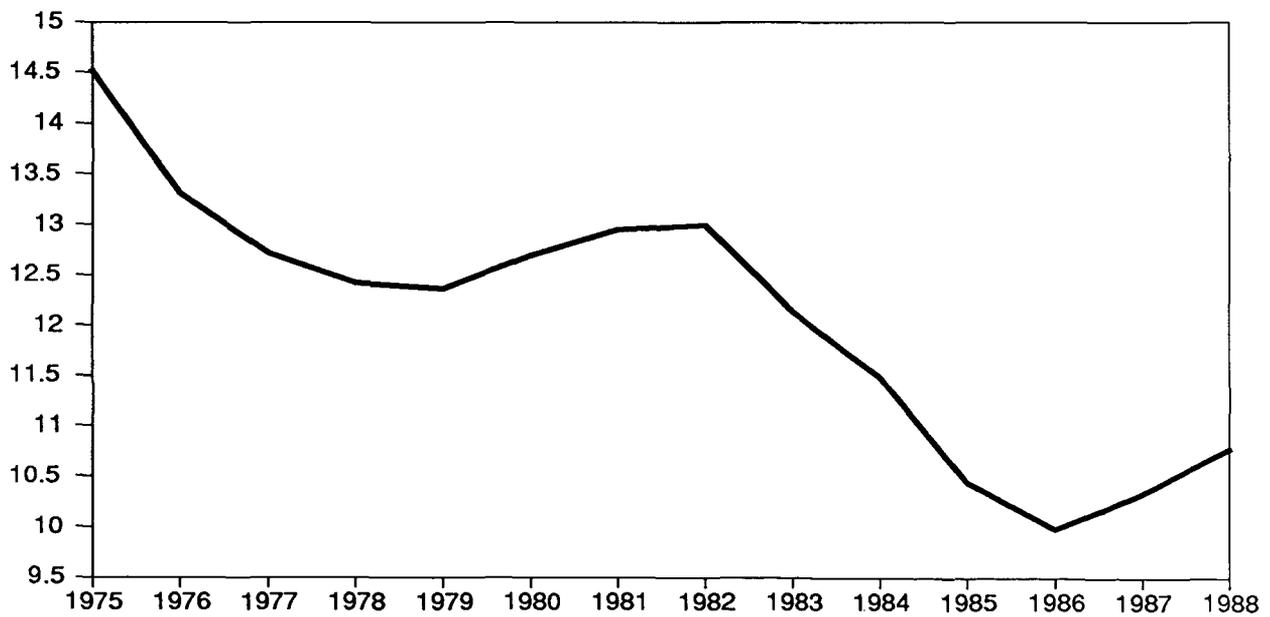


Figure 2

U.S. all sheep inventory

Million head



Stock sheep, ruminants like beef cattle, are excellent foragers in an arid environment. About two-thirds of all sheep operations also raise cattle. Sheep eat a slightly different browse than cattle, but tend to compete with beef cattle production for labor and land resources. (A general way to compare the competition for range resources between sheep and cattle is a feed consuming animal unit (AU). An AU is defined as one cow or five sheep.)

In the West, many sheep operations use government grazing land, which is generally arid. About 30-40 percent of the sheep in the 17 Western States use either Bureau of Land Management or Forest Service land (13).

Production Problems

Sheep and lambs are very susceptible to disease and predators. Therefore, sheep producers have had to acquire well developed management skills. Death losses are much higher for sheep and lambs than for other livestock. Death losses of sheep and lambs in 1987 were 1.2 million head (505,000 sheep and 731,000 lambs), 12 percent of beginning inventory. For cattle enterprises, death losses were only 4.7 percent, consisting of 1.7 million cattle and 3.1 million calves. There is little information available to allocate death losses among disease, predators, and other causes. Sheep are susceptible to parasites and generally have less resistance to disease and injury than other classes of livestock (9). As a result, sheep production requires more labor per animal unit than cattle production. In the past, resident aliens as well as domestic workers have furnished labor. The ability to attract and keep skilled sheep herders at a reasonable wage is frequently mentioned as a major challenge to the sheep industry.

Lambs on Feed

Although the number of lambs on feed has been declining, the percentage of the sheep inventory on feed has grown. The American Sheep Producers Council estimates that 65 percent of all lambs slaughtered go through feedlots (2). The only information available on lamb feeding is a January 1 inventory number from the National Agricultural Statistics Service (NASS), U.S. Department of Agriculture (USDA). This does not reflect the volume of lambs that go through feedlots, but it gives an indication of the trends in lamb feeding.

Only 7 percent of the sheep inventory was on feed on January 1, 1989. The largest number of lambs on feed, 7 million head in 1943, was 14.4 percent of the inventory. In 1989, lambs on feed totaled 1.9 million head, accounting for 17 percent of the January 1 inventory of all sheep and lambs.

Lambs on feed are concentrated in the Great Plains and California. Costs will continue to encourage lamb feeding. In finishing animals, grain feeding generally costs less per pound of gain than range feeding.

Costs and Returns in Sheep Production

Sheep producers compete with beef cattle producers for resources to operate their enterprises: grazing land, labor, water, and marketing and transportation facilities. Sheep production, which generally yields higher returns than cattle production, also requires more intensive use of labor and management. Higher returns to sheep operators than to cattle operators in the face of declining sheep numbers suggests that even higher returns to management are required to retain resources in sheep production.

Trends in Cost of Production

Cash receipts to sheep producers per breeding ewe increased from \$26 in 1972 to \$73 in 1987 (table 1). This increase (180 percent) was slightly greater than the rate of inflation as measured by the consumer price index (172 percent). Cash receipts from beef cow-calf enterprises increased 123 percent during the same period, substantially less than the rate of inflation (table 2).

Total cash expenses increased from \$21 per ewe in 1972 to \$45 in 1987 (114 percent). Thus, cash receipts less cash expenses have increased sharply for sheep enterprises, from \$5 per ewe in 1972 to \$28 in 1987 (460 percent). Sheep enterprises have had positive receipts less cash expenses for 15 of the last 16 years (1972-87). Preliminary estimates for 1988 and forecasts for 1989 indicate that positive returns will continue. Again, sheep have done better per breeding animal than cattle, which have had positive returns in only 7 of the last 16 years (fig. 4).

Receipts for sheep enterprises come from sales of animals and wool and from government wool program payments (fig. 5). The share from each source, although varying from year to year, has on average remained the same. Receipts from animals (feeder lambs, slaughter lambs, and cull ewes) made up 72 percent of total receipts in 1972 and 73 percent in 1987. Wool sales accounted for 10 percent of receipts in both 1972 and 1987. Government payments (wool incentive and unshorn payment) dropped from 18 percent of receipts in 1972 to 17 percent in 1987. When meat prices were under pressure from drought-induced liquidation of the cattle and sheep herds in 1983, animals accounted for 66 percent of total cash receipts, wool for 14 percent, and government payments for 20 percent.

Cash expenses for sheep producers have not increased as fast as receipts because variable expenses (such as feed) have not kept pace with other costs. Feed, which was almost 40 percent of total cash expenses in 1972, dropped to 28 percent by 1987. Other variable cash expenses decreased from 40 percent in 1972 to 36 percent in 1987, while fixed cash expenses (general farm overhead, taxes, insurance, and interest) increased from 21 to 36 percent during the same period.

Figure 3

Regional distribution of sheep inventory

Percent

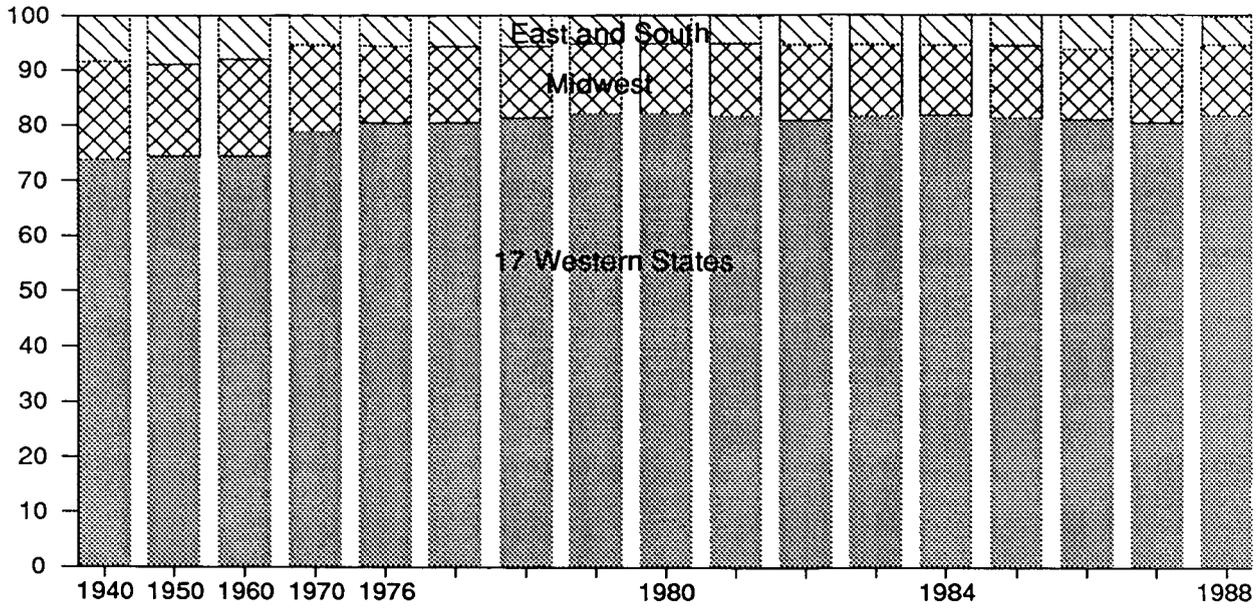
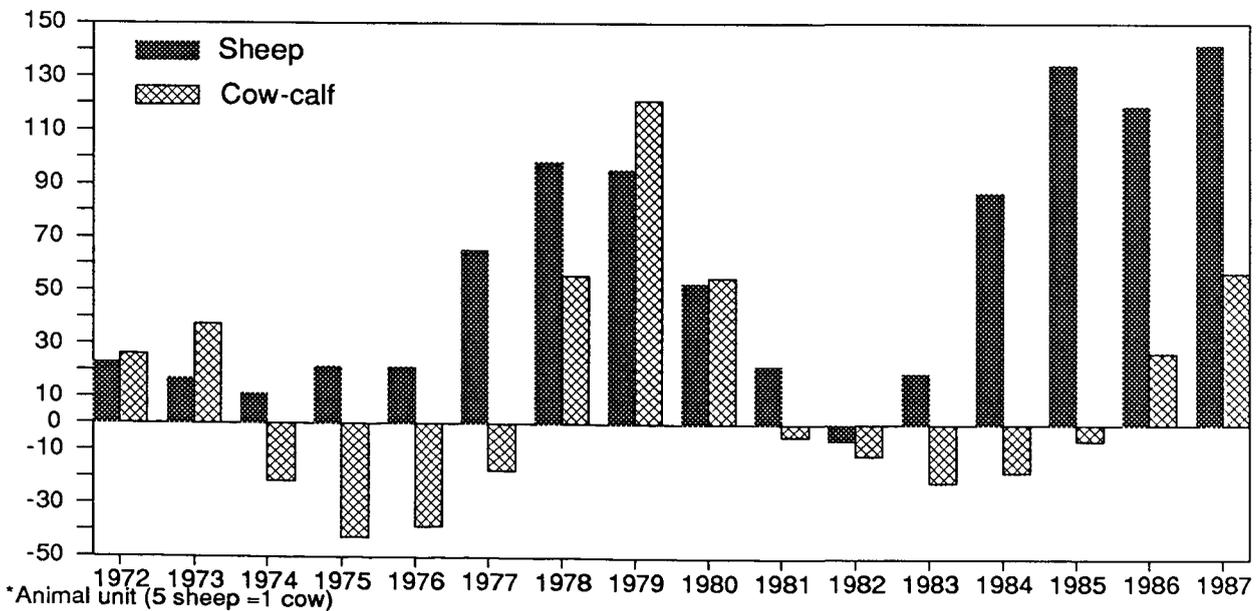


Figure 4

Returns to U.S. sheep and cow-calf enterprises

Dollars per animal unit*



*Animal unit (5 sheep = 1 cow)

Table 1--U. S. sheep production costs and returns per ewe

Item	1972	1973	1974	1975	1976	1977
	<u>Dollars</u>					
Cash receipts:						
Slaughter lambs	9.85	12.00	13.00	14.53	15.65	17.46
Feeder lambs	6.99	8.58	8.06	9.27	11.35	12.57
Cull ewes	1.72	3.30	2.63	2.56	3.30	3.45
Wool	2.60	6.15	4.39	3.32	4.88	5.35
Wool payments <u>1/</u>	3.88	0	1.35	2.86	.66	2.83
Unshorn lamb payments	.75	0	.26	.55	.13	.55
Total	25.80	30.03	29.71	33.09	35.97	42.22
Cash expenses:						
Feed--						
Grain	1.11	1.79	2.77	2.56	2.36	1.92
Protein supplements	1.76	3.82	2.82	2.31	2.31	2.83
Salt and minerals	.13	.14	.15	.17	.19	.21
Hay	2.24	2.55	2.99	3.74	3.89	2.89
Pasture	1.81	2.07	2.14	2.14	2.19	2.18
Public grazing (AUM) <u>2/</u>	1.25	1.31	1.41	1.41	1.65	.73
Crop residues	.05	.05	.05	.05	.05	.05
Total feed costs	8.34	11.74	12.34	12.39	12.64	10.82
Other--						
Veterinary and medicine	.60	.62	.59	.62	.59	.61
Livestock hauling	.66	.73	.66	.72	.66	.71
Marketing	.15	.16	.15	.16	.15	.16
Ram death loss	.13	.14	.15	.17	.18	.19
Shearing and tagging	.58	.62	.68	.75	.79	.84
Fuel, lube, and electricity	.50	.53	.74	.82	.87	.93
Machinery and building repair	2.57	2.62	2.82	2.98	2.87	1.22
Hired labor	2.72	2.98	3.41	3.67	4.15	4.32
Miscellaneous	.44	.47	.52	.57	.60	.64
Total variable expenses	16.71	20.61	22.07	22.84	23.49	20.44
General farm overhead	1.05	1.42	1.27	1.41	1.67	1.94
Taxes and insurance	.90	.92	.97	1.04	1.26	1.19
Interest	2.53	3.68	3.16	3.52	5.32	5.64
Total fixed expenses	4.48	6.02	5.40	5.97	8.25	8.77
Total cash expenses	21.18	26.63	27.47	28.81	31.74	29.21
Receipts less cash expenses	4.61	3.40	2.24	4.29	4.23	13.01
Capital replacement	2.19	2.32	2.52	2.75	2.90	2.84
Receipts less cash expenses and replacement	2.42	1.08	-.28	1.53	1.34	10.16

See footnotes at end of table.

Continued--

Table 1--U. S. sheep production costs and returns per
ewe--Continued

Item	1978	1979	1980	1981	1982	1983
	<u>Dollars</u>					
Cash receipts:						
Slaughter lambs	19.91	21.03	20.46	16.03	16.60	16.39
Feeder lambs	17.72	18.41	15.74	13.30	13.49	12.30
Cull ewes	4.70	5.52	3.55	3.43	3.05	2.17
Wool	5.54	6.42	6.55	7.45	6.28	6.72
Wool payments <u>1/</u>	3.09	3.29	3.52	4.61	6.28	7.75
Unshorn lamb payments	.66	.71	.76	.88	1.50	1.56
Total	51.62	55.37	50.58	45.70	47.20	46.89
Cash expenses:						
Feed--						
Grain	1.99	2.24	2.56	2.13	2.14	2.38
Protein supplements	2.85	3.21	3.64	3.38	3.16	3.60
Salt and minerals	.23	.26	.32	.35	.37	.38
Hay	2.69	2.45	2.93	3.53	3.71	3.65
Pasture	2.41	2.70	3.05	3.19	3.11	3.16
Public grazing (AUM) <u>2/</u>	.73	.93	1.13	1.11	.91	.70
Crop residues	.05	.04	.05	.06	.05	.06
Total feed costs	10.95	11.84	13.68	13.75	13.45	13.93
Other--						
Veterinary and medicine	.66	.73	.83	.91	.98	.99
Livestock hauling	.76	.87	1.00	1.12	1.18	1.20
Marketing	.17	.19	.22	.24	.26	.27
Ram death loss	.26	.34	.33	.31	.29	.28
Shearing and tagging	.90	.98	1.06	1.14	1.18	1.21
Fuel, lube, and electricity	.98	1.28	1.75	1.98	1.93	1.82
Machinery and building repair	1.32	1.45	1.59	1.74	2.19	2.29
Hired labor	4.62	5.05	5.44	5.83	6.05	6.22
Miscellaneous	.69	.77	.87	.96	1.02	1.04
Total variable expenses	21.31	23.51	26.77	27.98	28.53	29.25
General farm overhead	2.54	3.08	3.21	3.22	4.47	2.86
Taxes and insurance	1.20	1.45	1.55	1.57	1.80	1.82
Interest	6.93	8.25	8.49	8.52	13.59	9.10
Total fixed expenses	10.67	12.79	13.25	13.31	19.86	13.78
Total cash expenses	31.98	36.30	40.02	41.29	48.39	43.03
Receipts less cash expenses	19.64	19.07	10.56	4.41	-1.19	3.86
Capital replacement	3.89	4.90	5.12	5.69	6.58	6.95
Receipts less cash expenses and replacement	15.75	14.17	5.44	-1.29	-7.77	-3.09

See footnotes at end of table.

Continued--

Table 1--U. S. sheep production costs and returns per
ewe--Continued

Item	1984	1985	1986	1987
	<u>Dollars</u>			
Cash receipts:				
Slaughter lambs	19.93	21.58	20.86	22.96
Feeder lambs	15.02	18.48	18.76	24.02
Cull ewes	3.20	6.06	5.97	6.18
Wool	8.81	6.84	7.35	7.62
Wool payments <u>1/</u>	9.47	10.99	11.78	10.48
Unshorn lamb payments	1.81	2.21	2.40	1.79
Total	58.24	66.16	67.12	73.05
Cash expenses:				
Feed--				
Grain	2.52	2.01	1.60	1.19
Protein supplements	3.39	3.40	3.68	4.00
Salt and minerals	.38	.40	.40	.40
Hay	3.74	3.90	3.03	2.82
Pasture	3.43	3.31	3.47	3.41
Public grazing (AUM) <u>2/</u>	.71	.67	.68	.67
Crop residues	.06	.05	.05	.05
Total feed costs	14.23	13.74	12.91	12.54
Other--				
Veterinary and medicine	1.04	1.05	1.08	1.11
Livestock hauling	1.25	1.28	1.25	1.26
Marketing	.28	.29	.29	.30
Ram death loss	.27	.27	.27	.27
Shearing and tagging	1.23	1.24	1.29	1.34
Fuel, lube, and electricity	1.49	1.53	1.14	1.25
Machinery and building repair	2.26	2.39	2.32	2.35
Hired labor	6.34	6.49	6.73	6.98
Miscellaneous	1.08	1.12	1.15	1.19
Total variable expenses	29.47	29.40	28.43	28.59
General farm overhead	3.74	3.25	5.03	5.50
Taxes and insurance	1.70	1.82	1.76	1.80
Interest	5.99	4.80	8.05	8.77
Total fixed expenses	11.43	9.87	14.84	16.07
Total cash expenses	40.90	39.27	43.27	44.66
Receipts less cash expenses	17.34	26.89	23.85	28.39
Capital replacement	7.38	7.61	7.49	7.79
Receipts less cash expenses and replacement	9.96	19.28	16.36	20.60

1/ Wool payments based on previous years marketing.

2/ Animal Unit Month.

Table 2--U.S. cow-calf production costs per cow

Item	1972	1973	1974	1975	1976	1977
	<u>Dollars</u>					
Cash receipts:						
Steer calves	44.78	57.51	40.97	36.68	39.52	43.46
Heifer calves	26.50	34.04	24.25	21.71	23.38	25.72
Yearling steers	29.06	37.32	26.59	23.80	34.42	28.20
Yearling heifers	18.25	23.44	16.70	14.95	21.62	17.71
Cull cows	21.80	22.11	18.24	21.89	15.79	31.82
Total	140.39	174.42	126.75	119.01	34.73	146.91
Cash expenses:						
Feed --						
Grain	3.44	5.56	8.59	7.94	7.32	5.97
Silage	1.34	2.16	3.34	3.09	2.85	2.32
Protein supplements	4.25	9.24	6.81	5.58	5.58	6.84
Salt and minerals	1.52	1.63	1.83	2.07	2.25	2.55
Hay	27.13	31.00	36.28	45.38	47.21	35.03
All pasture and private range	24.61	28.26	29.15	29.18	29.84	29.66
Public grazing (AM and AUM) <u>1/</u>	.63	.73	.93	.93	1.37	1.37
Crop residue	.06	.06	.06	.06	.06	.07
Total feed costs	62.98	78.64	86.99	94.23	96.48	83.81
Other--						
Veterinary and medicine	3.85	4.01	3.82	3.98	3.79	3.94
Livestock hauling	.95	1.04	.95	1.03	.94	1.02
Marketing	2.48	2.63	2.46	2.61	2.44	2.59
Custom feed mixing	.29	.30	.29	.30	.29	.30
Fuel, lube, and electricity	5.52	5.83	8.08	9.00	9.52	10.23
Machinery and building repair	9.34	9.88	12.05	13.81	12.58	13.54
Hired labor	4.99	5.46	6.26	6.73	7.62	7.92
Total variable expenses	90.40	107.79	120.90	131.69	133.66	123.35
General farm overhead	4.10	5.55	4.96	5.53	6.54	7.59
Taxes and insurance	11.45	11.76	12.37	13.28	16.09	15.27
Interest	8.13	11.82	10.15	11.29	17.08	18.10
Total fixed expenses	23.68	29.13	27.48	30.10	39.71	40.96
Total cash expenses	114.08	136.92	148.38	161.79	173.37	164.31
Receipts less cash expenses	26.31	37.50	-21.63	-42.76	-38.64	-17.40
Capital replacement	26.65	28.16	30.64	33.49	35.21	34.59
Receipts less cash expenses and replacement	-.34	9.34	-52.27	-76.25	-73.85	-51.99

See footnotes at end of table.

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Table 2--U.S. cow-calf production costs per cow--Continued

Item	1978	1979	1980	1981	1982	1983
	<u>Dollars</u>					
Cash receipts:						
Steer calves	77.16	103.94	90.02	74.86	74.22	74.62
Heifer calves	45.66	61.51	53.27	44.02	44.25	43.80
Yearling steers	48.34	83.37	78.40	67.72	64.73	61.23
Yearling heifers	30.36	52.36	49.24	44.08	42.19	38.89
Cull cows	43.03	51.12	35.98	29.96	30.10	28.64
Total	244.55	352.30	306.91	260.64	255.49	247.18
Cash expenses:						
Feed--						
Grain	6.56	7.78	10.12	9.42	8.31	10.70
Silage	2.20	2.66	4.58	5.51	4.66	6.20
Protein supplements	9.21	12.34	17.28	18.21	17.26	18.13
Salt and minerals	2.60	2.65	2.13	2.41	2.40	2.52
Hay	33.05	29.86	32.03	40.23	41.47	38.99
All pasture and private range	30.84	34.15	35.81	37.40	39.02	36.45
Public grazing (AM and AUM) <u>1/</u>	1.12	1.08	.68	.76	.75	.65
Crop residue	.07	.06	.07	.07	.07	.08
Total feed costs	85.65	90.58	102.70	114.01	113.94	113.72
Other--						
Veterinary and medicine	4.45	4.54	5.05	5.52	5.91	6.11
Livestock hauling	1.07	1.23	1.40	1.75	1.70	1.74
Marketing	3.01	3.58	3.81	3.86	3.90	4.00
Custom feed mixing	.34	.38	.42	.44	.49	.47
Fuel, lube, and electricity	10.73	14.02	19.23	21.72	21.30	19.54
Machinery and building repair	14.62	16.04	17.60	19.31	21.17	22.09
Hired labor	9.00	10.46	11.72	13.41	13.02	13.48
Total variable expenses	128.87	140.83	161.93	180.02	181.43	181.15
General farm overhead	13.53	22.06	21.94	20.68	19.47	19.26
Taxes and insurance	16.15	19.82	20.52	19.62	20.87	23.43
Interest	30.30	48.45	47.50	44.86	45.43	44.96
Total fixed expenses	59.98	90.33	89.96	85.16	85.77	87.65
Total cash expenses	188.85	231.16	251.89	265.18	267.20	268.80
Receipts less cash expenses	55.70	121.14	55.02	-4.54	-11.71	-21.62
Capital replacement	37.39	46.74	54.19	59.22	62.88	64.28
Receipts less cash expenses and replacement	18.31	74.40	.83	-63.76	-74.59	-85.90

See footnotes at end of table.

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Table 2--U.S. cow-calf production costs per cow--Continued

Item	1984	1985	1986	1987
	<u>Dollars</u>			
Cash receipts:				
Steer calves	76.37	77.71	78.17	86.79
Heifer calves	44.36	46.22	47.81	60.01
Yearling steers	65.89	61.52	66.70	84.11
Yearling heifers	41.47	40.30	43.96	47.72
Cull cows	30.69	28.64	28.83	34.31
Total	258.78	254.39	265.47	312.94
Cash expenses:				
Feed--				
Grain	11.20	9.39	7.31	5.94
Silage	5.83	6.04	5.79	6.07
Protein supplements	18.69	16.00	16.73	17.65
Salt and minerals	2.62	2.69	2.67	2.69
Hay	43.34	42.96	34.15	35.17
All pasture and private range	39.30	36.44	36.23	39.78
Public grazing (AM and AUM) ^{1/}	.71	.66	.74	.71
Crop residue	.08	.07	.08	.06
Total feed costs	121.77	114.25	103.70	108.07
Other--				
Veterinary and medicine	6.31	6.38	6.56	6.69
Livestock hauling	1.80	1.85	1.88	1.98
Marketing	4.10	4.21	4.17	4.42
Custom feed mixing	.48	.49	.49	.28
Fuel, lube, and electricity	16.58	16.00	12.17	14.06
Machinery and building repair	21.58	22.51	21.92	21.96
Hired labor	13.72	13.98	14.07	15.01
Total variable expenses	186.34	179.67	164.96	172.47
General farm overhead	24.13	17.48	25.64	30.00
Taxes and insurance	19.54	19.04	10.47	9.77
Interest	46.52	44.30	37.20	43.60
Total fixed expenses	90.19	80.82	73.31	83.37
Total cash expenses	276.53	260.49	238.27	255.84
Receipts less cash expenses	-17.75	-6.10	27.20	57.10
Capital replacement	64.46	64.53	74.20	75.58
Receipts less cash expenses and replacement	-82.21	-70.63	-47.00	-18.48

^{1/} Animal Month and Animal Unit Month.

Labor is an exception to the general trend for variable expenses with an increase in cost share from 13 percent in 1972 to 16 percent in 1987. Variable labor costs for cattle increased from 6 to 9 percent during 1972-87. Labor has repeatedly been cited as a special problem in sheep production, in terms of skill required, working conditions, and availability of workers. The sheep industry in the past obtained special permission to bring in workers from other countries on a temporary basis.

Feed cost is the single largest cost item for sheep production even though it is declining in relative importance. Feed costs increased only 50 percent during 1972-87, while total costs doubled. Protein supplements account for a third of the feed costs, while hay and pasture each account for a fourth. The cost for using public grazing land, an important source of feed in the West, has declined due to reductions in grazing fees since 1980.

When longer run costs, such as capital replacement costs, are considered in addition to cash expenses, returns for ewes were positive for 12 of the 16 years since 1972. The 4 years with negative returns coincide with a drought in 1982 through 1984 and the liquidation phase of the cattle cycle. Sheep returns are sensitive to changes in the cattle cycle because of the lower prices associated with increased cattle sales. Droughts often cause both cattle and sheep producers to liquidate their inventories.

Colorado Lamb Feeding Cost

In addition to estimating long-term cost series for stock sheep, ERS also estimates a Colorado lamb feeding budget (based on a 1985 Colorado State University survey). This budget represents most of the lamb feeding in the Western States (table 3) (14). Over half of all lambs slaughtered are fattened in large commercial feedlots. Colorado is the leading lamb-feeding State with a fifth of all lamb feeding. Other major lamb-feeding States are California, Texas, and Wyoming.

Lambs are fed for a shorter time than cattle. Lamb purchases account for almost half of the cost, with feed cost the next largest at a fifth of total cost. Feeders adjust their bids for feeder lambs according to their cost structure and their expectations of slaughter lamb prices. Lower feed costs and smaller lamb supplies increase feeder lamb prices. Feeder lambs' cost accounted for 78 percent of total cost in 1988, compared with 76 percent in 1985. Overbidding for feeder lambs resulted in negative net margins in 1988.

Lamb and Mutton Production

Meat from sheep is called lamb or mutton, depending on the age of the animal. Lambs are generally slaughtered between 8 and 14 months of age. The Agricultural Marketing Service (AMS), USDA, sets grading standards for both lamb and mutton. Lamb is defined by the condition of the break-joint on the foreleg of the animal,

Table 3--Colorado lamb feeding budget, cost per head

Item	1985	1986	1987	1988
	<u>Dollars per head</u>			
Costs:				
Feeder lamb (83 lbs)	55.67	59.96	71.45	70.47
Feed--				
Corn (3 bu)	7.96	6.74	4.89	6.59
Hay pellets (64 lbs)	2.64	2.65	2.76	3.42
Protein supplement	.17	2.03	2.18	3.00
Feed additives	2.00	1.98	1.94	1.96
Total feed	12.76	13.40	11.77	14.97
Labor	.60	.62	.65	.65
Death loss	1.28	1.38	1.64	1.62
Veterinary and medicine	.37	.37	.38	.38
Miscellaneous and indirect costs	.78	.77	.77	.81
Machine hire	1.61	1.60	1.62	1.65
Interest on operating capital	1.45	1.45	1.45	1.45
Total costs	73.37	78.17	88.10	90.38
Selling price per cwt required to cover costs:				
	<u>Dollars per cwt</u>			
Feed and feeder costs (121 lbs)	56.56	60.63	68.78	70.61
All costs (121 lbs)	60.64	64.60	72.81	74.69
Feed costs per 100-lb gain	33.58	35.27	30.98	39.40
Choice slaughter lambs, South St. Paul	67.22	68.04	75.19	66.24
Net margin	6.58	3.44	2.38	-8.46
Prices:				
Choice slaughter lambs, South St. Paul	67.22	68.04	75.19	66.24
Feeder lamb, choice, South St. Paul	67.08	72.24	86.08	84.90
Corn (\$/bu)	2.65	2.25	1.63	2.20
Alfalfa pellets (\$/ton)	82.37	82.88	86.36	106.98
Soybean meal				
44 percent (\$/ton)	129.25	158.93	170.35	234.85
Annual interest rate	13.43	11.15	9.98	10.58
	<u>1977 = 100</u>			
Index of prices:				
Farm labor	153.60	158.25	166.00	166.00
Prices paid by farmers	163.60	159.92	161.08	168.25
Agricultural chemicals	128.00	126.83	124.25	125.33
Tractors and self-propelled equipment	178.30	174.33	173.33	178.50
Other machinery	183.20	182.25	184.08	195.00
Fuel and energy	200.20	171.25	158.25	164.00

in addition to the color and characteristics of the rib bones (roundness for lamb and flatness for mutton), and the characteristics of the lean meat. Mutton comes from any sheep that is too old to classify as lamb. Mutton accounts for about 5 percent of sheep meat produced.

Production Trends

Lamb and mutton production has declined since 1945, following the decline in sheep inventories. Lamb production has fallen less than inventories because of a trend toward heavier slaughter weights, reflecting genetic improvements and a larger proportion marketed as fed lambs. This trend toward heavier weights was developed to offset costs by reducing the number of breeding ewes necessary to produce a pound of lamb and to take advantage of reasonable grain prices.

Since 1979, lamb meat production has appeared to be cycling in a typical livestock cycle (fig. 6). Lamb production dropped to 275 million pounds in 1979, then recovered to 350 million pounds in 1984, and dropped again in 1987 to 303 million pounds. This reduction resulted in the lowest per capita supplies on record in the United States. Production recovered to 315 million pounds in 1988, partly because of an increase in carcass weights of 3 pounds per animal. The cyclical turning point between 1987 and 1988 created a sharp contrast between high prices in 1987 and the drop in prices as production recovered in 1988.

Seasonality of Lamb Production

Lamb production exhibits a distinct seasonal pattern with production higher in the spring and fall (fig. 7). Lamb slaughter is usually highest in March or April depending on the dates of the spring religious holidays. Mature sheep slaughter has a different pattern than that for lamb slaughter. These animals are culled after the weaning of the lambs in the early summer or in the fall.

Sheep and Lamb Marketing and Slaughter

Of 127 firms reporting purchases of lambs for slaughter in 1988, 116 were single-plant firms and 11 were multiplant firms (39). Most of the sheep and lambs marketed (81.4 percent in 1987) were purchased directly through nonpublic markets, rather than terminal or auction markets (table 4). The concentration of the industry in the West, the increasing percentage of lambs in feedlots, and the distance between markets have fostered direct marketing. The areas that tend to have a large proportion of packer feeding also have the largest percentages of direct purchases (39).

The proportion of sheep and lambs valued on a grade and weight basis has been increasing (table 5). Payment on grade and weight basis is a method that pays the producer on the carcass weight of the animal rather than its liveweight. In 1987, 35.9 percent of

Figure 5

U.S. stock sheep receipts, all sizes

Dollars per ewe

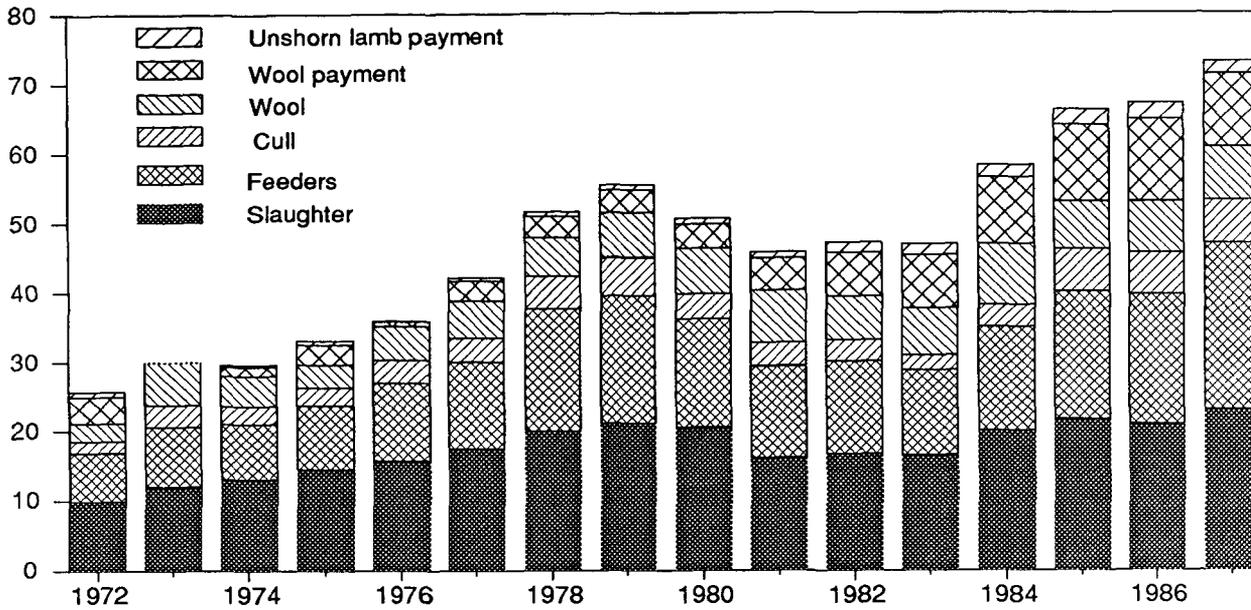


Figure 6

U.S. commercial lamb production

Million pounds

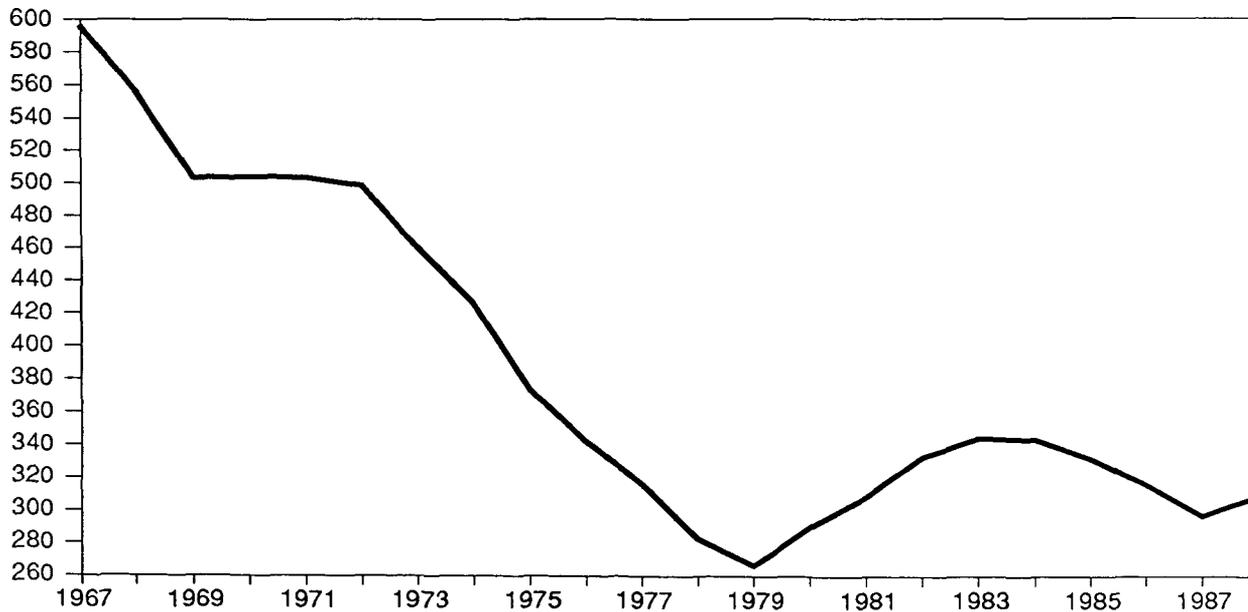


Table 4--Market outlets for sheep and lambs: Purchases by region and State of slaughter, reporting slaughter packers, 1987 ^{1/}

State/region ^{2/}	Nonpublic	Terminal	Auction	Total ^{3/}	Nonpublic	Terminal	Auction	Total
	----- 1,000 head -----				----- Percent -----			
New England	3	0	3	6	50.0	0	50.0	100.0
New York	20	0	29	48	40.8	0	59.2	100.0
New Jersey	4/	6	2	8	1.9	71.4	26.7	100.0
Pennsylvania	12	4/	64	77	16.1	0.4	83.5	100.0
North Atlantic ^{3/}	36	6	98	139	25.6	4.5	69.9	100.0
Ohio	3	0	5	8	33.3	0	66.7	100.0
Indiana	0	0	0	0	0.0	0	100.0	100.0
Illinois	190	105	6	301	63.1	34.9	2.0	100.0
Michigan	10	1	168	179	5.6	0.6	93.9	100.0
Wisconsin	0	1	0	0	100.0	0	0	100.0
East North Central	203	106	180	488	41.5	21.7	36.8	100.0
Minnesota	201	61	87	349	57.7	17.4	24.8	100.0
Iowa	324	49	93	463	69.9	10.0	20.0	100.0
Missouri	4/	2	10	12	0.4	15.6	84.1	100.0
North Dakota	0	0	0	0	0	0	0	0
South Dakota	72	13	2	86	83.5	14.6	1.9	100.0
Nebraska	0	0	0	0	0	0	0	0
Kansas	360	32	0	392	91.8	8.2	0	100.0
West North Central	957	154	191	1,302	73.5	11.8	14.7	100.0
Delaware	0	0	0	0	0	0	0	0
Maryland	0	4/	14	14	0	1.8	98.2	100.0
Virginia	70	0	69	140	50.3	0	49.7	100.0
West Virginia	0	0	0	0	43.5	0	56.5	100.0
North Carolina	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	100.0	0	0	100.0
Georgia	0	0	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	100.0
South Atlantic	70	4/	83	153	45.8	0.2	54.0	100.0
Kentucky	0	0	0	0	0	0	0	0
Tennessee	0	0	4/	0	0	0	100.0	100.0
Alabama	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0
Arkansas	0	0	0	0	0	0	0	0
Louisiana	4/	4/	4/	4/	12.2	8.7	79.1	100.0
South Central	4/	4/	4/	4/	11.8	8.4	79.7	100.0
Oklahoma	0	0	4/	4/	0	0	100.0	100.0
Texas	536	0	29	565	94.9	0	5.1	100.0
Southern Plains	536	0	29	565	94.9	0	5.1	100.0
Montana	4/	0	4/	4/	83.2	0	16.8	100.0
Idaho	2	0	1	3	76.1	0	23.9	100.0
Wyoming	0	0	0	0	0	0	0	0
Colorado	1,126	0	9	1,135	99.2	0	0.8	100.0
New Mexico	16	0	13	29	56.0	0	44.0	100.0
Arizona	0	0	0	0	0	0	0	0
Utah	13	0	4/	13	99.4	0	0.6	100.0
Mountain	1,157	0	23	1,180	98.1	0	1.9	100.0

See footnotes at end of table.

Continued--

Table 4--Market outlets for sheep and lambs: Purchases by region and State of slaughter, reporting slaughter packers, 1987 ^{1/}--Continued

State/region ^{2/}	Nonpublic	Terminal	Auction	Total ^{3/}	Nonpublic	Terminal	Auction	Total
	----- 1,000 head -----				----- Percent -----			
Washington	150	0	4	155	97.1	0	2.9	100.0
Oregon	1	0	4/	1	93.2	0	6.8	100.0
California	829	0	24	853	97.2	0	2.8	100.0
Pacific	980	0	28	1,008	97.2	0	2.8	100.0
48 States	3,939	266	631	4,837	81.4	5.5	13.1	100.0
Alaska	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0
United States	3,939	266	631	4,837	81.4	5.5	13.1	100.0

^{1/} Includes all purchases of livestock except from terminals and auctions. Nonpublic outlets are terminals that have more than one marketing agency selling on commission; auctions have only one.

^{2/} Location of slaughter, but not necessarily the origin of livestock.

^{3/} Totals may not add due to rounding.

^{4/} Less than 500 head.

Source: (35).

the sheep and lambs slaughtered was purchased on a grade and weight basis.

As the number of sheep and lambs slaughtered has declined, the infrastructure of the sheep industry has consolidated. Higher marketing costs result if marketing activities are handled by low-volume, less cost-efficient units, or if the area of procurement and distribution covered by these units increases. Higher procurement and transportation costs are generally borne by producers as the distance between sheep-raising areas and slaughter plants increases. These costs have helped encourage the feeding industry to locate slaughter plants in the feeding areas.

Another effect of the reduced volume in the sheep industry is the trend toward a few large plants slaughtering most of the sheep and lambs. The percentage of sheep and lambs slaughtered in large plants has not changed significantly during the present lamb cycle. In 1987, 95 percent of the lambs were slaughtered in plants of 10,000 head or more, compared with 97 percent in 1979. However, the number of plants slaughtering 10,000 head or more has declined from 26 to 22, even though total slaughter increased slightly (table 6).

As market concentration increases, the number of bidders for lambs is reduced. The increasing concentration has raised concerns in the industry. The effect of the reduction in slaughtering plants and the control of slaughter by fewer packers is dampened by the ease of entry into this activity. The increase in the number of plants slaughtering lambs between 1979 and 1983 indicates that entry into lamb slaughter is not that difficult. However, many of the smaller plants, which can increase slaughter quickly, are not full-time lamb-slaughtering

Table 5--Grade and weight purchases of sheep and lambs

Year	Grade and weight	Total	Grade and weight as share of total
	- - - - - <u>1,000 head</u> - - - - -		<u>Percent</u>
1974	771	8,868	8.7
1975	820	7,835	10.5
1976	623	6,795	9.2
1977	527	6,069	8.7
1978	517	5,106	10.1
1979	1,179	4,916	24.0
1980	1,542	5,452	28.3
1981	1,028	5,448	18.9
1982	1,643	5,677	28.9
1983	1,760	6,007	29.3
1984	1,377	6,482	21.2
1985	2,192	5,909	37.1
1986	2,413	5,089	47.4
1987	1,737	4,827	35.9

Source: (35).

Table 6--Sheep and lamb slaughter by plant size

Plant size (head)	1979		1983		1987	
	Plants	Total	Plants	Total	Plants	Total
	<u>Number</u>	<u>1,000 head</u>	<u>Number</u>	<u>1,000 head</u>	<u>Number</u>	<u>1,000 head</u>
Under 100	617	15.1	692	19.4	653	17.1
100-999	163	44.0	247	68.7	171	50.0
1,000-9,999	29	103.4	46	138.7	60	171.3
10,000 or more	26	4,733.2	31	6,185.1	22	4,763.5
Total	835	4,895.6	1,016	6,412.0	906	5,001.9

Source: (32).

plants and are likely higher cost slaughterers. As lamb slaughter declined during 1983-87, many plant operators found it unprofitable to remain in business and closed.

Lamb Prices

The Bureau of Labor Statistics (BLS) ceased publishing lamb and veal retail prices in 1981. Lamb prices were combined with mutton, organ meats, and game and reported as "other meats." The combination of high-value products (lamb and game) with low-value products (organ meats, such as liver, kidneys, and tripe) hampers demand analysis for retail lamb. This development coincides with a period when lamb and mutton production and consumption have stabilized, following a long period of decline that makes results of previous demand studies questionable.

Wholesale Prices

The wholesale price per hundred weight (cwt) for lamb carcasses has generally been higher than for other meats (fig. 8). This reflects the increasing specialty nature of lamb. As per capita consumption declined, the wholesale price of lamb has continued to increase, both in nominal levels and relative to other meats (fig. 9).

Seasonality in Prices

Wholesale carcass prices tend to increase during the period of peak lamb demand, which is in the winter and the early spring. Prices generally peak in May, then fall after the heavy Easter/Passover demand period and continue downward through summer and fall, bottoming in November. The cycle starts again in December, with holiday demand for lamb (fig. 10).

Wholesale cut prices exhibit a slightly different pattern, reflecting seasonal demand for leg of lamb. Wholesale leg prices peak in March, around the time of the spring religious holidays and drop off rapidly during the next several months. Leg prices also rebound during December, because of the December religious holidays. Leg prices help hold up the carcass price as production peaks in the spring. Prices of other cuts (chuck, loin, and rack) do not appear to have a significant seasonal pattern.

Live Lamb Prices

Prices of slaughter lambs reflect the final demand for the lamb product and, therefore, follow wholesale price patterns. The final demand encompasses retail and hotel, restaurant, and institutional levels.

The seasonal index for both slaughter and feeder lambs, indicates that prices peak in April (fig. 11). Slaughter prices are at their lowest in November.