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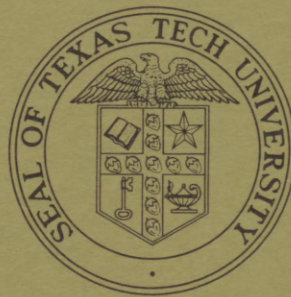
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*Swine - Cont. of pork*

**Economics of Swine-Pork Operation:  
Vertically Coordinated  
Texas High Plains**



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ECONOMICS OF SWINE-PORK OPERATION:  
VERTICALLY COORDINATED  
TEXAS HIGH PLAINS

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## INTRODUCTION

The relatively mild climate, availability of large quantities of feed grains, and the development of large scale total confinement swine production techniques have contributed greatly to an increase in hog production in Texas, especially the High Plains region, during the 1969-72 period. In 1971, Texas produced 2,234 thousand hogs for slaughter compared with 1,264 thousand hogs produced in 1968.

From 1955 to 1969, approximately 50 to 60 percent of the number of hogs slaughtered in Texas were primarily imported from the Midwest. For the 1970-73 period, Texas swine producers produced 90 percent of the total number of hogs required for slaughter within the state. However, during this same period, meatpackers in Texas which slaughtered hogs, did not replace their hog imports with Texas produced hogs on a one for one basis. Consequently, the additional hogs produced in the state became a defacto surplus due to this peculiar situation. Furthermore, since 1971, some of the major meatpacking firms in Texas have ceased their hog slaughter operations. These firms, which ceased their hog slaughter operations since 1971, had a combined hog slaughter volume of approximately 804 thousand head per year in 1970, or 40 percent of the state's total slaughter volume.

The major reason for the cessation of hog slaughter operations of some plants was generally due to high slaughter costs caused by old and inefficient facilities. From mid-1973 to present, the cost-price squeeze and the price-freeze have also contributed to these firms' cessation of hog slaughter operations.

The per capita consumption of pork has remained fairly stable since 1970, except for a decrease in 1973, a period of extremely high pork prices. On the

other hand, the hog slaughter volume in Texas has decreased considerably since 1971 which necessitated a larger amount of pork to be imported into the state.

Furthermore, a study by Lee and Perrin showed Texas to have a comparative advantage in supplying hogs, pork, or pork products to neighboring states.<sup>1</sup>

In spite of these favorable factors which should normally encourage production, the decrease in slaughter facilities in Texas has created a serious "bottleneck" which prevented increased hog production in Texas.

One method of removing this "bottleneck" is through a vertically coordinated swine-pork production operation which could simultaneously increase hog production and slaughter capacity. The vertically coordinated swine-pork production operation would produce market hogs, slaughter these hogs through a cooperatively owned hog slaughter plant, and sell wholesale fresh cuts of pork and by-products. Ideally this type of production operation would be of sufficient size so as to realize economies of size. Such an operation would provide the producers with a local outlet for their market hogs, while at the same time it would provide the slaughter operation with a dependable local source of quality hogs.

Traditionally, whenever meatpackers realized relatively high profits, hog producers had relatively low profits or a loss, and vice-versa. With a cooperatively owned slaughter facility, which is vertically coordinated with hog production operations, whenever hog producers are operating at a loss, the profits from the slaughter operation could either reduce or offset the loss resulting from hog production, whereas during periods of high hog prices, profits from hog production could reduce or offset losses from slaughter operations. The study, due to a number of limiting factors which were beyond the

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<sup>1</sup>Hong Y. Lee and John S. Perrin, Interregional Analysis of Texas Swine-Pork Industry, College of Agricultural Sciences Publication No. T-1-141, Texas Tech University, Lubbock, Texas, December 1975.

control of the investigators, was restricted to an analysis which assumed a 600 sow unit as the basic hog producing unit. Because of this restriction, the subsequent findings are also limited in its scope and implications. It is likely that costs of hog production on an industry-wide basis would be higher than the study may indicate and potential benefits from vertical coordination of swine-pork production may be lower as a result.

### Objectives

The primary objective of this study was to analyze the economic implications of a vertically coordinated swine-pork production operation proposed for the High Plains of Texas. More specifically the objectives of the study were:

1. To determine the economic efficiencies<sup>2</sup> associated with vertical coordination in a swine-pork production operation.
2. To determine the economic efficiencies associated with a vertically coordinated cooperatively owned hog slaughter operation.
3. To determine and evaluate the economic advantages and/or disadvantages of a vertically coordinated swine-pork production operation operating a cooperatively owned slaughter facility.

Vertical coordination, as utilized for the purpose of this study, is broadly defined as:

An agreement between two parties who engaged in performing tasks at two or more different levels of production and/or marketing. This agreement results in the transfer from one party to the other, part or all, of management control, assets, or functions.<sup>3</sup>

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<sup>2</sup>Economic efficiencies as used in this study are measured by net income expressed as a percentage of total investment.

<sup>3</sup>R.E. Schneider and L.A. Duewer, "An Introduction to Vertical Coordination", Symposium: Vertical Coordination in the Pork Industry. Connecticut: Avi Publishing Company, Inc., 1972, p. a

### General Procedures

In analyzing the economic efficiencies of a vertically coordinated swine-pork production operation, an optimum level of hog production and hog slaughter capacity was assumed from the conditions which exist on the Texas High Plains. To determine the economic feasibility of vertical coordination, the costs and returns of swine production and hog slaughter operations were derived for the five year period, 1970-74. The economic efficiencies of a vertically coordinated cooperatively owned hog slaughter facility were determined by comparing its costs and returns to a slaughter facility of similar size which is neither vertically coordinated nor cooperatively owned.

### Assumptions

The basic hog production unit for this study was a 600 sow complete confinement swine production operation. Owens, Snodgrass, and Lee concluded this size of swine production to be the most economical for the conditions which exist on the Texas High Plains.<sup>4</sup>

A large scale hog slaughter plant with a slaughter capacity of 600 head per hour was utilized throughout this study as the basic unit of hog slaughter operation. This size of operation was found by Lee and Condra to be the most economically and competitively feasible new plant size for the Texas High Plains.<sup>5</sup>

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<sup>4</sup>Owens, T.R., Snodgrass, J.C. and Lee, H.Y., Input Requirements and Production Costs, Complete Confinement Swine Rearing Operation, Texas High Plains, 1971. ICASALS Special Report No. 46, Texas Tech University, 1971.

<sup>5</sup>Lee, Hong Y. and Condra, Gary, "Economic Feasibility of Increased Hog Slaughter Facilities for Texas". Proceedings of the Twenty-Second Annual Swine Short Course, College of Agricultural Sciences Publication No. T-5-107. Texas Tech University, 1974.

The swine feed rations and feeding program used for this study were obtained from an earlier swine production efficiency study by Owens, Snodgrass and Lee. The ration and feeding information is presented in Appendix Tables A and B.

Slaughter hogs were assumed to be fed to a market weight of 225 pounds. A farrowing rate of 2.23 farrowings per year was assumed, along with sows being replaced every three years. Furthermore, a sow to boar ratio of 16:1 was utilized for purposes of this study. The price for 44 percent protein soybean meal on the Texas High Plains was assumed to be the Decatur price,<sup>6</sup> plus \$28 per ton to reflect handling and transportation costs incurred in providing soybean meal for distribution on the High Plains.

## FINDINGS

### Hog Production Costs

The cost of hog production per hundred pounds of hogs produced fluctuated widely from a low of \$16.79 in January, 1970 to a high of \$37.26 in October, 1974 during the 1970-74 period (see Table 1). Estimated hog production costs had increased into the thirty dollar per hundredweight range by 1974 primarily because of increased costs of feed grain and soybean meal in swine feed rations. During the 1970-74 period, costs of sorghum per hundred pounds of hogs produced varied from \$5.04 in June, 1970 to \$16.98 in October, 1974. Costs of soybean meal varied from \$2.90 in June, 1970 to \$14.15 by June, 1973 (see Table 1).

### Hog Production Revenues

The monthly revenues from a 600 sow swine production operation per hundred pounds of hogs produced are presented in Table 2. These revenues are the average

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<sup>6</sup>Decatur soybean meal prices are presented in the Feed Situation report which is published quarterly by the U.S. Department of Agriculture.

Table 1. Estimated Costs of Swine Production Per Hundred Pounds of Hogs Produced, by Major Components and Months, 600 Sow Complete Confinement Swine Production Operation, Texas High Plains, 1970-74

Month-Year	Sorghum	Soybean Meal	Other <sup>1</sup> Costs	Total <sup>2</sup>
-----Dollars-----				
1970:				
January	5.66	2.90	8.23	16.79
February	5.66	3.63	8.33	17.62
March	5.38	3.22	8.43	17.03
April	5.09	3.31	8.53	16.93
May	5.09	3.18	8.63	16.90
June	5.04	3.31	8.73	17.08
July	5.09	3.57	8.83	17.49
August	5.09	3.60	8.93	17.62
September	5.74	3.51	9.03	18.28
October	5.80	3.38	9.13	18.31
November	5.66	3.41	9.23	18.30
December	5.66	3.54	9.33	18.53
1971:				
January	5.66	3.47	9.43	18.56
February	6.03	3.41	9.53	18.97
March	6.03	3.38	9.63	19.04
April	6.37	3.28	9.73	19.38
May	7.16	3.41	9.83	20.40
June	7.07	3.54	9.93	20.54
July	7.16	3.60	10.03	20.68
August	6.79	3.44	10.13	20.36
September	5.66	3.25	10.23	19.14
October	5.38	3.31	10.33	19.02
November	5.38	3.28	10.43	19.09
December	5.70	3.51	10.53	19.64
1972:				
January	5.52	3.57	10.63	19.72
February	5.37	3.63	10.73	19.82
March	5.46	3.83	10.83	20.12
April	5.46	3.92	10.93	20.31
May	5.46	3.96	11.03	20.45
June	5.52	3.96	11.13	20.61
July	5.60	4.15	11.23	20.98
August	5.97	4.15	11.33	21.45
September	5.94	4.37	11.43	21.74
October	6.23	4.41	11.53	22.17
November	6.51	4.86	11.63	23.00
December	7.92	6.50	11.73	26.15

Table 1 (Continued)

Month-Year	Sorghum	Soybean Meal	Other <sup>1</sup> Costs	Total <sup>2</sup>
1973:				
January	7.78	6.95	11.83	26.56
February	7.92	7.95	11.93	27.80
March	7.92	7.33	12.03	27.28
April	7.87	7.43	12.13	27.43
May	8.21	11.03	12.23	31.47
June	9.56	14.15	12.33	36.04
July	10.04	10.90	12.43	33.37
August	13.67	10.07	12.53	36.27
September	10.70	7.59	12.63	30.92
October	11.32	6.05	12.73	30.10
November	11.40	6.27	12.83	30.50
December	11.46	7.08	12.93	31.47
1974:				
January	12.17	6.43	13.03	31.63
February	13.30	6.05	13.13	32.48
March	12.87	5.63	13.23	31.73
April	10.61	4.66	13.33	28.60
May	10.27	4.41	31.43	28.11
June	10.33	4.12	13.54	27.99
July	12.17	5.34	13.65	31.16
August	14.86	5.92	13.76	34.54
September	14.86	5.34	13.87	34.07
October	16.98	6.30	13.98	37.26
November	16.69	5.44	14.09	36.22
December	11.46	5.50	14.20	31.16

<sup>1</sup>Other costs include annual expense for buildings, equipment, vehicles, and land, plus breeding stock, labor, utilities, insurance, interest and other feed ingredient costs.

<sup>2</sup>Total Cost of Hog Production equals the sum of sorghum, soybean meal, and other costs.



Table 2. Estimated Average Monthly Price Received by Swine Producers per Hundred Pounds of Hogs Marketed,<sup>1</sup>  
Texas High Plains, 1970-74

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Dollars-----													
1970	27.75	28.25	25.75	24.25	24.50	24.75	25.25	20.75	19.00	18.00	16.00	16.25	22.54
1971	16.25	19.75	17.25	16.25	18.25	18.00	19.25	10.00	16.75	19.00	19.75	21.25	18.40
1972	24.25	26.25	23.75	23.00	25.50	26.50	28.75	29.00	28.25	27.50	27.25	31.00	26.75
1973	31.75	34.25	39.00	35.50	35.75	38.25	41.50	59.25	43.00	41.25	40.25	39.75	39.99
1974	41.25	51.25	37.25	30.75	27.75	25.50	37.25	37.75	33.25	37.75	38.25	40.75	35.73
1975	40.00	38.25	38.75	39.25									

<sup>1</sup> Average price received by swine producers on the Texas High Plains was assumed to be the same as the average price for barrows and gilts at San Antonio, Grade 1-3, 200-230 pounds.

Source: Texas Livestock Market News.

monthly San Antonio market hog prices for barrows and gilts, of grade 1-3, 200-230 pounds. These market prices fluctuated widely during the study period, varying from a low of \$16.00 in November, 1970 to a high of \$59.25 in August, 1973 or 270 percent.

#### Hog Production Profits

The monthly profits from hog production for the 1970-74 period were estimated to range from a net loss of \$3.13 in April, 1971 to \$22.98 in August, 1973 per hundred pounds of hog (see Table 3 and Figure 1). During this five year study period, profits normally existed for all years except 1971, which in comparison with 1970, experienced lower market hog prices but increased production costs.

Estimated profits from hog production decreased throughout 1970, reaching the lowest level in April, 1971 of a \$3.13 net loss per hundred pounds (see Figure 1). Profits fluctuated from \$2.69 to \$7.77 during 1972. During 1973 profits continued to be made, reaching a high of \$22.98 in August during the federal government's price freeze. Following this peak in August, profits started to decrease and reached a \$2.49 net loss by June, 1974. The remainder of 1974 experienced both periods of profits and losses, ranging from a net loss of \$0.82 to a profit of \$9.59 per hundred pounds of hogs produced. This erratic profit/loss situation created much uncertainty in areas of investment and expansion of operations for many commercial swine production enterprises.

#### Hog Slaughter Operational Costs

The annual average total costs of hog slaughter operations were estimated to have ranged from \$2.95 in 1970 to \$6.96 in 1975 per hog for a 136 percent cost increase. These total costs of slaughter were divided into direct and indirect costs (see Table 4).

Table 3. Estimated Monthly Swine Production Profits, 600 Sow Complete Confinement Swine Production Operation, Texas High Plains, 1970-74.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Dollars per Hundred Pounds of Hogs-----													
Hog Production													
1970	10.96	10.63	8.72	7.32	7.60	6.67	6.76	3.13	0.72	-0.31	-2.30	-2.28	4.97
1971	-2.31	0.78	-1.79	-3.13	-2.15	-2.54	-1.54	-1.36	-2.39	-0.02	0.66	1.61	-1.18
1972	4.53	6.43	3.63	2.69	5.05	5.89	7.77	7.55	6.51	5.33	4.25	4.85	5.37
1973	5.19	6.45	11.72	8.07	4.28	2.21	8.13	22.98	12.08	11.15	9.75	8.28	9.19
1974	9.62	8.77	5.52	2.15	-0.36	-2.49	6.09	3.21	-0.82	0.49	2.03	9.59	3.65

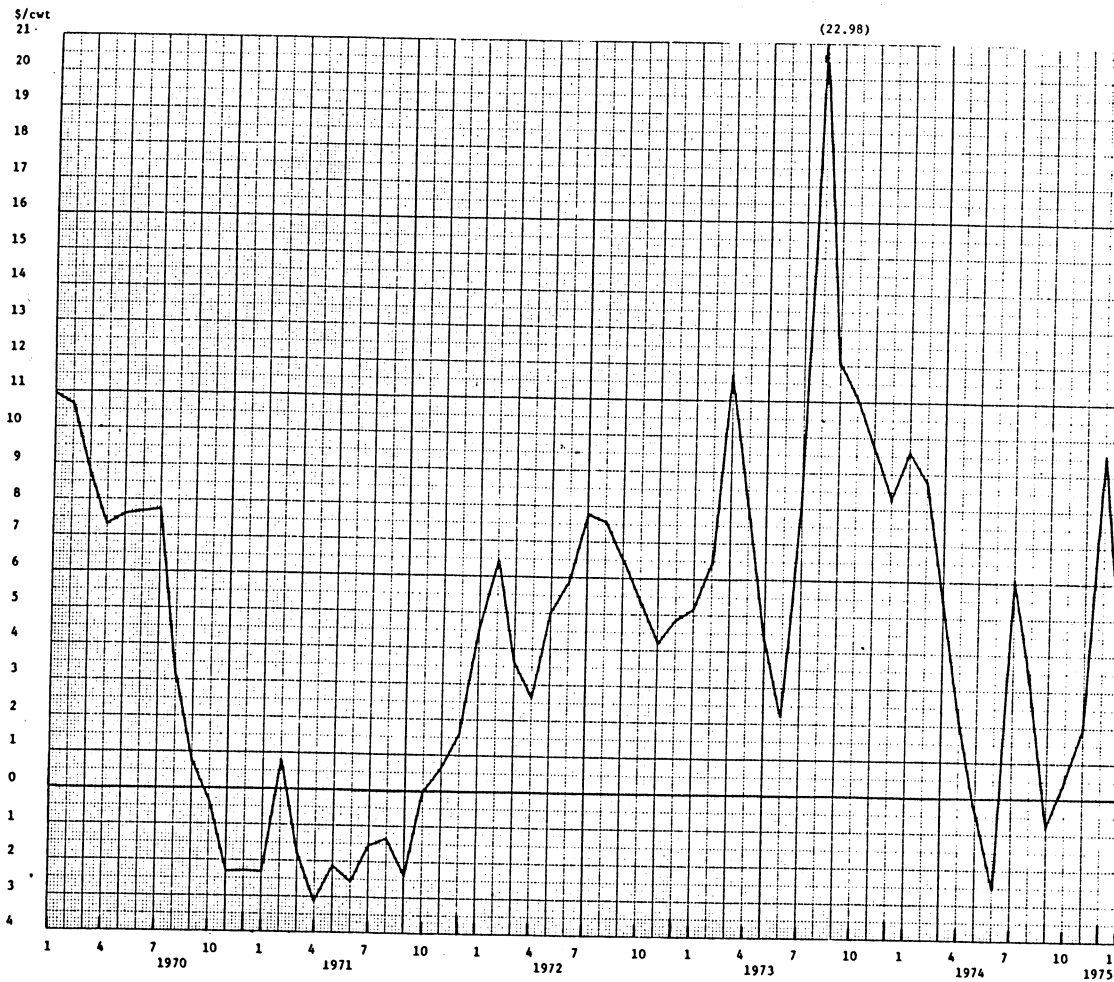


Figure 1. Estimated Monthly Profits from a 600 Sow Swine Production Operation, Texas High Plains, Dollars per Hundred Pounds of Hog, 1970-74 By Months

Table 4. Estimated Costs of Hog Slaughter: Average Annual Direct, Indirect, and Total Costs, 600 Head per Hour Slaughter Capacity Plant, Texas High Plains, 1970-75

Year	Direct Costs (DC)	Indirect Costs (IDC)	Average Total Costs (ATC)
	-----Dollars per Head <sup>1</sup> -----		
1970	1.93	1.02	2.95
1971	2.64	1.11	3.75
1972	3.35	1.20	4.55
1973	4.06	1.29	5.35
1974	4.77	1.38	6.15
1975	5.48	1.48	6.96

<sup>1</sup>Assumed a 225 lb. hog.

The annual average direct cost of hog slaughter per head included such items of expense as labor, utilities, distribution, and sales, all of which were directly related to the number of hogs slaughtered. From 1970 to 1975, the direct costs of slaughter were found to have increased from \$1.93 to \$5.48 per hog slaughtered. This represented a 184 percent increase in cost which was due primarily to increases in the cost of labor.

The indirect costs of slaughter are those costs attributed to plant overhead, that is, costs for management, administration, depreciation, and repairs and maintenance. From 1970 to 1975, indirect costs of slaughter increased from \$1.02 to \$1.48 per hog slaughtered, for an increase of 45 percent.

Utilization rate of plant capacity by meatpackers fluctuates over a period of time due to a number of factors such as a changing supply of hogs and demand for pork. Since the level of utilization of the plant capacity affects costs of the slaughter operation, it was essential to estimate levels of plant capacity utilization in the hog slaughter industry. The monthly actual utilization levels of plant capacity were estimated for the period 1970-74 and are presented in Table 5. The annual average slaughter plant actual capacity utilization level ranged from a low of 71 percent in 1973 to a high of 88 percent in 1971.

The level of capacity utilization affects the total costs of slaughter due to different quantities of hogs being slaughtered by the facility. To accurately reflect the indirect costs of slaughter under the various levels of actual capacity utilization estimated to exist in the hog slaughter industry, these costs were adjusted and are presented in Table 6, along with the estimated actual levels of slaughter plant capacity utilization.

Fewer hogs were slaughtered under estimated actual levels of capacity utilization as compared to 100 percent capacity utilization, thus the indirect

Table 5. Estimated Monthly Actual Capacity Utilization<sup>1</sup> of Hog Slaughter Facilities, United States, 1970-74

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Percent-----													
1970	76	68	78	81	71	70	71	74	85	93	90	98	80
1971	92	78	100	94	84	85	76	84	89	87	81	82	88
1972	78	76	94	81	81	76	63	77	76	83	83	74	79
1973	79	68	78	71	78	68	59	65	63	78	77	70	71
1974	81	66	77	81	83	70	68	75	77	83	76	74	76

<sup>1</sup>Capacity utilization was estimated on the assumption that the utilization level was in the same proportion as the monthly slaughter volume was to the slaughter volume for the base month, March, 1971.

Table 6. Estimated Monthly Indirect and Total Costs of Hog Slaughter Per Head for Estimated Actual Levels of Capacity Utilization, 600 Head Per Hour Hog Slaughter Facility, Texas High Plains, 1970-74 By Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Dollars Per Head <sup>1</sup> -----													
Indirect Costs													
1970	1.33	1.49	1.31	1.26	1.42	1.44	1.42	1.37	1.19	1.08	1.13	1.04	1.29
1971	1.19	1.42	1.10	1.17	1.31	1.31	1.44	1.31	1.24	1.26	1.22	1.19	1.26
1972	1.53	1.58	1.26	1.46	1.46	1.58	1.89	1.55	1.58	1.44	1.44	1.62	1.53
1973	1.62	1.89	1.64	1.80	1.64	1.89	2.18	1.98	2.03	1.64	1.67	1.82	1.82
1974	1.69	2.07	1.78	1.60	1.64	1.96	2.03	1.82	1.78	1.64	1.80	1.85	1.81
Total Costs													
1970	3.26	3.42	3.24	3.19	3.35	3.37	3.35	3.30	3.12	3.01	3.06	2.97	3.22
1971	3.83	4.06	3.74	3.81	3.95	3.95	4.08	3.95	3.88	3.90	3.86	3.83	3.90
1972	4.88	4.93	4.61	4.81	4.81	4.93	5.24	4.90	4.93	4.79	4.79	4.97	4.88
1973	5.68	5.95	5.70	5.86	5.70	5.95	6.24	6.04	6.09	5.70	5.73	5.88	5.88
1974	6.46	6.84	6.55	6.46	6.41	6.73	6.80	6.59	6.55	6.41	6.57	6.62	6.58

<sup>1</sup>Assumed a 225 pound hog.



costs of slaughter from Table 6 for estimated levels of actual capacity utilization were greater than those at 100 percent capacity utilization. The average annual indirect costs of slaughter for estimated actual levels of capacity utilization were found to range from \$1.26 to \$1.82 per hog slaughtered as compared to a range of \$1.02 to \$1.48 per hog at 100 percent capacity utilization. Increases in indirect costs, due to adjustments in the level of capacity utilization, were estimated to be \$0.27, \$0.15, \$0.33, \$0.53, and \$0.43 for the years 1970 through 1974, respectively. The magnitude of increase in slaughter costs was closely related to the plant capacity utilization level. It was observed that the lower the level of plant capacity utilization, the higher the increase in indirect cost of slaughter.

#### Total Production Costs of Pork

By combining the total cost of hog slaughter with the purchase cost of a market hog the monthly production costs of pork were estimated for selected levels of slaughter plant capacity utilization for the years 1970-74 (see Table 7).

The annual average production cost of pork per hundred pounds of hog varied from \$20.07 to \$42.34 at 100 percent capacity utilization, from \$20.10 to \$42.39 at 90 percent capacity utilization, and from \$20.13 to \$42.57 at estimated actual levels of capacity utilization. The similarity of these pork production costs was due to the fact that approximately 92 percent of the total cost of pork production is for the cost of market hogs, irrespective of the level of capacity utilization. Even though the differences in total production cost of pork per unit between the three selected levels of plant capacity utilization appeared to be minor, the differences became quite large on an annual basis for a large slaughter plant as shown in Table 8. From this table,

Table 7. Estimated Total Production Cost of Pork<sup>1</sup> for Selected Levels of Slaughter Plant Capacity Utilization, 600 Head per Hour Hog Slaughter Facility, Texas High Plains, 1970-74 By Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Dollars per Hundred Pounds of Hog-----													
100 Percent Capacity Utilization													
1970	29.06	29.56	27.06	25.56	25.81	26.06	26.56	22.06	20.31	19.31	17.31	17.56	23.85
1971	17.92	21.42	18.91	17.92	19.92	19.67	20.92	20.67	18.42	20.67	21.42	22.92	20.07
1972	26.27	28.27	25.77	25.02	27.52	28.52	30.77	31.02	30.27	29.52	29.27	33.02	28.77
1973	34.13	36.63	41.38	37.88	38.13	40.63	43.88	61.63	45.38	43.63	42.63	42.13	42.34
1974	43.98	43.98	39.98	33.48	30.48	28.23	39.98	40.48	35.98	40.48	40.98	43.48	38.46
90 Percent or Greater Capacity Utilization													
1970	29.11	29.61	27.11	25.61	25.86	26.11	26.61	22.11	20.36	19.34	17.36	17.57	23.90
1971	17.95	21.46	18.91	17.94	19.96	19.71	20.96	20.71	18.46	20.71	21.46	22.95	20.10
1972	26.33	28.33	25.80	25.08	27.58	28.58	30.83	31.08	30.33	29.58	29.33	33.08	28.83
1973	34.18	36.68	41.43	37.93	38.18	40.68	43.93	61.68	45.43	43.68	42.68	42.18	42.39
1974	44.05	44.05	40.05	33.55	30.55	28.30	40.05	40.55	36.05	40.55	41.05	43.55	38.53



Table 8. Estimated Annual Cost of Pork by Selected Levels of Slaughter Plant Capacity Utilization, 600 Head Per Hour Hog Slaughter Facility, Texas High Plains, 1970-74

Level of Capacity Utilization	Annual Hog Slaughter Volume	1970	1971	1972	1973	1974
		-----Million Dollars-----				
100 Percent	1,125,000	60.37	50.80	72.83	107.24	97.36
90 Percent	1,012,500	54.45	45.84	65.68	96.66	87.78
Estimated Actual	a	48.54	44.85	57.83	76.57	74.36

<sup>a</sup>Estimated actual annual hog slaughter volume for the individual years were: 1970 - 900,000 head; 1971 - 990,000 head; 1972 - 888,750 head; 1973 - 798,750 head; and 1974 - 855,000 head.

total pork production costs of \$97.36, \$87.78, and \$74.36 million were derived for 1974 at 100 percent, 90 percent, and estimated actual levels of plant capacity utilization, respectively, for differences of \$5.56, \$13.44, and \$19.00 million in annual costs between the selected levels of plant capacity utilization.

The costs for lower levels of capacity utilization involved a lower slaughter hog volume which led to a lower annual cost. For this reason, the annual total production cost of pork was estimated to be the greatest at 100 percent capacity utilization, and the lowest at estimated actual levels of capacity utilization. The higher annual total production cost of pork at 100 percent capacity utilization was more than offset by the higher revenues generated from the larger volume of hogs slaughtered, thus affecting the profitability of the slaughter operation. For example, in 1974 100 percent capacity utilization would have handled an estimated 31.6 percent more hogs at an estimated increase of 30.9 percent in production cost when compared with estimated actual levels of capacity utilization for the year.

#### Hog Slaughter Revenues

Based on percentage cut-outs of various pork cuts and by-products<sup>7</sup> along with prices of these cuts published in the "Yellow Sheets" of the National Provisioner, monthly carcass, by-product, and wholesale values of a market hog for a 600 head per hour slaughter capacity plant were estimated and are presented in Table 9 for the period of 1970-74. Approximately 95 percent of the total revenues of the slaughter operation was derived from the sale of wholesale pork cuts with the remainder coming from the sale of by-products. The

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<sup>7</sup>See Appendix Tables D and E for a complete hog carcass and by-product cut-out for a 225 pound market hog.

Table 9. Estimated Carcass, By-Product, and Wholesale Value of a 225 Pound Market Hog, Texas 1970-74 By Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
-----Dollars-----												
Carcass Value <sup>1</sup>												
1970	69.18	67.72	63.30	59.21	57.56	60.73	61.92	57.95	54.88	48.95	44.37	45.36
1971	44.28	51.04	42.21	43.67	47.66	47.46	51.81	50.05	48.92	51.55	50.01	51.45
1972	59.95	62.72	56.04	56.53	63.05	64.71	67.01	70.66	70.41	70.53	66.12	73.33
1973	74.94	82.32	87.55	79.16	28.95	87.32	111.71	114.89	103.70	93.98	94.68	92.73
1974	95.58	90.30	77.42	74.88	67.77	60.99	81.30	89.24	80.82	88.80	89.02	94.97
By-Product Value <sup>2</sup>												
1970	3.64	3.73	3.79	3.75	3.33	3.17	3.17	3.25	3.23	3.20	5.63	2.62
1971	2.71	2.10	3.03	2.94	2.94	2.83	3.05	3.08	3.01	3.07	3.03	2.87
1972	4.15	3.39	3.37	3.53	3.38	3.51	3.36	4.07	3.91	4.17	4.05	3.75
1973	4.82	5.70	6.68	6.28	7.00	7.44	7.78	9.07	7.25	6.84	6.87	7.54
1974	7.31	7.56	6.87	5.90	5.29	4.44	5.58	6.17	5.33	6.15	5.99	5.28

Table 9 (Continued)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Wholesale Value <sup>3</sup>											
1970	72.82	71.45	67.09	62.96	60.89	63.90	65.09	61.20	58.11	52.15	50.00	47.98
1971	46.99	53.14	45.24	46.61	50.60	50.30	54.86	53.13	51.93	54.62	53.04	54.32
1972	64.10	66.11	59.41	60.06	66.43	68.22	70.64	74.73	74.32	74.70	70.17	77.08
1973	79.76	88.02	94.23	85.44	89.95	94.76	119.49	123.96	110.95	100.82	101.55	100.27
1974	102.89	97.36	84.29	80.78	67.06	65.43	86.88	95.41	86.15	94.95	95.01	100.25

<sup>1</sup>Carcass Values based upon products of Appendix D.

<sup>2</sup>By-Product Value based upon products of Appendix E.

<sup>3</sup>Wholesale Values equals Carcass Value plus By-Product Values.

wholesale value of a 225 pound market hog sold as pork and by-products varied from a low of \$45.24 in March, 1971 to a high of \$123.96 during August, 1973.

The carcass and wholesale values were converted to a liveweight basis to analyze the marketing margin between farm and wholesale levels. The estimates of carcass and wholesale values converted to a liveweight basis are presented in Table 10. A comparison of the data of Table 10 with the estimated value of a market hog at the farm level (shown in Table 2) yields the estimated differences in value per hundred pounds of market hog between the farm and wholesale levels. These differences are presented in Table 11, and were estimated to be \$4.63, \$4.40, \$3.84, \$4.06, and \$3.42 per 100 pounds of liveweight on an annual basis for the years 1970-74, respectively. These differences in values between marketing levels reflect the size of the margin a slaughter operation has from which to meet its operational expenses. How well it has met these expenses is explained in the next section on profits.

#### Hog Slaughter Profits

Data from Tables 7 and 10 were used to estimate monthly profits for a 600 head per hour hog slaughter facility for selected levels of capacity utilization. These profit estimates are given in Table 12 and Figure 2 for the period of 1970-74.

The estimated annual average profits per hundred pounds of hog slaughtered ranged from \$0.69 to \$3.32 at 100 percent capacity, from \$0.62 to \$3.28 at 90 percent capacity utilization, and from \$0.49 to \$3.20 at estimated actual levels of capacity utilization. These ranges revealed a variation of 381 percent, 429 percent, and 553 percent for 100 percent, 90 percent, and estimated actual levels of capacity utilization, respectively. This wide variation in monthly profits for a slaughter operation can be observed in Figure 2.



Table 10. Estimated Carcass and Wholesale Value Per Hundred Pounds of Market Hog, Texas, 1970-74 By Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Dollars-----													
Carcass Value (Liveweight Basis)													
1970	30.75	30.10	28.13	26.32	25.58	26.99	72.52	25.76	24.39	21.76	19.72	20.16	25.60
1971	19.68	22.68	18.76	19.41	21.18	21.09	23.03	22.24	21.74	22.91	22.23	22.87	21.49
1972	23.53	27.88	24.91	25.12	28.02	28.76	29.78	31.40	31.29	31.35	29.39	32.59	28.67
1973	33.31	36.59	38.91	35.18	36.87	38.81	49.65	51.06	46.09	41.77	42.08	41.21	40.96
1974	42.48	40.13	34.41	33.28	27.45	27.11	36.13	39.66	35.92	39.47	39.56	42.21	36.48
Wholesale Value (Liveweight Basis) <sup>1</sup>													
1970	32.36	31.76	29.82	27.98	27.06	28.40	28.93	27.20	25.83	23.18	22.22	21.32	27.17
1971	20.89	24.02	20.11	20.71	22.49	22.35	24.38	23.61	23.08	24.28	23.57	24.14	22.80
1972	28.49	29.38	26.40	26.69	29.52	30.32	31.40	33.22	33.04	33.20	31.19	34.26	30.59
1973	35.45	39.12	41.88	37.98	39.98	42.12	53.11	55.09	49.31	44.81	45.13	44.56	44.05
1974	45.73	43.49	37.46	35.90	29.80	29.08	38.61	42.40	38.29	42.20	42.23	44.56	39.15

<sup>1</sup>Wholesale value of fresh wholesale pork cuts and by-products per 100 lbs. liveweight.

Table 11. Hog Marketing Margin: Farm to Wholesale Level, Texas,  
1970-74 By Months

	1970	1971	1972	1973	1974
	-----Dollars per Hundredweight----- (Liveweight Basis)				
January	4.61	4.64	4.24	3.70	4.48
February	3.51	4.27	3.13	4.87	2.24
March	4.07	2.86	2.65	2.88	0.21
April	3.73	4.46	3.69	2.48	5.15
May	2.56	4.24	4.02	4.23	2.05
June	3.65	4.35	3.82	3.87	3.58
July	3.68	5.13	2.65	11.61	1.36
August	6.45	4.61	4.22	-4.16	4.65
September	6.83	6.33	4.79	6.31	5.04
October	5.18	5.28	5.70	3.56	4.45
November	6.22	3.82	3.94	4.88	3.98
December	5.07	2.89	3.26	4.81	3.81
Average	4.63	4.40	3.84	4.06	3.42

Table 12. Estimated Profits from a 600 Head Per Hour Hog Slaughter Facility, For Selected Levels of Capacity Utilization, Texas High Plains, 1970-74, By Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
-----Dollars per Hundred Pounds of Hogs-----													
100 Percent Capacity Utilization													
1970	3.30	2.20	2.76	2.42	1.25	2.34	2.37	5.14	5.52	3.87	4.91	3.76	3.32
1971	2.97	2.60	1.20	2.79	2.56	2.68	3.46	2.94	4.66	3.61	2.14	1.22	2.74
1972	2.22	1.11	0.63	1.67	2.00	1.80	0.63	2.20	2.77	3.68	1.92	1.24	1.82
1973	1.32	2.49	0.50	0.10	1.85	1.49	9.23	-6.54	3.93	1.18	2.50	2.43	1.71
1974	1.75	-0.49	-2.52	2.42	-0.68	0.85	-1.37	1.92	2.31	1.72	1.25	1.08	0.69
90 Percent or Higher Capacity Utilization													
1970	3.25	2.15	2.71	2.37	1.02	2.29	2.32	5.09	5.47	3.84	4.86	3.75	3.28
1971	2.94	2.56	1.20	2.77	2.53	2.64	3.42	2.90	4.62	3.57	2.11	1.19	2.70
1972	2.16	1.05	0.60	1.61	1.94	1.74	0.57	2.14	2.71	3.62	1.86	1.18	1.77
1973	1.27	2.44	0.45	0.05	1.80	1.44	9.18	-6.59	3.88	1.13	2.45	2.38	1.66
1974	1.68	-0.56	-2.59	2.35	-0.75	0.78	-1.44	1.85	2.24	1.16	1.18	1.01	0.62

Table 12 (Continued)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
	Estimated Actual Capacity Utilization												
1970	3.16	1.99	2.63	2.31	1.07	2.15	2.19	4.98	5.44	3.84	4.86	3.75	3.20
1971	2.94	2.47	1.20	2.77	2.49	2.70	3.32	2.86	4.61	3.55	2.11	1.19	2.68
1972	2.07	0.94	0.60	1.55	1.88	1.63	0.32	2.05	2.60	3.57	1.81	1.05	1.67
1973	1.18	2.23	0.35	-0.12	1.70	1.23	8.85	-6.84	3.61	1.03	2.34	2.20	1.48
1974	1.61	-0.80	-2.70	2.28	-0.80	0.59	-1.66	1.72	2.13	1.60	1.06	0.87	0.49

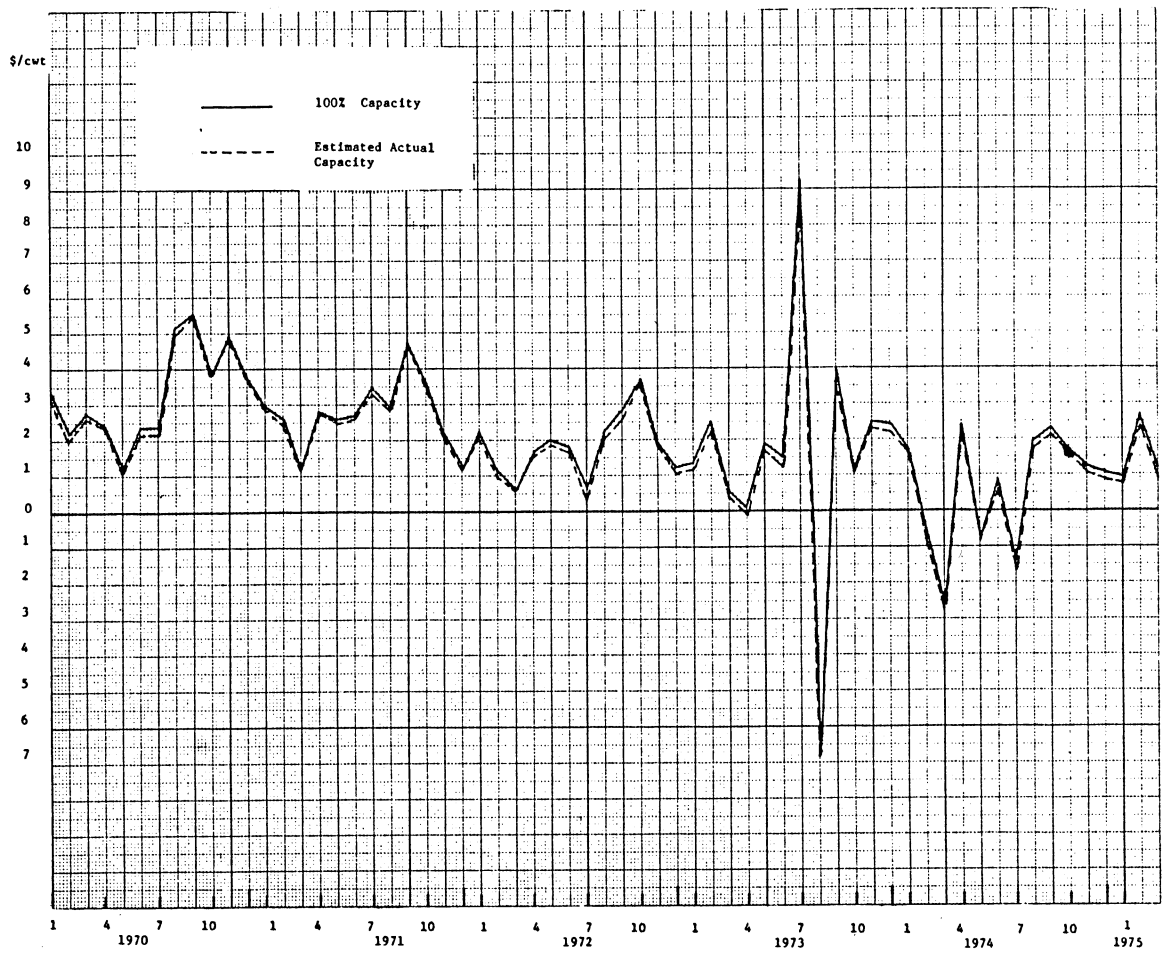


Figure 2. Estimated Profits from a 600 Head per Hour Hog Slaughter Facility By Selected Levels of Capacity Utilization, Dollars per Hundred Pounds of Hog, Texas High Plains, 1970-74 By Months

A close examination of Table 12 and Figure 2 showed a large degree of similarity in monthly hog slaughter operation profits for a plant operating at 100 percent capacity utilization and one operating at selected levels of actual capacity utilization. Once these monthly profit figures for various levels of capacity utilization were converted to an annual basis, the differences in profits between 100 percent and estimated actual levels of capacity utilization became quite substantial as shown in Table 13.

The estimated average profits for a large scale hog slaughter operation during the period of 1970-74 were \$5.2, \$4.6, and \$3.9 million for 100 percent, 90 percent, and estimated actual levels of capacity utilization, respectively. As would be expected, the larger the percentage of capacity utilization, the larger the total amount of profits.

#### Cooperatives as a Means of Achieving

##### Vertical Coordination

The total capital investment requirement for a large scale hog slaughter facility located on the Texas High Plains was estimated at approximately 14 million dollars for 1974. One method by which this large amount of investment capital could be secured for the proposed slaughter operation is through the formation of an agricultural cooperative by the swine producers of the Texas High Plains. This hog slaughter cooperative would provide the producers with a local outlet for their hogs, and permit them to share the profits (or losses) of the slaughter operation.

Figure 3 shows estimated monthly costs, revenues, and profits per hundred pounds of hog from a 600 sow complete confinement swine production unit and a 600 head per hour hog slaughter operation. As it was mentioned earlier, a 600 sow unit swine production operation during the October 1970-October 1971 period

Table 13. Estimated Annual Profits from a 600 Head Per Hour Hog Slaughter Facility by Selected Levels of Capacity Utilization, Texas High Plains, 1970-74

Level of Capacity Utilization	1970	1971	1972	1973	1974	Average
	-----Thousand Dollars-----					
100 Percent	8,403.75	6,935.63	4,606.88	4,328.44	1,746.56	5,204.25
90 Percent	7,472.25	6,150.94	4,032.28	3,781.69	1,412.44	4,569.92
Estimated Actual	6,480.00	5,969.70	3,339.48	2,659.84	942.64	3,878.33

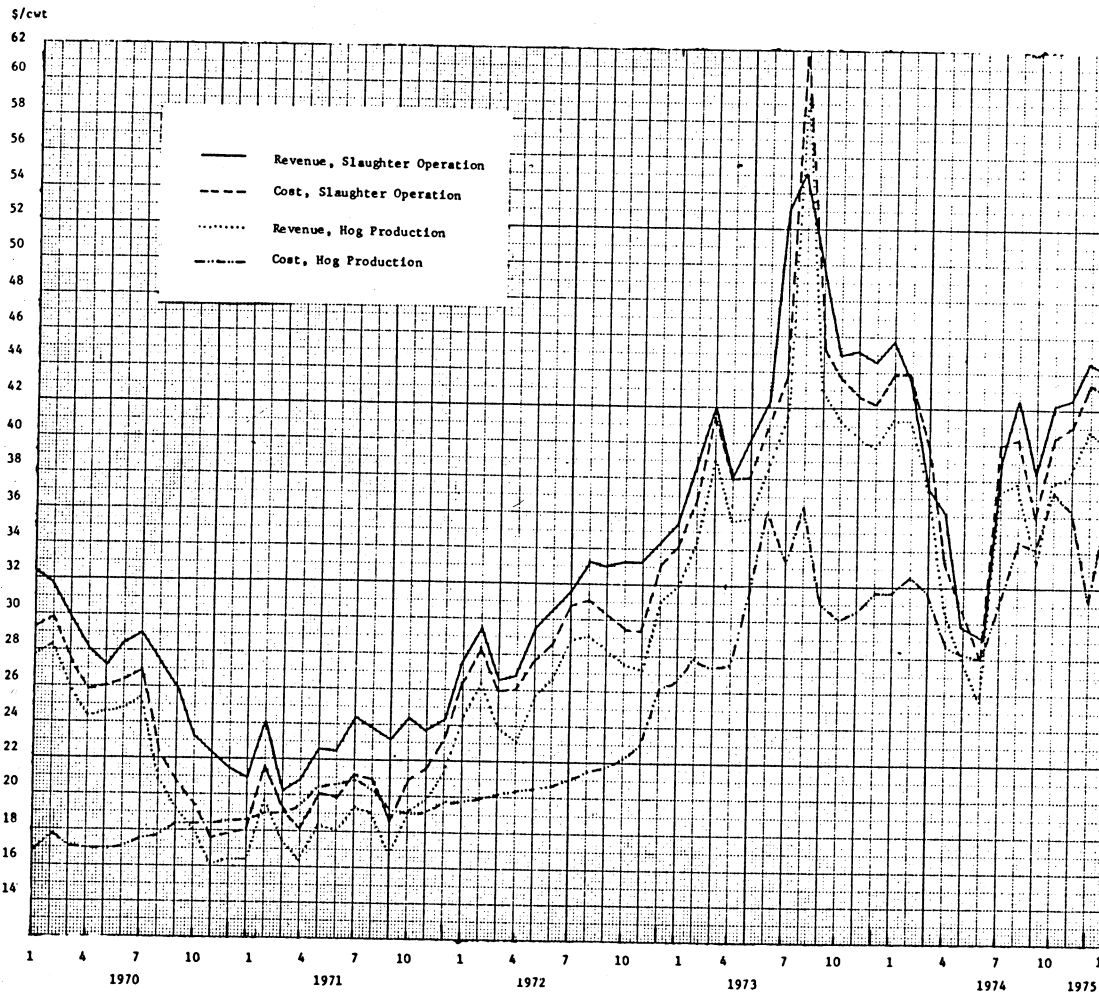


Figure 3. Estimated Costs and Returns: Hog Production (600 Sow Units) and Hog Slaughter Operation (600 Head per Hour), Texas High Plains, Dollars per One Hundred Pounds of Hog, 1970-74



was not profitable.<sup>8</sup> Such an operation also incurred a net loss during part of 1974. A large scale hog slaughter operation, on the other hand, was quite profitable during the period when swine production was not. A vertically coordinated cooperatively owned swine-pork production operation would have alleviated severe losses to swine producers during this period.

To obtain a closer examination and comparison of profits from various types of coordinated production operations, annual profits were estimated and are shown in Table 14 for selected types of vertically coordinated swine-pork enterprises. The annual average profit to swine producers from a swine-pork production operation was 44 percent greater than from a swine production operation. The estimated profits of the cooperatively owned slaughter operation were assumed to be entirely distributed to the member swine producers on a patronage basis. This distribution of all profits would be the extreme case since it could become necessary for some profits to be held back for purposes of paying off loans for capital investment.

Estimated annual profits for a swine-pork production operation increased by 63 percent, 219 percent, 31 percent, 17 percent, and 16 percent over those of a swine production operation for the years 1970-74, respectively (see Table 14). The estimated annual profits of a vertically coordinated swine-pork production operation, which operated a cooperatively owned hog slaughter plant, had larger profits than a non-coordinated swine production operation for each year of the study period.

#### Rates of Return on Investment

The rates of return on investment were estimated for a swine production operation, hog slaughter operations (at 100 percent, 90 percent, and estimated

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<sup>8</sup>See Table 3 on page 10.

Table 14. Estimated Annual Profits to Swine Producers: Swine Production Only vs. Vertically Coordinated Swine-Pork Production Operation, Texas High Plains, 1970-74

Year	Type of Production Operation	
	Swine Production <sup>1</sup>	Swine-Pork Production <sup>2</sup>
	-----Thousand Dollars-----	
1970	123.49	201.33
1971	-29.32	34.75
1972	133.43	175.43
1973	228.35	267.74
1974	90.69	105.40
1970-74 Average	109.33	156.93

<sup>1</sup> 600 sow complete confinement swine production operation which annually produces 2,484,720 pounds of market hogs.

<sup>2</sup> 600 sow swine production operation vertically coordinated with a 600 Head per Hour cooperatively-owned hog slaughter operation.

actual levels of capacity utilization), and a vertically coordinated swine-pork production operation for the period of 1970-74. The rates of return on investment were computed by using net income before taxes, and, furthermore, no allowance was made for cost of money.

### Swine Production Operation

The annual total revenues received from swine production varied from a low of \$443 thousand in 1971 to a high of \$963 thousand in 1973 (see Table 15). Throughout the five year study period, the annual costs of operating a swine production operation increased from \$383 thousand in 1970 to \$813 thousand by 1974 for a 112 percent increase. Due to this variation in revenues and steadily increasing costs of operation, profits realized from swine production were erratic, ranging from a net loss of \$47 thousand in 1971 to a profit of \$258 thousand in 1973.

The capital investment required by a 600 sow complete confinement production operation was estimated to be \$551 thousand in 1970. By 1974 this capital investment requirement had reached \$909 thousand for a 65 percent increase over that of 1970.

The amount of operating capital required by a 600 sow swine operation ranged from \$76 thousand to \$179 thousand for the 1970-1974 period. These estimates of capital investment and operating capital resulted in total investment estimates of \$627 thousand in 1970 to \$1,088 thousand by 1974. Estimates of the rate of return on investment for a 600 sow complete confinement swine operation were derived from estimates of net income and total investment, and were determined to be 25.15 percent, -6.38 percent, 5.42 percent, 26.51 percent, and 4.39 percent for the years 1970-74, respectively (see Table 15).

Table 15. Estimated Rate of Return on Investment: 600 Sow Complete Confinement Swine Production Operation, Texas High Plains, 1970-74

Item	Unit	1970	1971	1972	1973	1974
Total Revenue	dollars	542,853	443,146	644,247	963,119	860,521
Operating Expense <sup>1</sup>	dollars	383,019	490,446	597,872	705,299	812,725
Net Income	dollars	159,834	-47,300	46,375	257,820	47,796
Net Income as Percent of Sales	percent	29.44	-10.67	7.20	26.77	5.55
Capital Investment	dollars	550,605	640,100	729,595	819,090	908,585
Operating Capital <sup>2</sup>	dollars	75,975	101,757	125,540	153,322	179,104
Total Investment	dollars	626,580	741,857	855,135	972,412	1,087,689
Rate of Return on Total Investment <sup>3</sup>	percent	25.51	- 6.38	5.42	26.51	4.39

<sup>1</sup>Includes depreciation but excludes interest expenses.

<sup>2</sup>Annual cost minus depreciation minus interest divided by 2.23 farrowings per year divided by 2.

<sup>3</sup>Rate of Return on Investment before taxes and cost of money.

### Swine Slaughter Operation--100 Percent Capacity Utilization

The annual total revenue received by a large scale hog slaughter operation, operating at 100 percent capacity utilization, was estimated at \$68.8, \$57.7, \$77.4, \$111.5, and \$99.1 million for 1970-74, respectively (see Table 16). The slaughter operation, at 100 percent capacity utilization realized an annual net income of \$8.4, \$6.9, \$4.6, \$4.3, and \$1.7 million for the period of 1970-74.

The requirements for capital investment were estimated to be \$8.0, \$8.8, \$9.5, \$10.3, and \$11.0 million for the five year study period, respectively. Operating capital requirements were determined to be \$2.4, \$2.0, \$2.9, \$4.3, and \$3.9 million for the same period of 1970-74, respectively. Total capital investment for a large scale hog slaughter operation were estimated to be \$10.4, \$10.8, \$12.4, \$14.6, and \$14.9 million for the period of 1970-74, respectively. The estimated rates of return on investment derived from net income and total investment estimates for a large scale hog slaughter plant were 80.50 percent, 64.18 percent, 37.06 percent, 29.22 percent, and 11.66 percent for 1970-74, respectively.

### Swine Slaughter Operation--90 Percent Capacity Utilization

The revenues, costs, and rates of return on investment for a large scale slaughter plant operating at 90 percent of capacity were estimated to be lower than corresponding estimates for the same plant operating at 100 percent capacity. This is largely due to a loss of efficiency by a 10 percent reduction in hog slaughter volume, or a decrease in slaughter of 112,500 hogs annually.

The annual revenues from a large scale hog slaughter operation operating at 90 percent capacity were estimated to be \$61.9, \$51.9, \$69.7, \$100.4, and \$89.2 million for the years of 1970-74, respectively (see Table 17). The

Table 16. Estimated Rate of Return on Investment: 600 Head Per Hour Kill Capacity Hog Slaughter Operation, 100 Percent Capacity Utilization, Texas High Plains, 1970-74

Item	1970	1971	1972	1973	1974
	-----Thousand Dollars-----				
Total Revenue	68,774	57,713	77,434	111,502	99,098
Cost of Hogs	57,054	46,575	67,711	101,225	90,442
Cost of Slaughter Operations	3,319	4,219	5,119	6,019	6,919
Total Cost	60,373	50,794	72,830	107,243	97,360
Net Income	8,401	6,919	4,604	4,258	1,738
Capital Investment	8,000	8,750	9,500	10,250	11,000
Operating Capital	2,436	2,030	2,923	4,325	3,906
Total Investment	10,436	10,780	12,423	14,575	14,906
	-----Percent-----				
Rate of Return on Total Investment	80.50	64.18	37.06	29.22	11.66

<sup>1</sup>Operating Capital equals cost of 12 day's hog purchased plus 7 day slaughter cost plus 3 day inventory cost.

<sup>2</sup>Rate of Return on Investment before taxes and cost of money.

Table 17. Estimated Rate of Return on Investment: 600 Head Per Hour Kill Capacity Hog Slaughter Operation, 90 Percent Level of Capacity Utilization, Texas High Plains, 1970-74

Item	1970	1971	1972	1973	1974
	-----Thousand Dollars-----				
Total Revenue	61,897	51,941	69,688	100,351	89,189
Cost of Hogs	51,349	41,918	60,940	91,102	81,397
Cost of Slaughter Operations	3,098	3,918	4,739	5,559	6,379
Total Cost	54,447	45,836	65,678	96,661	87,776
Net Income	7,449	6,105	4,010	3,691	1,412
Capital Investment	8,000	8,750	9,500	10,250	11,000
Operating Capital <sup>1</sup>	2,195	1,830	2,634	3,896	3,520
Total Investment	10,195	10,580	12,134	14,146	14,520
	-----Percent-----				
Rate of Return on Total Investment <sup>2</sup>	73.07	57.71	33.04	26.09	9.73

<sup>1</sup>Operating Capital equals cost of 12 days' hogs purchased plus 7 day slaughter cost plus 3 day inventory cost.

<sup>2</sup>Rate of Return on Investment before taxes and cost of money.

corresponding annual total costs were estimated to be \$54.4, \$45.8, \$65.7, \$96.7, and \$87.8 million. This resulted in an annual estimated net income of \$7.4, \$6.1, \$4.0, \$3.7, and \$1.4 million for the period of 1970-74, respectively.

The total investment estimates for a slaughter plant at 90 percent capacity utilization were very similar to those at 100 percent capacity utilization, with the difference being in the estimates of operating capital. For a slaughter plant operating at 90 percent capacity utilization, total investment requirements were estimated at \$10.2, \$10.6, \$12.1, \$14.1, and \$14.5 million for the period of 1970-74, respectively (see Table 17). The rates of return on investment were estimated to be 73.07 percent, 57.71 percent, 33.04 percent, 26.09 percent, and 9.73 percent for the five year study period, respectively.

#### Swine Slaughter Operation--Estimated

##### Actual Levels of Capacity Utilization

Utilizing the annual average actual capacity utilization rates from Table 5, estimates of annual revenues, costs, and investments were derived to determine the estimated rates of return on investment for a large scale hog slaughter plant and are presented in Table 18. Annual hog slaughter volume fluctuated from a low of 71 percent in 1973, during periods of high market hog prices, to a high of 88 percent in 1971 during periods of low hog prices (see Table 18). This variation in slaughter volume caused annual revenues to vary as shown by estimates of \$55.0, \$50.8, \$61.2, \$79.2, and \$75.3 million for 1970-74, respectively. The total operational costs of a slaughter plant under estimated actual levels of capacity utilization increased from 1970 to 1974. These costs were estimated to be \$48.5, \$44.8, \$57.8, \$76.6, and \$74.4 million for 1970-74, respectively.

Since the capital investment requirements for a large scale hog slaughter



Table 18. Estimated Rate of Return on Investment: 600 Head Per Hour Kill Capacity Hog Slaughter Operation, At Estimated Actual Levels of Capacity Utilization, Texas High Plains, 1970-74

Item	1970	1971	1972	1973	1974
	----- Thousand Dollars -----				
Total Revenue	55,019	50,787	61,170	79,166	75,315
Cost of Hogs	45,644	40,986	53,492	71,870	68,736
Cost of Slaughter Operations	2,898	3,861	4,337	4,697	5,626
Total Cost	48,542	44,847	57,829	76,566	74,361
Net Income	6,478	5,940	3,342	2,600	953
Capital Investment	8,000	8,750	9,500	10,250	11,000
Operating Capital <sup>2</sup>	1,955	1,790	2,317	3,082	2,979
Total Investment	9,955	10,540	11,817	13,332	13,979
	-----Percent-----				
Rate of Return on Total Investment <sup>3</sup>	65.07	56.36	28.28	19.50	6.82

<sup>1</sup>See Table 5, p. 14.

<sup>2</sup>Operating Capital equals cost of 12 days' hogs purchased plus 7 day slaughter cost plus 3 day inventory cost.

<sup>3</sup>Rate of Return on Investment before taxes and cost of money.

facility were the same regardless of the level of capacity utilization, all differences in total investment were due to different operating capital requirements. From Table 18, it can be seen that estimates of \$10.0, \$10.5, \$11.8, \$13.3 and \$14.0 million were determined as the total investment requirements for a large scale hog slaughter operation at estimated actual levels of capacity utilization. The rates of return on investment for this particular plant, at estimated actual levels of capacity utilization, were found to decrease annually from 1970 (65.07 percent) through 1974 (6.82 percent).

#### Vertically Coordinated Swine-Pork Production Operation

The annual total revenues from a vertically coordinated swine-pork operation were estimated to be \$114.0, \$94.5, \$131.5, \$192.8, and \$171.8 million for 1970-74, respectively (see Table 19). Annual total costs were determined to be \$91.2, \$92.9, \$123.1, \$164.4, and \$165.8 million for the same five years. The corresponding annual net incomes were thus determined to be \$22.8, \$1.6, \$8.5, \$28.4, and \$6.0 million.

The total capital investment for the required number of swine operations was estimated to be \$60.2, \$71.2, \$82.1, \$93.4, and \$104.4 million for 1970-74, respectively.<sup>9</sup> The total capital requirements for a 600 head per hour hog slaughter facility at 90 percent capacity utilization were previously discussed and were shown in Table 19. From these two sets of estimates, the total capital investment requirements for a vertically coordinated swine-pork production operation were determined. The total capital investment requirements were estimated to be \$70.3, \$81.8, \$94.2, \$107.5, and \$118.9 million for 1970-74,

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<sup>9</sup>The total capital investment is for 96 units of 600 sow complete confinement swine production operations.

Table 19. Estimated Rate of Return on Investment: Vertically Coordinated Swine-Pork Production Operation,<sup>1</sup> Texas High Plains, 1970-74

Item	1970	1971	1972	1973	1974
-----Thousand Dollars-----					
Revenue:					
Swine Operations	52,114	42,542	61,848	92,459	82,610
Slaughter Facility	61,897	51,941	69,688	100,351	89,189
Total Revenue	114,011	94,483	131,536	192,811	171,799
Cost:					
Swine Operations	36,770	47,083	57,396	67,709	78,022
Slaughter Facility	54,447	45,836	65,678	96,661	87,776
Total Cost	91,217	92,919	123,074	164,370	165,798
Net Income	22,794	1,565	8,462	28,441	6,001
Capital Investment:					
Swine Operations	60,152	71,218	82,093	93,352	104,418
Slaughter Facility	10,195	10,580	12,134	14,146	14,520
Total Capacity Investment	70,347	81,798	94,227	107,498	118,938
-----Percent-----					
Rate of Return on Total Investment <sup>2</sup>	32.40	1.91	8.98	26.46	5.05

<sup>1</sup>96 complete confinement swine production operations consisting of 600 sows each which is vertically coordinated with a 600 head per hour hog slaughter facility operating at 90 percent capacity.

<sup>2</sup>Rate of return on investment before taxes and cost of money.

respectively. These investment requirements showed a 69 percent increase from 1970 to 1974.

Annual rates of return on investment for a vertically coordinated swine-pork production operation were determined to be 32.40 percent, 1.91 percent, 8.98 percent, 26.46 percent, and 5.05 percent for 1970-74, respectively. The estimated rates of return on investment for the selected types of swine and slaughter operations were compared and presented in Table 20. The comparison shows a substantially higher rate of return on investment for the slaughter operations at selected levels of capacity utilization than that of swine production, except for 1973 when they were quite similar.

When rates of return on investment for each particular type of operation were averaged for the five year period of 1970-74, the slaughter operations showed the highest rate of return on investment with 39.89 percent,<sup>10</sup> followed by a vertically coordinated swine-pork operation with 14.96 percent, and then a swine production operation with 11.09 percent.

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<sup>10</sup>Simple average of the rate of return for a slaughter plant at 100 percent, 90 percent, and estimated actual levels of capacity utilization.

Table 20. Estimated Rates of Return on Investment:<sup>1</sup> Summary of Swine Production, Slaughter Operations, and Vertically Coordinated Swine-Pork Operation, Texas High Plains, 1970-74

Types of Operation	1970	1971	1972	1973	1974	Average
Swine Production <sup>2</sup>	25.51	-6.38	5.42	26.51	4.39	11.09
Slaughter Operation <sup>3</sup> 100 Percent	80.50	64.18	37.06	29.22	11.66	44.52
Slaughter Operation <sup>4</sup> 90 Percent	73.07	57.71	33.04	26.09	9.73	39.93
Slaughter Operation <sup>5</sup> Estimated Actual Levels	65.07	56.36	28.28	19.50	6.82	35.21
Vertically Coordinated Swine Pork Operation <sup>6</sup>	32.40	1.91	8.98	26.46	5.05	14.96

<sup>1</sup> Rate of return on investment before taxes and cost of money.

<sup>2</sup> Complete confinement 600 sow swine production operation (Table 15).

<sup>3</sup> 600 head per hour hog slaughter facility operating at 100 percent capacity utilization (Table 16).

<sup>4</sup> 600 head per hour hog slaughter facility operating at 90 percent capacity utilization (Table 17).

<sup>5</sup> 600 head per hour hog slaughter facility operating at estimated actual levels of capacity utilization (Table 18).

<sup>6</sup> 96 complete confinement 600 sow swine production operations vertically coordinated with a 600 head per hour hog slaughter facility operating at 90 percent capacity utilization (Table 19).

## SUMMARY AND CONCLUSION

The major objective of this research project was to analyze the economic implications of a vertically coordinated swine-pork production operation which operated a cooperative hog slaughter facility on the Texas High Plains. To achieve this objective, costs and returns of swine producers and meatpackers were derived for the five year period, from 1970 to 1974. The costs of hog production were obtained from swine production budgets for a complete confinement 600 sow unit, farrow to finish operation. Previous study on economy of size indicated a 600 sow unit to be of the optimum size. The revenues to hog producers were based on the San Antonio monthly average price for barrows and gilts, 1-3, 200-230 pounds.

The total cost of slaughtering a market hog was calculated by using cost equations and data obtained from meatpacking companies. A complete wholesale carcass cut-out, to include by-products, plus wholesale prices for these products, were used to derive the revenues obtained from the hog slaughter operation. This slaughter operation was assumed to "kill and chill" only, and possess a 600 head per hour kill capacity. Furthermore, in determining the economic feasibility of vertical coordination, annual net incomes and total capital investment requirements were estimated for swine production, slaughter operations (at selected levels of capacity utilization), and vertically coordinated swine-pork production operations.

The average annual cost of hog production per hundred pounds was determined to be \$17.57, \$19.58, \$21.38, \$30.80, and \$32.08 for the five year study period of 1970-74, respectively. The cost of swine production fluctuated with price movements of sorghum and soybean meal which fluctuated widely during the study period. Market prices on an annual average basis per hundred pounds of hog

were \$22.54, \$18.40, \$26.75, \$39.99, and \$35.73 for 1970-74, respectively. Profits for a 600 sow unit commercial hog production operation on the Texas High Plains on an annual average basis per hundred pounds of hog produced were estimated at \$4.97, -\$1.18, \$5.37, \$9.19, and \$3.65 for 1970-74, respectively.

Total annual costs for a large scale hog slaughter plant operating at estimated actual levels of capacity utilization were \$48.54, \$44.84, \$57.81, \$76.51, and \$74.35 million for 1970-74, respectively. Actual hog slaughter industry capacity utilization rates on an annual average basis for 1970-1974 were estimated to be 80 percent, 88 percent, 79 percent, 71 percent, and 76 percent of total capacity, respectively.

A hog slaughter plant vertically coordinated with commercial swine production operations was assumed to operate at a minimum of 90 percent capacity utilization due to its controlled supply of hogs. Total annual costs of pork production under such conditions were estimated at \$54.45, \$45.79, \$65.68, \$96.57 and \$87.79 million for 1970-74, respectively.

The estimated annual average wholesale values of a market hog per hundred pounds liveweight were \$27.17, \$22.80, \$30.59, \$44.05, and \$39.15 for 1970-74, respectively. These annual average revenues for hogs at the wholesale level were compared with corresponding revenues at the farm level to determine a marketing margin of \$4.63, \$4.40, \$3.84, \$4.06, and \$3.42 per hundred pounds of hog, 1970-74, respectively.

Annual profits for the 1970-74 period were determined to be \$109.33 million for swine production and \$156.93 million for the vertically coordinated swine-pork production. The vertically coordinated swine-pork production operation was assumed to farrow and finish hogs and to market these hogs through a cooperative slaughter facility. The profits from this slaughter operation were assumed to be entirely distributed to the member swine producers. Profits to

swine producers from a vertically coordinated swine-pork production operation for the duration of the five year study period were 44 percent greater than profits received from a swine production operation.

Estimates of the rate of return on investment were determined for swine production, slaughter operations at selected levels of capacity utilization, and a vertically coordinated swine-pork production operation. These estimates include neither taxes nor any costs for money. For 1974 these net incomes were estimated at \$0.05 million for swine production; \$1.74 million for slaughter operation at 100 percent capacity utilization; \$1.41 million for slaughter operation at 90 percent capacity utilization; \$0.95 million for slaughter operation at estimated actual levels of capacity utilization; and \$6.00 million for a vertically coordinated swine-pork production operation.

The amount of capital required for investment and operating purposes was estimated by years for each of the selected operations. In 1974, a 600 sow complete confinement swine production operation had an estimated total capital investment requirement of \$1.09 million. The estimated total capital requirement in 1974 for a large scale hog slaughter operation was estimated at \$14.90 million and \$14.50 million for 100 percent and 90 percent levels of capacity utilization. The investment requirement for a vertically coordinated swine-pork production operation, which consisted of ninety-six 600 sow units for swine production operations and one 600 head per hour slaughter operation, was estimated to be \$118.94 million for 1974.

The five year average rates of return on investments were estimated at 11.09 percent for swine production alone, 39.93 percent for a slaughter operation only, and 14.96 percent for a vertically integrated swine-pork production operation. All estimates of rates of returns were computed before taxes and do not include costs of borrowed money. The higher rate of return from slaughter



operations becomes available to producers as a result of integration. Thus, the rate of return on investment to individual producers from an integrated operation is 35 percent greater than the rate of return from non-integrated producer operations.

Profits of the individual hog production operation were enhanced by the availability of a dependable local market for hogs. The profitability of the slaughter operation was improved by its ability to schedule daily "hog kills" more efficiently resulting in improved utilization of plant labor and facilities. Returns to the slaughter operation were further enhanced by the implicit assumption of a constant marginal supply cost for hogs.

Integration of production and slaughter operations would have resulted in increased stability for both operations. During the period 1970-74, when hog producers were operating at a loss, profits from the slaughter operation could have offset the deficit. At other times, profits from hog production would be available to cover losses suffered by the slaughter operation.

The study, based upon the 1970-74 data, indicated a strong economic justification for a vertically coordinated, cooperatively owned swine-pork production operation for the Texas High Plains area. The study was restricted to a particular time period and to the examination of a single size and type of swine and slaughter operation.

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## APPENDICES

- A. Swine Ration Composition
- B. Annual Sorghum and Soybean Meal Requirements
- C. Average Monthly Price of Soybean Meal
- D. Hog Carcass Cut-Out
- E. By-Product Yields of a Market Hog

Table A. Swine Ration Ingredients and Percentage Contributions by Types of Rations, Complete Confinement Swine Production Operation, Texas High Plains, 1974

Ingredient	Growing and Lactation Ration (No 1)	Finishing Ration (No 2)	Creep Ration (No 3)	Gestation and Boar Ration (No 4)
Sorghum	73.75	81.75	65.90	71.30
Soybean Meal	23.00	15.00	31.00	24.00
Salt	0.50	0.50	0.50	0.50
Poly Phos	1.25	1.25	1.00	1.00
Vitamin and Mineral Pre-Mix	1.50	1.50	1.60	3.20
TOTAL	100.00	100.00	100.00	100.00

Source: Input Requirements and Production Costs, Complete Confinement Swine Rearing Operations, Texas High Plains, 1971.

Table B. Estimated Annual Requirements of Sorghum and Soybean Meal, 600 Sow Complete Confinement Swine Production Operation, Texas High Plains, 1974

Classification	Ration <sup>1</sup>	Days on Ration	Feed per Day	Pigs per Sow	No. of Breeding Unit	No. of Farrowing Per Year	Required Quantities:	
							Sorghum	Soybean Meal
Market Hog:								
Birth - 40 lb.	3	24	0.42	8.5	600	2.23	755.48	355.38
20-125 lb.	1	35	3.40	8.2	600	2.23	9,628.95	3,002.93
125-225 lb.	2	94	5.70	8.0	600	2.23	46,885.29	8,602.80
Sows	4	124	4.50	-	600	2.23	5,323.29	1,791.85
	1	40	12.00	-	600	2.23	4,736.52	1,477.15
Replacement Gilts	1	60	5.00	-	200		442.50	138.00
Boars	4	365	4.00	-	36		374.75	126.14
Total Quantities Required:							68,146.78	15,494.25

<sup>1</sup>Ration Compositions are given in Table A.

Table C. Soybean Meal: Average Monthly Price, Decatur and Lubbock Basis, 44% Protein, 1970-74 By Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
-----Dollars Per Ton----- <sup>1</sup>												
	Decatur Basis											
1970	88	85	72	75	71	75	83	84	81	77	78	82
1971	80	78	77	74	78	82	84	79	73	75	74	81
1972	83	85	91	94	95	95	101	101	108	109	123	174
1973	188	219	200	203	315	412	311	285	208	160	167	192
1974	172	160	147	117	109	100	138	156	138	168	141	143
	Lubbock Basis <sup>2</sup>											
1970	116	113	100	103	99	103	111	112	109	105	106	110
1971	108	106	105	102	106	110	112	107	101	103	102	109
1972	111	113	119	122	123	123	129	129	136	137	151	202
1973	216	247	228	231	343	440	339	313	236	188	195	220
1974	200	188	175	145	137	128	166	184	166	196	169	171

<sup>1</sup>Source: USDA Feed Situation.

<sup>2</sup>Source: Great Plains Coop Oil Mill, Lubbock, Texas, Price equals Decatur plus \$28.

Table D. Hog Carcass Cut-Out, Yields per 225 Pound Market Hog,  
 Grades 1-3

Product	Percent of <sup>1</sup> Liveweight	Pounds per 225 Hog
	(Percent)	(Pounds)
1. Hams, Skinned	15.55	34.99
2. Picnics	6.50	14.63
3. Bellies	11.50	25.88
4. Loins, Fresh	13.50	30.38
5. Boston Butts	5.00	11.25
6. Spareribs	2.30	5.18
7. Neckbones	0.90	2.03
8. Feet, front	0.99	2.23
9. 50% Lean Trimmings	1.18	2.66
10. 80% Lean Trimmings	2.30	5.18
11. Jowls, Skinned	1.66	3.74
12. Raw Lard Fat	10.40	23.40
13. Skins	<u>1.46</u>	<u>3.29</u>
Total	73.24	164.84

<sup>1</sup>Yields based upon "cold carcass."

Table E. By-Product Yields per 225 Pound Market Hog, Grades 1-3

By-Products	Percent of Liveweight	Pounds per 225 Hog
	(Percent)	(Pounds)
Edible		
1. Cheek Meat, Trimmed	0.54	1.22
2. Heart	0.31	0.70
3. Kidney	0.20	0.45
4. Liver	1.07	2.41
5. Melt (Spleen)	0.16	0.36
6. Snout	0.35	0.79
7. Scalded Stomach	0.47	1.06
8. Leaf Lard (Rendered)	2.21	4.97
9. Scalded Tongue	0.22	0.50
10. Pork Tail	<u>0.95</u>	<u>2.14</u>
Sub-Total	6.48	14.60
Inedible		
1. Tallow	2.67	6.01
2. Dried Blood	0.80	1.80
3. Tankage, rendered	2.53	5.69
4. Grease, inedible	<u>1.39</u>	<u>3.13</u>
Sub-Total	7.39	16.63
Total By-Products	<u>13.87</u>	<u>31.23</u>