

The Economics of Finishing Hogs in Hoop Structures and Confinement; Financial Comparison

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Summary and Implications

From June 30, 1998 to Feb 21, 2001, a study to compare swine production facility types was conducted at the Iowa State University Rhodes Research and Demonstration. The two types of pork grow-finish production facilities compared in this study were hoop and total confinement. This report evaluates financial measurements from six groups of hogs; three groups fed in during the winter and three groups fed during the summer.

This financial examination provides mixed results. The hoop facilities have superior return on investment, internal rate of return, modified internal rate of return, and a shorter pay back period. These advantages can be attributed largely to the hoops' smaller initial investment. However, the confinement facility has the advantage of a longer service life as well as higher net profit per year per pig space. This gives the confinement system an advantage of a higher net present value. Hoop operations will need to invest in more pig spaces to generate the same net present value.

The report goes on to examine the sensitivity of the financial measures to changes in input and output values such as carcass prices, ration cost, and cost of capital. The result is that due to its lower investment per pig space, shorter service life, and lower net profit per year the hoop facilities are more sensitive to changes in hog prices, ration costs, facility costs, and net profit per head. However, the confinement facility is more sensitive to changes in the cost of capital due to its longer service life and higher initial investment level.

This makes the question of which system is a better financial investment dependent on several issues. The availability of initial capital, operating capital, land for manure application, labor available, and pig flow are all important in order to make a decision on which investment is best. Operators must also consider the cost of capital, value of alternative uses for the capital, market conditions, risk aversion level, as well as intrinsic values of the alternatives when deciding on which pig finishing option to select.

Introduction

The evolution of the Swine Industry has forced industry members to reevaluate their operations and utilize an increasing level of risk management. This has caused producers to examine how they are using their capital. A survey conducted in May of 2001 showed that hoop buildings are becoming an increasingly important part of the swine production industry. This is especially true for the grow-finish production phase. Hoop buildings became widely available during the mid 1990's and by the year 2001 their use had grown to represent about four percent of the market hogs finished in Iowa. The growth in hoop facility usage prompted this ongoing study in order to help producers evaluate the effective use of capital in pork production facilities. The project compares hoop facilities to confinement facilities and evaluates alternative management practices used in hoop production. This report looks at some financial measurements that can be used to evaluate the financial attractiveness of each investment.

Materials and Methods

The report details six groups of hogs, which were on test during the June 30, 1998 to Feb 21, 2001 time period at the Rhodes Research Farm. Results have been evaluated by using the actual production efficiency values while using the average or typical costs for feeder pigs (\$38), feed (\$.065 per pound), etc. during the 1990-1999 time period. Average market hog prices (\$60 per carcass weight) during this time period are also used. This allows for comparison of expected costs and returns under average input costs and hog price relationships.

Two groups were finished in each facility annually. Seasonal comparisons were established by starting hogs in the spring (summer group) and fall (winter group) of each year. In this way hogs were finished under seasonal extremes. The seasonal groups were then averaged in order to approximate the year round systems' average efficiencies and net incomes. During all but one of the groups the hogs were placed on feed over a four-week period in which three hoops and the total confinement facility each received one-week of feeder pig production. The hogs were marketed to Excel with varied marketing dates in an attempt to market the hogs at similar marketing weights for each facility.

The economic results from these groups were summarized and the net profit per pig for each facility provided. The net profits per pig are then multiplied by the number of turns per year in order to generate an average net profit per year. The net profits per year are then used in calculating the financial results.

Results and Discussion

Financial Analysis

Table 1 provides income flows considering selected financing options. The net income and return to labor and management per year are calculated by assuming an average year's production for each facility. Three different net incomes have been created in order to look at the system with 100 percent financing, no financing, and 100 percent financing with labor and management return included. The first net income per year is calculated with 100 percent of the initial investment financed. This is calculated by multiplying the profit per hog by the turns per year. For example, the hoop net income per year was calculated by multiplying the profit per hog (\$13.46) by the number of turns per year (Approximately 2.54) in order to figure the total net income per year of \$34.13. The net income per year is then calculated for a scenario where financing is not needed. This is calculated by adding the fixed investment cost per hog to the profit per hog and then multiplying by the number of turns per year. For example the hoop net

income per year was calculated by adding the profit per hog (\$13.46) and the fixed investment per hog (\$6.24) and then multiplying by the number of turns per year (Approximately 2.54) in order to figure the total net income per year per year (\$49.96). The initial investment is shown in year zero with facility, equipment and manure handling investment per pig space of \$91 for the hoop and \$216 for the confinement. The last set of columns in Table 1 represents the net income plus labor and management returns with 100 percent financing. This value will allow producers to examine the disposable income that they will have if they are providing their own labor and management. This is calculated by adding the labor cost per hog and the profit per hog and then multiplying by the number of turns per year. For example the hoop net income per year was calculated by adding the profit per hog (\$13.46) and the labor per hog (\$2.82) and then multiplying by the number of turns per year (Approximately 2.54) in order to figure the total net income per year (\$41.27).

Table 1. Net Income and Return to Labor and Management per Pig Space by Production System Under Selected Financing Options

Year	100 percent Financed		No Financing		100 Percent Financed Labor and Management	
	Hoop	Confinement	Hoop	Confinement	Hoop	Confinement
0	0	\$0	-91	-\$216	0	\$0
1	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
2	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
3	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
4	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
5	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
6	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
7	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
8	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
9	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
10	\$34.13	\$41.94	\$49.96	\$71.78	\$41.27	\$47.33
11	N/A	\$41.94	N/A	\$71.78	N/A	\$47.33
12	N/A	\$41.94	N/A	\$71.78	N/A	\$47.33
13	N/A	\$41.94	N/A	\$71.78	N/A	\$47.33
14	N/A	\$41.94	N/A	\$71.78	N/A	\$47.33
15	N/A	\$41.94	N/A	\$71.78	N/A	\$47.33

Table 2 provides a summary of the financial ratios. The hoop facilities have a return on investment (ROI) level of 38 percent as compared to a return on investments of 19 percent for the confinement facility. This is calculated by dividing the net income per year (100 percent financed) by the initial investment. For example, the hoops average income of \$34.13 divided by the initial investment of \$91 provides a return on investments of 38 percent. As indicated above their values are based on the pig price and input costs from 1990 to 1999.

The hoop facilities have an internal rate of return of 54 percent as compared to 33 percent for the confinement

facilities. The internal rate of return is calculated by determining the discount rate that would yield a net present value of \$0 for the net income with 100 percent financing. For example the initial investment of the hoop facilities hoop facilities would have to have a cost of capital of 54 percent to provide a net present value (NPV) of \$0 under the 100 percent financed net income.

The net present value (NPV) for the facilities is calculated using a 10 percent cost of capital and is provided for each net income given. The net present value examines the present value for the selected investment. Thus with a discount rate of 10 percent and the net

income per year flow of the hoop facilities under 100 percent financing has a net present value of \$209.71, while the net present value of the confinement facilities is \$318.99.

The net present value of the net income and labor and management return reflects a monetary value to the labor that is invested in the two facilities and slightly decreases the gap between the two systems' NPV since the hoop facilities are more labor intensive. This will be advantageous to owner operators. However, in order to be more conservative the remainder of the paper will focus on the NPV of a system that is 100 percent financed but does not include labor.

It should be noted that the internal rate of return as well as the net present value comparison should be made with a little more caution. The investment level per pig space as well as the duration of the two investments compound are different. The internal rate of return assumes that you can invest an unlimited amount of money on the same project over an infinite time period. Thus, if the same number of dollars is invested over the same time period the hoop facilities would have a higher return. The net present value however examines the value of a single pig space over the life span of the facility. This provides an advantage to the confinement facility due to the higher initial investment and an additional 5 years of net income per year. However, if the producer were able to invest in 1.52 hoop pig spaces per each confinement space there would be an equal net present value. At this level the initial investment would only be \$138.42 for the hoop facilities compared to \$216 for the confinement facility. Additionally, the confinement requires five more years to realize the same net present value.

Another evaluation tool is the modified internal rate, which takes into account the cost of reinvestment. The modified rate of return with an interest rate of 10 percent and a reinvestment opportunity of 10 percent of the net income per year with 100 percent financing is 24 percent for the hoop facilities and 17 percent for the confinement facility. This is calculated by determining the present

value of the investment under a 10 percent opportunity interest rate and then determining the future value of the net income per year under the 10 percent reinvestment rate. The cost of capital that is required to provide an interest rate that will yield the calculated present value is then determined. However, even though the modified internal rate of return takes into account the investors ability to reinvest their cash flow it still does not account for the difference in initial investment level or service life.

While the confinement facility has an advantage in terms of a longer period of income, this can also lead to more risk from changes in the industry's net income levels. One way to measure the time risk of an investment is the payback period. The payback period suggests the length of time that it will take the facility to pay for itself under the given cash flows. This is calculated by dividing the initial investment by the level of income per year. Thus with the 100 percent financed net income per year the hoop facilities could be paid for in 2.67 years as compared to 5.15 years for the confinement facility.

The ratios suggest that the hoop facilities, under the given cost and market hog prices assumptions, are superior to the confinement facilities in all of the categories with the exception of net present value. However, the net present value figure is extremely important. It tells us that if a producer is restricted to a set amount of pig spaces the producer would have a larger net present value with the money invested in the confinement facility. This would occur if a producer were restricted by land, labor, operating capital, initial capital, or any other restriction that the producer would have in place on the number of hogs that can be placed on feed. Producers must therefore examine the opportunity cost of capital as well as any restriction on the number of hogs in order to determine the system while using net present value to determine the best investment. Under the given assumptions the hoop system would need 1.52 pig spaces (Exhibit 3) per each confinement pig space in order to return the same net present value under the 100 percent financed net income per year.

Table 2. Swine Grow Finish Financial Information by Production System

Financial Measure	Hoop	Confinement
Return on investments (ROA)	38%	19%
Internal Rate of Return (IRR)	54.18%	32.76%
Modified Internal Rate of Return	24%	17%
Net Present Value (100% Financed)	\$209.71	\$318.99
Net Present Value (No Financing)	\$216.00	\$329.94
Net Present Value (100% Financed Labor and Management)	\$253.58	\$360.00
Pay Back Period	2.67	5.15

Sensitivity Analysis

Table 3 examines the net present value (NPV) under selected changes in net income per pig and assuming 100

percent financing. It then examines the number of hoop hogs that are required to produce the same net present value as the confinement facility. Finally it provides the

difference in initial capital that is required in order to provide the same net present value. For example, with a \$5 decrease in net income per pig marketed for both facility types the net present value for the hoop system would be \$131.80 as compared to \$220.58 for the confinement system. Under these conditions a producer would need 1.67 hoop pig spaces in order to provide the

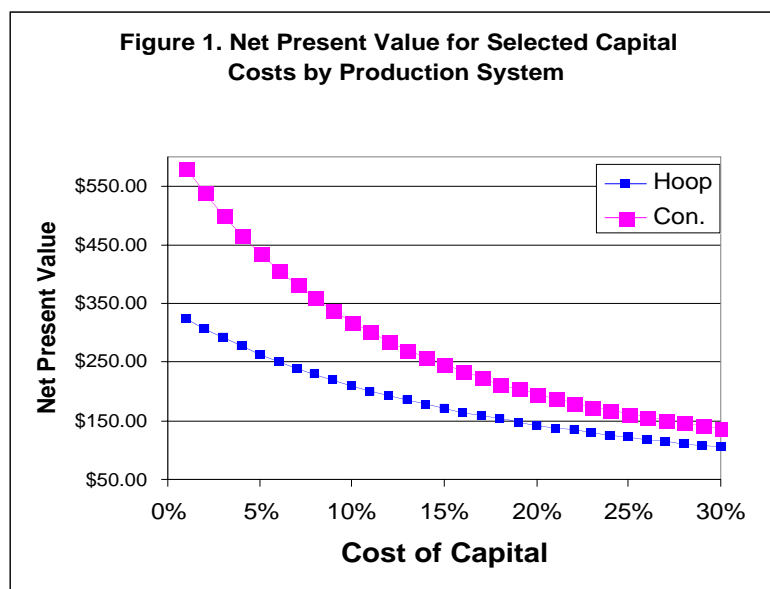
same level of net present value as one confinement space. However, the pig spaces required for the hoop facilities require only \$152.30 of initial investment, which is \$63.70 less than the \$216 initial investment for a single confinement facility pig space.

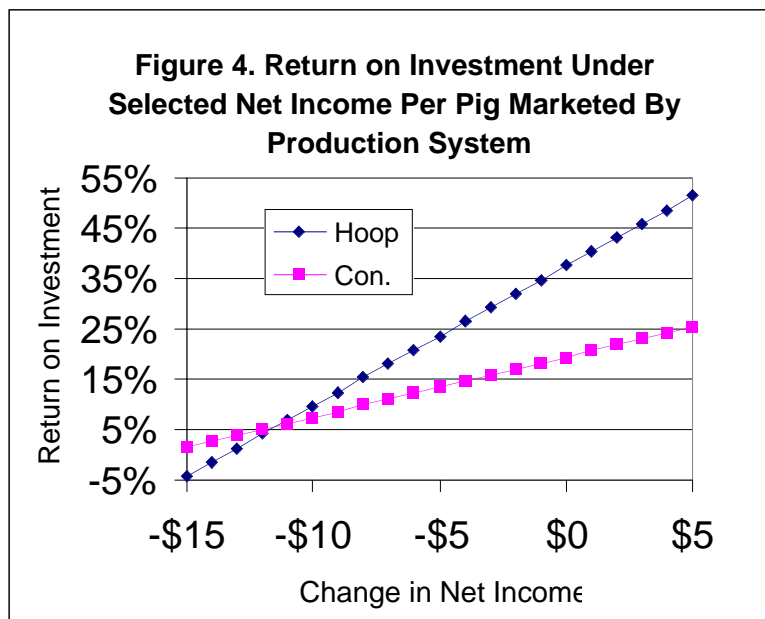
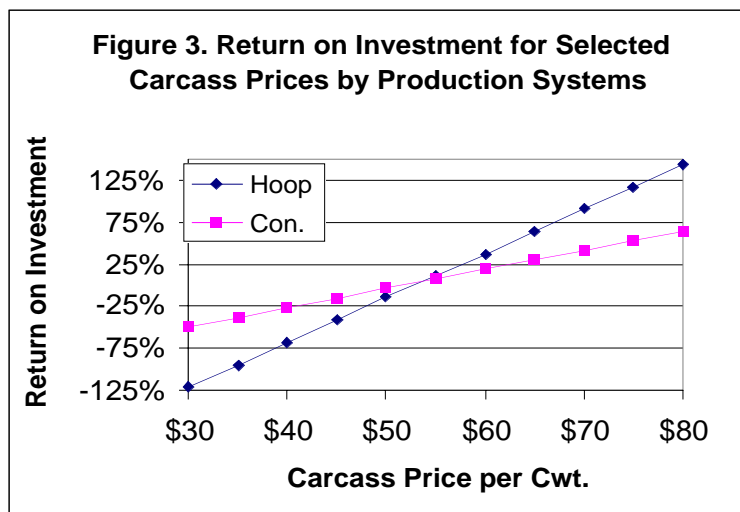
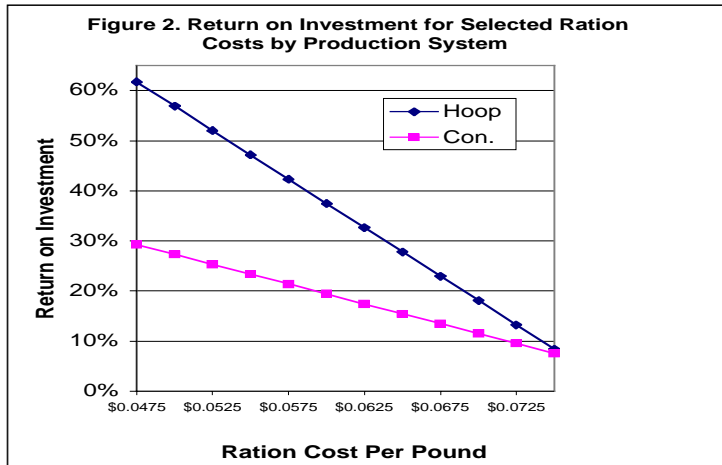
Table 3. Sensitivity of Net Present Value (NPV) to Changes in Net Income per Pig Marketed and the Difference in Pig Spaces and Capital Required to Provide an Equal NPV Between Production Systems

Change in Net Income per Pig	NPV Hoops	NPV Confinement	Number of Hoop Pig Spaces Needed to Provide Equal NPV	Difference in Initial Capital Required for Equal NPV
-\$10.00	\$53.88	\$122.17	2.27	-\$9.67
-\$7.50	\$92.84	\$171.38	1.85	-\$48.02
-\$5.00	\$131.80	\$220.58	1.67	-\$63.70
-\$2.50	\$170.75	\$269.78	1.58	-\$72.22
\$0.00	\$209.71	\$318.99	1.52	-\$77.58
\$2.50	\$248.67	\$368.19	1.48	-\$81.26
\$5.00	\$287.62	\$417.39	1.45	-\$83.94
\$7.50	\$326.58	\$466.60	1.43	-\$85.99
\$10.00	\$365.54	\$515.80	1.41	-\$87.59

Figure 1 examines the effects of changing cost of capital on the net present value under varying costs of capital. This shows that the higher investment cost and longer service life of the confinement causes the NPV to be more sensitive to interest rates that are applied to the initial investments. However, the cost of capital alone would not cause the NPV of the two facility types to cross. However, it is important to note that at higher costs of capital it will require fewer additional hoop pig spaces to create the same NPV between the two systems.

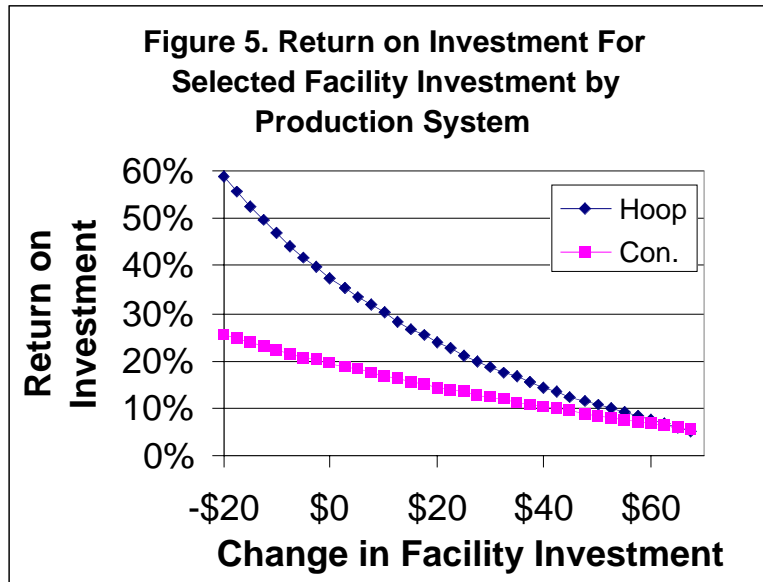
Figures 2, 3, and 4 evaluate the effects of changes of the feed ration price, carcass price, and net income on the systems' return to investments respectively. The exhibits are similar in that they show actions that change the net revenue per pig space. This allows an examination of the effects of the ration price and carcass price on both net revenue and the return on investment. The hoop system is more sensitive to changes in net profit due to its lower investment cost and net income. However, large changes are required before the return on investment for the hoop





system declines to the confinement system level. The hoop system has a higher return until the ration price increases to \$.08 per pound, carcass prices fall below \$54, or there is a change in net income per pig of more than \$11 per pig.

Figure 5 shows the effects of changes on the initial facility investment per pig space on the return to investment. It was calculated by changing the initial investment and examining its effect on both the income



streams (net profits) and the rate of return. This shows that the confinement system is less sensitive to changes in the initial investment, due to its large initial investment and longer service life. The hoops' return on investments however begins to become less sensitive as the investment level grows. Assuming that both systems have equal increases in construction costs it would take a \$68 increase in order to have equal return on initial investment.

Tables 4 and 5 along with Figure 6 evaluate the return on investment to the confinement and hoop facilities under selected facility investment prices as well as market hog carcass prices. Table 4 provides the return on investments for the confinement system. For example, if the confinement investment level per pig space was \$10 lower and the market hog carcass price was \$55 per hundred pounds then the return on investment for the confinement facility would be 10 percent. At the same

time if the hoop facility's cost per pig space (Table 5) was \$10 lower and the market hog carcass price was \$55 per hundred pounds then the return on investment would be 17 percent. Thus, these tables allow the examination of projected individual producer returns under different carcass prices and alternative facility construction costs.

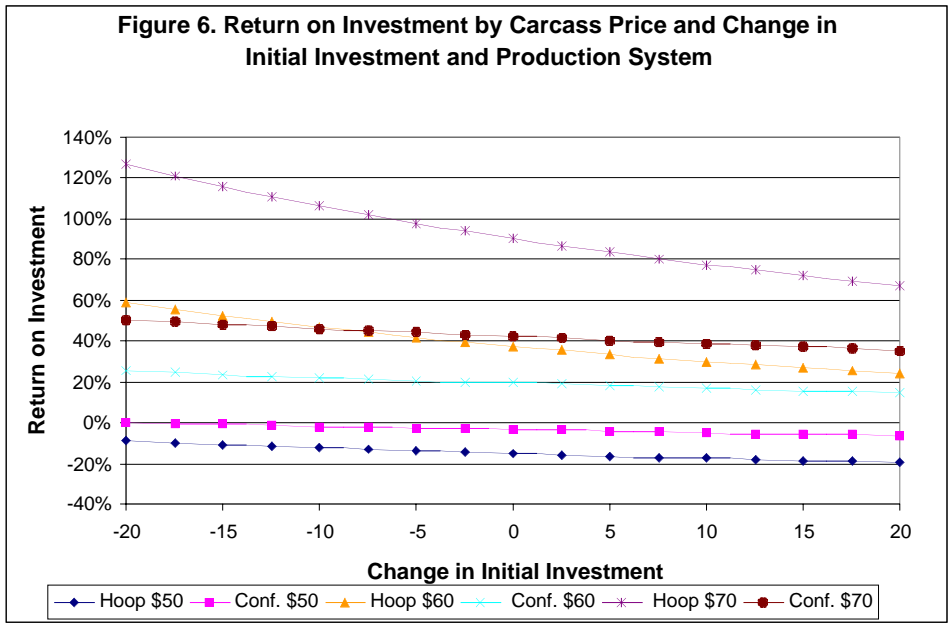
Figure 6 graphically depicts these results by showing the two facility types' return on initial investment by selected market prices and changing initial investment. The graph shows the two systems with \$50, \$60, and \$70 market hog carcass prices and ranging from a \$20 increase to \$20 decrease in initial investment. The graph shows that the confinement system is less sensitive to changes in market hog carcass price and thus provides a better return on initial investment at lower market prices. However, at a \$70 market hog carcass price the return on initial investment is comparable to that of a hoop facility receiving \$60.

Table 4. Confinement Facility Return on Investments for Selected Changes in Investment and Carcass Prices

Change in Investment Per Pig Space	Carcass Prices Per Hundred Pounds				
	\$50	\$55	\$60	\$65	\$70
-\$20.00	0%	12%	25%	38%	50%
-\$17.50	-1%	12%	24%	37%	49%
-\$15.00	-1%	11%	23%	36%	48%
-\$12.50	-2%	11%	23%	35%	47%
-\$10.00	-2%	10%	22%	34%	46%
-\$7.50	-2%	9%	21%	33%	45%
-\$5.00	-3%	9%	20%	32%	44%
-\$2.50	-3%	8%	20%	31%	43%
\$0.00	-4%	8%	19%	31%	42%
\$2.50	-4%	7%	18%	30%	41%
\$5.00	-5%	7%	18%	29%	40%
\$7.50	-5%	6%	17%	28%	39%
\$10.00	-5%	6%	17%	27%	38%
\$12.50	-6%	5%	16%	27%	38%
\$15.00	-6%	5%	15%	26%	37%
\$17.50	-6%	4%	15%	25%	36%
\$20.00	-7%	4%	14%	25%	35%

Table 5. Hoop Facility Return on Investments for Selected Changes in Investment and Carcass Prices

Change in Investment Per Pig Space	Carcass Prices Per Hundred Pounds				
	\$50	\$55	\$60	\$65	\$70
-\$20.00	-9%	25%	59%	93%	127%
-\$17.50	-10%	23%	55%	88%	121%
-\$15.00	-11%	21%	52%	84%	116%
-\$12.50	-12%	19%	50%	80%	111%
-\$10.00	-13%	17%	47%	77%	106%
-\$7.50	-13%	15%	44%	73%	102%
-\$5.00	-14%	14%	42%	70%	98%
-\$2.50	-15%	12%	40%	67%	94%
\$0.00	-15%	11%	38%	64%	90%
\$2.50	-16%	10%	35%	61%	87%
\$5.00	-17%	9%	34%	59%	84%
\$7.50	-17%	7%	32%	56%	81%
\$10.00	-18%	6%	30%	54%	78%
\$12.50	-18%	5%	28%	52%	75%
\$15.00	-19%	4%	27%	50%	72%
\$17.50	-19%	3%	25%	47%	70%
\$20.00	-19%	2%	24%	46%	67%



* Legend shows the facility type and carcass price.

Figure 7 graphically depicts these results by showing the two facility types' return on initial investment by different market types by carcass prices and changing production costs. The graph shows the two systems with \$50, \$60, and \$70 market hog carcass with production cost per pig changes prices and ranging from an \$11 increase to \$5 decrease. The graph shows that the confinement system is less sensitive to changes in market hog carcass price giving it a better return on initial investment at lower market prices. The graph also shows

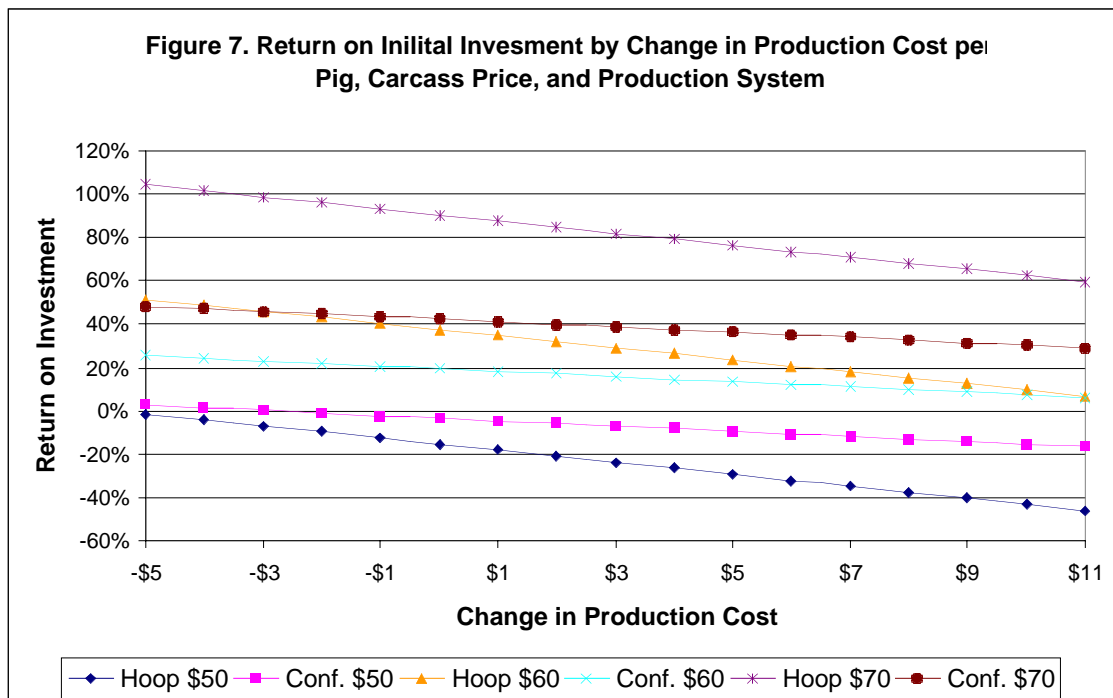
that the hoops are more sensitive to changes in production costs as well as market hog carcass prices. They have a wider distribution in terms of market price and they have a steeper slope. For example, hoops with a \$60 market hog carcass price range from a 51 percent return to a seven percent return. The range in return on investment for the confinement system with a \$60 market hog carcass price was from 25 percent to 6 percent – a much smaller range.

Table 7. Confinement Facility Return on Investments for Selected Production Costs (per pig) and Carcass Prices

Change in Production Cost per Pig	Carcass Prices Per Hundred Pounds				
	\$50	\$55	\$60	\$65	\$70
-\$5	2%	14%	25%	37%	48%
-\$4	1%	12%	24%	35%	47%
-\$3	0%	11%	23%	34%	46%
-\$2	-1%	10%	22%	33%	44%
-\$1	-3%	9%	20%	32%	43%
\$0	-4%	8%	19%	31%	42%
\$1	-5%	6%	18%	29%	41%
\$2	-6%	5%	17%	28%	40%
\$3	-7%	4%	16%	27%	38%
\$4	-9%	3%	14%	26%	37%
\$5	-10%	2%	13%	25%	36%
\$6	-11%	0%	12%	23%	35%
\$7	-12%	-1%	11%	22%	34%
\$8	-13%	-2%	10%	21%	32%
\$9	-15%	-3%	8%	20%	31%
\$10	-16%	-4%	7%	19%	30%
\$11	-17%	-5%	6%	17%	29%

Table 8. Hoop Facility Return on Investments for Selected Production Costs (per pig) and Carcass Prices

Change in Production Cost per Pig	Carcass Prices Per Hundred Pounds				
	\$50	\$55	\$60	\$65	\$70
-\$5	-1%	25%	51%	78%	104%
-\$4	-4%	22%	49%	75%	102%
-\$3	-7%	19%	46%	72%	99%
-\$2	-10%	17%	43%	70%	96%
-\$1	-13%	14%	40%	67%	93%
\$0	-15%	11%	38%	64%	90%
\$1	-18%	8%	35%	61%	88%
\$2	-21%	5%	32%	58%	85%
\$3	-24%	3%	29%	56%	82%
\$4	-27%	0%	26%	53%	79%
\$5	-29%	-3%	24%	50%	76%
\$6	-32%	-6%	21%	47%	74%
\$7	-35%	-8%	18%	44%	71%
\$8	-38%	-11%	15%	42%	68%
\$9	-40%	-14%	12%	39%	65%
\$10	-43%	-17%	10%	36%	62%
\$11	-46%	-20%	7%	33%	60%



* Legend shows the facility type and carcass price.