Economics of Finishing Pigs in Hoop Structures and Confinement: A Summer Group under Different Space Restrictions

Ben Larson, research assistant
James Kliebenstein, professor, Department of Economics
Mark Honeyman, associate professor, Department of Animal Science
Arlie Penner, research associate, Department of Animal Science

ASL-R1818

Summary and Implications

The study was conducted at the ISU Rhodes Research and Demonstration farm. The two types of pork grow-finish production facilities compared in this study are hoop and total confinement. This is the eighth group of finishing pigs that has been evaluated in these facilities and the forth summer group. This study was conducted from April 2001 to September 2001.

Past reports examined the differences between the two facility types to evaluate facility performance under summer and winter seasons. This report similarly examines the difference between the two facility types. An additional focus of this group is pig stocking density rates. Stocking rates of 9, 10.5, and 12 square feet per pig are evaluated for the hoop system. Net revenue per pig for the hoop systems were $19.79 (12 square feet), $22.41 (10.5 square feet), and $17.74 (9 square feet), respectively. The net revenue per pig for the confinement system was $16.25 per pig.

The hoop facilities showed a dramatic drop in production efficiency when the facilities were stocked at a rate of 9 square feet per pig. The feed conversion increased nearly a tenth of a pound of feed per pound of gain and the average daily gain decreased by .6 pounds per day compared with the other stocking densities. However, feed efficiency and average daily gain only improved slightly when the space allowed per pig was 12 square feet compared with 10.5 square feet. Moreover, the reduction in space per pig from 12 to 10.5 square feet allowed a more efficient use of both facilities and bedding per pig. This allowed the group stocked at 10.5 square feet per pig to increase net revenue by $2.62 per pig over the hoop stocked at 12 square feet per pig. This difference is impacted somewhat by a difference in the weight of the pigs that were marketed (Table 1). They were on feed for a slightly longer time period. Despite this difference in sale weight the study suggests that a decrease in space utilized from 12 to 10.5 square feet per pig would increase the profit level for hoop facilities during the summer.

Net revenue for the hogs from the hoop facility with 12 square feet of space was $3.54 per pig over the confinement system. This difference was greater than the average of the three previous summer groups, which favored the hoops by $1.43 and saw a difference in hoop net revenue vs. confinement net revenue that ranged from $.20 to $3.05 per pig. The range of differences can be explained by a number of reasons. Some can be attributed to on farm research variables such as weather and disease exposure. Another key issue is the distribution of marketing. This changes the performance of the remaining hogs as well as the average sale weight.

Introduction

The evolution of the swine industry has forced industry members to reevaluate their operations and use an increasing level of risk management. A survey conducted in May 2001 showed that hoop buildings are becoming an important part of the Iowa swine industry. Hoop buildings became widely available around 1995 or 1996 and their use has grown. It is projected that in 2001 approximately 4% of the market hogs finished in Iowa were finished in hoop facilities.

This report is part of an ongoing research project that is being conducted at the Iowa State University Rhodes Research Farm. The project is designed to evaluate the use of hoop buildings in pork production. It compares hoop to confinement facilities along with evaluating alternative management practices used in hoop production. This report provides results from a group of pigs finished during the summer season of 2001 with different stocking rates used in the hoop facilities.

Materials and Methods

This report provides results for the eighth group of hogs, that were on test from April 25, 2001, until September 25, 2001, at the Rhodes Research Farm. Results are evaluated by using the actual production efficiency values while using the average (1990–1999) or typical costs for feeder pigs, feed, etc. along with average market hog prices. This allows for comparison of expected costs and returns using normal input costs and hog price conditions. Future reports will examine the risks and efficiency of the use of capital of the two systems. Previous reports have evaluated results for previous groups of hogs raised in the hoop (11.5 square feet per pig) and confinement facilities.

This trial also evaluated stocking density in hoop facilities to examine the effects of stocking density on the hoop facility's performance. Each hoop facility was stocked

with 143 hogs. Then the building space was restricted using panels in order to create density rates of 12, 10.5, and 9 square feet per pig. The hoop and confinement facilities are then compared using results from the facility with 12 square feet per pig. This is the density level, which is closest to the level used for previous studies, thus allowing for a better comparison to the previous studies.

Results and Discussion

Productivity

Production efficiencies are provided in Table 1. Important efficiency numbers would include the percent of pigs marketed, feed efficiency, and average daily gain. The percent of pigs marketed is calculated by taking the pigs that are marketed as market hogs and dividing by the pigs that were placed on feed. This percentage has a direct effect on the system's returns because the pigs marketed represents revenue. Revenue from these pigs need to cover the entire systems costs. During this trial the hoop facilities marketed 97.90% (12 square feet per pig space), 98.6% (10.5 square feet per pig space), and 95.8% (9 square feet per pig space) of the pigs, respectively. The feed efficiency is using the weight of the marketed animals at the slaughter plant and the total feed consumed by the respective group on test.

Feed efficiency was 2.98 for the hoop stocked at a density of 9 ft per pig vs. 2.88 and 2.86 for the hoops stocked at a density of 10.5 and 12, respectively. This suggests a decline of efficiencies between the 10.5 and 9 square feet per pig stocking rate. It also suggests that there is potentially only a very slight benefit in feed efficiency by reducing the density from 10.5 to 12 sq. ft per animal. Average daily gain information showed similar results with the pigs in the hoop stocked at 9 square feet growing at a rate of 1.61 pounds per day while those in the hoops stocked at 10.5 and 12 grew at 1.67 and 1.68 pounds per day respectively.

Productivity for the confinement system was lower than the hoop stocked at 12 square feet in all three efficiency areas. Of the pigs placed on feed in the confinement facility 96.97% were marketed; feed efficiency was 2.92, and average daily gain was 1.54 pounds. Thus, when compared to the hoop system with 12 square feet of space the confinement system exhibited a decrease of .93% of pigs marketed, a feed efficiency decrease of .06, and reduced growth rate of .14 pounds per day. This is slightly different from past summer groups in which the confinement system showed 1.1% fewer pigs marketed, whereas .07 more pounds of feed was used per pound of gain, growth rate was .03 pounds per day slower than for the hoop pigs.

Table 1. Productivity Information for Hoop and Confinement Facilities.

	Facility			
	Hoop			Confinement
	9 sq. ft.	10.5 sq. ft.	12 sq. ft.	
Number of pigs	143	143	143	132
Total bedding	25345	28645	30040	
Feeder pig average weight	31.8	33.0	35.0	36.4
Death loss %	4.20	1.40	2.10	3.03
Percent pigs marketed	95.80	98.60	97.90	96.97
Average daily gain	1.60	1.67	1.68	1.54
Feed efficiency	3.00	2.88	2.86	2.92
Plant weight	233.8	249.4	242.2	238.6
Carcass yield	78.87	77.87	78.10	78.32
Carcass weight	184.37	194.22	189.14	186.86
Average days on feed per pig	124.61	128.96	123.53	130.34
Total facility days	140	147	142	149

Table 2 shows the placement and marketing sequence of the pigs. It should be noted that the hoop pigs were brought in over three successive weeks as each hoop was filled at a different time. Confinement system pigs were all placed on feed at the same time. The difference in placement date and sale date led to a slight difference in average days on feed per pig (Table 1). Average days on feed ranged from approximately 124 days to 130 days. Another measure is the total facility days which represents the time from when the first pig is placed on feed until the last pig is out of the system plus 8 days for cleanup. For example, the hoop stocked at 9 square feet

used 140 facility days, there were 84 pigs marketed during the first marketing and 53 pigs during the second marketing and were on feed an average of 124.61 days. The hoop stocked at 10.5 square feet had 147 facility days, marketed 118 pigs in its first marketing and 23 pigs in the second marketing. They were on feed an average of 128.96 days. It should be noted that the difference in marketing in each facility would cause some of the difference in performance due to changes in efficiencies after the first hogs are sold.

The difference in starting (placement) weights and ending weights can create some problems that are notable.

However, the confinement pigs were placed at a heavier weight, were on feed longer, had a lower average daily gain, and had a lighter market weight than did the hoop pigs in the 10.5 and 12 square foot per pig facilities.

Weights at the plant ranged from 249 for the 10.5 square feet hoop to 233 pounds per group for the 9 square feet hoop. The yields (Table 1) of the pigs declined at heavier weights. This resulted in hoop pig carcass weights of 189.14 (12 square feet per pig space), 194.22 (10.5 square feet per pig space), and 184.37 (9 square feet per pig space), whereas the confinement marketed 186.86 pounds of carcass weight per pig.

Table 2. Placement and Marketing Information.

	Facility			
	Hoop			Confinement
	9 sq. ft.	10.5 sq. ft.	12 sq. ft.	
Date Placed on Feed	5/16/01	5/9/01	5/2/01	4/25/01
Date Marketed	Number Marketed			
8/29/01	0	0	97	78
9/13/01	84	118	43	0
9/25/01	53	23	0	49
Total Marketed	137	141	140	127

Economic Results

Economic results provide a comparison of costs and returns of the two facility types. Sensitivity tables provide information showing the impact of changes in selected costs, and production efficiencies such as feed price, feeder pig price, etc.

Facility costs are budgeted at $180 per pig space for a confinement operation and $57.69 (12 square feet per pig space), $50.48 (10.5 square feet per pig space), and $43.27 (9 square feet per pig space) plus $36 for manure and feed handling equipment (Table 3). Annual fixed costs were calculated at 13.2% of the investment for confinement and 16.5% for hoops. The confinement facilities are depreciated over 15 years, whereas the hoops are depreciated over 10 years. Insurance and taxes represent 1.5% of the fixed investment with interest at 10% for both confinement and hoops. This value is distributed across the number of turns that can be completed by each facility. The value is determined by dividing the number of facility days by 365. The hoops were turned at a rate of 2.43 (12 square feet per pig space), 2.35 (10.5 square feet per pig space), and 2.47 (9 square feet per pig space) turns per year. The confinement was turned at a rate of 2.32 groups per year. These turn rates are in line with the total facility days or total days the system was in use for each group. Turning pigs at a faster rate allows facility costs to be spread over more pigs.

Fuel, repairs, utilities, veterinary and medical, marketing, and miscellaneous are based on Iowa State University and Midwest Plan Service, Livestock Enterprise Budgets. Bedding requirements per pig increased as pig density declined. The result of this was that the bedding requirements per pig were $3.58, $3.39, and $3.08 respectively for the 12, 10.5, and 9 square feet per pig space requirements. Bedding cost is $20 per 1200 pounds. Labor was valued at $10.00 per hour with .2 hours per head for the confinement and .27 hours per head for the hoop hogs. Feed prices were established at $.06 per pound, which was the average price with grind, mix, and delivery of feed from 1990 to 1999 ($2.35 per bushel of corn and $190 per ton of soybean meal). This represents the same feed costs as used for the previous groups analyzed. All feed used was applied to the pigs that were marketed.

Feeder Pig as well as market hog prices were calculated using a rounded average price from the 1990 to 1999 time period and also has been held constant for all the trials. The feeder pig prices then take into account costs from dead or culled pigs as well as a 10% interest rate that is charged against all expenses except labor and marketing costs. Market hog prices were adjusted to a carcass weight basis in order to take into account the yield differences and lean premiums. The yield levels for each group are provided in Table 1. The lean premium difference (Table 3) was calculated by figuring the difference of the facility above or below the average hoop premium based on sales to IBP. It should be noted that these lean premiums can vary depending upon the packer that is used.

The result of the trial is that, for this summer group, per pig net revenues (Table 3) for the hoops was $19.79 (12 square feet per pig space), $22.41 (10.5 square feet per pig space), and $17.74 (9 square feet per pig space) respectively. The net revenue for the confinement system was $16.25 per pig marketed, which is lower than any of the hoops and is $3.54 lower than the level for the 12 square feet hoop.

Total operating costs per pig marketed (Table 3) for the hoops were $86.91 (12 square feet per pig space), $88.07 (10.5 square feet per pig space), and $87.54 (9 square feet per pig space) respectively. The confinement system had a total operating costs of $83.40 per pig marketed, which is lower than the level for each of the hoops and $3.51 lower than the 12 square feet hoop. This

is primarily due to the bedding costs associated with the hoop systems.

Per pig total fixed costs (Table 3) for the hoops were $6.49 (12 square feet per pig space), $6.15 (10.5 square feet per pig space), and $5.54 (9 square feet per pig space) respectively per pig marketed. This is related to increasing the number of hogs that are finished in the facility as the square footage per pig is decreased. The confinement facility had a total facility cost of $12.65 per pig marketed, which is considerably higher than each of the hoops and $6.16 higher than the level for the 12 sq. ft hoop.

One of the most important factors is revenue per pig (Table 3), which for the hoops was $113.19 (12 square

feet per pig space), $116.62 (10.5 square feet per pig space), and $110.82 (9 square feet per pig space). The confinement had a revenue of $112.30 per pig marketed. The differences in revenues are attributed to the difference in plant weight, yields, and lean premiums (Table 3).

The result of this summer group suggests that the hoop facilities provide a higher profit during the summer. It also suggests that the hoop system, which was stocked at a rate of 10.5 square feet per pig provided the greatest profit per pig. Profit levels were higher at this stocking rate than for the other two stocking rates.

Table 3. Grow finish Production Budget for Summer Group.

	Facility			
	Hoop			Confinement
	9 sq. ft.	10.5 sq. ft.	12 sq. ft.	
Facility investment				
Building (per pig space)**	$43.27	$50.48	$57.69	$180.00
Feed & manure handling	$36.00	$36.00	$36.00	$36.00
Total initial investment	$79.27	$86.48	$93.69	$216.00
Turns/year	2.47	2.35	2.43	2.32
Total initial investment per turn	$32.14	$36.72	$38.50	$92.91
Fixed cost				
% Interest taxes, depreciation, Insurance	16.5	16.5	16.5	13.2
Facility cost per hog marketed	$5.54	$6.15	$6.49	$12.65
Fixed cost per cwt marketed	$2.37	$2.46	$2.68	$5.30
Operating costs (per hog marketed)				
Feeder pigs	$38.00	$38.00	$38.00	$38.00
Feeder pig death loss	$1.38	$0.54	$1.09	$2.13
Interest on feeder pig	$1.27	$1.28	$1.27	$1.27
Fuel repairs utilities	$1.04	$1.01	$1.02	$1.03
Bedding	$3.08	$3.39	$3.58	$0.00
Feed ($.06/lb)	$36.15	$37.37	$35.45	$35.21
Health costs	$1.57	$1.52	$1.53	$1.55
Interest on mixed costs	$0.73	$0.73	$0.71	$0.65
Marketing and misc.	$1.50	$1.50	$1.50	$1.50
Labor	$2.82	$2.74	$2.76	$2.06
Total operating cost	$87.54	$88.07	$86.91	$83.40
Operating costs/cwt marketed	$37.44	$35.31	$35.89	$34.96
Total cost (per pig marketed)	$93.07	$94.22	$93.40	$96.05
Break even/cwt	$39.81	$37.77	$38.57	$40.26
Lean premium difference***	-$0.19	-$0.10	$0.29	$0.10
Revenue from $60 per cwt	$110.82	$116.62	$113.19	$112.30
Net revenue	$17.74	$22.41	$19.79	$16.25

* This is the eighth group.
** Hoop facilities are calculated at $4.81 per square ft.
***Premium difference is calculated by subtracting grade premiums from the hoop average.

Economic Effects of Production Efficiency

As shown in Table 1 there were production efficiency differences between the two systems. The following sensitivity tables will focus upon feed efficiency and average daily gain. The comparisons are provided for selected market weights. However, it does not perfectly reflect ADG due to differences in starting weight and days on feed.

Tables 4 and 5 are most effectively used to measure the effects of varied average daily gain, feed costs, and feed efficiency. Table 4 provides the total pounds of feed needed per pig for selected marketing weights and feed efficiencies. For each comparison the starting feeder pig weight was a 35-pound feeder pig.

By using the information on total pounds of feed, shown in Table 4, Table 5 can be used to determine the total feed costs for selected feed prices, feed efficiencies, and market weights. For example, producing a 275-pound pig at a 3.5 feed efficiency would require 840 pounds of feed. By rounding the feed to 850 pounds you can determine the effects of feed price on total feed costs. If the feed price was $.05 the total feed costs would be roughly $42.50. However, at $.07 it would be $59.50 or a $17 increase.

Table 4. Sensitivity of Total Pounds of Feed Needed Per Pig by Feed Efficiency and Market Weight.

Feed Efficiency	Market Weight							
	235	245	255	265	275	285	295	305
2.9	580	609	638	667	696	725	754	783
3.0	600	630	660	690	720	750	780	810
3.1	620	651	682	713	744	775	806	837
3.2	640	672	704	736	768	800	832	864
3.3	660	693	726	759	792	825	858	891
3.4	680	714	748	782	816	850	884	918
3.5	700	735	770	805	840	875	910	945
3.6	720	756	792	828	864	900	936	972

Table 5. Sensitivity of the Total Feed Cost Per Pig by Pounds of Feed and Feed Price.

Feed Price	Pounds of Feed									
	650	675	700	725	750	775	800	825	850	875
$0.0450	$29.25	$30.38	$31.50	$32.63	$33.75	$34.88	$36.00	$37.13	$38.25	$39.38
$0.0475	$30.88	$32.06	$33.25	$34.44	$35.63	$36.81	$38.00	$39.19	$40.38	$41.56
$0.0500	$32.50	$33.75	$35.00	$36.25	$37.50	$38.75	$40.00	$41.25	$42.50	$43.75
$0.0525	$34.13	$35.44	$36.75	$38.06	$39.38	$40.69	$42.00	$43.31	$44.63	$45.94
$0.0550	$35.75	$37.13	$38.50	$39.88	$41.25	$42.63	$44.00	$45.38	$46.75	$48.13
$0.0575	$37.38	$38.81	$40.25	$41.69	$43.13	$44.56	$46.00	$47.44	$48.88	$50.31
$0.0600	$39.00	$40.50	$42.00	$43.50	$45.00	$46.50	$48.00	$49.50	$51.00	$52.50
$0.0625	$40.63	$42.19	$43.75	$45.31	$46.88	$48.44	$50.00	$51.56	$53.13	$54.69
$0.0650	$42.25	$43.88	$45.50	$47.13	$48.75	$50.38	$52.00	$53.63	$55.25	$56.88
$0.0675	$43.88	$45.56	$47.25	$48.94	$50.63	$52.31	$54.00	$55.69	$57.38	$59.06
$0.0700	$45.50	$47.25	$49.00	$50.75	$52.50	$54.25	$56.00	$57.75	$59.50	$61.25
$0.0725	$47.13	$48.94	$50.75	$52.56	$54.38	$56.19	$58.00	$59.81	$61.63	$63.44
$0.0750	$48.75	$50.63	$52.50	$54.38	$56.25	$58.13	$60.00	$61.88	$63.75	$65.63

Table 6 demonstrates the effects on feed cost per hundredweight gain for selected feed efficiencies and weights. The table is based on a $.06 cost per pound of feed at different market hog weights and feed efficiencies. It provides information on how the weight and feed efficiency affects the feed cost of gain. With a feed cost of six cents a drop in feed efficiency of .1 pounds would reduce the break-even production cost by $.52-$.54. However, there is a trade off here, as a reduction of sale weight can increase other costs as far as the breakeven price is concerned.

Table 6. Sensitivity of the Feed Cost Per Hundred Weight by Feed Efficiency and Market Weight.

				Market Weight				
Feed Efficiency	235	245	255	265	275	285	295	305
2.9	$14.81	$14.91	$15.01	$15.10	$15.19	$15.26	$15.34	$15.40
3.0	$15.32	$15.43	$15.53	$15.62	$15.71	$15.79	$15.86	$15.93
3.1	$15.83	$15.94	$16.05	$16.14	$16.23	$16.32	$16.39	$16.47
3.2	$16.34	$16.46	$16.56	$16.66	$16.76	$16.84	$16.92	$17.00
3.3	$16.85	$16.97	$17.08	$17.18	$17.28	$17.37	$17.45	$17.53
3.4	$17.36	$17.49	$17.60	$17.71	$17.80	$17.89	$17.98	$18.06
3.5	$17.87	$18.00	$18.12	$18.23	$18.33	$18.42	$18.51	$18.59
3.6	$18.38	$18.51	$18.64	$18.75	$18.85	$18.95	$19.04	$19.12

Market weights can have a significant effect on the comparison of systems. Table 7 demonstrates the effects on the breakeven of market weight vs. various total fixed costs. With this approach the effects of spreading fixed costs across heavier market weights can be examined. For example, with a $12 fixed cost, such as the confinement system has, and a 245-pound market weight there is a fixed cost expense of $4.90 per hundred weight but with a 275-pound market hog there is a $4.36 fixed cost per hundred weight or a difference of $0.54. For hoop raised hogs, the same weight comparison and fixed costs of $6.00 per hog there would be a fixed cost difference of $.27 per hundred weight ($2.45 vs. $2.18). This amplifies the sensitivity of the confinement system to average daily gain and adds risk to the operation where marketing is controlled by pig flow or the need for space for incoming pigs.

Table 7. Sensitivity of Fixed Costs per Hundred Weight by Market Weight and Fixed Costs.

				Market Weight				
Fixed Cost/Hog	235	245	255	265	275	285	295	305
$5.0	$2.13	$2.04	$1.96	$1.89	$1.82	$1.75	$1.69	$1.64
$5.5	$2.34	$2.24	$2.16	$2.08	$2.00	$1.93	$1.86	$1.80
$6.0	$2.55	$2.45	$2.35	$2.26	$2.18	$2.11	$2.03	$1.97
$6.5	$2.77	$2.65	$2.55	$2.45	$2.36	$2.28	$2.20	$2.13
$7.0	$2.98	$2.86	$2.75	$2.64	$2.55	$2.46	$2.37	$2.30
$7.5	$3.19	$3.06	$2.94	$2.83	$2.73	$2.63	$2.54	$2.46
$8.0	$3.40	$3.27	$3.14	$3.02	$2.91	$2.81	$2.71	$2.62
$8.5	$3.62	$3.47	$3.33	$3.21	$3.09	$2.98	$2.88	$2.79
$9.0	$3.83	$3.67	$3.53	$3.40	$3.27	$3.16	$3.05	$2.95
$9.5	$4.04	$3.88	$3.73	$3.58	$3.45	$3.33	$3.22	$3.11
$10.0	$4.26	$4.08	$3.92	$3.77	$3.64	$3.51	$3.39	$3.28
$10.5	$4.47	$4.29	$4.12	$3.96	$3.82	$3.68	$3.56	$3.44
$11.0	$4.68	$4.49	$4.31	$4.15	$4.00	$3.86	$3.73	$3.61
$11.5	$4.89	$4.69	$4.51	$4.34	$4.18	$4.04	$3.90	$3.77
$12.0	$5.11	$4.90	$4.71	$4.53	$4.36	$4.21	$4.07	$3.93
$12.5	$5.32	$5.10	$4.90	$4.72	$4.55	$4.39	$4.24	$4.10
$13.0	$5.53	$5.31	$5.10	$4.91	$4.73	$4.56	$4.41	$4.26

Although feeder pig prices are not considered fixed costs they are a sunk cost after their purchase. They again reflect an increase in sensitivity at higher purchase prices, which increases the risk associated with poor pig performance. For example, with a 275 pound finished hog and a $35 feeder pig price $12.73 per hundred weight is needed to cover the cost of the feeder pig. If the finished weight were decreased by just ten pounds to 265 then it would require an additional $.52 per hundred pounds of sale weight in order to breakeven against the cost of the feeder pig. Selling at heavier weights spread the cost of the feeder pig over more pounds.

Table 8. Market Hog Price Needed to Cover Feeder Pig Purchase Cost.

Feeder Pig Cost	Market Weight							
	235	245	255	265	275	285	295	305
$20	$8.51	$8.16	$7.84	$7.55	$7.27	$7.02	$6.78	$6.56
$25	$10.64	$10.20	$9.80	$9.43	$9.09	$8.77	$8.47	$8.20
$30	$12.77	$12.24	$11.76	$11.32	$10.91	$10.53	$10.17	$9.84
$35	$14.89	$14.29	$13.73	$13.21	$12.73	$12.28	$11.86	$11.48
$40	$17.02	$16.33	$15.69	$15.09	$14.55	$14.04	$13.56	$13.11
$45	$19.15	$18.37	$17.65	$16.98	$16.36	$15.79	$15.25	$14.75
$50	$21.28	$20.41	$19.61	$18.87	$18.18	$17.54	$16.95	$16.39
$55	$23.40	$22.45	$21.57	$20.75	$20.00	$19.30	$18.64	$18.03
$60	$25.53	$24.49	$23.53	$22.64	$21.82	$21.05	$20.34	$19.67
$65	$27.66	$26.53	$25.49	$24.53	$23.64	$22.81	$22.03	$21.31
$70	$29.79	$28.57	$27.45	$26.42	$25.45	$24.56	$23.73	$22.95
$75	$31.91	$30.61	$29.41	$28.30	$27.27	$26.32	$25.42	$24.59

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