AN ECONOMIC ANALYSIS OF KENTUCKY'S
LIVESTOCK AUCTION MARKETS

Gerald E. Grinnell and D. Milton Shuffett

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AN ECONOMIC ANALYSIS OF KENTUCKY'S
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by

Gerald E. Grinnell and D. Milton Shuffett*

Introduction

Growth in the number of organized livestock auction markets[1] in Kentucky since the 1920's has paralleled the decline in importance of terminal markets in the state. After reaching a peak of 66 auctions in 1955, the number diminished to 59 in 1969. Direct to packer sales of slaughter livestock have increased in recent years. The number of cattle and hogs marketed through the state's auctions is rising, while receipts of calves, sheep and goats are falling. During 1969, Kentucky's 59 auctions handled $194,650,601 worth of livestock, consisting of 1,005,452 head of cattle, 291,198 calves, 822,066 hogs, 91,950 sheep and goats, and 13,420 horses and mules. Despite a wide range in market size (gross value of livestock handled ranged from $21,588 to $19,174,470

in 1969), the largest four firms accounted for 29.4% and the largest eight firms accounted for 45% of total gross value of livestock handled by Kentucky's auctions during 1969.

Problem

Livestock auction markets in Kentucky incur costs and receive revenue by providing facilities and personnel necessary for assembling, handling, and selling all livestock consigned by sellers. A tariff schedule (fees are levied on each consignment according to species, size, and number of livestock and the amount of optional services provided) must be approved by the Packers and Stockyards Division, U.S. Department of Agriculture and must be posted prominently in the stockyards. In the short run, an auction's tariff rates may be considered fixed and invariant to quantity of livestock handled, thereby giving the firm a perfectly elastic demand schedule. In the long run the fee schedule may be changed, but once changed, it becomes fixed again. Auctions in close geographic proximity tend to post similar tariff schedules.

Volume of livestock handled per unit time by a given auction also depends on the following non-price variables: (1) the

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[1] An organized livestock auction market may be defined as a firm which operates facilities at regularly scheduled intervals for the purpose of offering to the public, for a fee, services appropriate for assembling, handling, and selling to the highest bidder, among simultaneously competing buyers, livestock consigned to it.

concentration of livestock produced in the area served by that auction; (2) the number of other marketing firms which serve the same area; and (3) the quality and quantity of services provided by the given auction and by other marketing firms serving producers in the area. The only variable under direct control of a given auction is quality and quantity of services offered patrons. To maximize total profits, entrepreneurs need to concentrate managements' efforts within the firms, i.e., increase operating efficiency for a given volume of livestock and increase quality and quantity of services offered when the effect is to increase a firm's market share while maintaining or reducing unit costs. An auction market operator thus needs knowledge of the relationship between unit costs and volume of livestock handled.

A knowledge of cost-volume relationships also is necessary in evaluating performance of firms in an industry. Each firm should operate a plant of such size that the short-run average total cost curve is tangent to the long run average cost curve at the minimum point of the latter; or at least significant economies of size should not be left unexploited.[2]

Except for implementation of special feeder calf sales, few changes have occurred in the operation of livestock auction markets while changes elsewhere have altered the economic setting of Kentucky's agricultural sector. A period of renewed growth[3] of Kentucky's livestock market industry may have been initiated during the mid-1960's

when some auction market operators expressed a desire to make changes which would improve their methods of operation.

Objectives

The broad objective of this study was to appraise the present performance of Kentucky's livestock auction market industry relative to its potential. Three aspects of performance were considered: (1) the degree of efficiency attained relating to facility utilization and economies of size; (2) the relationship between sales promotion costs and volume of transactions; and (3) technological progressiveness. Factors considered were restricted to those within the control of individual firms, i.e., this study sought to determine ways industry performance may be improved through internal adjustments by entrepreneurs of livestock auction markets in Kentucky.[4] Specific objectives of the study were to use historical accounting records of Kentucky's livestock auctions to: (1) determine a homogeneous measure of firm output; (2) determine relationships between selected costs and volume of auction transactions; (3) identify key factors of firm efficiency; (4) estimate rates of return to market operators; and (5) project the effect of multiple sale-days per week on unit costs.

Data Used

The primary source of data consisted of annual reports filed during the 1965-69 period by each livestock auction market in

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[2]The rate of output at which significant economies of size are exploited is of necessity an arbitrary determination made by the researcher based upon his perceived notions of societal values and sanctions, or by an individual (or group of individuals) duly authorized via society's political or judicial process to render such a decision.

[3]As used here growth refers to improvement and progress, not necessarily changes in number of firms.

[4]This includes the long run option of removing one's resources from the industry.

Kentucky with the Packers and Stockyards Division, Consumer and Marketing Service, U.S. Department of Agriculture. These reports contained information on firm assets, volume of livestock handled, itemized costs, and revenue from various sources. After editing, the reports of 42 firms were usable.

Additional information was obtained from personal observations of auction market operations in Kentucky and other states and from discussions with auction operators, farmers, buyers, and University of Kentucky extension specialists.

Methodology

To identify key factors of firm efficiency, firms were grouped by size. Unit cost and income from various sources were computed for each type of cost or income and averaged by year. Rates of return to market operators (profit per dollar gross income, profit per dollar net worth, and profit per dollar investment) were calculated and averaged by size group.[5]

Cost functions of livestock auction markets may be estimated using the synthetic method or the statistical accounting method. The synthetic method, which requires that physical input-output relationships be converted to cost estimates, calls for detailed time and motion analyses of production of each product using each available production process at alternative rates of output for each of several plants differing in size. Disadvantages of the synthetic method are its stringent data requirements and the inability to apply statistical tests of reliability. Cost functions estimated by the synthetic method,

though prone to understatement by omission of costs, closely approximate long run average cost functions postulated by economic theory.

The statistical method for deriving cost functions may take two basic forms. First, historical cost-output data from a single plant in which rate of output is varied over time without altering plant size or changing technology may be used to develop short-run cost curves; long-run cost functions may be developed if plant size is varied. Second, historical cost-output data from a cross-section sample of plants of varying size, each having similar accounting methods similar technology and equal managerial ability, may be used to estimate long-run cost functions. Cost functions usually are estimated with least squares regression analysis. Short-run cost functions generally are not estimated because necessary time series data are not available. Available cross section data, generally lack information needed to determine whether sample firms are operating with least-cost methods of production and degree of plant utilization. An additional limitation of accounting data is its historical perspective. If these limitations can be overcome or judged not crucial, long-run cost functions estimated by the statistical accounting method[6] will be useful and may closely approximate theoretical curves.

Deficiencies of typical cross-section sample data are overcome, in part, when supplemented with multiperiod observations from each sample firm. When cross section observations are obtained by selecting the least unit cost observation of each firm from a time series of observations, the probability is increased that selected firms are "caught" operating with least-cost methods of production and that they are near capacity

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[5]Profit, defined as the return to owners for management, owners' labor, and risk, was related to total investment as well as to net worth because the former is more appropriate for interfirm comparisons.

[6]Research costs generally are much lower for the statistical accounting method than for the synthetic method.

(i.e. near the bottom of the short run average total cost curve) Thus error associated with the regression fallacy is minimized

The methods discussed above allow estimation of a long run average cost function which applies to firms which operate in the same manner as the sample firms Since auctions in Kentucky generally hold regular sales only one day per week this curve would not apply to firms with multiple sale days per week Based upon the following assumptions, a long run average cost curve applicable for multiple sale days per week was synthesized from the accounting data of individual firms.

1 Total costs can be categorized accurately as fixed or variable
2 Doubling operating time per week (holding sales two days per week rather than one) doubles output (volume of livestock handled per week) and total variable costs while leaving total fixed costs unchanged
3 Each firm's percentage distribution of livestock, by type of animal, remains constant as livestock volume increases

Output of livestock auction markets in Kentucky differs according to the mix of livestock handled by each Since development of accurate cost functions for each type of animal handled is impossible with accounting data[7] a homogeneous measure of output applicable to all auctions in Kentucky was needed Four measures of output employed in previous studies of auction market costs are: (1) gross income; (2) value of livestock handled; (3) investment; and (4) animal units. An appropriate measure would reflect accurately the quantity of services required to handle each type of animal without reference to the costs of providing such services. Neither value of livestock nor investment

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[6]Research costs generally are much lower for the statistical accounting method

[7]Such functions would have limited usefulness also

reflects quantity of services required to handle each type of animal Animal units based upon nutritional requirements of animals is unacceptable (though widely used), while animal units developed by weighing each species according to its contribution to total costs (or total variable costs) produces a measure of output which is a function of costs Since an auction's tariff rates reflect the quantity of services needed to handle each type of animal, gross income was selected as an appropriate measure of firm output.

Data Adjustment Procedures

Since auctions' annual reports filed with the Packers and Stockyards Administration are not designed for interfirm economic analyses, an editing procedure was designed to improve the usefulness of the reports When a firm's reports were totally unusable or unavailable during one or more of the 5 years included in the study, the firm was deleted from the analyses In some instances incomplete reports were made usable, e.g. when labor costs were not itemized by function in the reports, costs were computed for each labor function and when an owner obviously replaced hired workers, a charge was made as if workers were hired Reports covering less than 12 months were prorated to an annual basis Reported rental expenses, which include depreciation, taxes, insurance, repairs and maintenance, opportunity cost and profit to the lessor, were used to calculate property values (depreciable and nondepreciable) and appropriate costs Assuming that livestock auction market entrepreneurs seek maximum total returns from the employment or sale of their available resources and recognizing that rates of return to auction market enterprises are regulated, an effort was made to eliminate bias which may be injected into the reports by entrepreneurs attempting to increase their

profits subject to the regulatory constraint. Nonauction related assets (e.g. farms, stores, savings accounts, certificates of deposit, and government bonds) and goodwill and nonauction related costs and income were deleted from the reports where possible. Salaries of owners and officers were removed from the reports because they probably show little correlation with entrepreneur opportunity costs and may reflect provisions of existing tax laws and/or rules of the federal regulatory agency.

Reasons for deleting firms from the sample are important if eliminated auctions exhibit characteristics which deviate appreciably from those of firms analyzed in this study. Incomplete or inconsistent reports may result from improper accounting procedures, lack of knowledge of or disregard for filing requirements, and/or possible attempts by entrepreneurs to camouflage their true financial or income positions. Improper accounting procedures and incomplete knowledge of filing requirements may be associated with small firms, firms with low profits (or losses), and firms which provide a secondary source of income to entrepreneurs. Exclusion of firms for these reasons probably results in an understated number of small firms and possibly overstated net returns (or understated losses) among small auctions. Exculsion of firms because of insufficient disaggregation of data was assumed to be unrelated to firm size, i.e. potential error thus being randomly distributed.

Functional Cost-Volume Relationships

Scatter diagrams were constructed relating unit costs and gross income,[8] by year,

to determine the nature of four cost-volume relationships: (1) unit total costs of hired labor; (2) unit total fixed costs; (3) unit total variable costs; and (4) unit total costs.

Two types of regression analysis were employed. First, specific unit cost-volume relationships were estimated using observations from each year and "best of 5" data[9] in separate models. The 5-year data also were pooled if a specific cost-volume relationship had the same functional form each of the 5 years and if estimates of the slope parameters were not significantly different (.95 probability level) among years. Second, in analyzing unit total costs, the time-series of cross-section observations were pooled in a covariance regression model in an attempt to remove the effects of excluded variables systematically related to time and interfirm variations. However, the covariance model was found inappropriate and results are not reported.[10]

Scatter diagrams indicated that cost-volume relationships were curvilinear and that each relationship could be fitted with one of four regression models, each linear in the parameters. The regression models postulated were:

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[8]Gross income included commission income, profit or loss on market support activities, profit or loss on feed account, rental, interest, and miscellaneous (bad debt collections, income from vending machines, sale of inventory or assets, etc.) income of the auctions.

[9]"Best of 5" data consists of the least unit total cost observation of each of the 42 firms from the five-year time series.

[10]The linear model used was: $Y_{ij} = a + c_i + d_j + bX_{ij} + u_{ij}$, where Y_{ij} represents unit total costs of the ith firm in year j, X_{ij} is the annual gross income of the ith firm in year j, a and b are constants over all firms and all years, c_i represents firm constants, d_j represents year constants, and u_{ij} is an error term. This model was found inappropriate because the functional relationship between unit total costs and gross income varied among years. Year constants (d_j) made an insignificant contribution and the firm constants (c_i) were correlated with one or more independent variables. The latter indicated that the coefficients of regression did not reflect a "pure" unit cost-gross income relationship. For additional explanation see[1], pp. 151-170.

$$(1) \quad Y = a + b_1(G.I.) + b_2(G.I.)^2,$$
$$(2) \quad Y = a + b_1(1000/G.I.) + b_2(G.I.)$$
$$(3) \quad Y = a + b_1(1000/G.I.) + b_2(G.I.)^2, \text{ and}$$
$$(4) \quad Y = a + b(1000/G.I.)$$

where Y is unit cost and F.I. is annual gross income. Relatively low values of coefficients of determination were anticipated because of wide variability in unit costs among firms of similar size. Parameter estimates and statistics are based upon 42 observations for each year except 1968 when 41 observations were used.

Labor Costs[11]

Based upon t tests for individual explanatory variables, F tests and standard errors of estimate for entire models, and judging a model to have specification bias when a significant explanatory variable was left out model 2 provided the best estimate of unit labor cost-gross income relationships by year. The 5-year data also were suitable for pooling. Parameter estimates and appropriate statistics are in Table 1.

Total labor costs per dollar of gross income dropped precipitously each year as annual gross income increased to $30,000. Unit labor costs continued to decline until auction size reached about $70,000 gross income annually. As gross income increased above $80,000 annually, unit hired labor costs rose steadily (see Fig. 1 and Appendix Table 9, p.47). While unit labor costs among the larger firms ($80,000 or more, annual gross income) declined each year from 1965 through 1969, the reduction was not significant — large firms remained less efficient in use of hired workers than were

auctions in the $40,000 to $80,000 gross income range. Unit hired labor costs also increased as gross income exceeded $80,000 annually when Best of 5 data were used. Since the Best of 5 data represent a pragmatic potential of the 42 auctions (in terms of minimizing unit total costs) the conclusion may be drawn that Kentucky's largest auctions were incapable of reducing unit total hired labor costs to the level enjoyed by smaller auctions ($40,000 to $80,000 gross income range), *given* the methods of operation employed by auction managers during the 1965-69 period (assuming entrepreneurs attempted to keep unit labor costs down).

Fixed Costs[12]

Data in Appendix Table 16, p.54, indicated that unit total fixed costs and gross income were inversely related with a tendency for unit costs to rise at observed extreme upper values of gross income. Owing to the paucity of observations at upper values of gross income model 4 was postulated to provide best data fit. All four models were run however. Model 1 produced total F and t_{b_1} statistics insignificant at the 0.95 probability level. Coefficients of multiple determination also were low each year, ranging from 0.044 to 0.148. Model 2 produced total F statistics significant at the 0.99 level each year. Student t values indicated that b_1 estimates were significantly different from zero at the 0.99 level each year, but b_2 estimates were insignificant at the 0.95 probability level each year. Model 3 gave results nearly identical with those of

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[11]Labor costs included costs of auctioneers, weighmasters, starters, ringmen, solicitors, office help, year help, and other help (e.g. night watchmen, painters, carpenters, repairmen, custodians).

[12]Fixed costs included insurance (excluding unemployment insurance), license and bond premiums, dues and subscriptions, taxes (excluding income taxes), legal and accounting fees, depreciation, charity and contributions, and explicit and implicit interest.

TABLE 1

STATISTICAL UNIT TOTAL LABOR COST – GROSS INCOME RELATIONSHIPS, BY YEAR,

TABLE 1

STATISTICAL UNIT TOTAL LABOR COST – GROSS INCOME RELATIONSHIPS, BY YEAR, BEST OF FIVE, AND POOLED DATA, 1965-69[a]

Year	Model Number[b]	Number of Observations	a	b_1	b_2	R^2	Total F	Standard Error
1965	2	42	0.26	2.09** (0.77)	0.00000093** (0.00000035)	0.19	4.59*	0.12
1966	2	42	0.26	2.40** (0.78)	0.00000085** (0.00000030)	0.22	5.64**	0.11
1967	2	42	0.25	2.58** (0.80)	0.00000065** (0.00000025)	0.22	5.66**	0.10
1968	2	41	0.24	3.15** (0.37)	0.00000067** (0.00000021)	0.66	37.01**	0.11
1969	2	42	0.26	3.16** (0.43)	0.00000060** (0.00000023)	0.58	26.57**	0.13
Best of Five	2	42	0.26	1.42* (0.69)	0.00000055** (0.00000021)	0.16	3.77*	0.09
5-Year Data Pooled	2	209	0.24	2.92** (0.23)	0.00000075** (0.00000011)	0.43	79.20**	0.11

[a] A single and double asterisk denote statistical significance at 0.95 and 0.99 probability levels, respectively.

[b] See the text for description models.

Source: Computed from data contained in annual reports of Kentucky's livestock auction markets to the Packers and Stockyards Administration.

Unit
labor
cost
($)

.66

.62

.58

.54

.50

.46

.42

.38

.34

.30

1965

1966

5-years pooled

1967
1968
1969

Best of 5

1969

1969

10 20 40 60 80 100 150 200 250 300 350 400

Gross income (in thousands)
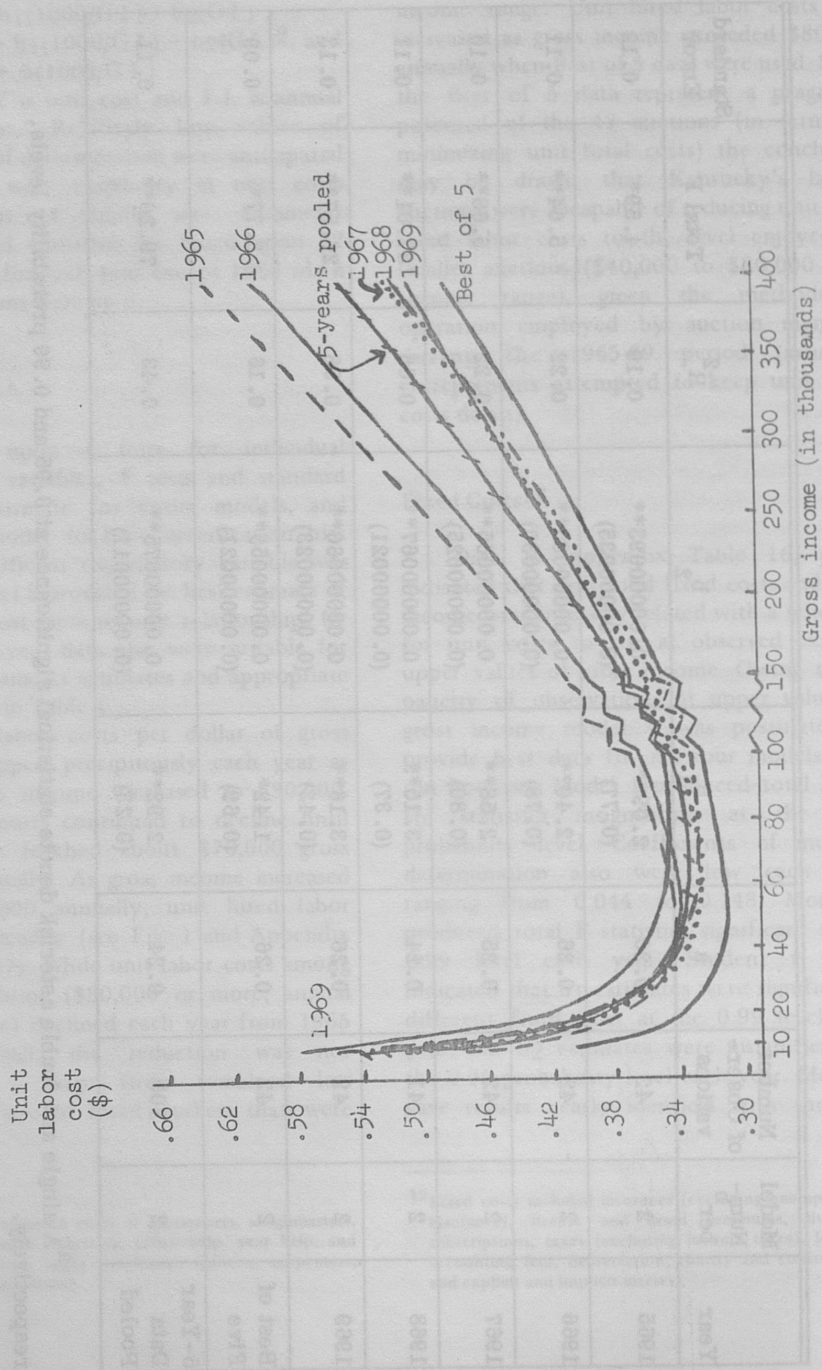
Figure 1.--Unit total labor cost-gross income relationships, by year

model 2. The second explanatory variable $[(G.I.)^2]$ was consistently rejected at the 0.95 probability level each year while values of total F and t_{b1} were significant at the 0.99 level. Model 4 produced the most satisfactory results among the four models tested. F statistics were highly significant (0.99 level) each year. The regression coefficients of model 4 did not differ significantly among years and the 5-year data also were pooled. Parameter estimates and appropriate statistics for model 4, by year, are shown in Table 2.

As shown in Figure 2, total fixed costs per dollar of gross income declined very rapidly each year as auction size increased to $30,000 annual gross income. Although declining through the largest firms observed, reduction in unit total fixed costs was well beyond $70,000 annual gross income.

Variable Costs[13]

Total variable costs per dollar of gross income exhibited wide variability among firms of similar size within and among years. Analysis of average unit costs in Appendix Table 13, p.51, and scatter diagrams by year indicated the relationship between unit variable costs and gross income was unstable among years. Data in Appendix Table 13 provided some support for the hypothesis that the relationship between unit total variable costs and gross income was U-shaped. Scatter diagrams provided little confirmation. Data for 1965 and 1966, and Best of 5 data showed great variation in unit variable costs among firms of similar size but no cost-volume relationship was apparent.

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[13]Variable costs included total hired labor costs, unemployment insurance, utilities, travel and entertainment, automobile expenses, repairs and maintenance, supplies, bad debts, trucking and hauling, variable rental expenses, and miscellaneous expenses.

The four models postulated above were used to estimate unit total variable cost-volume relationships. Model 1 gave insignificant (.95 probability level) total F and t_{b1} statistics each year except 1969. Model 2 produced significant (0.95 level) total F and t_{b1} statistics only when 1967, 1968, and 1969 data were used, and t_{b2} was significant only when 1967 data were used. Model 3 produced insignificant total F and t_{b1} statistics using 1965, 1966, and Best of 5 data. Using 1968 data, model 3 generated highly significant (0.99 level) total F and t_{b1} statistics but t_{b2} was statistically insignificant (0.95 level). 1967 and 1969 data produced highly significant (0.99 level) total F and t_{b1} statistics and significant (0.95 level) t_{b2} statistics. Model 2 was preferred over model 3 for 1967 data because the former produced a higher coefficient of multiple determination and a lower standard error of estimate than did the latter. Model 4 gave statistically insignificant (0.95 level) total F and t_b statistics using 1965, 1966, and Best of 5 data. 1967 data produced significant (0.95 level) F and t_b statistics (however, R^2 was lower and standard error of estimate was higher than with model 2). Data for 1968 and 1969 produced highly significant (0.99 level) F and t_b statistics. Model 3 fit 1969 data better than did model 4 (higher R^2 and lower standard error estimate) and model 4 resulted in specification bias due to exclusion of a significant explanatory variable.

None of the four models gave satisfactory fits for 1965, 1966, or Best of 5 data. Furthermore, since a simple linear model of the form AVC = a + b(G.I.) produced insignificant t_b statistics using these data, the conclusion was drawn that the best estimates of the unit total variable costs-gross income relationships were the respective annual means of unit variable costs - $0.605, $0.591, and $0.512 for 1965, 1966 and Best of 5 data respectively.

Parameter estimates and appropriate statistics for 1967, 1968, and 1969 data are in

TABLE 2

STATISTICAL UNIT TOTAL FIXED COST-GROSS INCOME RELATIONSHIPS, BY YEAR, BEST OF FIVE AND POOLED DATA, 1965-69[a]

Year	Model Number[b]	Number of Observations	a	b	R^2	Total F	Standard Error
1965	4	42	0.14	1.94** (0.42)	0.35	21.51**	0.08
1966	4	42	0.15	1.76** (0.46)	0.27	14.80**	0.08
1967	4	42	0.14	1.94** (0.57)	0.23	11.73**	0.09
1968	4	41	0.14	2.61** (0.27)	0.71	94.17**	0.08
1969	4	42	0.16	2.01** (0.28)	0.57	53.41**	0.09
Best of Five	4	42	0.12	2.05** (0.47)	0.33	19.27**	0.07
5-Year Data Pooled	4	209	0.14	2.17** (0.55)	0.49	197.35**	0.08

[a] A single and double asterisk denote statistical significance at 0.95 and 0.99 probability levels, respectively.

[b] See the text for description of models.

Unit labor cost ($)

.42
.38
.34
.30
.26
.22
.18
.14
.10

1969 1966 1967
5 years pooled
1965
1968
Best of 5

10 20 40 60 80 100 150 200 250 300 350 400

Gross income (in thousands)

Figure 2.--Unit total fixed cost-gross income relationships, by year

Table 3. These relationships are presented graphically in Fig. 3.

The problem of predicting the relationship between unit variable costs and gross income among auctions in Kentucky is left unresolved. The 1965 and 1966 data indicated that variation in unit total variable costs is not a function of annual gross income while 1967, 1968 and 1969 data indicate that a distinct relationship exists. Unit total hired labor costs of the auctions declined rapidly, then rose steadily as gross income increased. Since labor costs comprised a large portion (averaging about 64%) of total variable costs, this relationship would be expected to appear in the unit variable cost-gross income relationship (as in 1967 and 1969) unless the relationships of other unit variable costs and gross income were markedly different. If large auctions are much more efficient than small- and medium-sized firms in the use of variable inputs other than hired labor, unit total variable costs would be related to gross income as shown by 1968 data. If both small- and large-sized auctions are more efficient than intermediate-sized firms in the use of variable inputs other than hired labor, unit total variable costs would tend to show no relationship with gross income (as with the 1965, 1966, and Best of 5 data). Finally, the insensitivity of the postulated regression models to moderate changes in unit costs in conjunction with the paucity of observations at upper observed ranges of gross income may tend to bias the statistically estimated unit cost-volume relationships in the direction of asymptotic descent (model 4) unless unit costs are very high among the largest firms.

Small and/or large auctions reported lower unit costs of specific variable inputs (see Appendix Tables 10-12) than were reported by intermediate-sized firms during each of the 5 years. During most years these cost advantages of small and large firms offset to some degree the cost disadvantages these firms encountered in the utilization of hired labor. During 1967 and 1969, labor cost disadvantages of small and large auctions clearly outweighed cost advantages achieved in the use of variable inputs other than hired labor. Large firms appeared to offset labor cost disadvantages during 1968 by utilizing other variable inputs more efficiently than did intermediate-sized auctions. Both small and large firms appeared to counteract labor inefficiency during 1965 and 1966 by efficiently using other variable inputs. Best of 5 data likewise indicated that, at their best, small and large firms utilized variable inputs as efficiently as did medium-sized auctions.

On balance, both very small and very large auctions *tend* to incur higher unit total variable costs than do intermediate-sized firms. During any given year the unit total variable cost advantage of intermediate-sized firms over small firms generally will be statistically significant. However, the unit total variable cost advantage of intermediate-sized firms over large auctions likely will not be statistically significant during any given year because the cost advantage is not very large and because the scarcity of large firms reduces their relative influence in the statistical procedure.

Total Costs

Analyses of unit total costs in Appendix Table 17, p. 55, and scatter diagrams indicated that the relationship between unit total costs and gross income was curvilinear approximating a modified U-shape. Given the unit fixed and variable cost functions presented above, however, statistical unit total cost functions of the U-shape were postulated only when 1967 and 1969 data were used.[14] Each of the four models was run.

[14]In no year did unit total fixed costs rise at observed upper values of gross income and only when 1967 and 1969 data were used did unit total variable costs rise at observed upper values of gross income.

TABLE 3

TABLE 3

STATISTICAL UNIT TOTAL VARIABLE COST - GROSS INCOME RELATIONSHIPS, BY YEAR, 1967, 1968, AND 1969[a]

Year	Number of Observations	Model Number[b]	a	b_1	b_2	R^2	Total F	Standard Error
1967	42	2	0.44	2.88** (0.85)	0.00000061* (0.00000026)	0.23	5.92**	0.11
1968	41	4	0.53	3.03** (0.58)		0.41	26.88**	0.18
1969	42	3	0.50	3.99 (0.49)	0.00000000000013* (0.00000000000065)	0.63	33.37**	0.15

[a] A single and double asterisk denote statistical significance at 0.95 and 0.99 probability levels, respectively.

[b] See the text for description of models.

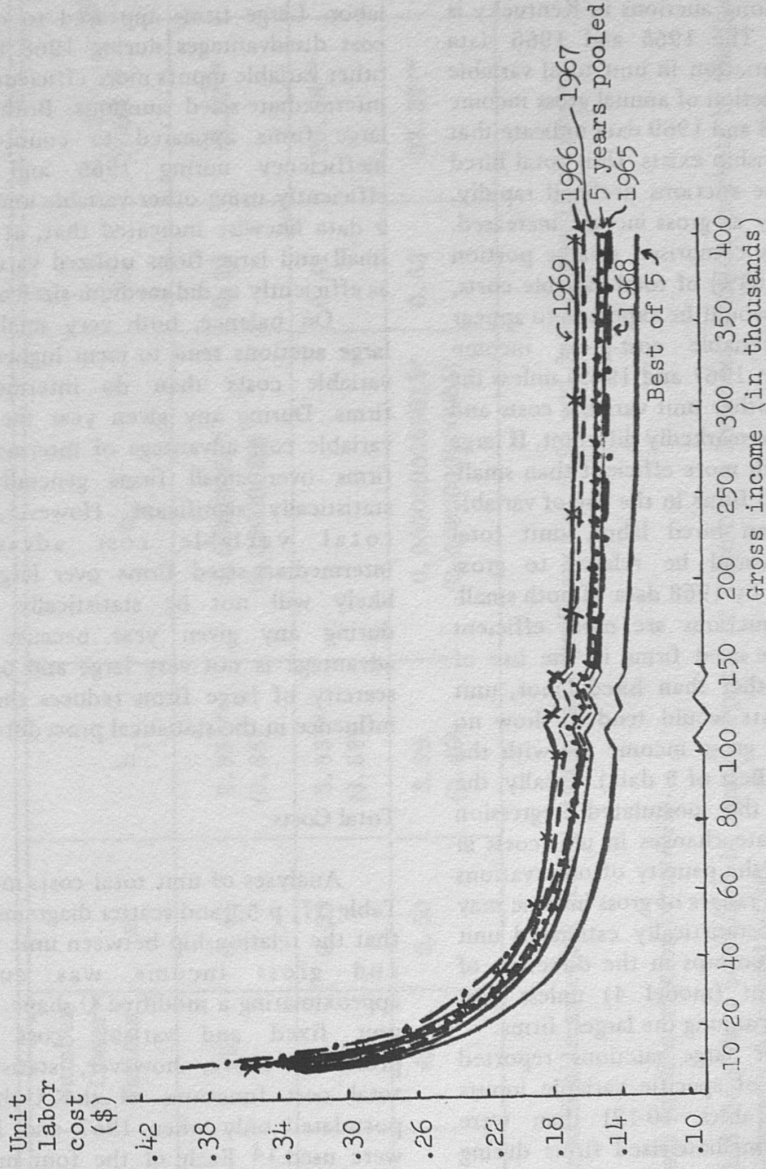Source: Computed from data contained in annual reports of Kentucky's livestock auction markets to the Packers and Stockyards Administration.

Figure 3.--Unit total variable cost-gross income relationships, by year

Model 1 produced insignificant (0.95 probability level) total F statistics each year except 1969. Model 1 also gave highly significant (0.99 level) t_{b_1} and t_{b_2} statistics using 1969 data, although the coefficient of multiple determination was relatively low (0.183) and the standard error of estimate was relatively high ($0.321). Model 2 generated significant (0.95 level) total F ratios and highly significant (0.99 level) t_{b_1} statistics each year. With the exception of 1967 data, the second explanatory variable (G.I.) made an insignificant contribution to the model (indicated by statistically insignificant t_{b_2} values at the 0.95 level). Model 3 produced results nearly identical with those of Model 2. Total F, t_{b_1} statistics, and coefficients of multiple determination generally were slightly lower, while standard errors of estimate were slightly higher than with model 2. Model 4 gave statistically significant (0.95 level) total F and t_b statistics each year. Coefficients of determination remained relatively low except when 1968 and 1969 data were used.

Continuing the procedure established above, when model 1, 2, or 3 produced statistically significant (0.95 level) total F, t_{b_1} and t_{b_2} statistics, it was selected over model 4 (even though the latter also gave significant total F and t_b statistics) to minimize specification bias. Parameter estimates and appropriate statistics are in Table 4. These relationships are presented graphically in Fig. 4.

None of the unit total cost functions developed using annual and Best of 5 data provided good data fit throughout the entire observed range of annual gross income. This, in large measure, was due to wide variability of unit total costs among firms of similar size and relatively small number of observations at observed upper values of gross income.[15] Among the unit total cost functions presented above, each tends to fit the data well in the $10,000 – $100,000 range of annual gross income; the model for 1969 data understates unit total costs of firms in the $100,000 – $325,000 range, while the models for 1965, 1966, 1968 and Best of 5 data *may* understate unit total costs slightly in this range; and 1965, 1968 and Best of 5 models tend to understate unit total costs among firms with more than $325,000 annual gross income.

Most economies of size (ranging from $0.20–$0.47 per dollar of gross income) were realized when auction size increased from $10,000 to $60,000 gross income annually. Diseconomies of size tended to outweigh economies of size as gross income surpassed $380,000 per year although the cost disadvantage of very large auctions over intermediate sized auctions generally was not statistically significant. Using Best of 5 data, Kentucky's auctions demonstrated that when gross income exceeded $80,000 annually, they were capable of averaging unit total costs of $0.62 to $0.64 per dollar of gross income.

The unit total cost functions herein developed represent approximations of the long-run average cost function of selected livestock auction markets in Kentucky. Being derived from historical accounting data these functions indicate central tendencies of

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[15]Wootan and McNeely reduced the "problem" associated with large variances in unit total costs among similar-sized firms (resulting in low values of R^2) by grouping 140 of Texas' auctions into 12 size categories and using mean cost and output figures as the regression input [3, p. 27]. If average unit cost and output data of firms grouped by size (as in Appendix Table 17, p. 55) were used in this analysis the above models (especially 1-3) would show improved fit because variation in unit costs among firms of similar size would be reduced dramatically, and further, the influence of large firms would be increased in relation to small firms. However, values of R^2, Total F, and t_b would be biased upward to the extent that total squared variation was reduced.

TABLE 4

STATISTICAL UNIT TOTAL COST – GROSS INCOME RELATIONSHIPS, BY YEAR, AND BEST OF FIVE DATA, 1965-69[a]

Year	Model Number[b]	Number of Observations	a	b_1	b_2	R^2	Total F	Standard Error
1965	4	42	0.72	2.79** (1.08)		0.14	6.72*	0.21
1966	4	42	0.71	2.75* (1.14)		0.13	5.79*	0.19
1967	2	42	0.56	5.28** (1.19)	0.00000086* (0.00000037)	0.33	9.81**	0.15
1968	4	41	0.67	5.64** (0.72)		0.61	61.40**	0.22
1969	1	42	1.10	-0.0000048** (0.0000016)	0.00000000000011** (0.00000000000041)	0.18	4.37**	0.32
Best of Five	4	42	0.61	2.90** (0.99)		0.18	8.50**	0.15

[a] A single and double asterisk denote statistical significance at 0.95 and 0.99 probability levels, respectively.

[b] See the text for description of models.

Source: Computed from data contained in annual reports of Kentucky's livestock auction markets to the Packers and Stockyards Administration.
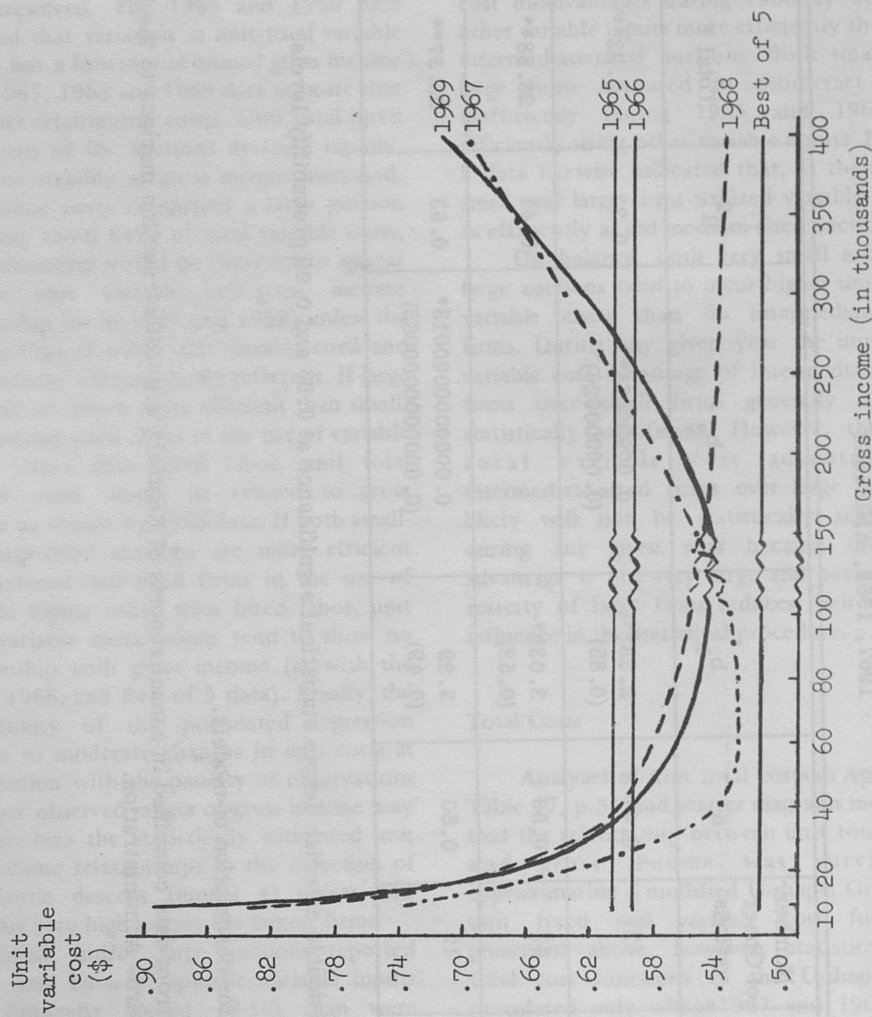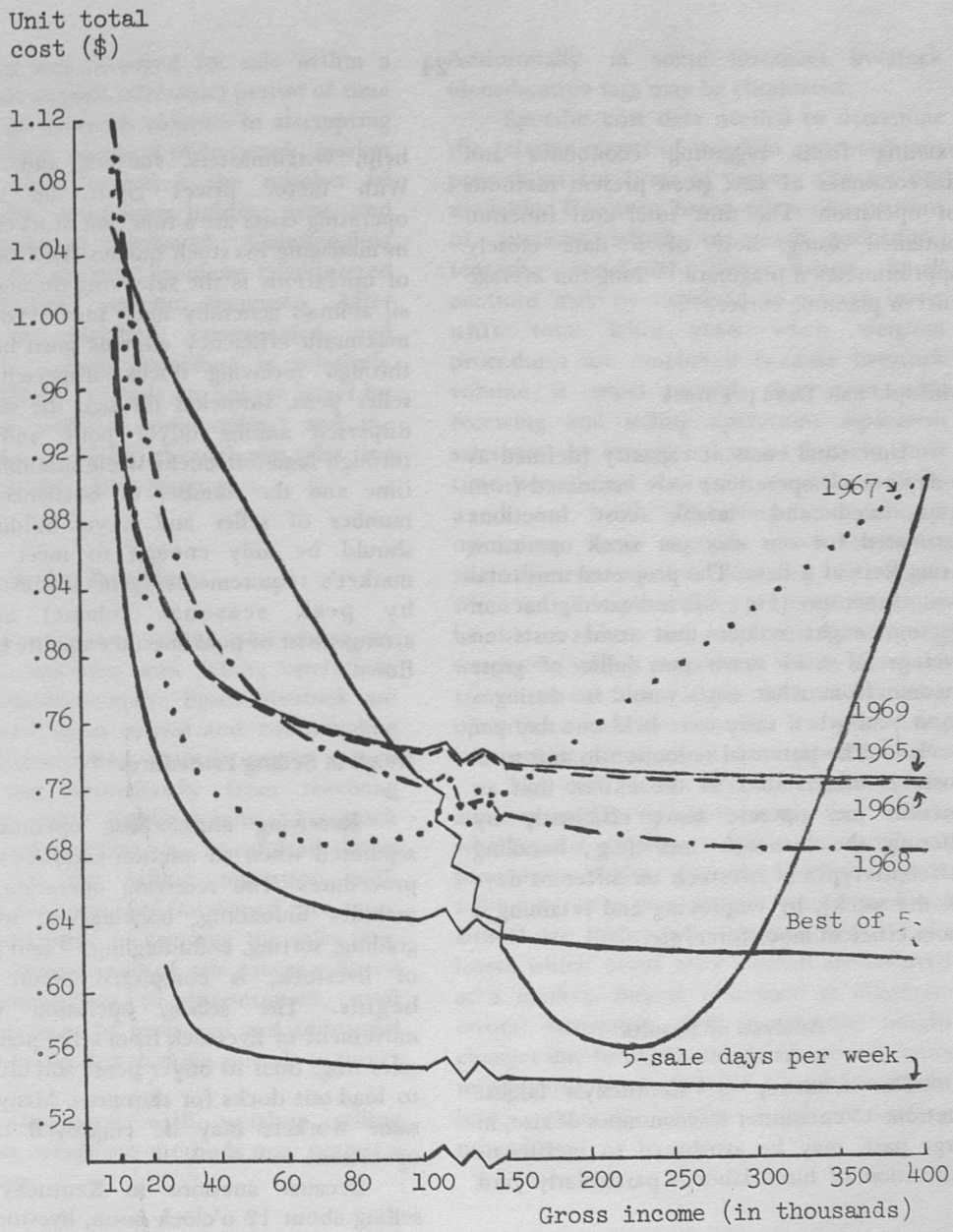
Unit total
cost ($)

Figure 4.--Unit total cost-gross income relationships, by year

existing firms regarding economies and diseconomies of size, *given* present methods of operation. The unit total cost function obtained using Best of 5 data closely approximates a pragmatic[16] long-run average cost or planning curve.

Multiple Sale Days per Week

Unit total costs at capacity (defined as 5-day-a-week operation) were estimated from unit fixed and variable cost functions estimated for one day per week operation using Best of 5 data. The projected unit total cost function (Fig. 4) indicated that an auction might reduce unit total costs an average of 6-11 cents per dollar of gross income from what costs would be during a good year when sales were held one day per week.[17] The potential reduction in unit total costs is understated to the extent that an auction can operate more efficiently by altering the livestock mix (e.g., handling different types of livestock on different days of the week), by employing and retaining a more efficient labor force, etc.

Analysis of Results

The tendency of Kentucky's largest auctions to encounter diseconomies of size, in large part, may be attributed to inefficient utilization of hired labor — particularly yard help, weighmasters, starters, and ringmen. With factor prices given, an auction's operating costs are a function of its efficiency in managing livestock queues. The focal point of operations is the sales ring through which all animals generally must move. To achieve maximum efficiency animals must be moved through receiving docks, dispersed among seller pens, funneled through the sales ring, dispersed among buyer pens, and moved through load-out docks while minimizing idle time and the number of bottlenecks. The number of seller and buyer holding pens should be only enough to meet a given market's requirements (generally established by peak seasonal volume) and the arrangement of pens should expedite livestock flows.

Weigh-in Selling Procedures[18]

Receiving and selling operations are separated when an auction employs weigh-in procedures. The receiving operation, which includes unloading, backtagging, weighing, grading, sorting, commingling,[19] and penning of livestock, is completed before selling begins. The selling operation involves movement of livestock from seller pens to the sales ring, then to buyer pens, and ultimately to load-out docks for shipment. Many of the same workers may be employed in both operations.

Because auctions in Kentucky begin selling about 12 o'clock noon, livestock must

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[16]Pragmatic in the sense that these unit total costs have been achieved under actual operating conditions vis-à-vis cost functions which may be derived from engineering estimates or from estimates in which methods of operation are hypothetically altered.

[17]Note that *increasing* livestock volume in the time dimension, which increases plant utilization, is not the same as *spreading* existing volume over more than one sale day per week unless plant size is reduced proportionately in the latter case.

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[18]Weigh-in selling refers to the practice of weighing livestock immediately upon arrival at a market, whereas weigh-out selling refers to the practice of weighing livestock while the animals are in the sales ring or immediately prior to or following sale.

[19]Auctions commingle the livestock of more than one producer on the basis of grade, weight, sex, etc. under the assumption that animals will command a higher price when sold in larger groups. Commingling generally necessitates weighing animals individually.

be received and prepared for sale within a relatively short (and inflexible) period of time regardless of livestock volume. In attempting to handle large numbers of livestock, market operators have increased the number of docks, scales, temporary holding pens, and yard workers employed. Commingling intensifies the queuing problems encountered when livestock volume increases. After livestock are weighed, commingled, and penned the selling procedure is relatively efficient because animals are sold in larger lot sizes (than without commingling) and the animals may be moved through the sales ring as rapidly as the selling progresses.

Weigh-out Selling Procedures

When weigh-out selling procedures are employed, receiving and selling operations proceed simultaneously. Since livestock are not weighed upon arrival and commingling must be discontinued, animals may be moved directly and immediately from receiving docks to seller holding pens. Livestock grading and sorting is transferred from receiving to the selling operation with individual consignments fractioned into more salable units prior to entering the sales ring. Since the average size of sale lots is reduced when commingling is discontinued, total selling time may be increased and additional trips may be needed to drive animals to buyer pens.

As contrasted with weigh-in selling procedures, weigh-out methods may permit a reduction in:

1. the number of receiving docks (and holding pens at the docks);
2. the number of scales (only one is necessary);
3. labor used in the receiving operation; and
4. the number of seller pens.[20]

Additionally in some instances livestock identification tags may be eliminated.

Specific cost data needed to determine the relative merits of weigh-in and weigh-out procedures for firms of varying size are not available. However, based upon observations of auctions which use each procedure, tentative conclusions were drawn. Small auctions may be expected to achieve lower unit total labor costs when weigh-in procedures are employed because livestock volume is small enough that even with receiving and selling operations separated, sales may be completed in a relatively short time period and the same workers may be used in both (receiving and selling) operations. Large auctions which encounter size diseconomies in receiving operations when weigh-in procedures are employed may be able to reduce unit total costs by adopting weigh-out selling procedures which allow the time constraint imposed on receiving operations to be relaxed by permitting livestock to be received throughout the sale.

Non-cost factors also are considered by auction market operators when they decide whether to employ weigh-in or weigh-out procedures. Sellers generally prefer weigh-in selling because they believe prices paid per animal are higher when buyers bear weight losses which occur after animals are received at a market. Buyers who want to eliminate errors associated with estimating weight changes due to filling and shrinkage and errors in adjusting prices bid per pound for weight losses generally prefer weigh-out selling procedures.

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[20]With continuous selling, total holding capacity of seller pens may be a fraction of total livestock handled per sale day. The actual ratio depends upon seller delivery rates, the time selling begins and the selling rate.

Technological Changes

Performance of an industry, which depends, in part, upon the progressiveness of the industry's firms, is not satisfactory when the rate of adoption of known technological improvements is low. Two innovations adopted by auctions in states other than Kentucky are telephone bidding and computerized records-keeping. Feasibility of adoption of each innovation is dependent upon auction's existing characteristics and methods of operation

Conclusions

Conclusions regarding each of the four hypotheses of the study were as follows:

1. Economies of plant size exist in Kentucky's livestock auction market industry and are not being realized by some firms in the industry. Auctions with less than $60,000 annual gross income could reduce unit total costs by increasing volume of livestock handled and auctions with less than $15,000 annual gross income tend to be very inefficient in the utilization of most inputs

2. Kentucky's largest auctions encounter diseconomies of plant size. Large firms showed a *tendency* to encounter size diseconomies but statistics did not consistently show these diseconomies to be significant.

3. Unit costs can be reduced by operating auctions in Kentucky more than one sale day per week. Increasing the number of sale days per week will reduce unit total costs if a firm can increase volume handled in the time dimension without increasing total fixed or unit variable costs, or if an auction can spread existing livestock volume over more sale days

(reducing plant size) while retaining enough volume on each sale day to provide efficient operation.

Implications for Kentucky's Livestock Auction Market Industry

If market operators make changes consistent with the conclusions drawn in this study other market participants will be affected. The most important implication is that the volume of livestock handled by auctions in Kentucky is insufficient to permit each existing firm to handle enough livestock to achieve lowest possible unit total costs, especially if auctions hold sales more than one day each week.

Based upon the conclusion that $80,000 annual gross income represents minimum efficient size when firms conduct sales one day per week, the following projections were made of the number of markets needed in Kentucky

Number of Sale Days Per Week	Number of Auctions
1	55
2	26
3	18
4	14
5	12

The reduction in number of firms associated with projected 5-day-a-week auction operations would permit total investment in the industry to be decreased from about $5 million (59 firms in 1969) to about $1.2 million.

The foregoing projections of reductions in number of firms and investment in the industry are made without consideration of spacial characteristics of the industry, livestock assembly costs, factors involving potential performance of the industry

regarding pricing efficiency, or means of achieving the projected reduction in number of firms. As the number of auctions decreases, average distance from farm to market rises, resulting in higher transportation costs. So long as the benefit which accrues to sellers from the reduction in number of auctions exceeds the resulting increase in transportation costs, elimination of existing auctions is justified per economic criteria.[21]

Firms may be expected to undertake changes voluntarily only when the changes are expected to increase profits. Since rates of return among Kentucky's auctions, which are regulated by the Packers and Stockyards Administration, are very good under existing conditions, the conclusion may be drawn that improvements in efficiency of operation would not be permitted to increase profits. Consequently, potential for gain from changing to multiple sale days per week, for example, probably would not warrant the risks associated with such a change.[22] An auction operator may even lack incentive to reduce unit costs under existing methods of operation if profits are at the maximum allowable level already. The only auctions which might have incentive to undertake change are those with profit rates below allowable levels, i.e., very small and very large firms. It is unlikely that these firms can (or will) initiate changes which would result in widespread emulation throughout the industry.

The likelihood that volume handled per auction will increase due to voluntary

disappearance of existing firms does not appear promising because few firms are incurring sustained economic losses of sufficient magnitude to anticipate exit from the industry and, historically, auctions have exhibited a tendency to change ownership without ceasing operations.

The implication which follows is that auctions in Kentucky will undertake desired changes only if pressure from outside the industry is brought to bear on them. First, the federal regulatory agency might disapprove proposed tariff increases on the basis that auctions are not operating efficiently with existing methods of operation.[23] Second, state laws might be enacted to restrict entry into the industry and to require compliance with desired operating procedures.[24] Third, interindustry competition eventually might prod auction market operators to undertake changes. If direct livestock sales to feed lot operators will yield prices as high as received at auctions, farmers will avoid the auctions' commission fees. Resultant diminution of the role of auctions would present a serious problem regarding price discovery of live animals.

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[21]Hick and Badenhop[2] found that economies of firm size were sufficient to permit sizeable reduction in the number of auctions in Tennessee before cost advantages were offset by rising assembly costs.

[22]Since an auction may increase volume handled by operating more than one sale day per week with little (if any) increase in investment (and rate base), profits *per dollar of gross income* would be reduced. See footnote 25, p.37.

[23]In practice, conformity with local norms is permitted.

[24]The possibility of requiring weigh-out sales has been considered by Kentucky's legislature without resulting in enactment of a statute.

SUMMARY

Livestock auction markets have served an important marketing function in Kentucky since the 1920's. The role of terminal markets has declined dramatically in recent years. While direct-to-packer sales of slaughter livestock have increased, auction markets continue to have a dominant position in marketing of livestock in the state. During 1969, Kentucky's 59 livestock auction markets handled about $194,650,601 worth of livestock. Except for the implementation of special feeder calf sales, few changes have occurred in Kentucky's livestock auction markets during the past 20 years.

This study was undertaken to: determine relationships between costs and volume of auction transactions and identify key factors of firm efficiency; identify and evaluate innovations which might improve efficiency of and services provided by auctions; project the effect of multiple sale days per week on unit costs; estimate rates of return to market operators; and assess the performance of the industry by determining the efficiency attained relating to facility utilization and economies of size, the relationship between sales promotion costs and volume of transactions, and the rate of technological progressiveness.

Data were taken from two main sources: the 1965-69 annual reports of 42 of Kentucky's auctions to the Packers and Stockyards Division, Consumer and Marketing Service, U.S. Department of Agriculture and personal observations of auctions in Kentucky and other states and discussions with auction market participants (market operators, sellers and buyers).

Cost analyses were performed in two ways: 1) Specific unit costs were related to firm size and contrasted among years by computing means and standard deviations of observations grouped by size of firm; and 2) functional relationships between selected costs and gross income were estimated by the method of least squares regression analysis.

Unit costs (cost per dollar of gross income) among firms of similar size. Variable costs accounted for about 74% of total costs, and total hired labor costs averaged about 48% of total costs (costs of entrepreneurs' managerial and labor services were not included). The most important individual costs were*: yard help (21.2%); office help (10.5%); total interest (9.9%); weighmasters, starters, and ringmen (7.6%); auctioneers (6.0%); insurance, excluding unemployment insurance (5.4%); utilities (5.2%); and depreciation (5.2%). Advertising costs were unexpectedly low, averaging $0.0194 per dollar gross income (2.4% of total costs) among the 42 auctions during the 1965-69 period.

Rates of return to market operators were higher, on the average, among medium-sized firms than among very small or very large auctions. Net returns, which averaged about $0.19 per dollar of gross income among the 42 firms during the 5-year period, were judged very good, on the average, when related to entrepreneurs' investment and equity.

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*Figures in parenthesis denote percentage of total costs among the 42 firms studied during the 1965-69 period.

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SUMMARY (Continued)

Statistically estimated unit cost-gross income functions indicated that auctions encountered both economics and diseconomies of size in the utilization of total hired labor. Unit total fixed costs diminished as firm size increased to largest levels of gross income observed. Estimated unit variable and unit total cost functions exhibited economies of plant size and diseconomies of plant size were found to be significant during 2 of the 5 years. Diseconomies of plant size were not statistically significant each of the 5 years because the diseconomies were not great and the lack of observations at upper observed values of gross income weakened statistical estimation in this range. The primary source of diseconomies of plant size among the largest firms was inefficient use of hired labor, particularly yard help and weighmasters, starters, and ringmen.

Unit total costs were projected to decline to an average of about $0.55 under the assumption that firms operate auction sales 5 days each week. This represents a reduction of about $0.25 from the 5-year average and about $0.08 below average unit total costs during the year each firm encountered its lowest unit total costs during the 1965-69 period. Operating auctions more than one day each week also reduces the number of firms needed to handle the volume of livestock currently moving through auctions in Kentucky. If all auctions operated with an average of $80,000 annual gross income, based on one sale day per week, 55 auctions would be needed to handle the livestock volume which moved through Kentucky's auctions during 1969. If there were two sale days per week, only 26 auctions would be needed; if there were five sale days per week, only 12 auctions would be needed. Constraints imposed by transportation costs were not included in these projections.

It would appear to be economically beneficial if auctions in Kentucky operated more than one sale day each week and if weigh-out selling procedures were adopted. Such changes are unlikely because the profit motive provides little incentive for change among many firms, and influence from outside the industry generally is impotent or nonexistent. The Packers and Stockyards Administration *might* be able to stimulate increased efficiency by disallowing tariff increases. Kentucky's legislature might require weigh-out selling procedures and it could limit entry into the industry by restrictive licensing. Finally, interindustry competition might slowly force auctions to improve services and decrease tariff schedules under pain of penalty similar to that imposed on terminal markets, i.e. become dispensable.

Characteristics of Livestock Auction Markets in Kentucky

Introduction

Livestock auction markets were grouped into eight categories on the basis of annual gross income to determine relationships between specific variables and auction size. Size groups were: Group I, less than $15,000 gross income; Group II, $15,000 - $29,999 gross income; Group III, $30,000 - $44,999 gross income; Group IV, $45,000 - $59,999 gross income; Group V, $60,000 - $79,999 gross income; Group VI, $80,000 - $149,999 gross income; Group VII, $150,000 - $279,999 gross income; and Group VIII, $280,000 or more gross income. Size categories were developed to emphasize size differences with recognition that an excessive number of categories may result in size groups with no observations. Annual and "Best of 5" (the least unit total cost observation of each of the 42 firms from the 5-year time series of observations) data were analyzed.

General Characteristics

Changes in the size distribution of auctions in Kentucky (Appendix Table 1), which indicate a trend toward larger markets, must be interpreted with caution because part of the increase in gross income among firms (gross income increased from an average of $63,642 in 1965 to $86,716 in 1969 among the 42 auctions) was a result of higher tariff rates rather than increased livestock receipts.

Leasing of land and facilities partially or wholly, which was more prevalent among small firms, remained about constant over the 5-year period at 10 firms each year. Sole proprietorships and partnerships were more characteristic of small than large firms with the corporate form of organization found among firms in all size categories. The number of sole proprietorships remained nearly constant (about 5 firms) between 1965 and 1969, while the number of partnerships declined from 16 to 12 and the number of corporations increased from 20 to 25.

The number of public sale days, which showed little correlation with firm size and remained stable over the 1965-69 period, averaged 54.7 days per market per year.

To increase livestock consignments many auctions assure sellers a "fair" price by engaging in price support activities which usually involve purchase of livestock whenever the starter's opening price is the high bid. While a larger proportion of large than small auctions engaged in market support activities, the number of firms which supported prices fell from 34 in 1966 to 21 in 1969.

About 15% of the 42 auction market operators also were livestock dealers during the 1965-69 period. The distinction between market support and dealer activities may become blurred in practice because a market operator may buy and sell livestock at his own auction. In a strict sense, dealer activities are not one of the legitimate functions of an auction market. The possibility may exist for a market operator to use his position in the market to purchase livestock at "bargain" prices. Also, since dealers who operate auctions frequently use auction facilities in their dealer activities, inaccurate apportioning of operating costs may result in misstated net returns to each venture. In general, dealer

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profits were correlated positively with auction size during the 1965-69 period. Losses were reported by one firm in 1965 and 1966.

The number of cattle handled by the 42 firms showed an upward trend during the 1965-69 period. During the 1965-67 period, however, only Group I firms experienced an increase in receipts of cattle (Appendix Table 2). Cattle receipts of Group I markets declined during 1968 and 1969 while receipts of firms in Groups II, III, IV, and VIII increased. Kentucky's auctions handled fewer calves each year, on average, after 1965 (Appendix Table 3). This trend was observed among all firm sizes except Groups V and VI. The decline in calf receipts may be traced to the declining number of dairy cattle in Kentucky. Average hog receipts per market increased from 10,472 in 1965 to 14,617 in 1968, then declined to 13,352 in 1969 (Appendix Table 4). Only Group I firms reported a decline in average number of hogs handled between 1965 and 1968. In contrast, from 1968 to 1969, firms in all size categories, except Groups V and VII, reported lower hog receipts. Receipts of sheep and goats declined between 1965 and 1969, reflecting declines in sheep and goat production in Kentucky (Appendix Table 5). Horse and mule receipts showed a downward trend from 1965 to 1969. Averaging only 354 head per market annually during the 5-year period, sales of horses and mules constituted a minor source of income.

Financial Characteristics

Assets of an auction must be sufficient to provide, efficiently, the services desired by patrons. Additionally auction firms need liquid assets to cover transaction requirements as they arise. An auction frequently must pay consignors for livestock before receiving payment from buyers as well as meet payroll requirements and purchase livestock on its

market support account. The amount of assets deemed necessary by auction entrepreneurs showed considerable variation among firms within and between size groups. Generally, land needs depend upon size of a facility and the amount of on-premises parking provided. Buildings ranged from converted barns with little current appraised value to specially designed yards, sales, and office facilities with high replacement cost. Except as adjusted in the editing procedure discussed above, auctions' balance sheet entries were used in this study as reported by the firms.

Average value of current assets per firm (cash, inventories of feed and livestock, short-term marketable securities, accounts receivable, short-term notes receivable, prepaid expenses, interest receivable, and miscellaneous current assets) increased among the 42 firms during the 5-year period (Appendix Table 6). Average land values among the 42 firms increased by about $3,000 over the 1965-69 period. Apportionment of this increase between increased quantities of land and increased land prices was not possible. Auctions in Kentucky increased their investments in buildings, structures, and equipment from an average of $30,664 at the end of 1965 to $37,811 at the end of 1969. Assuming an annual rate of depreciation of 6%, the increased value was about 50% greater than it would have been if firms had not made investment expenditures between 1965 and 1969. Firms in Group VII reported relatively low investment in buildings, structure, and equipment compared with smaller firms (Appendix Table 6). Average total assets of the 42 firms increased from $74,974 in 1965 to $92,877 in 1969, while average total assets of firms in Groups I, III, IV, V, and VI declined (Appendix Table 6).

Kentucky's auctions increased their current liabilities by about $7,600 between 1965 and 1968, then reduced their short term

indebtedness by about 50% to an average of $7,516 per firm by the end of 1969. Long term liabilities increased sharply from an average of $9,431 in 1965 to $17,823 per firm in 1966 followed by declines in 1967, 1968, and 1969. Net worth declined slightly from 1965 through 1967, followed by increases in 1968 and 1969. Auctions in Groups II, III, VII, and VIII reported higher net worths, on average, in 1969 than in 1965 (Appendix Table 6).

Cost Characteristics

The annual reports of the auctions contained 25 different categories of costs. Costs were classified into fixed and variable categories for analyses. Fixed costs included insurance (excluding unemployment insurance), license and bond premiums, dues and subscriptions, taxes (excluding income taxes), legal and accounting fee, depreciation, charity and contributions, and explicit and implicit interest. Variable costs included hired labor costs (auctioneers, weighmasters, starters, ringmen, solicitors, office workers, yard help, and other help), unemployment insurance, utilities, travel and entertainment, automobile expenses, repairs and maintenance, supplies, bad debts, trucking and hauling, variable rental expenses, and miscellaneous expenses.

Variable Costs

Unit costs of auctioneers were highest among Group I firms each of the five years and Group II firms generally reported higher unit costs than did larger auctions (Appendix Table 7). During all years except 1965 unit costs of auctioneers was related inversely with firm size. Unit costs of auctioneers increased among all firms, on average, from $0.045 in 1965 to $0.053 in 1969.

A weighmaster certifies livestock weight, a starter establishes the opening price on each lot of livestock in the sales ring, and a ringman moves livestock in the sales ring. Ringmen and starters also assist the auctioneer in spotting bidders. Unit costs of weighmasters, starters and ringmen were highest among Group I firms and second highest among Group II firms each year except 1965 (Appendix Table 7). Group VI firms averaged lower unit costs of weighmasters, starters and ringmen over the 5-year period than did firms in other size categories. Unit costs among Group VIII firms averaged higher than among firms in Groups III, IV, V, and VII each year.

Solicitors are firm representatives who travel through an auction's market area contacting buyers and sellers to create goodwill and solicit patronage for the auction. Solicitors were more prevalent among large than small firms but represented a very small proportion of total costs among all firms (Appendix Table 7).

Unit costs of office personnel, which exhibited a tendency toward economies and diseconomies of size during the 1965-69 period, increased from an average of $0.084 among all firms in 1965 to $0.091 in 1969 (Appendix Table 7). Firms in either Group V or Group VI (depending upon year) reported lowest unit costs each of the five years.

Yard help comprised the largest single cost of nearly all firms during the years studied. Each year large firms averaged higher unit costs of yard help than did firms of small or intermediate size. Group I firms reported higher unit costs of yard help than did intermediate-sized firms during 1965, 1966, and 1968 (Appendix Table 8). Group I firms reported lowest unit costs among all size groups during 1967 and 1969. Firms of Group V size, or larger, generally reported above-average unit costs of yard help each year.

Workers who did not fit into the labor categories listed above, e.g. night watchmen, painters, carpenters, repairmen, and

custodians were included in "other help." Unit costs of other help averaged $0.014 per market per year over the 5-year period (Appendix Table 7).

Total labor costs averaged 48% of total costs among the 42 auctions during the 5 years. Unit costs of all hired workers increased from an average of $0.408 per firm in 1965 to $0.385 per firm in 1969 (Appendix Table 9). Unit costs, which were highest among Group I firms, declined gradually as firm size increased, reached a minimum among Group III or Group V firms (depending on year), then rose as firm size increased to the largest size observed. Average unit costs of Group VIII firms were nearly as high as among Group I firms. Large auctions were less efficient than intermediate-sized firms in the utilization of weighmasters, starters and ringmen, solicitors, office help, and yard help.

Unemployment insurance, which comprises a very small proportion of total costs (about 1.1%, on average) during the 1965-69 period, was not related to firm size (Appendix Table 10).

Utilities costs exhibited an inverse relationship with firm size each year. Utilities were the second largest variable cost, averaging 4.2 cents per dollar of gross income among the 42 firms during 1965-69 (Appendix Table 10).

Travel and entertainment, among the lowest costs incurred by the 42 auctions, averaged about 1 mill per dollar of gross income (Appendix Table 10). Automobile costs also were very low, averaging less than $0.01 per dollar of gross income during the 5-year period. Small firms had a lower incidence of automobile expenses than did large firms (Appendix Table 10).

Advertising expenditures (radio, television, newspapers, handbills, signs, etc.) averaged about 2.4% of total costs among the 42 firms during the 1965-69 period. Unit costs of advertising were directly related to firm size. Group VIII firms averaged higher unit advertising costs each year than did smaller auctions (Appendix Table 11). Operators of large auctions appeared to be in greater accord than were operators of small firms concerning the proportion of gross income to devote to advertising expenditures (indicated by smaller standard deviations among firms in the size groups containing larger auctions).

Expenditures for repairs and maintenance averaged about 2.2 cents per dollar of gross income among all firms each year. Group IV firms generally incurred higher unit costs than did firms in other size groups (Appendix Table 12).

Supplies used by auctions include routine office supplies, yard supplies (cleaning agents, weight tickets, receipt forms, etc.), and veterinary supplies. Average unit costs of supplies ranged from 3.5 to 4.8 cents per dollar of gross income among the 42 firms. Although Group V firms reported higher-than-average unit costs of supplies, no distinct relationship was apparent between unit costs and firm size (Appendix Table 12).

Bad debts of auctions are associated with the financial credibility of livestock buyers and the nature and extensiveness of credit checks performed by auctions. Unit costs of bad debts were not associated with firm size (Appendix Table 12).

Some auctions in Kentucky haul livestock for patrons. Costs of trucking and hauling averaged about 1.5% of total costs among all firms during the 1965-69 period. Unit costs, and the incidence of such costs, showed considerable variability among firms (Appendix Table 12).

Rental payments by auctions for land and/or buildings were removed from the reports of the firms in the editing procedure. Rental payments for machines and equipment (not adjusted in the reports) averaged about one mill per dollar of gross income among the 42 firms each year (Appendix Table 12).

Variable costs which did not fit into any of the cost categories above were identified as "miscellaneous" or "other variable" costs. Other variable costs include errors and corrections on daily transactions, veterinary fees, Christmas gifts, death losses, post office box rent, bank charges, police protection, etc. Variations in unit costs of miscellaneous inputs between and within size groups, in large part, may be attributed to differences in reporting practices among auctions (Appendix Table 12).

Total variable costs per dollar of gross income first declined then rose as auction size increased. Group V firms reported lowest unit total variable costs among firms in the eight size groups during 1965, 1967, and 1968 (Appendix Table 13). Group III firms averaged lowest unit total variable costs during 1966, while Group VI firms averaged lowest unit costs during 1969. Average unit total variable costs of firms in Groups I, II, V, and VIII increased between 1965 and 1969. Time trends are not confirmed due to variability among firms in a given size group over time.

Fixed Costs

Insurance premiums were paid for protection against fire, theft, liability for personal injury and, in some instances, injury to and death of livestock on-premises or enroute to or from an auction. Unit costs showed little variation among firms in different size categories and remained about constant over the 1965-69 period, averaging about 4.5 cents per dollar of gross income among the 42 firms (Appendix Table 14).

Auctions in Kentucky must purchase a license to operate and they are required to have certain employees (e.g. weighmasters) bonded. Additionally, bonding requirements, established on the basis of livestock receipts, assure that sellers will receive payment for livestock consigned to a market. Unit costs of licenses and bonds exhibited an inverse

relationship with firm size (Appendix Table 14).

Unit costs of dues and subscriptions, which showed little relation to firm size, averaged only 2.3 mills per dollar of gross income among the 42 markets each year (Appendix Table 14).

Unit costs of taxes (excluding income taxes) were highest among Group I firms each year except 1965. Taxes showed a trend upward, increasing from an average among all firms of 2.1 cents in 1965 to 3.1 cents per dollar of gross income in 1969 (Appendix Table 14).

Legal and accounting fees per dollar of gross income were highest among Group I firms each year. Group V firms reported lowest unit costs during the 5-year period (Appendix Table 14).

Depreciation, the second largest fixed cost, averaged 5.1% of total costs among all firms during the 1965-69 period. Generally, unit costs of depreciation declined as firm size increased to Group V, then increased among Group VI firms, declined among firms in Group VII, and increased with the two firms in Group VIII (Appendix Table 14). Group VII firms reported the lowest depreciation costs during the years 1965-68.

Charity and contributions constituted a very small proportion of total costs among Kentucky's 42 auctions during the 1965-69 period. Small auctions tended to have a lower incidence of charitable offerings than did larger firms (Appendix Table 14).

Total interest, calculated at the rate of 6% of total assets of each auction, consisted of explicit and implicit interest. The latter, a residual, represented opportunity cost of owners' capital. Explicit and implicit interest are a function of the quantity and value of assets and the proportion of assets financed by debt instruments. Explicit interest averaged about one-fifth of total interest costs among the 42 firms during the 1965-69 period. Total interest, the largest fixed cost, averaged 8.1 cents per dollar of gross income

during the five years. Generally, unit total interest costs declined as firm size increased, although Group VI firms reported relatively high unit costs during 1966, 1967, and 1968, and firms in Group VII reported relatively high unit costs during 1968 and 1969 (Appendix Table 15). Unit total interest costs among the 42 firms declined from $0.084 in 1965 to $0.074 in 1967, increased to $0.083 in 1968, and declined to $0.081 in 1969.

Total fixed costs among the 42 firms increased from an average of $11,549 per firm during 1965 to $15,922 per firm in 1969. Firms in Groups II, VII, and VIII reported higher total fixed costs in 1969 than in 1965. Unit total fixed costs of the 42 firms averaged slightly higher during 1966 than during 1965, declined in 1967, then rose in 1968 and 1969 (Appendix Table 16). Total fixed costs of the 42 markets averaged $0.209 per dollar of gross income (about 26% of total costs) during the 5 years. During 1965, 1966, and 1967, intermediate-sized firms averaged lower unit total fixed costs than did either small or large auctions. During 1968 and 1969, however, lowest unit costs were reported by firms in Group VIII. Group I firms reported much higher unit total costs each year than were reported by larger firms.

Total Costs

Total costs (the sum of all fixed and variable costs) among the 42 auctions increased steadily from an average of $50,577 in 1965 to $68,409 in 1969. Firms in Groups I, II, V, VII, and VIII reported higher total costs, on average, during 1969 than during 1965. Unit total costs among the 42 firms declined from an average of $0.809 in 1965 to $0.796 in 1966, and $0.764 in 1967, followed by increases to $0.842 and $0.855 in 1969 respectively (Appendix Table 17). Total costs exceeded gross income among Group I auctions each year. Intermediate-sized firms reported lower unit total costs, on average, than did either small

or large firms. Size groups reporting lowest unit total costs were V in 1965, 1967, and 1968, III in 1966, and VI in 1969. Best of 5 data indicate that auctions in Groups IV, V, and VI were capable of operating at lower unit total costs than were firms either smaller or larger. Group I firms, while able to show profits *part* of the time, were much less efficient than were firms in Group II. Firms in Groups II, III, and VII showed about equal potential for efficiency than did smaller firms (excluding Group 1).

Observing unit total costs of Kentucky's 42 selected auctions during the 1965-69 period, on the basis of annual averages or on the basis of potential, intermediate-sized firms were more efficient than were large or small firms. Further, based upon data in Appendix Table 17, the conclusion may be drawn that most size economies were realized when auction size reached about $30,000 annual gross income and that size diseconomies were not encountered sharply until auction size exceeded $280,000 gross income annually.

Appendix Table 18 contains a summary of specific unit costs reflecting their relative importance as a percentage of total costs based upon 5-year averages over all firms.

Income Characteristics

Livestock auction markets in Kentucky derive most of their income from "selling commissions" which are a function of livestock species, sex, weight, type of animal, and selling price. Commissions may be a flat rate per head, a percentage of sale price, or a combination of the two. Special services, e.g. hay and feed, livestock storage, weighing (no sale) entail additional fees. Many auctions require that commissions be paid on livestock sold on the premises even though the livestock are not handled by auction personnel. The justification given is that use of the auction as a meeting place for transactions constitutes a service rendered. Additionally, some auction operators believe

that these fees discourage direct sales to "pinhookers."

Receipts

Averaging $63,642 in 1965 and $86,716 in 1969, gross income of the 42 auctions increased about 36% over the 5-year period. Firms in Groups I, III, IV, V, and VI reported lower gross income, on average, in 1969 than in 1965 (Appendix Table 19). Gross income of Group VII firms increased about $21,500, while gross income of the two firms in Group VIII increased an average of $107,658 between 1965 and 1969. Data in Appendix Table 19, regarding changes in gross income among firms in a given size group, must be interpreted with caution because when a firm's gross income changed from year to year the firm may have been included in another size group.

Commission income (selling, buying, "no sale," and "other" commissions, plus yardage) per dollar of gross income generally was higher among relatively small firms (less than $60,000 gross income) than among larger markets during the 1965-69 period (Appendix Table 20). Many firms reported total commission income in excess of gross income because of losses on feed and market support accounts. The decline in average commission income per dollar gross income among the 42 markets between 1965 and 1969 in large part may be attributed to a reduction in losses on market support account (Appendix Table 20). Losses on feed sales, which averaged only 1-2 mills per dollar of gross income, were more prevalent among smaller auctions (Groups I-V) each year (Appendix Table 20).

Rental income averaged about one percent of gross income each year among the 42 auctions. Group VIII firms received a larger portion of gross income in rent than did smaller auctions (Appendix Table 20). Interest income comprised a minute proportion of gross income among the 42 firms during the 1965-69 period (Appendix Table 20). In general, firms in Groups VII and VIII received a larger proportion of total income from miscellaneous sources than did firms in other size groups. Miscellaneous income (bad debt collections, sales of inventory, etc.) averaged 2-3% of gross income among the 42 firms (Appendix Table 20).

Net Returns

Net returns (gross income less total costs) per dollar of gross income exhibit perfect correlation with total costs per dollar of gross income (Appendix Table 17). Since owners' opportunity costs of labor and management were not included in total costs of the auctions, net returns are not pure profits.

Net returns per dollar total investment (Appendix Table 21) and net returns per dollar net worth (Appendix Table 22) varied widely among Kentucky's 42 auctions during the 1965-69 period. If one considers entrepreneurs' average total investments and equity (Appendix Table 6), average rates of return appear to be very good but cannot be considered excessive without accounting for the value of entrepreneurs' managerial and labor services.[25]

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[25]*On average*, rates of return to auction entrepreneurs were not excessive per Packers and Stockyards standards. P and S allows salary of one owner as follows: $0.50 per marketing unit for the first 20,000 marketing units; $0.25 per marketing unit for the next 20,000 marketing units; and $0.05 per marketing unit for all additional marketing units. When more than one owner works in a market, the above allowance is made for one owner only, while the salaries of other owners are adjusted as if their functions were performed by employees. An additional allowance of $0.075 per marketing unit is allowed all firms for all marketing units as payment for managerial functions. One marketing unit, based on tariff rates by type of animal, equals one head of cattle, one calf, three hogs, four sheep or goats, or one horse or mule. After compensations of owners and managers are added to total costs, P and S determines allowable rate of return as follows: 8% of the value of auction facilities and land (returns to capital); plus 14% of total costs (return for risk). The 8% return to capital is considered low and is expected to be increased in the future.

LITERATURE CITED

1.   Grinnell, Gerald E. "Livestock Auction Markets in Kentucky: An Economic Analyses," unpublished Ph.D. dissertation, University of Kentucky, 1973.

2.   Hicks, Billy G., and Badenhop, M.B. *Optimum Number, Size and Location of Livestock Auction Markets in Tennessee*, Bulletin 478, Agricultural Experiment Station, University of Tennessee, March, 1971.

3.   Wootan, Charley V., and McNeely, John G. *Factors Affecting Auction Market Operating Costs*, B-1056, Texas Agricultural Experiment Station, Texas A&M University, October, 1966.

APPENDIX
TABLE 1

Number of Markets by Size Group, 1965–69

Size Group	1965	1966	1967	1968	1969	Best of 5
	----------number of firms----------					
I	5	3	2	4	4	3
II	8	10	8	6	5	8
III	11	7	9	5	8	7
IV	5	7	6	8	5	7
V	4	6	5	3	6	3
VI	6	4	7	10	7	9
VII	1	3	3	3	5	3
VIII	2	2	2	2	2	2
Total	42	42	42	41	42	42

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 2

Average Number of Cattle Handled Annually
by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	----------------------number of cattle----------------------					
I	1,630	1,414	2,343	1,177	3,072	465
II	4,168	1,365	3,699	2,470	3,378	3,142
III	8,702	5,163	7,904	1,961	7,582	2,412
IV	15,523	4,181	12,616	3,527	11,656	4,218
V	27,476	4,279	19,912	2,079	19,169	5,403
VI	35,697	13,081	34,217	5,772	29,345	9,676
VII	51,086	–	49,442	2,547	50,002	3,549
VIII	76,205	3,343	76,131	11,442	75,322	8,656
All firms	17,676	19,277	17,728	19,072	18,411	19,065

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	----------------------number of cattle----------------------					
I	1,097	1,408	1,930	2,974	2,597	984
II	4,011	2,519	4,544	2,437	3,383	1,655
III	6,413	4,423	8,918	4,669	8,387	2,949
IV	12,314	4,617	13,061	5,783	12,521	3,113
V	14,978	4,354	15,186	5,983	22,223	3,147
VI	28,726	8,283	27,664	14,079	30,470	12,393
VII	59,414	3,937	53,923	16,445	57,594	9,729
VIII	82,560	4,422	89,550	5,333	79,001	611
All firms	20,335	21,593	21,442	23,390	20,307	21,082

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 3

Average Number of Calves Handled Annually by Size of Market, 1965–69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
			----number of calves----			
I	2,966	2,066	2,955	1,454	2,089	511
II	6,106	2,095	5,355	1,971	5,817	2,603
III	7,174	3,086	7,198	2,966	6,731	2,844
IV	9,116	4,061	7,514	4,403	5,879	1,810
V	6,035	3,306	5,716	3,019	3,909	2,507
VI	7,044	4,815	4,918	4,227	7,251	6,818
VII	17,310	–	12,010	2,261	12,221	3,214
VIII	6,684	2,854	5,711	2,952	3,463	4,586
All firms	6,792	3,777	6,353	3,467	6,202	4,044

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
			----number of calves----			
I	2,365	1,716	1,778	1,647	2,920	1,450
II	5,773	2,625	4,119	744	6,221	2,545
III	4,318	2,878	5,965	3,530	6,407	2,568
IV	6,880	2,591	7,353	2,791	7,804	3,327
V	5,023	3,192	6,332	6,501	7,958	510
VI	6,759	5,649	7,156	4,144	6,069	6,120
VII	11,009	3,344	7,872	4,179	10,900	4,419
VIII	4,999	2,661	4,442	2,456	5,910	3,949
All firms	6,010	3,937	5,917	3,979	6,691	3,910

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 4

Average Number of Hogs Handled Annually
by Size of Market, 1965–69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	-------------------- number of hogs --------------------					
I	3,695	4,225	4,312	3,156	1,949	1,412
II	4,060	2,820	4,866	2,693	5,465	2,847
III	9,089	6,038	9,396	5,536	11,695	5,424
IV	5,138	3,529	6,445	5,268	6,025	5,846
V	9,061	3,072	5,830	4,506	7,830	4,815
VI	12,895	7,711	13,126	8,367	15,666	10,603
VII	18,833	–	13,088	6,540	17,256	9,649
VIII	65,384	28,902	79,006	43,756	77,527	26,744
All firms	10,472	14,456	10,887	17,711	12,968	16,896

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	-------------------- number of hogs --------------------					
I	2,698	3,953	2,234	3,686	1,663	1,112
II	5,747	4,003	5,558	3,956	5,818	2,858
III	10,675	8,169	7,598	5,928	11,469	5,871
IV	8,907	9,312	5,158	3,213	6,766	3,144
V	12,307	6,249	12,627	15,748	6,174	6,588
VI	13,243	12,040	11,390	11,438	10,307	9,404
VII	19,722	10,277	21,917	14,661	16,453	11,565
VIII	100,440	73,096	86,216	76,387	98,537	75,787
All firms	14,617	24,577	13,352	22,913	12,783	23,731

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 5

Average Number of Sheep and Goats Handled Annually
by Size of Market, 1965–69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	---------------------number of sheep and goats ---------					
I	106	140	1,035	1,153	129	153
II	392	883	101	124	308	734
III	138	216	133	224	139	146
IV	409	358	292	522	244	343
V	1,532	1,579	2,363	4,564	2,380	4,573
VI	7,083	10,624	7,192	11,604	4,282	9,158
VII	20,501	–	7,567	9,609	7,608	10,748
VIII	29,596	24,225	27,570	20,174	4,954	6,904
All firms	3,227	8,852	3,045	8,042	1,906	5,176

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	---------------------number of sheep and goats --------------					
I	13	10	16	11	89	128
II	300	664	335	651	277	504
III	38	83	72	88	131	272
IV	311	490	145	244	249	363
V	2,577	4,003	1,314	2,590	865	836
VI	3,061	8,095	541	627	4,541	9,166
VII	6,874	8,930	7,952	10,802	6,517	9,223
VIII	23,675	25,293	20,994	24,459	27,155	20,773
All firms	2,704	7,943	2,297	7,143	2,916	8,133

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX

TABLE 6

Selected Balance Sheet Entries, Averages by Size of Market, 1965 and 1969

Size Group	Current Assets		Land		Year-end Value of Buildings, Structures, and Equipment	
	1965	1969	1965	1969	1965	1969
			----dollars----			
I	9,186	7,258	3,321	4,677	10,998	10,828
II	9,841	13,284	4,725	8,199	12,057	17,848
III	17,802	18,824	10,111	6,917	25,440	16,515
IV	17,020	17,684	18,039	12,970	24,515	13,057
V	46,290	24,187	7,086	13,813	40,953	30,090
VI	64,187	27,775	15,270	15,853	37,556	47,696
VII	94,465	162,959	20,494	24,636	22,228	86,511
VIII	61,426	53,048	91,760	108,717	161,331	155,567
All firms	28,409	37,974	13,805	17,008	30,664	37,811

Size Group	Year-end Value of Total Assets		Current Liabilities		Long-Term Liabilities		Net Worth	
	1965	1969	1965	1969	1965	1969	1965	1969
				----dollars----				
I	23,678	22,912	1,068	1,148	7,000	6,571	15,609	15,193
II	26,623	39,331	6,333	5,525	1,063	4,200	19,228	29,606
III	56,090	42,256	5,475	2,019	13,964	2,500	36,651	37,736
IV	59,637	43,719	6,212	1,372	7,677	4,200	45,749	38,147
V	104,529	68,221	17,209	787	0	25,000	87,321	42,434
VI	118,244	91,615	7,562	8,446	6,667	19,399	104,016	63,769
VII	142,726	274,121	11,739	28,749	0	43,905	130,987	201,466
VIII	316,030	317,331	38,271	26,430	60,300	56,017	217,459	234,885
All firms	74,974	92,877	8,328	7,516	9,431	16,801	57,216	68,560

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 7

Average Unit Cost of Auctioneers, Weighmasters, Starters and Ringmen,
Solicitors, Office Help and Other Help by Size of Market, 1965 and 1969

Size Group	Auctioneers		Weighmasters, Starters, and Ringmen		Solicitors		Office Help		Other Help	
	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969
					dollars					
I	.058	.164	.080	.216	0	0	.088	.162	.045	0
II	.045	.060	.071	.122	.007	0	.102	.135	.009	.021
III	.045	.044	.049	.041	0	.016	.079	.075	.015	.006
IV	.035	.035	.054	.068	.001	.006	.072	.082	.006	.007
V	.043	.043	.055	.074	0	.022	.062	.102	.016	.016
VI	.041	.038	.049	.039	0	.005	.090	.053	.005	.013
VII	.031	.032	.051	.048	0	.002	.101	.071	.004	.000
VIII	.056	.036	.123	.081	.010	.005	.082	.081	.003	.114
All firms	.045	.053	.061	.078	.002	.008	.084	.091	.014	.014

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 8

Average Unit Cost of Yard Help by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	-------	-------	-------	dollars	-------	-------
I	.207	.111	.178	.061	.126	.048
II	.136	.073	.133	.084	.135	.052
III	.156	.074	.123	.049	.149	.053
IV	.187	.053	.148	.079	.158	.044
V	.155	.074	.188	.080	.177	.060
VI	.221	.057	.221	.055	.200	.050
VII	.231	-	.214	.048	.223	.069
VIII	.279	.005	.319	.006	.291	.044
All firms	.179	.077	.168	.080	.170	.062

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	-------	-------	-------	dollars	-------	-------
I	.259	.267	.089	.073	.120	.037
II	.138	.041	.161	.055	.122	.047
III	.106	.061	.127	.056	.111	.043
IV	.164	.052	.183	.073	.153	.051
V	.136	.076	.175	.098	.123	.042
VI	.205	.047	.180	.059	.182	.055
VII	.209	.055	.208	0	.208	.056
VIII	.303	.047	.202	.099	.276	.009
All firms	.180	.101	.163	.071	.152	.061

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 9

Average Unit Total Cost of Hired Workers by Size of Market,
1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------------------------- dollars -------------------------					
I	.478	.206	.529	.160	.596	.053
II	.369	.163	.392	.139	.383	.135
III	.343	.117	.294	.066	.319	.098
IV	.353	.098	.370	.112	.353	.119
V	.330	.074	.378	.102	.321	.110
VI	.406	.089	.377	.057	.349	.045
VII	.417	-	.382	.068	.379	.106
VIII	.553	.057	.523	.035	.497	.050
All firms	.385	.134	.384	.117	.367	.114

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------------------------- dollars -------------------------					
I	.633	.444	.632	.476	.379	.167
II	.435	.143	.499	.061	.360	.104
III	.340	.104	.309	.092	.283	.085
IV	.334	.097	.380	.177	.314	.086
V	.307	.115	.433	.164	.324	.086
VI	.346	.058	.328	.062	.340	.087
VII	.361	.078	.365	.083	.352	.088
VIII	.526	.076	.518	.002	.492	.028
All firms	.391	.176	.408	.189	.340	.098

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX

TABLE 10

Average Unit Cost of Unemployment Insurance, Utilities, Travel and Entertainment, and Automobiles by Size of Market, 1965 and 1969

Size Group	Unemployment Insurance		Utilities		Travel and Entertainment		Automobiles	
	1965	1969	1965	1969	1965	1969	1965	1969
					----dollars----			
1	.022	.003	.055	.120	0	0	0	0
11	.006	.004	.049	.055	.002	.004	0	0
111	.005	.009	.050	.040	.001	.000	.010	.012
1V	.008	.013	.032	.036	0	.000	0	.004
V	.008	.003	.031	.039	.001	0	.001	.007
V1	.018	.009	.036	.030	.000	.008	.006	.002
V11	.005	.019	.026	.027	.002	.000	0	.001
V111	.005	.014	.022	.021	.007	.009	.012	.004
All firms	.010	.009	.043	.045	.001	.002	.004	.004

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 11

Average Unit Cost of Advertising by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------	------	--dollars--	------	------	------
I	.009	.010	.023	.021	.014	.019
II	.021	.020	.015	.022	.009	.009
III	.020	.032	.012	.013	.014	.014
IV	.019	.018	.014	.015	.014	.015
V	.021	.010	.023	.015	.020	.011
VI	.027	.014	.026	.012	.031	.018
VII	.021	—	.033	.011	.030	.008
VIII	.039	.000	.050	.002	.042	.007
All firms	.021	.021	.020	.018	.019	.016

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------	------	--dollars--	------	------	------
I	.012	.015	.015	.015	.016	.024
II	.011	.010	.011	.006	.016	.019
III	.020	.021	.015	.023	.010	.008
IV	.014	.018	.012	.014	.013	.016
V	.011	.006	.018	.010	.023	.017
VI	.024	.013	.018	.008	.019	.005
VII	.032	.016	.027	.014	.025	.013
VIII	.037	.011	.043	.023	.034	.007
All firms	.019	.016	.018	.015	.017	.014

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX

TABLE 12

Average Unit Cost of Repairs and Maintenance, Supplies, Bad Debts, Trucking and Hau[ling]
Rent, and Other Variable Expenses, by Size of Market, 1965 and 1969

Size Group	Repairs and Maintenance		Supplies		Bad Debts		Trucking and hauling		Rent		Other Variab. Expense	
	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969	1965	19
						dollars						
1	.023	.032	.031	.067	.051	.019	.006	.061	0	0	.013	
11	.014	.040	.051	.032	.006	.004	.010	.003	.001	0	.021	
111	.026	.020	.059	.044	.036	.058	.014	.005	.002	.001	.077	
1V	.032	.030	.047	.031	.010	.003	.051	.010	.002	.002	.024	
V	.009	.015	.051	.039	.004	.040	0	.000	.003	.001	.003	
V1	.014	.025	.044	.038	.019	.027	.017	.006	.000	.001	.035	
V11	.041	.020	.018	.025	.017	.004	.006	.001	.002	.000	.002	
V111	.009	.018	.034	.025	.009	.010	.001	.003	.002	.002	.020	
All firms	.020	.025	.048	.038	.022	.025	.015	.010	.001	.001	.035	

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 13

Average Unit Total Variable Costs by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	---------------------dollars---------------------					
I	.689	.166	.731	.173	.803	.015
II	.551	.193	.607	.154	.576	.107
III	.643	.181	.523	.190	.537	.153
IV	.580	.164	.577	.124	.590	.115
V	.465	.061	.587	.146	.505	.094
VI	.622	.118	.524	.086	.514	.088
VII	.556	–	.607	.063	.584	.007
VIII	.713	.039	.704	.071	.681	.054
All firms	.605	.162	.591	.145	.567	.121

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	---------------------dollars---------------------					
I	.919	.498	1.029	.519	.594	.197
II	.586	.150	.712	.044	.513	.119
III	.606	.245	.558	.233	.483	.147
IV	.574	.106	.561	.173	.493	.079
VI	.526	.108	.670	.141	.500	.157
VII	.588	.240	.520	.085	.489	.095
VIII	.634	.084	.529	.090	.523	.070
	.705	.098	.746	.015	.661	.035
All firms	.624	.233	.637	.242	.512	.116

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 15

Average Unit Cost of Total Interest by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	---------------------- dollars ----------------------------					
I	.141	.105	.172	.079	.190	.093
II	.074	.033	.076	.021	.071	.020
III	.093	.064	.073	.052	.076	.058
IV	.070	.052	.071	.040	.049	.018
V	.082	.047	.055	.032	.055	.033
VI	.061	.034	.100	.066	.082	.052
VII	.051	—	.089	.051	.061	.002
VIII	.066	.035	.065	.031	.071	.048
All firms	.084	.058	.081	.049	.074	.049

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	---------------------- dollars ----------------------------					
I	.167	.101	.193	.131	.051	.098
II	.080	.017	.098	.056	.071	.033
III	.100	.072	.071	.027	.085	.081
IV	.059	.019	.052	.018	.049	.011
V	.057	.031	.060	.028	.063	.060
VI	.074	.043	.059	.031	.049	.032
VII	.089	.054	.089	.044	.057	.004
VIII	.053	.024	.050	.024	.063	.039
All firms	.083	.054	.081	.061	.069	.053

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 16

Average Unit Total Fixed Costs by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------------------------------dollars----------------------					
I	.354	.160	.393	.120	.456	.072
II	.179	.049	.201	.041	.198	.031
III	.206	.102	.184	.095	.200	.138
IV	.185	.075	.187	.090	.145	.050
V	.175	.045	.170	.049	.166	.046
VI	.157	.051	.219	.101	.202	.099
VII	.173	-	.183	.027	.171	.028
VIII	.184	.033	.190	.032	.174	.068
All firms	.204	.099	.205	.087	.197	.100

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	----------------------------dollars------------------------					
I	.484	.349	.468	.257	.357	.111
II	.208	.068	.276	.148	.182	.035
III	.243	.173	.174	.062	.198	.139
IV	.165	.039	.163	.026	.125	.022
V	.168	.081	.187	.065	.152	.045
VI	.186	.077	.175	.075	.143	.064
VII	.178	.026	.208	.052	.159	.019
VIII	.158	.061	.162	.058	.161	.065
All firms	.218	.153	.219	.131	.174	.089

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 17

Average Unit Total Costs by Size of Market, 1965-69

| Size Group | 1965 | | 1966 | | 1967 | |
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------------------------dollars------------------------					
I	1.043	.295	1.124	.142	1.258	.056
II	.730	.230	.809	.168	.773	.099
III	.849	.218	.707	.273	.737	.239
IV	.764	.229	.764	.170	.735	.151
V	.639	.105	.757	.181	.671	.103
VI	.779	.144	.743	.185	.715	.136
VII	.730	-	.790	.088	.755	.032
VIII	.897	.006	.894	.103	.855	.122
All firms	.809	.223	.796	.200	.764	.184

| Size Group | 1968 | | 1969 | | Best of 5 | |
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	------------------------dollars------------------------					
I	1.404	.842	1.497	.762	.952	.280
II	.794	.164	.988	.114	.695	.132
III	.850	.329	.732	.262	.681	.262
IV	.739	.114	.725	.187	.618	.090
V	.694	.140	.858	.182	.653	.178
VI	.774	.275	.695	.128	.631	.100
VII	.812	.084	.738	.105	.681	.070
VIII	.863	.159	.908	.074	.822	.101
All firms	.842	.354	.855	.346	.686	.172

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 18

Specific Unit Costs, Means and Rank in Relation to Total Costs,
All Firms, 1965–69 Averages

Cost Category	Rank	Mean Unit Cost	Percentage of Total Costs	Cumulative Percentage Totals
Yard help	1	$.1720	21.16%	21.16%
Office help	2	.0854	10.50	31.66
Total interest	3	.0806	9.91	41.57
Weighmasters, starters, and ringmen	4	.0618	7.62	49.19
Auctioneers	5	.0486	5.98	55.17
Insurance	6	.0442	5.44	60.61
Utilities	7	.0422	5.19	65.80
Depreciation	8	.0412	5.07	70.87
Supplies	9	.0398	4.90	75.77
Miscellaneous expenses	10	.0396	4.87	80.64
Bad debts	11	.0262	3.22	83.86
Taxes	12	.0256	3.15	87.01
Repairs and maintenance	13	.0216	2.66	89.67
Advertising	14	.0194	2.39	92.06
Other help	15	.0142	1.75	93.81
Trucking and hauling	16	.0124	1.53	95.34
Unemployment insurance	17	.0092	1.13	96.47
Legal and accounting fees	18	.0086	1.06	97.53
License and bond premiums	19	.0052	.64	98.17
Automobiles	20	.0050	.62	98.79
Solicitors	21	.0048	.59	99.38
Dues and subscriptions	22	.0024	.30	99.68
Travel and entertainment	23	.0012	.15	99.83
Rent	24	.0010	.12	99.95
Charity and contributions	25	.0006	.07	100.02
Total Costs		$.8128		

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX
TABLE 19

Average Gross Income by Size of Market, 1965-69

Size Group	1965		1966		1967	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	----------------------dollars----------------------					
I	11,219	3,207	11,510	3,985	9,589	1,989
II	21,521	4,726	21,572	3,372	20,475	4,351
III	38,035	5,394	35,099	3,479	36,109	3,860
IV	54,533	3,161	52,803	4,774	54,641	4,411
V	77,195	4,002	73,177	4,074	68,746	4,490
VI	112,616	27,030	105,045	19,711	106,963	18,444
VII	171,923	-	153,910	2,868	197,227	19,435
VIII	298,620	256	310,511	6,160	360,906	9,227
All firms	63,642	65,718	66,847	67,594	75,899	78,886

Size Group	1968		1969		Best of 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	----------------------dollars----------------------					
I	10,039	4,898	9,600	5,220	10,549	2,429
II	23,146	5,147	24,197	5,415	24,775	4,442
III	36,730	5,212	37,415	4,713	38,364	4,057
IV	52,088	4,805	51,833	4,810	54,493	4,283
V	66,497	4,069	69,820	6,825	76,934	3,375
VI	107,785	23,178	103,636	20,906	107,214	22,765
VII	206,965	20,084	193,454	37,837	210,041	21,380
VIII	384,346	49,257	406,278	53,987	359,026	85,065
All firms	84,056	87,228	(86,716)	91,828	81,518	82,827

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX

TABLE 20

Income from Selected Sources per Dollar of Gross Income,
Averages by Size of Market, 1965 and 1969

Size Group	Commission Income		Market Support Income		Feed Income		Rental Income		Interest Income		Miscellaneous Income	
	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969	1965	1969
					----dollars----							
I	1.056	.945	-.054	0	-.009	-.024	.008	.010	0	.001	0	.069
II	1.000	.997	-.020	-.010	-.001	0	.005	.010	.000	.000	.016	.003
III	1.027	1.001	-.041	-.010	-.005	-.001	.001	.000	.001	0	.019	.009
IV	1.038	1.011	-.054	-.040	-.015	-.000	.015	.017	.001	0	.016	.014
V	.997	.993	-.007	-.000	-.001	-.002	.010	.009	0	0	.001	.001
VI	.982	.997	-.026	-.011	-.002	-.001	.007	.006	.001	.007	.034	.008
VII	1.025	.942	-.066	-.015	-.015	-.006	.001	.011	0	.003	.025	.048
VIII	.917	.898	-.011	-.029	-.033	-.011	.031	.029	.000	.003	.030	.088
All firms	1.012	.983	-.034	-.013	-.002	-.002	.007	.009	.000	.001	.017	.022

Source: Computed from annual reports of auction markets in Kentucky.

APPENDIX

TABLE 21

Average Net Returns per Dollar of Year-End Total Investment
by Size of Market, 1965-69

Size Group	1965	1966	1967	1968	1969	Best of 5
			----dollars----			
I	.052	-.061	-.091	-.038	-.066	.068
II	.327	.179	.228	.177	.038	.335
III	.209	.485	.497	.497	.367	.608
IV	.369	.274	.390	.314	.337	.504
V	.482	.318	.418	.455	.300	.425
VI	.315	.301	.326	.261	.571	.674
VII	.326	.196	.249	.171	.243	.346
VIII	.113	.141	.212	.228	.154	.253
All firms	.271	.260	.333	.265	.283	.466

Source: Computed from annual reports of auction markets in Kentucky.

TABLE 22

Average Net Returns per Dollar of Year-End Net Worth
by Size of Market, 1965-69

Size Group	1965	1966	1967	1968	1969	Best of 5
			----dollars----			
I	.056	-.061	-.148	.073	-.081	.071
II	.391	.238	.272	.181	.025	.408
III	.314	.504	.508	.473	.403	.627
IV	.478	.263	.479	.409	.372	.654
V	.514	.623	.457	.524	.321	.672
VI	.352	.382	.523	.749	.479	.785
VII	.355	.215	.527	.202	.348	.647
VIII	.147	.206	.315	.330	.210	.376
All firms	.335	.331	.416	.409	.294	.577

Source: Computed from annual reports of auction markets in Kentucky.