SPATIAL PRICE DIFFERENTIALS FOR SWINE

by

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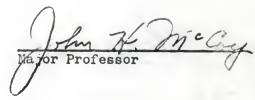

Major Professor

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INTRODUCTION

Swine is the second most important meat animal to Kansas livestock producers from the standpoint of sales. Swine has always had a major role in the Kansas farm enterprise. In order to maintain this role the swine producer must keep informed of current conditions in the swine industry. He must be particularly cognizant of the implications of hog prices which are disseminated through the news media. Additionally he must be aware of current hog studies which will help him increase profits.

There have been many studies concerned with swine production and profitability of swine enterprises at Kansas State University.[1] In its simplest economic concept, profitability is based on total revenue minus total cost. This can be determined by the equilibrium point of supply and demand, this point denoting market price, and its relation to the costs of production. Figure 1 gives a pictorial representation of the complex short-run demand, supply, and price structure for live hogs. In itself the live hog price structure is a complex system of factors which are constantly changing. A very restricted segment of this price structure was examined in this study, that is, market price quotations. This analysis revealed that live hog prices frequently undergo severe fluctuations from year to year, and vary among spatially separated markets.

The main objective of this study was the analysis of market price quotations for live hogs. Specifically the purpose was to analyze prices

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[1] A partial listing of studies from Kansas State University is found in the Sources Consulted.

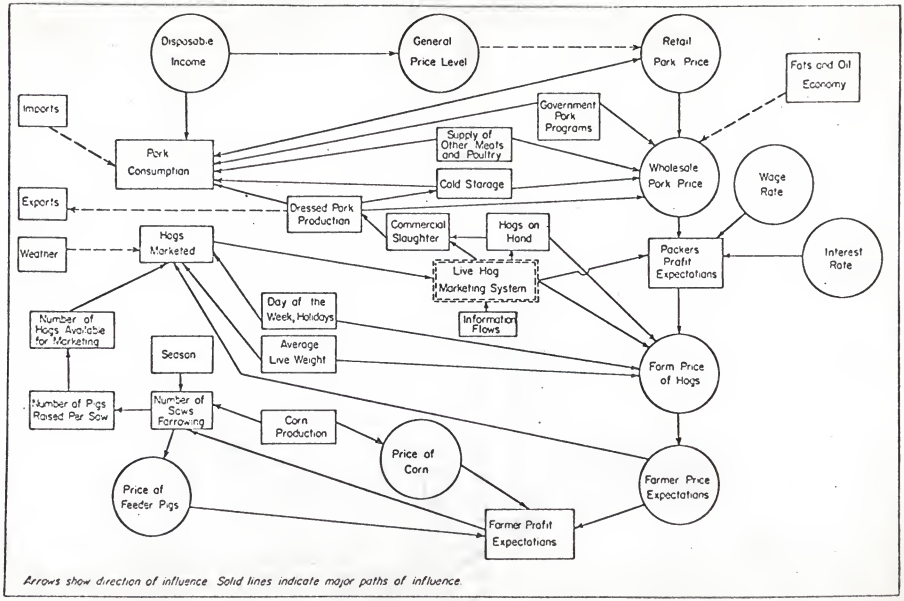

Fig. 1.—The short-run demand, supply and price structure for live hogs.

Source: Unpublished Ph.D. dissertation of Raymond M. Leuthold, University of Wisconsin, 1968, p. 62.

received for hogs in Kansas, to compare these prices with prices paid in other states, and to see if the price differential trend is changing.

Before analyzing market price quotations, a limited look at historical data on the supply of live hogs is important to establish the relative importance of Kansas hog production and to note particular changes taking place.

TABLE 1.—Number of Kansas hog producers and January 1 hog numbers, 1963-1969.

Year	Number of Producers	Number of Hogs[b]	Hogs/Producer
1963	33,000	1,393,000	42
1964	28,000	1,365,000	49
1965	22,000	1,283,000	58
1966	21,000	1,190,000	57
1967	21,000	1,440,000	69
1968	21,000	1,541,000	73
1969[a]	19,000	1,711,000	90

[a]1969 data is a preliminary estimate.

[b]Includes pigs.

Source: Kansas Crop and Livestock Reporting Service.

The number of hogs, producers and hog numbers in Kansas for the past seven years are shown in Table 1. On January 1, 1969, the estimated number of hogs per hog producer in Kansas was approximately ninety; this is the highest hog to producer ratio on record. The total number of hogs in Kansas was higher in previous years, particularly in the early thirties and during the war years. For example, in 1933, 3,165,000 hogs were on Kansas farms, but at the same time producers were estimated to be nearly

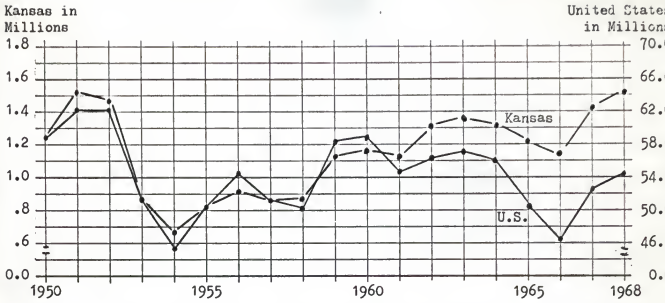

Fig. 2.—Hog numbers, United States and Kansas, January 1, 1950 - 1968.

Source: Kansas Crop and Livestock Reporting Service.

100,000.[2] The hog to producer ratio in this case was approximately thirty-two.

United States and Kansas data on hog numbers for the years 1950 to 1968 are shown in Figure 2. In Figure 2 it can be seen that in 1954 Kansas hog numbers reached a low level and then started a period of increasing numbers. In 1961, hog numbers in Kansas began to increase at a faster rate than the United States as a whole. United States hog numbers in 1951 were at the highest level since World War II.

Table 2 shows hog numbers broken down by Kansas Crop Reporting Districts for the years 1950 through 1969. Crop Reporting Districts are shown in Figure 3. If 1954 is used as the base point and 1969 estimates are used as the end points, several significant increases have taken place.[3]

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[2]Data taken from Kansas Crop and Livestock Reporting Service.

[3]It appears that 1954 was a turning point in Kansas hog numbers.

TABLE 2.—Number of hogs on farms by crop district, Kansas, January 1, 1950–1969.

Year	North West	West Central	South West	North Central	Central	South Central	North East	East Central	South East
					THOUSAND HEAD				
1950	72.5	26.4	31.6	223.1	79.5	98.0	319.6	238.3	165.0
1951	66.4	26.2	24.4	215.5	92.1	124.6	382.2	313.5	259.1
1952	63.3	28.5	27.0	230.3	100.7	134.4	367.3	294.2	243.0
1953	45.8	19.4	15.4	142.6	60.4	90.8	268.1	179.5	145.8
1954	35.7	12.6	9.4	124.6	39.3	64.5	230.6	143.6	113.7
1955	36.0	11.0	13.6	128.0	60.0	59.0	245.0	156.0	106.5
1956	41.5	13.5	17.5	134.5	72.0	67.5	264.5	190.0	128.0
1957	34.0	8.8	13.6	101.0	58.3	59.4	243.0	167.0	122.9
1958	43.0	13.0	15.0	125.0	64.0	62.0	240.0	160.0	118.0
1959	59.0	21.0	24.0	163.0	85.0	94.0	267.0	195.0	160.0
1960	62.0	23.0	26.0	179.0	88.0	105.0	290.0	214.0	190.0
1961	58.0	20.0	26.0	189.0	87.0	102.0	280.0	210.0	170.0
1962	78.0	23.0	29.0	231.0	104.0	116.0	303.0	233.0	193.0
1963	78.0	25.0	32.0	247.0	114.0	122.0	324.0	251.0	200.0
1964	74.0	25.0	33.0	248.0	115.0	117.0	305.0	244.0	204.0
1965	75.0	19.0	30.0	237.0	108.0	105.0	295.0	231.0	183.0
1966	60.0	20.0	27.0	220.0	94.0	112.0	272.0	195.0	190.0
1967	75.0	23.0	33.0	265.0	119.0	140.0	321.0	234.0	230.0
1968	79.0	28.0	38.0	295.0	134.0	142.0	330.0	246.0	249.0
1969[a]	95.0	34.0	40.0	384.0	170.0	168.0	300.0	234.0	281.0

[a] 1969 data is a preliminary estimate.

Source: Kansas Crop and Livestock Reporting Service.

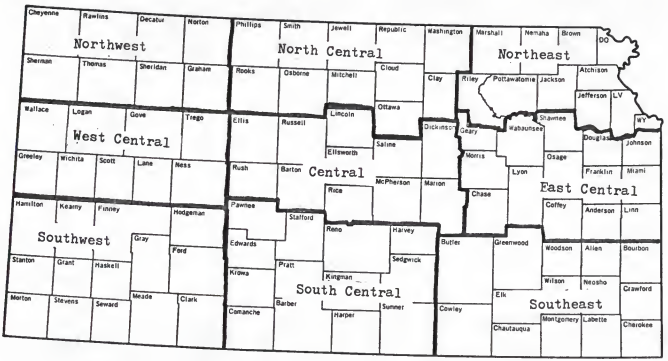


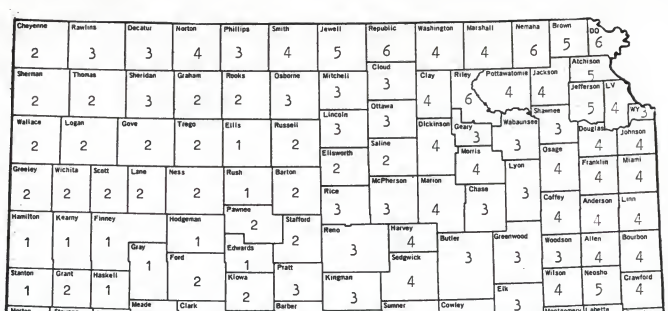
Fig. 3.—A map of Kansas crop reporting districts.

In the southwest district hog numbers increased approximately 4-fold, and the central district hog numbers increased approximately $3\frac{1}{2}$-fold. Except for the northeast and east central districts, which increased approximately one-half their 1954 hog numbers, the other Kansas crop district hog numbers increased approximately 2-fold. The southeast district had the largest total hog number increase. During this fifteen-year period, i.e. from 1954 through 1969, several crop districts increased by 100,000 or more hogs.

Kansas hog production density for the period 1963-1968 and 1969 are shown in Figures 4 and 5 respectively. Hog production density is number of hogs per rural square mile. Both 1963-1968 and 1969 density computation used 1968 rural square mile estimates. It should be noted that a county which has a code number of 4 is not four times as dense as a county which has a code number of 1. In order to represent the best possible comparison of densities, equal class intervals were not possible.

The greatest hog density was in the northeast district, around Kansas City and St. Joseph markets. Additionally the counties of Smith, Jewell, Republic, Washington and Clay in the north central district had high concentrations of hogs. The 1969 estimates of production density resulted in twenty counties increasing to the next higher density categories while four counties decreased from the 1963-1968 density categories. The north central district showed the greatest increase with six counties moving into the next higher density category. The southwest and central districts both had five counties advancing to a higher category. In the southeast district, Butler and Cowley counties increased to a higher category. Both the south central and east central districts increased one county each

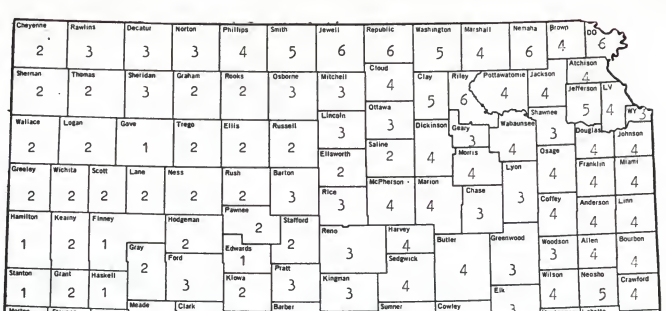
Fig. 4.—Kansas hog density, 1963–1968 average.



CODE	DENSITY	CODE	DENSITY
1	Three or less hogs per rural square mile	4	26–50 hogs per rural square mile
2	4–10 hogs per rural square mile	5	51–60 hogs per rural square mile
3	11–25 hogs per rural square mile	6	61 or more hogs per rural square mile

Source: Original data from Kansas Crop and Reporting Service.

Fig. 5.—Kansas hog density, 1969.



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1	Three or less hogs per rural square mile	4	26–50 hogs per rural square mile
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Source: Original data from Kansas Crop and Reporting Service.

into a higher density category. Other counties were close to changing density categories, particularly in western counties of Kansas.

The number and percent of Kansas producing units and hogs produced by size of operation for the years 1950, 1960, 1963, and 1967 are shown in Table 3. During this period the percentage of hogs produced by size of operation decreased in the four smallest size categories and increased in the two largest size categories. In the size category of 300 or more hogs, the percentage increase was approximately 21-fold. The number of producers raising 150 - 299 hogs doubled in percentages. From this data, it is apparent that Kansas swine producers are increasing their size of operation. According to the study conducted by Olson, only 122 producers were raising 300 or more hogs in 1950, but in 1967, 2,255 producers were raising 300 or more hogs per year.[4]

The distribution of hog production in the United States changed during the 1963-1968 period. Table 4 shows relative production by six geographical regions, and the five states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma. From 1964-1968 Kansas was the only state of the five examined to increase each year its percentage share of United States hog production.

A study by the Kansas State Department of Economics projected hog production in Kansas to increase by thirty percent during the period 1966 to 1980 compared to twenty-one percent for the nation.[5] This is due in part, as reported in a Kansas State University bulletin to:

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[4]Unpublished study by Ross A. Olson, Kansas State University, 1967.

[5]Unpublished study by Department of Economics, Kansas State University, 1969.

TABLE 3.—Number and percent of producing units and hogs produced by size of operation, Kansas. 1950, 1960, 1963, 1967.

	Size Category	1950		1960		1963		1967	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
	1 - 25	436,000	20.00	91,863	5.19	51,960	2.29	32,546	1.89
	26 - 50	622,810	28.53	221,604	12.52	134,098	5.91	96,604	5.61
Hogs	51 - 75	380,934	17.45	205,143	11.59	146,351	6.45	108,314	6.29
	76 - 149	447,733	20.51	401,259	22.66	313,349	13.81	194,806	17.12
	150 - 299	242,750	11.12	582,507	32.91	965,008	42.52	455,125	26.43
	300 or more	52,174	2.39	267,801	15.13	658,464	29.02	734,605	42.66
	1 - 25	34,029	53.17	10,319	27.89	6,194	18.78	3,511	16.72
	26 - 50	17,536	27.40	9,424	25.47	6,329	19.18	4,074	19.40
Producing	51 - 75	6,304	9.85	5,295	14.31	4,099	12.42	2,764	13.16
Units	76 - 149	4,666	7.29	6,316	17.07	5,392	16.34	4,586	21.84
	150 - 299	1,344	2.10	4,821	13.03	8,705	26.34	3,810	18.14
	300 or more	122	.19	825	2.23	2,277	6.90	2,255	10.74

Source: Data for the years 1950, 1960, and 1963 was taken from the unpublished study by Ross A. Olson, Kansas State University, 1967. Data for 1967 was computed from data received from the Kansas Crop Reporting Service.

TABLE 4.—Percent of hogs on farms, January 1, by regions and selected states. 1963-1968.

Regions and Selected States	1963	1964	1965	1966	1967	1968
	PERCENT OF U. S. TOTAL[a]					
Kansas	2.37	2.35	2.42	2.51	2.71	2.84
Oklahoma	0.71	0.56	0.51	0.59	0.67	0.75
Nebraska	4.64	4.84	4.97	5.41	5.20	5.05
Colorado	0.40	0.42	0.42	0.34	0.35	0.39
Missouri	7.15	7.25	7.21	7.22	7.27	7.70
FIVE STATE TOTAL	15.27	15.42	15.53	16.07	16.20	16.73
North Atlantic	1.58	1.53	1.51	1.50	1.52	1.48
East North Central	31.73	31.84	31.41	30.18	29.57	28.34
West North Central	46.16	46.59	47.79	49.81	49.44	49.71
South Atlantic	7.94	7.86	7.73	7.63	7.90	8.26
South Central	10.35	9.91	9.37	9.00	9.67	10.31
Western	2.24	2.27	2.19	1.88	1.90	1.90

[a]U. S. Total based on forty-eight states.

Source: U.S. Department of Agriculture, Agricultural Statistics, 1963-1968.

> The population build-up in the West and Southwest is a significant development in the demand for pork. ... If that rate continues, these states will have 21.1 million more people in 1975 than 1957. Since Kansas is located geographically closer to these areas than the Corn Belt is, Kansas may compete effectively with other areas in supplying at least part of this new demand for pork.[6]

The bulletin than goes on to say:

> ... From a competitive standpoint, hog producers in the Kansas areas could expect prices that would compare favorably with other surplus producing areas.[7]

The last sentence quoted is of prime importance to this study.

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[6] John H. McCoy, Paul L. Kelley, and Milton L. Manuel. The Competitive Position of Kansas in Marketing Hogs. Kansas State University Experiment Station Technical Bulletin 118, October, 1961, p. 5.

[7] Ibid., p. 36.

OBJECTIVES OF THE STUDY

The purpose of this study was to analyze market prices received for live hogs in Kansas, to compare these prices with prices paid in other states, and to determine if the price differential trend is changing. This entailed analyzing prices among spatially separated hog markets and developing an economic price landscape for the six-year period 1963-1968.

The major source of price data was price quotations collected and disseminated by U.S. Department of Agriculture Livestock News Service on specified grade and weight classifications of hogs from public markets throughout the United States.

From this price data source, in which thirty public markets had sufficient data that was applicable, the markets were divided into two groupings for analytical purposes. These groupings were (1) all thirty markets which were compared by analysis of variance, and (2) eight of the former including the Kansas markets and those immediately surrounding markets which were compared by analysis of variance and by price differentials. Monthly and yearly price quotations were used.

Specifically the objectives were (1) to determine the statistically significant difference among means of live hog prices for the six-year period, 1963 through 1968; (2) to determine monthly and yearly price differentials, for live hog prices, among eight public markets located at Wichita, Kansas; Kansas City, Missouri; St. Joseph, Missouri; Omaha, Nebraska; Chicago, Illinois; Denver, Colorado; St. Louis, Illinois; and Oklahoma City, Oklahoma for the six-year period, 1963 through 1968; and

(3) to determine if any distinguishable price differential trends are taking place among the public markets. In order to obtain consistent and accurate results, grade and weight classification was held constant in so far as this was possible with available quotations.

Studies of market prices received for hogs by Kansas producers have been limited in recent years. In general most studies have examined only seasonal price trends of one terminal market, that of Kansas City. That type of study is helpful in determining the best time to market, assuming other Kansas markets vary accordingly, and in predicting expected prices.[8] The seasonal index for Wichita and Kansas City public markets for U.S. No. 1, 2, and 3, 200-220 pound barrows and gilts is shown in Figure 6.

No attempt was made in this study to determine the profitability of the Kansas swine enterprise either in absolute or relative terms. This study was designed to appraise the relative price quotations based on grade and weight for live hogs in Kansas and other states. This examination of hog prices was based on geographical or spatial differences among public markets, and among selected states.

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[8] See Sources Consulted for referenoes which explain procedures in each case.

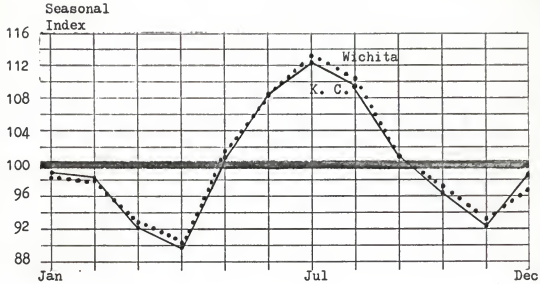

Fig. 6.—Seasonal index for Wichita and Kansas City public markets' price quotations for U.S. No. 1, 2, and 3,[a] 200–220 pound barrows and gilts. 1963–1968.

[a]Actual grades are U.S. No. 1, 2, and 3 for January 1963 - June 1968; U.S. No. 2 and 3 for July 1968 - December 1968. These classifications are comparable due to changes in grade standards July 1, 1968.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

SCOPE AND PROCEDURES

Source of Data and Selection of Areas Compared

The source of data examined in the Analysis of Data section of this paper was from the U.S. Department of Agriculture Livestock Detailed Quotations. Sources of data which were considered but which presented several individual disadvantages were Farm Management records, public auction records, individual farm records, packing plant records, and Statistical Reporting Service mid-month estimates of the average price received per hundredweight by farmers for all hogs by states. Basically the difficulty in using these sources of data were the lack of consistent records, problems of bias, the aggregation of various grades and weights, and the problem of obtaining similar data outside of Kansas. Other sources of data presented in the Introduction were from the U.S. Department of Agriculture Agricultural Prices publications, Kansas Crop and Livestock Reporting Service reports, and other related agricultural and economic publications, periodicals, journals, and unpublished works.

The selection of areas compared was in part limited to the sources of data which were available. Thirty public markets in twenty-two states were included in the study. Figure 7 shows the location of these markets. In the listing of these markets immediately following, the number shown before the market indicates that market's location in Figure 7. These thirty public markets are: (1) North Portland, Oregon; (2) Stockton, California; (3) Moses Lake, Washington; (4) Ogden, Utah; (5) Denver, Colorado; (6) West Fargo, North Dakota; (7) Sioux Falls, South Dakota;

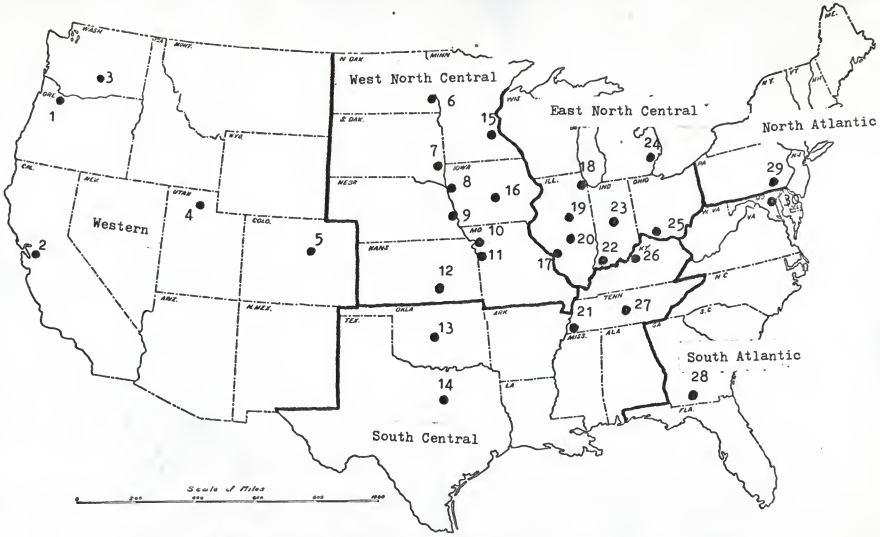

Fig. 7.—A map of the United States showing location of thirty public markets and the six geographical regions of the United States.

(8) Sioux City, Iowa; (9) Omaha, Nebraska; (10) St. Joseph, Missouri; (11) Kansas City, Missouri; (12) Wichita, Kansas; (13) Oklahoma City, Oklahoma; (14) Fort Worth, Texas; (15) South St. Paul, Minnesota; (16) Des Moines, Iowa; (17) St. Louis, Illinois; (18) Chicago, Illinois; (19) Peoria, Illinois; (20) Springfield, Illinois; (21) Memphis, Tennessee; (22) Evansville, Indiana; (23) Indianapolis, Indiana; (24) Detroit, Michigan; (25) Cincinnati, Ohio; (26) Louisville, Kentucky; (27) Nashville, Tennessee; (28) Thomasville, Georgia; (29) Lancaster, Pennsylvania; and (3) Baltimore, Maryland.

Eight of these public markets are of prime interest to Kansas because of their proximity to Kansas, their importance in overall market volume, and notable price differentials. These eight public markets are located at Denver, Omaha, Wichita, Oklahoma City, St. Joseph, Kansas City, Chicago, and East St. Louis. As can be seen in Figure 7, these eight public markets are located in west north central, east north central, and south central regions of the United States. On January 1, 1968, these three regions had over eighty-eight percent of the total United States hogs on farms.[9] In general these regions are surplus in regards to hog production.[10]

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[9]See Table 4 of this report.

[10]See the series of articles on Spatial Structure of the Livestock Economy in Sources Consulted.

U.S. Department of Agriculture Public Market Quotations

The U.S. Department of Agriculture Livestock Market News Service collects and disseminates livestock price information for approximately sixty markets. From these sixty markets, thirty markets had sufficient data on hog prices that could be utilized.[11] And from these thirty markets the following grade and weight classification was used: U.S. No. 1 and 2, 200-220 pound barrows and gilts.[12]

The market price quotations by grade and weight are an average for the month or year of prices quoted for that particular time period.

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[11]Quotations were not available for the following times and markets:
South St. Paul - April, 1965;
Ogden - November and December, 1966, and February and June, 1967;
Fort Worth - February, May and June, 1963, and March, 1964.

[12]Due to grade standard change which became effective July 1, 1968, the U.S. No. 1 and 2 became U.S. No. 2 and 3.

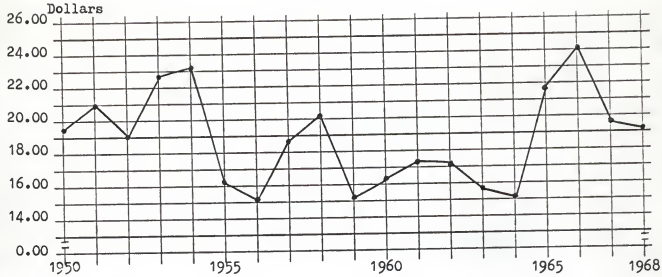

Fig. 8.—Kansas City yearly market price quotations in dollars per hundredweight for U.S. No. 1 and 2, 200–220 pound barrows and gilts, 1950–1968.[a]

[a]Due to changes in grade standards the actual grades were good and choice January 1950 - December 1951; choice, January 1952 - June 1955; U.S. No. 1, 2, and 3, July 1955 - December 1958; U.S. No. 1 and 2, January 1959 - July 1968; U.S. No. 2 and 3, July 1968 to present.

Source: U.S. Department of Agriculture Livestock Detailed Quotations.

Selection of Time Period

A problem in doing any type of historical data comparison is the selection of the time period. In this paper prices were analyzed for the base period 1963 through 1968. This period was selected because it was the latest available. In addition it covered a period in which hog production went through three years of decreasing and then two years of increasing hog numbers; and one year of decreasing, two years of increasing and then two years of decreasing prices. Figure 2 gives a graphic view of hog numbers, and Figure 8 gives a graphic view of hog prices during the period studied. In several sections of this paper, reference is made to the period 1950 to 1969 to show comparative trends.

Selection of Methods of Analysis

During the late 1940's and early 1950's, many agricultural experiment station bulletins were published which examined spatial or geographical price variations. Prior to this time most studies were concerned with hog price trends; the price cycles or seasonal fluctuations of prices; methods of forecasting hog prices; factors which affect hog prices; and types of markets available to hog producers. A limited listing of these publications is found in the section entitled Sources Consulted.

According to the U. S. Department of Agriculture,[13] H. A. Wallace in 1920 was the first economist to apply exact statistical methods in the analysis of hog prices.

Several statistical methods are available to the economist in analyzing hog prices. A few of these methods are indexes, correlation coefficients, trend lines by use of regression, standard errors of estimate, deviations, price differentials and analysis of variance computations. The last two methods are used in this study.

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[13] U.S. Department of Agriculture. Factors Affecting the Price of Hogs. Department Bulletin No. 1440, November, 1926.

Price Differentials

One method of comparing geographical price variations is price differentials. By this method the price of hogs at one location can be compared to the price at another location by simple subtraction of the price at Location B from the price at Location A. By use of this procedure it can be said that the price received at Location A is so many dollars higher or lower than at Location B.

An example of this procedure is as follows:

	Location A (Base)	Location B	Price Differential Spread
	DOLLARS	DOLLARS	DOLLARS
1963	13.50	13.80	.30
1968	23.40	23.20	-.20

In this study, monthly and yearly price differentials were examined.

This method has been used in various reports and publications; a few are mentioned below.

A Michigan State College Agricultural Experiment Station Bulletin by D. H. Stark and Matthew Madnick examined price differences for Michigan slaughter hogs for the period 1933-1941.[14] C. D. Phillips, in a Kentucky Agricultural Experiment Station Bulletin, examined price differences for Kentucky slaughter hogs for the period 1937-1941.[15] In 1948 the North Central Livestock Marketing Research Committee published a bulletin on

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[14] D. H. Stark and Matthew Madnick. Price Differences Among Markets for Michigan Slaughter Hogs. Michigan State College Agricultural Experiment Station Special Bulletin 341, June, 1947.

[15] C. D. Phillips. Price Differences for Slaughter Hogs, 1937-1941, at Markets Where Kentucky Hogs are Sold. Kentucky Agrioultural Experiment Station Bulletin 520, June, 1948.

price differentials for slaughter hogs for the period 1931-1941.[16] One of the latest reports to use price differentials is by W. K. McPherson, published in 1969.[17]

[16] North Central Livestock Marketing Research Committee. Price Differentials for Slaughter Hogs. Agricultural Experiment Station, Iowa State College, Bulletin P93, August, 1948.

[17] W. K. McPherson. Differences Between Cattle and Calf Prices in National and Southern Markets. Supplement to Bulletin No. 132, Southern Cooperative Series, 1969.

Analysis of Variance

In 1933, Theodore W. Schultz and A. G. Black examined spatial price variations by use of analysis of variance. This was the first study to use analysis of variance to determine if price variations in hog markets were statistically significant.[18] Analysis of variance is a method used to test differences among several statistical means. This method was also used by the North Central Livestock Marketing Research Committee in a 1948 bulletin.

Analysis of variance can be used in several different ways. In this paper it was used to determine the least significant differences among public market price quotations by location and by time periods, a two-way analysis of variance. Schultz and Black used an analysis of variance table to determine if price variations were significantly different by location and time. Table 5 gives the analysis of variance table for price quotations for swine among thirty public markets used in this study. This table is presented to point out how analysis of variance can be used in an overall analysis. From the F statistic it can be seen that there is significant variation among both years and location. This in itself is meaningful, but what is the significant difference in dollars and cents per hundredweight? Which markets are not significantly different from each other? To answer these questions, Fisher Least Significant

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[18] Theodore W. Schultz and A. G. Black. Variations in Swine Prices Within Iowa Including a Study in Statistical Procedure. Iowa State College Agricultural Experiment Station Research Bulletin No. 161, June, 1933.

[19] North Central Livestock Marketing Research Committee. Price Differentials for Slaughter Hogs, op. cit.

Difference was determined. A five percent level of significance was used in all the computations.

By use of Fisher Least Significant Difference it can be determined if one market's mean is statistically different from another market's mean. That is, if the least significant difference is twenty-five cents per hundredweight based on price quotations, then a market that is different by twenty-five cents or more, either higher or lower, than the base market, is statistically different from the base market. For example, Market A's mean is $10.00 per hundredweight, Market B's mean is $10.30 per hundredweight, and Market C's mean is $10.60 per hundredweight. In this case Markets A and C are statistically different from the base market B using twenty-five cents as the least significant difference.

The Kansas State University Statistic Department provided the computer program which was used in Fisher Least Significant Difference computations, and an IBM 360-50B computer was used to analyze the data.

TABLE 5.—Analysis of variance table: yearly average price quotations among thirty public markets, 1963-1968.[a]

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square	F Statistic
Years	5	1647.85	329.57	8404.72[b]
Location	29	57.49	1.98	50.55[b]
Error	145	5.69	.04	
Total	179	1711.02		

[a]Means based on yearly price quotations in dollars per hundredweight of U.S. No. 1-2, 200-220 pound barrows and gilts.

[b]Significantly different at five percent level.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

ANALYSIS OF DATA

Public Market Price Data Available

U. S. Department of Agriculture grade standards were changed July 1, 1968. Table 6 shows the results of two studies conducted before the reclassification. From these studies it was found that eighty-four percent of the hogs marketed in the first quarter of 1968 were graded as No. 1 and 2. These grades of No. 1 and 2 are now the present grades of No. 2 and 3 as of July, 1968.

TABLE 6.—Results of study on U.S. Department of Agriculture hog grades: 1960-1961, 1968.

Category	Percent Graded[a]	
	1960-1961	1968
U.S. No. 1	33	49
U.S. No. 2	38	35
U.S. No. 3	25	12
Others	3	3

[a]Percent Graded is rounded so does not total 100 percent.

Source: National Hog Farmer, August, 1968, p. 7.

The present grade U.S. No. 2 and 3, 200-220 pound barrows and gilts was selected to be used as the base grade and weight group for comparison and analysis in this study. By using only one grade and weight classification for analysis, it is possible to definitely state what took place. When all market hogs are grouped together as a whole unit, it is impossible without complete documentation to know how weighing each classification effected the actual results. Therefore in this study it is hoped that the reader will be able to make a definite conclusion from the data presented.

Analysis of Variance of Thirty Selected Markets

Figure 7 gives the location of the thirty markets which were compared in this paper. Tables 7 through 10 give the ordered array of means of thirty public markets based on the mean price quotations by grade and weight for the years 1963-1968, 1963-1964, 1966-1967, and 1967-1968. It was found during the period examined that the Lancaster, Pennsylvania, market always had the highest price while at the lower end, the Thomasville, Georgia, market had the lowest price except for the 1963-1964 period, when the Des Moines, Iowa, market had the lowest price.

It was also found that the east and west coast markets, followed by the markets in the large cities of Chicago, Indianapolis, and Detroit, had the highest price quotations. Through analysis of variance this study found Fisher Least Significant Differences among the arithmetic means of thirty public markets based on price quotations of live hogs of specific grade and weight during the period 1963-1968. The price quotations from the markets of Wichita, St. Joseph, and Kansas City statistically were not significantly different from each other. Of particular interest was the fact that the markets of Omaha, East St. Louis, and Denver, which are relatively close in distance to the Wichita, St. Joseph, and Kansas City markets, were statistically different from, i.e. higher than, the markets of Wichita, St. Joseph, and Kansas City. It should be pointed out, however, that a statistical price difference does not necessarily indicate that one market is a more profitable selling point than another. Related costs, e.g. transportation, shrinkage, and other marketing costs must be taken into account in each situation.

TABLE 7.—Hog prices, thirty public markets, 1963-1968 mean.[a,b]

Years	Public Market Location	Ordered Array of Means Largest to Smallest
		DOLLARS
1963-1968	Lancaster, Pennsylvania	21.29
	Moses Lake, Washington	20.91
	North Portland, Oregon	20.90
	Baltimore, Maryland	20.74
	Chicago, Illinois	20.35
	Stockton, California	20.33
	Indianapolis, Indiana	20.22
	Detroit, Michigan	20.17
	Cincinnati, Ohio	20.05
	Ogden, Utah	20.04
	Denver, Colorado	20.03
	Peoria, Illinois	20.02
	Louisville, Kentucky	19.96
	Memphis, Tennessee	19.94
	St. Louis, Illinois	19.84
	Omaha, Nebraska	19.81
	Oklahoma City, Oklahoma	19.78
	Evansville, Indiana	19.77
	South St. Paul, Minnesota	19.72
	Sioux City, Iowa	19.66
	St. Joseph, Missouri	19.58
	Nashville, Tennessee	19.53
	Sioux Falls, South Dakota	19.52
	Kansas City, Missouri	19.51
	Wichita, Kansas	19.49
	Springfield, Illinois	19.36
	West Fargo, North Dakota	19.30
	Des Moines, Iowa	19.13
	Fort Worth, Texas	18.87
	Thomasville, Georgia	18.84

[a]Least significant difference is $.23.

[b]Means based on yearly price quotations of U.S. No. 1-2, 200-220 pound barrows and gilts.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 8.—Hog prices, thirty public markets, 1963-1964 mean.[a,b]

Years	Public Market Location	Ordered Array of Means Largest to Smallest
		DOLLARS
1963-1964	Lancaster, Pennsylvania	17.60
	North Portland, Oregon	17.27
	Baltimore, Maryland	17.15
	Moses Lake, Washington	17.12
	Stockton, California	16.82
	Ogden, Utah	16.75
	Chicago, Illinois	16.48
	Indianapolis, Indiana	16.43
	Detroit, Michigan	16.38
	Denver, Colorado	16.32
	Cincinnati, Ohio	16.30
	Louisville, Kentucky	16.26
	Oklahoma City, Oklahoma	16.18
	Peoria, Illinois	16.17
	Memphis, Tennessee	16.17
	Omaha, Nebraska	16.09
	Evansville, Indiana	16.07
	St. Louis, Illinois	16.04
	Nashville, Tennessee	16.01
	St. Joseph, Missouri	15.91
	Sioux City, Iowa	15.86
	Kansas City, Missouri	15.81
	Wichita, Kansas	15.80
	Sioux Falls, South Dakota	15.78
	Springfield, Illinois	15.77
	South St. Paul, Minnesota	15.76
	Thomasville, Georgia	15.74
	Fort Worth, Texas	15.67
	West Fargo, North Dakota	15.53
	Des Moines, Iowa	15.34

[a]Least significant difference is $.20.

[b]Means based on yearly price quotations of U.S. No. 1-2, 200-220 pound barrows and gilts.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 9.—Hog prices, thirty public markets, 1966-1967 mean.[a,b]

Years	Public Market Location	Ordered Array of Means Largest to Smallest
		DOLLARS
1966-1967	Lancaster, Pennsylvania	23.96
	North Portland, Oregon	23.67
	Moses Lake, Washington	23.64
	Baltimore, Maryland	23.33
	Chicago, Illinois	23.10
	Stockton, California	23.03
	Indianapolis, Indiana	22.86
	Detroit, Michigan	22.84
	Peoria, Illinois	22.74
	Cincinnati, Ohio	22.60
	Denver, Colorado	22.58
	Ogden, Utah	22.58
	Memphis, Tennessee	22.57
	Louisville, Kentucky	22.51
	St. Louis, Illinois	22.45
	Omaha, Nebraska	22.40
	Oklahoma City, Oklahoma	22.33
	Sioux City, Iowa	22.33
	Evansville, Indiana	22.30
	South St. Paul, Minnesota	22.30
	Sioux Falls, South Dakota	22.14
	St. Joseph, Missouri	22.13
	Kansas City, Missouri	22.07
	Wichita, Kansas	22.04
	Nashville, Tennessee	21.94
	West Fargo, North Dakota	21.92
	Springfield, Illinois	21.85
	Des Moines, Iowa	21.74
	Fort Worth, Texas	21.20
	Thomasville, Georgia	21.12

[a]Least significant difference is $.33.

[b]Means based on yearly price quotations of U.S. No. 1-2, 200-220 pound barrows and gilts.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 10.—Hog prices, thirty public markets, 1967-1968 mean.[a,b]

Years	Public Market Location	Ordered Array of Means Largest to Smallest
		DOLLARS
1967-1968	Lancaster, Pennsylvania	21.48
	Moses Lake, Washington	21.47
	North Portland, Oregon	21.09
	Baltimore, Maryland	20.72
	Chicago, Illinois	20.62
	Detroit, Michigan	20.48
	Indianapolis, Indiana	20.47
	Stockton, California	20.40
	Denver, Colorado	20.30
	Peoria, Illinois	20.28
	Cincinnati, Ohio	20.24
	Memphis, Tennessee	20.17
	St. Louis, Illinois	20.08
	South St. Paul, Minnesota	20.06
	Omaha, Nebraska	20.05
	Louisville, Kentucky	20.04
	Evansville, Indiana	19.94
	Sioux City, Iowa	19.90
	Oklahoma City, Oklahoma	19.83
	St. Joseph, Missouri	19.75
	Kansas City, Missouri	19.73
	Sioux Falls, South Dakota	19.72
	Ogden, Utah	19.67
	Wichita, Kansas	19.66
	West Fargo, North Dakota	19.57
	Nashville, Tennessee	19.54
	Des Moines, Iowa	19.47
	Springfield, Illinois	19.44
	Fort Worth, Texas	18.72
	Thomasville, Georgia	18.67

[a]Least significant difference is $.23.

[b]Means based on yearly price quotations of U.S. No. 1-2, 200-220 pound barrows and gilts.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

The markets in the west north central, east north central and south central regions of the United States tended to fall in the lower end of the price range of the thirty public markets for all the periods examined.

The Ogden market position declined over the six-year period,[20] while during the same time period, the West Fargo and South St. Paul markets increased their relative positions. It should also be noted that the Oklahoma City market declined in its relative position during the 1967-1968 time period as compared to the other time periods.

The least significant difference range for all analysis of variance comparison was $.20 to $.33. Statistically a twenty-three cent price difference (or more) indicated a significant difference over the six years, 1963-1968, when all thirty markets were examined on yearly price quotations. The thirty-three cent significant difference occurred during the 1966-1967 period when hog prices were the highest.

From Table 7 it can be seen that price quotations from Lancaster averaged $2.44 per hundredweight over the Thomasville price quotations. This was the highest differential among the thirty markets.

Table 11 gives the ordered array of means by years for the period 1963 through 1968. The year 1966 had the highest mean of all the years; 1963 and 1964 had the lowest means and were not significantly different from each other.

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[20] Price quotations were not available for November and December, 1966, and February and June, 1967, for Ogden, Utah.

TABLE 11.—Hog prices, years' means.[a,b]

Years	Ordered Array of Means Largest to Smallest
	DOLLARS
1966	24.65
1965	22.14
1967	20.29
1968	19.81
1963	16.25
1964	16.18

[a]Least significant difference is $.10.

[b]Years' means based on thirty public markets' yearly price quotations of U.S. No. 1-2, 200-220 pound barrows and gilts.

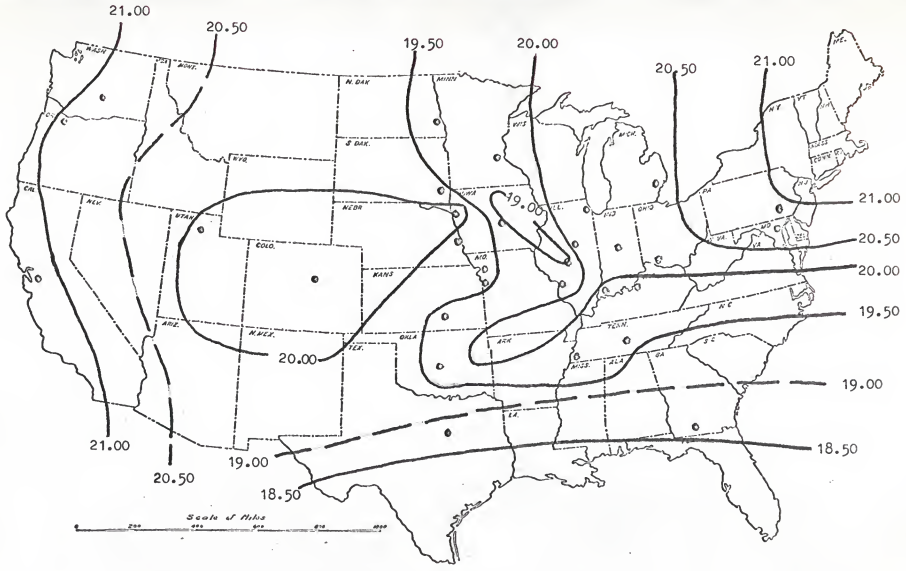
Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

Price Surface Maps - Thirty Selected Markets

In comparing the thirty public markets a graphical method can also be used. Figures 9 through 12 give price surface maps for the 1963-1968 average, 1966-1967 average, 1967-1968 average, and 1968. Price surface mapping is a fairly inaccurate art, but it does provide a simple graphic comparison. In this study a limited number of pricing points were available in some areas.

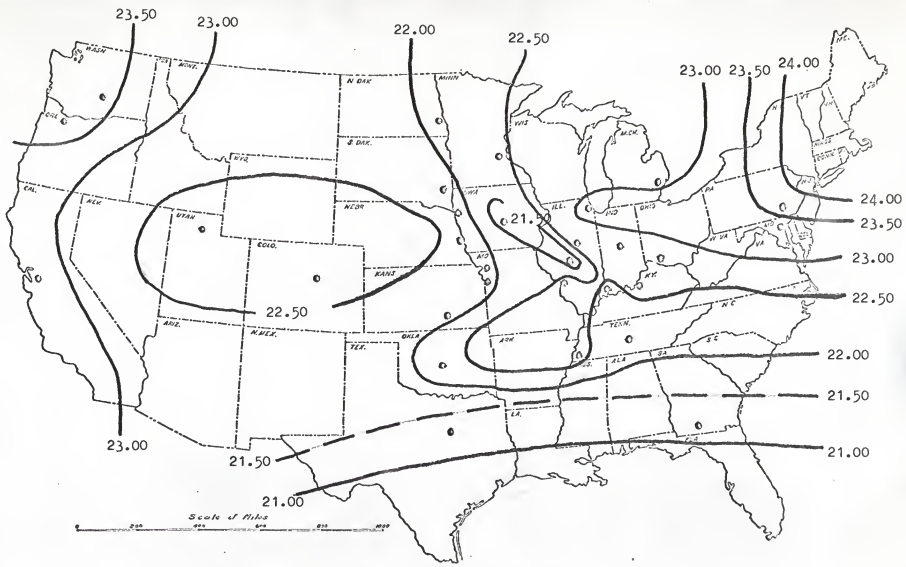
The iso-price lines in Figures 9 through 12 are separated by a difference of $.50.

As can be seen in each price surface map, the highest iso-price lines are in the New England area and the west coast area. Additionally high iso-price pockets occur in the Rocky Mountain region of the United States. A low iso-price pocket occurs in the interior Iowa-Illinois area. Southern coastal states comprise another relatively low priced region.



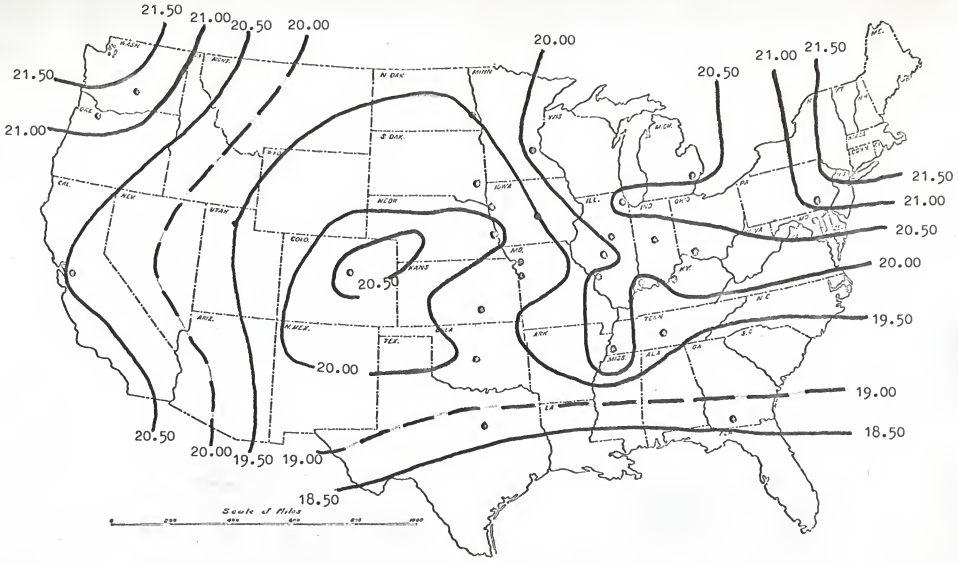
——— Indicates arbitrarily located iso-price line – a shortage of price reporting markets in these regions did not permit accurate mapping.

Fig. 9.—U.S. price surface map based on price quotations at thirty public markets, U.S. No. 1–2, 200–220 pound barrows and gilts. 1963–1968 average.



——Indicates arbitrarily located iso-price line – a shortage of price reporting markets in these regions did not permit accurate mapping.

Fig. 10.—U.S. price surface map based on price quotations at thirty public markets, U.S. No. 1-2, 200-220 pound barrows and gilts. 1966-1967 average.



——— ———Indicates arbitrarily located iso-price line – a shortage of price reporting markets in these regions did not permit accurate mapping.

Fig. 11.—U.S. price surface map based on price quotations at thirty public markets, U.S. No. 1-2, 200–220 pound barrows and gilts. 1967–1968 average.

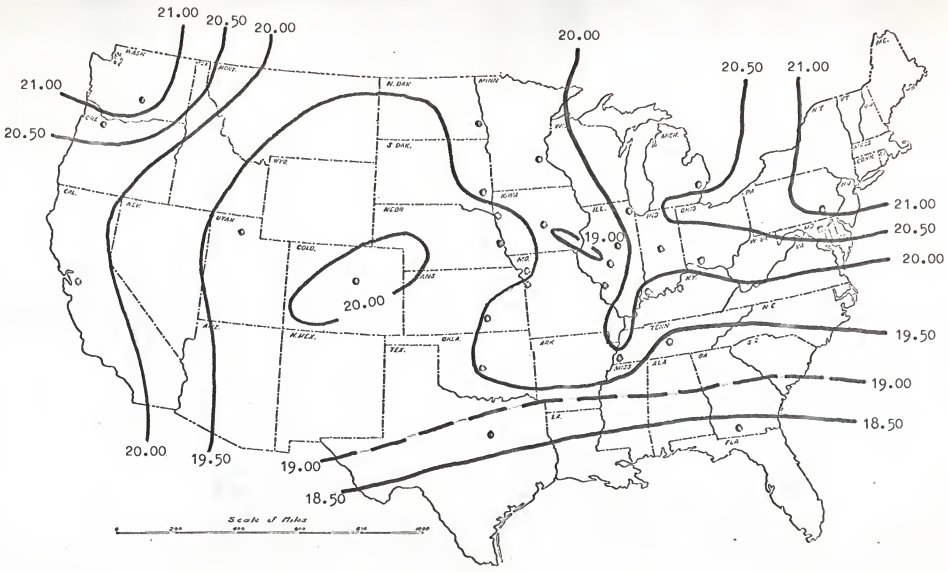


Fig. 12.—U.S. price surface map based on price quotations at thirty public markets, U.S. No. 1-2, 200-220 pound barrows and gilts. 1968.

Analysis of Variance of Eight Selected Markets

From the original thirty public markets, eight public markets were selected because of their proximity to Kansas. These markets are located at Wichita, Omaha, Denver, St. Joseph, Kansas City, East St. Louis, Chicago, and Oklahoma City. Table 12 gives the ordered array of means of eight public markets for 1968 based on monthly price quotations. Twelve cents was the statistical significant difference. There was no notable difference in the relative positions of the eight markets as compared to previous periods as shown in Tables 7 through 10.

TABLE 12.—Hog prices, eight public markets, 1968 mean.[a,b]

Years	Public Market Location	Ordered Array of Means Largest to Smallest
		DOLLARS
1968	Chicago, Illinois	20.31
	Denver, Colorado	20.12
	St. Louis, Illinois	19.91
	Omaha, Nebraska	19.83
	Oklahoma City, Oklahoma	19.56
	St. Joseph, Missouri	19.52
	Kansas City, Missouri	19.50
	Wichita, Kansas	19.43

[a]The least significant difference for 1968 is $.12.

[b]Means based on yearly price quotations in dollars per hundredweight of U.S. No. 1-2, 200-220 pound barrows and gilts.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

Price Differentials among Eight Selected Markets

Figure 13 gives the yearly average price differential among the eight public markets using Wichita market price quotations as the base. Since Wichita, Kansas, has the largest interior market in Kansas, it was used as the base in most of the analyses. Of particular interest here is a slight decline of price spread between Oklahoma City and Wichita. By using the 1966 and 1964 price quotations as the high and low years, respectively, it was possible to determine if the price spread increased with higher hog prices,[21] or decreased with lower prices. From Figure 13 it is apparent there is no consistency in market price differentials with variation in price level at least as measured by these two time intervals. Each market behaved differently with respect to the Wichita market in regards to price differentials. The markets of Omaha, East St. Louis, and Denver seem to be slightly increasing the price differential spread over Wichita. The Chicago market increased in the early part of the period but appeared to be slightly decreasing in the latter part.

Using these eight markets, a monthly and yearly price differential for different time periods was established using Wichita as the base. Tables 13 through 16 show the results of these computations. Table 13 gives the six-year average monthly price differentials for the eight public markets using Wichita as the base.

Oklahoma City in 1964 averaged thirty-six cents per month above Wichita while in 1968 it averaged only twelve cents. During the same

[21] See Table 11.

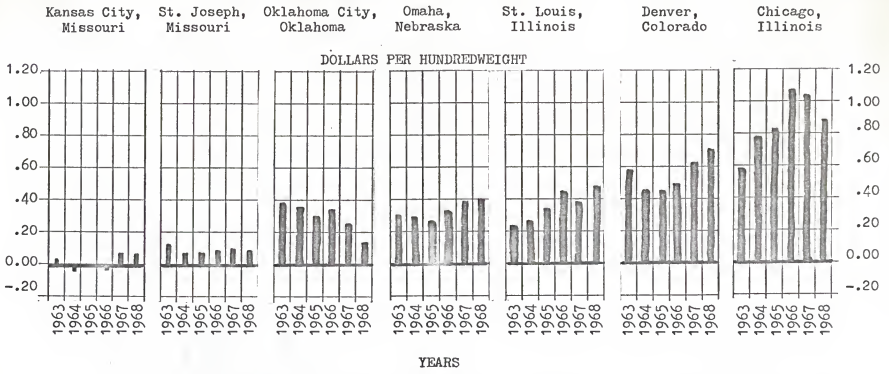


Fig. 13.—Yearly average price differential, eight public markets, U.S. No. 1-2, 200-220 pound barrows and gilts, Wichita as base equal to zero. 1963-1968.[a]

[a]Due to change in grade standards subsequent to July 1, 1968, quotation for U.S. No. 2-3, 200-220 pounds were comparable to former U.S. No. 1-2.

Source: Original data taken from U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 13.—Six-year average monthly price differentials, eight public markets, U.S. No.[a] 1-2, 200-220 pound barrows and gilts, Wichita as base equal to zero. 1963-1968 average.

Market	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.[b]
	DOLLARS PER HUNDREDWEIGHT												
Kansas City, Missouri	-.01	.02	.04	.07	.05	.04	.05	.00	-.04	.01	.02	.02	.02
St. Joseph, Missouri	.13	.14	.15	.19	.13	.07	.02	-.05	.03	.11	.10	.10	.08
Oklahoma City, Oklahoma	.46	.35	.24	.28	.19	.20	.19	.29	.33	.34	.32	.31	.29
Omaha, Nebraska	.34	.27	.25	.33	.32	.31	.46	.29	.27	.32	.28	.41	.32
St. Louis, Illinois	.20	.16	.25	.37	.41	.32	.20	.19	.48	.56	.63	.48	.35
Denver, Colorado	.60	.48	.45	.53	.51	.53	.65	.47	.57	.60	.55	.57	.54
Chicago, Illinois	.73	.60	.66	.89	1.06	.92	.75	.58	.87	.98	1.21	1.09	.86

[a]Due to change in grade standards subsequent to July 1, 1968, quotation for U.S. No. 2-3, 200-220 pounds were comparable to former U.S. No. 1-2.

[b]Based on twelve-month average price quotation.

Source: U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 14.—Average monthly price differentials, eight public markets, U.S. No. 1-2, 200-220 pound barrows and gilts, Wichita as base equal to zero. 1964.

Market	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.[a]
	DOLLARS PER HUNDREDWEIGHT												
Kansas City, Missouri	-.01	-.02	-.04	.00	-.05	-.06	.01	.01	.03	-.09	-.02	-.08	-.02
St. Joseph, Missouri	.18	.11	.06	.12	.02	-.03	.10	.08	-.01	.09	.08	.02	.07
Oklahoma City, Oklahoma	.35	.28	.33	.44	.31	.17	.16	-.06	.41	.59	.82	.46	.36
Omaha, Nebraska	.27	.23	.08	.21	.34	.33	.37	.28	.18	.36	.29	.37	.28
St. Louis, Illinois	-.02	-.03	.02	.30	.28	.29	.16	.19	.55	.38	.36	.44	.25
Denver, Colorado	.44	.43	.30	.49	.38	.48	.47	.28	.49	.58	.52	.49	.45
Chicago, Illinois	.46	.42	.44	.85	.92	1.12	.84	.59	.81	.92	1.03	.97	.78

[a]Based on twelve-month average price quotation.

Source: U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 15.—Average monthly price differentials, eight public markets, U.S. No. 1-2, 200-220 pound barrows and gilts, Wichita as base equal to zero. 1966.

Market	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.[a]
	DOLLARS PER HUNDREDWEIGHT												
Kansas City, Missouri	-.05	-.04	.01	.00	-.14	-.01	-.12	-.06	-.09	.16	.13	.08	-.01
St. Joseph, Missouri	.18	.14	.19	.22	.18	.09	-.03	-.06	-.10	.22	.02	.04	.09
Oklahoma City, Oklahoma	.50	.47	.42	.34	.18	.40	.00	.24	.33	.56	.25	.49	.35
Omaha, Nebraska	.47	.33	.30	.40	.30	.24	.16	.25	.20	.48	.24	.58	.33
St. Louis, Illinois	.32	.18	.39	.62	.53	.43	.10	.13	.49	.85	.74	.57	.45
Denver, Colorado	.84	.62	.42	.57	.47	.60	.65	.20	.08	.50	.31	.48	.48
Chicago, Illinois	1.00	.66	.89	1.32	1.42	.94	.51	.56	1.14	1.31	1.03	.68	1.09

[a]Based on twelve-month average price quotation.

Source: U.S. Department of Agriculture Livestock Detailed Quotations.

TABLE 16.—Average monthly price differentials, eight public markets, U.S. No. 1-2, 200-220 pound barrows and gilts, Wichita as base equal to zero. 1968.[a]

Market	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.[b]
	DOLLARS PER HUNDREDWEIGHT												
Kansas City, Missouri	.10	.16	-.01	.08	.11	.15	.12	.00	.12	.08	-.07	.06	.07
St. Joseph, Missouri	.11	.15	.08	.14	.13	.07	-.11	-.08	.15	.11	.13	.24	.09
Oklahoma City, Oklahoma	.19	.01	-.09	-.07	.07	-.10	.32	.48	.49	.29	.02	.00	.12
Omaha, Nebraska	.39	.32	.19	.31	.33	.37	.20	.27	.54	.25	.29	.45	.40
St. Louis, Illinois	.39	.28	.20	.42	.38	.45	.42	.58	.88	.62	.61	.38	.47
Denver, Colorado	.75	.61	.44	.58	.74	.71	.91	.60	.92	.61	.57	.54	.67
Chicago, Illinois	.81	.77	.61	.77	1.09	1.07	.83	.85	1.16	.97	.91	.76	.88

[a]Due to change in grade standards subsequent to July 1, 1968, quotation for U.S. No. 2-3, 200-220 pounds were comparable to former U.S. No. 1-2.

[b]Based on twelve-month average price quotation.

Source: U.S. Department of Agriculture Livestock Detailed Quotations.

two periods, Omaha averaged twenty-eight cents and forty cents respectively. East St. Louis, Denver, and Chicago showed similar gains in price differentials over Wichita.

Table 15 gives the average monthly price differentials for 1966. As noted in previous paragraphs, 1966 had the highest hog prices during the period under analysis. The highest monthly price differential occurred in May when Chicago was $1.42 above Wichita and $1.56 above Kansas City. The twelve-month average price differential between Wichita and Chicago was $1.09 in 1966. The twelve-month average price differential for 1963-1968, 1964, and 1968 were $.86, $.78, and $.88 for these two markets.

Comparing the 1964 and 1966 average yearly price quotations results in a very limited price spread increase for the markets at Kansas City, St. Joseph, Oklahoma City, Omaha, and Denver. But the East St. Louis market increased twenty cents while the Chicago market increased thirty-one cents in the price differential over Wichita.

The 1968 average monthly price differentials are shown in Table 16. The month of September gave the highest price differentials between Wichita and five of the other markets. The exceptions were St. Joseph and Kansas City.

SUMMARY

The Kansas swine industry since 1961 is growing at a rate exceeding that of the United States as a whole. In the area of January 1 hog numbers, Kansas has increased in its percentage share of the United States total each year during the five-year period of 1964 through 1968. The Kansas hog producer has increased his size of operation considerably in the past seven years. In addition to the increased size of operation, more hogs are being raised in the western section of Kansas. This western section is now up to or surpassing the hog numbers which existed in the early 1950's.

The purpose of this study was to analyze the market prices received for hogs in Kansas, to compare these prices with prices paid in other states, and to see if the price differential trend is changing. This entailed analyzing prices among spatially separated hog markets and developing an economic price landscape.

The major source of price data was price quotations collected and disseminated by U.S. Department of Agriculture Livestock News Service on specified grade and weight classifications of hogs from public markets throughout the United States.

From the price data source, in which thirty public markets had sufficient data that was applicable, the markets were divided into two groups for analytical purposes. These groups were (1) all thirty markets which were compared by analysis of variance, and (2) eight of the former including the Kansas markets and those immediately surrounding markets

which were compared by analysis of variance and by price differentials. Monthly and yearly price quotations were used.

It was found that the New England and west coast markets, followed by the markets in the large cities of Chicago, Indianapolis, and Detroit, had the highest price quotations. Through analysis of variance this study found Fisher Least Significant Differences among the arithmetic means of thirty public markets based on price quotations of live hogs of specific grade and weight during the period 1963-1968. The price quotations from the markets of Wichita, St. Joseph, and Kansas City statistically were not significantly different from each other. Of particular interest was the fact that the markets of Omaha, East St. Louis, and Denver, which are relatively close in distance to the Wichita, St. Joseph, and Kansas City markets, were statistically different from, i.e. higher than, the markets of Wichita, St. Joseph, and Kansas City. It should be pointed out, however, that a statistical difference does not necessarily indicate that one market is more profitable than another. Related costs must be taken into account in each situation.

Prices in the central regions of the United States tended to fall in the lower range of the market price quotations. Exceptions were markets in the large cities.

It was found that the price spread between Wichita and seven other markets did not increase significantly with higher hog price levels nor decrease significantly with lower hog prices. Over the time period studied, each market behaved differently with respect to the Wichita market. Monthly price differentials of eight selected markets for the six-year period ranged from $.05 under Wichita to $1.09 over Wichita.

The Ogden market position declined over the six-year period, while at the same time the West Fargo and South St. Paul markets increased their positions relative to Wichita.

Several changes in price differential spreads appeared to be taking place. There was a slight decline in the price differential spread between the Oklahoma City market relative to Wichita for the period examined. The markets of Omaha and Denver seem to be slightly increasing the price differential spread over Wichita, while the Chicago market appears to be slightly decreasing the price spread over the Wichita market in the last two years examined.

It should be pointed out that although markets are statistically different from each other, it does not necessarily indicate that it is more profitable to sell to the market with the highest price quotations. Marketing costs and associated costs must be taken into account.

Geographic or spatial differentials in hog prices are generally attributed to deficit and surplus areas with respect to production and consumption in the national market place plus movement costs. Another source of price variation could be imperfections in the market. These imperfections might be attributed to inadequate price information, inadequate information about transportation, time lags in the national market level of prices, time lags in demand and consumption information, and possible insufficient competition among hog buyers. This study made no attempt to analyze market imperfections.

Several factors place limitations on the findings of this study. First only one hog grade and weight classification was used. But by using only one grade and weight classification more consistent results

were obtained. The problem of using only thirty public markets also places limitations on the findings. However, this can be somewhat discounted because the news media daily broadcasts and publishes the price quotations from these markets, and they generally set a precedent for other markets.

Another factor which qualifies the findings is the fact that time period averages were used in the study. This problem is somewhat compounded when the averages are yearly averages. This limitation points out that the real extremes were not observed.

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SPATIAL PRICE DIFFERENTIALS FOR SWINE

by

GERALD WILLIAM ZIMMERMAN

B. S., Kansas State University, 1964

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1969

The purpose of this study was to analyze market prices received for live hogs in Kansas, to compare these prices with prices paid in other states, and to determine if the price differential trend is changing. This entailed analyzing prices among spatially separated hog markets and developing an economic price landscape for the six-year period 1963-1968.

The major source of price data was price quotations collected and disseminated by U.S. Department of Agriculture Livestock News Service on specified grade and weight classifications of hogs from public markets throughout the United States.

From this price data source, thirty public markets had sufficient data that was applicable; these markets were divided into two groupings for analytical purposes. These groupings were (1) all thirty markets which were compared by analysis of variance, and (2) eight of the former including the Kansas markets and those immediately surrounding markets which were compared by analysis of variance and by price differentials. Monthly and yearly price quotations were used. In order to obtain consistent and accurate results, grade and weight classification was held constant in so far as was possible with available quotations.

It was found that the New England and west coast markets, followed by the markets in the large cities of Chicago, Indianapolis, and Detroit, had the highest price quotations. Through analysis of variance this study found Fisher Least Significant Differences among the arithmetic means of thirty public markets based on price quotations of live hogs of specific grade and weight during the period 1963-1968. The level of significance was at the five percent level. The least significant range for all analysis of variance comparison was $.20 to $.33.

Statistically a twenty-three cent price difference indicated a significant difference over the six years, 1963-1968. The thirty-three cent significant difference occurred during the 1966-1967 period when hog prices were the highest.

The price quotations from the markets of Wichita, St. Joseph, and Kansas City statistically were not significantly different from each other. Of particular interest was the fact that the markets of Omaha, East St. Louis, and Denver, which are relatively close in distance to the Wichita, St. Joseph, and Kansas City markets, were statistically different from, i.e. higher than, the markets of Wichita, St. Joseph, and Kansas City. It should be pointed out, however, that a statistical price difference does not necessarily indicate that one market is a more profitable selling point than another.

The markets located in the west north central, east north central and south central regions of the United States tended to fall in the lower end of the price range of the thirty public markets for all the periods examined. Monthly price differentials of the eight selected markets for the six-year period using the Wichita market as the base ranged from $.05 under Wichita to $1.09 over Wichita.

Several changes in price differential spreads appeared to be taking place. There was a slight decline in the price differential spread between Oklahoma City market relative to Wichita for the period examined. The markets of Omaha and Denver seem to be slightly increasing the price differential spread over Wichita, while the Chicago market appears to be slightly decreasing the price spread over the Wichita market in the last two years examined.