AN ECONOMIC ANALYSIS OF THE GREATER KANSAS CITY MILK MARKET

by

LLOYD LESLIE WISEMAN

B. S., Kansas State College
of Agriculture and Applied Science, 1949

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics and Sociology

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1957

TABLE OF CONTENTS

INTRODUCTION

Milk marketing in large city markets has gradually evolved from conditions approximating pure competition to a much more complex structure. Formerly a large number of milk producers sold to many milk distributors. In some cases producers also bottled and distributed their own output. This elementary market structure gradually evolved into one with a few large distributors dominating the processing field. Associations of producers or farmer cooperatives then formed for the purpose of bargaining collectively with these few distributors. State laws favoring the cooperative movement were passed in eleven states during the years 1866 and 1877[1], but it was not until the early 1900's that state legislation to encourage the cooperative movement became generally accepted.

Cooperatives, however, still met with considerable opposition on the grounds that they violated the Sherman Anti-Trust Act. Only after the enactment of national legislation was the nature and legal right of the cooperative defined. The first national act of the above nature was the Clayton Act. Then in 1922 the Capper-Volstead Act was passed. Under this latter law farmers could bargain collectively to determine price and terms of sale.

As milk markets became more complex a market structure

---

[1]Henry H. Bakken and George Max Beal, Fluid Milk Marketing, Mimir Publishers Incorporated, Madison, Wisconsin, 1956, p. 202.

approximating bilateral monopoly developed.[1] The price to be paid in a fluid milk market, under conditions of bilateral monopoly, becomes within comparatively broad limits a question of relative bargaining power.

This type of competitive structure expanded rapidly in city milk markets during the latter part of the 1920's. Major metropolitan markets witnessed on one side the growth of strong producer cooperatives and on the other fewer and larger distributive organizations. The period of post World War I prosperity was marked by a rising demand for milk which placed farmers both collectively and individually in a strong bargaining position. At the same time large distributing firms acquired pasteurization plants and distribution facilities which enabled them to obtain substantial control over the marketing of milk. However, the impression before 1931 was that there was comparatively equal bargaining power between dealers and producer associations.[2] Producer associations were thus reasonably satisfied with their own ability to secure equitable pricing through collective action and were successful in preventing the disastrous price drops which beset the rest of agriculture in 1930 and 1931. This situation changed and became serious in 1932 and 1933 as fluid milk prices declined rapidly. This development caused producers to seek inclusion under the newly passed Agricultural Adjustment Act,

---

[1]Bilateral monopoly exists when a single seller disposes of his product to a single buyer.

[2]*Ibid.*, p. 249.

Title I, of the Farm Relief Act of 1933. The result was the introduction of the Federal government in the milk pricing field. Procedures and policies were established whereby producers and distributor bargained under governmental regulation.

This governmental supervision passed through several critical periods: first, issuance of marketing agreements; second, agreements by federal license with a market administrator appointed by the Secretary of Agriculture; and finally, market orders. The market order agreement provisions of the newly passed Agricultural Market Agreement Act of 1937 began to receive favorable Supreme Court action which the other farm acts of the 1930's had not been able to obtain.

Federal Milk Market Orders, as they are known today, trace their legal basis to the Agricultural Marketing Act of 1937. Fifty-six Federal Market Orders are now in effect in major markets over the United States. The population of the sales area of the 56 markets on the basis of the 1950 census represents nearly half of the urban population of the country.[1] In 1954 more than 186,000 farmers sold 27 billion pounds of milk to dealers who were required to pay the minimum prices established by these orders. The total value of the milk marketed under the program was over one billion dollars for the year.[2]

The increase in the number of Federal Milk Market Orders in

---

[1] _Federal Milk Market Orders and Amendments_, United States Department of Agriculture, April 1, 1955.

[2] _Loc. Cit._

recent years has been due in part to the expansion in urban population and in part by requests of producers of milk who needed a stable price for their products. Increased capital required to remain in a grade A fluid milk production coupled with increasingly strict health ordinances, have been strong pressures encouraging producers to seek inclusion in these orders to reduce price risks.

One of the major administrative problems arising under Federal Market Orders is to determine those factors affecting the price and quantity of milk delivered to the market. This study is concerned with these relationships, or the determination of the structural relationships in the market such as the supply and demand for milk, and consequently the price of milk.

An attempt was made to select relationships that will prove to be of practical significance for the prediction of a particular change in the market structure, such as governmental price subsidies or production controls. It is hoped that this will help as a basis for practical decisions by farmers, the government, and other interested parties. This study attempts to use existing data and points out its limitations. It will also show the need for the collection of additional data. This work will be more significant if it forms a basis for criticism and discussion leading to a more extensive attempt by an investigator to formulate assumptions with an even greater degree of accuracy.

Emphasis was based on finding relationships between dependent and independent variables to make possible an analysis of the market structure. The best possible economic relationships were selected and used in equations denoting inventory, production, demand, and supply relationships. The ultimate objective was to predict the values of economic variables and the consequences of economic policies. Thought was also given to the intermediate objective of providing an example of the formulation of economic relationships in a fluid milk market. This included consideration of a survey of data and examples of possible economic relationship by using available data.

THE PROBLEM

The Kansas City milk market is not typical of many agricultural markets. This market is confronted with problems of resource allocation in a market structure which departs substantially from that of a pure competition model. Thus resource allocation is determined by the provisions of the Federal Market Order under which minimum producer prices of fluid grade A milk are established after public hearings.

Under these conditions, knowledge of the structural relations of the market is needed. Assuming that the structural relations do not change, what are the effects of administrative decisions? Knowledge of structural relations and the effects of changes in price and other variables within this structure is the problem to which answers are sought in this study.

OBJECTIVES OF THE STUDY

The purpose of this study is to analyze the Kansas City milk market as it has operated under a Federal Milk Market Order from January, 1945 to December, 1955. Specifically, the objectives of this study are to determine:

1. An economic model which will show the important structural relations in the market.
2. Coefficients for independent variables in the various structural equations.
3. Predictions based on the estimated structural relations of assumed administrative changes in important variables in the model.
4. An inventory of pertinent measurement data for the variables of the model.
5. An inventory of measurement data required for more extensive and refined analysis of the problem.

THE ECONOMIC MODEL

A proposed economic model will be developed to explain basic economic relationships existing in the market area as previously defined. This model is admittedly crude but will be used as a starting point for further revisions and refinements. The model to be developed will outline the specific types of economic measurements desired to obtain estimates of the various structural relationships defined by the model. Measurements desired for use in the analysis of the proposed model are necessarily obtained from existing information in the market place. These measurements are generally computed for specialized administrative purposes. As a result, many of the measurements that are desired for use in the proposed model may not be available at the present time or they may be in a form unsuitable for the purposes of the model.

As a result, the model serves the useful purpose of defining rather explicitly measurement data that public agencies might well consider developing in the future. In addition, the process of seeking out the desired economic measurements in most instances suggests revisions or changes in the proposed model. It follows, then, that the model cannot be developed completely independent of an inventory of pertinent economic measurement if estimates of the unknown parameters of the structural relations in the market are to be obtained. For the purposes of this study a revision of the initial model proposed by Hildreth and Jarrett will be considered.[1]

The initial model proposed by Hildreth and Jarrett was as follows:[2]

(2.1) $h_t : p_{t-1}, q_{t-1}, s_{t-1}$ (inventory relation)

(2.2) $l_t : h_t, f_t, t$ (production relation)

(2.3) $p_t : l_t, y_t, n_t, r$ (demand for livestock products)

(2.4) $q_t : p_t, f_t, h_t$ (demand for feed)

---

[1]Clifford Hildreth and F. G. Jarrett, A Statistical Study of Livestock Production and Marketing, John Wiley and Sons, Incorporated, New York; Chapman and Hall, Limited, London, 1955, pp. 9-11.

[2]A different notation system is used in the subsequent analysis of the different models.

where h_t = number of animals on hand at the beginning of the t^{th} time period

p_t = price of livestock products (the t subscript will be used to denote the t^{th} time period throughout)

q_t = price of feed

l_t = quantity of livestock products produced during period (at this stage assumed equal to quantity sold

f_t = quantity of feed fed to livestock (at this stage assumed exogenous and equal to quantity produced

y_t = consumer income

n_t = population

r_t = index of other prices

s_t = unspecified factors affecting expectations of producers about conditions at t + 1

t = time

In the notation used above a colon means "depends on" while a comma means "and". Thus the production relation may be read, the quantity of livestock products depends on the number of animals on hand at the beginning of the t^{th} period, the quantity of feed fed during the t^{th} period, and time.

A parallel initial model for the Greater Kansas City milk market is proposed as follows:

$Y_{1t} = f_1(X_{1t-1}, X_{2t-1}, X_{3t-1})$ inventory relation

$Y_{2t} = f_2(Y_{1t}, X_{4t}, t)$ production relation

$X_{1t} = f_3(Y_{2t}, X_{5t}, X_{6t}, X_{7t})$ demand for milk

$X_{2t} = f_4(X_{1t}, X_{4t}, Y_{1t})$ demand for feed where Y_1 = estimated number of cows on farms January 1 in the Greater Kansas City milkshed whose milk output is delivered to the Greater Kansas City milk market.

X_1 = price in dollars per cwt of grade A milk at test, f.o.b. the Greater Kansas City milk market.

X_2 = price in dollars per bushel of No. 2 yellow corn in the Kansas City market.

X_3 = unspecified factors affecting producer expectations at period $t + 1$.

Y_2 = average daily deliveries of milk to the Greater Kansas City milk market at test.

X_4 = quantity of feed fed to dairy cows producing for the Greater Kansas City milk market.

t = time.

X_5 = index of consumer incomes in Greater Kansas City milk market.

X_6 = population in Greater Kansas City milk market.

X_7 = index of U. S. wholesale prices.

Before proceeding to the problem of actually estimating coefficients for the variables defined in the initial model of the Greater Kansas City milk market, we need to appraise the causal relationships in the model. This has important policy implications because we want to know the effect of changes in certain variables on other variables in the system. Changes of this type are sometimes made by administrative action in Federal Order Milk Markets much as the Greater Kansas City market. Some knowledge of the possible effects of these changes on other structural relations in the market, then, can be extremely useful in policy decisions.

In order to demonstrate the causal relationships in the initial model of the Greater Kansas City milk market, certain definitions are necessary. Since the particular model considered is a recursive model, the following definitions will be given:[1]

1. Recursive model - a causally ordered model whose complete subsets of various orders contain just one equation and one endogenous variable each. Example:

	V	W	X	Y	Z
1	X				
2	X	X			
3	X	X	X		
4	X	X	X	X	
5	X	X	X	X	X

2. Causally ordered model - a model that is <u>neither</u> minimal self contained nor unintegrated.

3. Minimal self-contained model - a model that is self contained, but does not have a subset of equations that is self contained.

4. Self-contained model - a model that has exactly as many variables as equations.

5. Unintegrated model - a model all of whose variables are included in <u>two</u> or more minimal self-contained subsets of the

---

[1]Definitions were obtained from mimeographed unpublished Econometrics class notes of Dr. Walter Fisher, Kansas State College, 1956.

equations of the model; i.e., the minimal self-contained sets could just as well be considered as separate models in isolation from each other.

6. Subset of equations of zero order - a minimal self-contained subset of some model.

7. Complete subset of equations of first order - a minimal self-contained subset in a derived model of the first order.

8. Derived model of the first order - a self-contained model derived from a larger causally ordered model by (1) solving explicitly for all variables within each complete subset of zero order, and (2) eliminating these variables from the model by substituting their values in the remaining equations.

9. Derived model of order K - a self-contained model derived from a larger causally ordered model by repeating the elimination process described in definition 8, K times, using successively the complete subsets of orders 0 to K - 1, inclusive.

10. Complete subset of order K - a minimal self-contained subset in a derived model of order K.

11. Endogenous variable in a model m (assuming that the equation of a model m forms a complete subset of order K embedded in a larger model M) - a variable that appears in m but that does not appear in any complete subset of M of order lower than K.

12. Predetermined variable in a model m - a variable that is not endogenous in the model.

13. Causal dependence - a variable, x, is said to be directly causally dependent on another variable, w ($w \longrightarrow x$) if x is endogenous in some model and if w is predetermined in that model.

One can list the equations of the initial recursive model with eight artificial equations added for the predetermined variables as follows:

1. $X_{1t-1} = X_{1t-1}$
2. $X_{2t-1} = X_{2t-1}$
3. $X_{3t-1} = X_{3t-1}$
4. $X_{4t} = X_{4t}$
5. $t = t$
6. $X_{5t} = X_{5t}$
7. $X_{6t} = X_{6t}$
8. $X_{7t} = X_{7t}$
9. $Y_{1t} = f_1(X_{1t-1}, X_{2t-1}, X_{3t-1})$
10. $Y_{2t} = f_2(Y_{1t}, X_{4t}, t)$
11. $X_{1t} = f_3(Y_{2t}, X_{5t}, X_{6t}, X_{7t})$
12. $X_{2t} = F_4(X_{1t}, X_{4t}, Y_{1t})$

In the above notation the first subscript for a variable refers to the name of the specific variable. The second subscript refers to the time period where t = the current time. The period t-1 is a previous time period and at this phase of the analysis is still undefined in terms of exact months or years.

The twelve equations in the initial Greater Kansas City model can now be presented in a two-way form where an x in the body of the Form 1 shows that a variable enters the equation with a non-zero coefficient.

From definition 6, equations 1 through 8 form subsets of equations of zero order; that is, in these equations it is not possible to derive a subset of equations in which there are as

Form 1. Array of variables showing equation in which variable appears and the order of the various subsets of equations.

Eq. No.	X_{1t-1}	X_{2t-1}	X_{3t-1}	X_{4t}	t	X_{5t}	X_{6t}	X_{7t}	Y_{1t}	Y_{2t}	X_{1t}	X_{2t}
1	X_0											
2		X_0										
3			X_0									
4				X_0								
5					X_0							
6						X_0						
7							X_0					
8								X_0				
9	X	X	X						X_1			
10				X	X				X	X_2		
11						X	X	X		X	X_3	
12				X					X		X	X_4

many equations as there are unknowns.

Equation 9 is a subset of the first order according to the criteria set forth in definitions 7 and 8. By the same reasoning, equation 10 is of the second order, and similarly for equations 11 and 12.

Establishment of the particular order of the subset of equations is necessary to define endogenous variables in the system according to the criteria of definition 11. For example, Y_{1t} appears in the first order equation 9. However. Y_{1t} does not appear in any equation of order less than 1 in the complete model. Therefore, Y_{1t} is endogenous. Similarly, Y_{2t} appears in the second order equation number 10, but does not appear in any first order equation. Therefore, Y_{2t} is endogenous in equation 10. The same criteria can be used for defining X_{1t} and X_{2t} as endogenous.

Causal dependence in the system of equations can now be outlined in Fig. 1 by applying the criteria of definition 13; that is, a variable x is said to be directly causally dependent on another variable if X is endogenous in some model and w is predetermined in that model. Thus in Fig. 1, X_{1t-1}, X_{2t-1}, X_{3t-1}

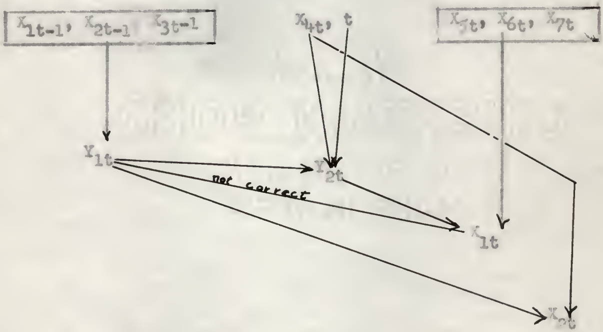


Fig. 1. Structural relations of supply and demand for milk in the Kansas City milk market.

are predetermined variables for Y_{1t}. That is, Y_{1t}, or the number of cows in the Greater Kansas City milk market, is said to be directly caused by X_{1t-1}, X_{2t-1}, and X_{3t-1}. Similarly, Y_{2t} is said to be directly dependent on X_{4t} and t. Likewise, X_{1t} is directly dependent on X_{5t}, X_{6t}, and X_{7t}. Y_{2t}, while directly dependent on X_{4t} and t, is also dependent on Y_{1t}. Also, X_{1t} is directly dependent on X_{5t}, X_{6t}, X_{7t}, and Y_{2t}. Finally, X_{2t}, or the price of No. 2 yellow corn, is directly dependent on Y_{1t}, X_{1t}, and X_{4t}. The diagram in Fig. 1 makes it possible to determine what effects changes in one variable will have on other variables in the system. For example, changes in X_{5t} (consumer income) influence X_{1t} (the price of milk), and eventually X_{2t}, the price of No. 2 yellow corn. However, current changes in the price of corn will have no effect on other variables in the system. It is only as current changes are introduced into the system as past prices of corn X_{2t-1}, that a causal relationship between other variables in the system can be described.

The value for policy reasons of setting forth explicitly the causal relations in the system is immediately apparent when certain of the variables may in the future be subject to administrative change.

STATISTICAL ASSUMPTIONS

The least squares method of estimating the unknown parameters in the initial model of the Greater Kansas City milk market can be used if certain assumptions are made.

> "If one assumes that unobserved random disturbances that enter the relations are serially independent, then lagged values of the variables may be regarded as

predetermined.[1] If (2.1) were written as an expression linear in known functions[2] of the observed variables and an additive random disturbance, unknown parameters in the expression can be estimated by least squares. If a similar expression is written for (2.2) and the disturbance in (2.2) is assumed to be serially independent and independent of the disturbance in (2.1),[3] then h_t may be regarded as predetermined in (2.2), and least squares methods will give unbiased estimates of parameters in (2.2)[4]. Likewise, if the disturbances in linear expressions for (2.3) and (2.4) are independent of each other and of disturbances in the preceding equations, then l_t may be regarded as predetermined in (2.3), p_t and f_t may be regarded as predetermined in (2.4), and

---

[1]A variable is predetermined at time t if the random disturbances that enter relations at time t are distributed independently of the variable. In models with serially independent disturbances, both exogenous and lagged endogenous variables are predetermined. See T. C. Koopmann, When Is an Equation System Complete for Statistical Purposes? Statistical Inference in Dynamic Economic Models, Cowles Commission Monograph 10, p. 406, and T. C. Koopmann and William C. Hood, op. cit., pp. 120-125.

[2]Logs of observed variables or squares and cross products of observed variables are most common examples.

[3]The estimation problems that would be encountered if the investigator did not assume independence of disturbances have been discussed by Lawrence R. Klein in A Textbook of Econometrics, Row Peterson and Co., 1953, pp. 112-117.

[4]Clifford Hildreth and F. G. Jarrett, A Statistical Study of Livestock Production and Marketing, John Wiley and Sons, Inc., New York, 1955, pp. 13-14.

least square methods are appropriate for these equations also.

INVENTORY OF DATA

The ideal data to be used for the models might best be obtained by controlled experiment. It is impossible, however, to set up a controlled experiment because of the vast number of forces at work over a large area, the cost, and the general impracticality of controlled social and biological phenomena over time.

Presented here is an inventory of data considered to be essential to the solution of the economic model. Some choices of different data series existed for some variables, whereas for other variables appropriate data were not available at all or only in a limited form. One main objective of this study is to determine if data were available and to appraise the possibilities of obtaining data which are not available at the present time. An inventory of the data variables is now listed.

X_{1t} Ratio of 3.8 per cent blend price of milk to top price of 900-1100-pound good butcher steers, Kansas City, monthly, January, 1944 through December, 1955.

X_{2t} Farm wage rates in Kansas with board, monthly, January, 1944 through December, 1955.

X_{2ta} Farm wage rates in Kansas with board, monthly January, 1944 through December, 1955 rounded to nearest dollar.

X_{3t} Effective consumer buying power Kansas City greater metropolitan area, monthly, January, 1944 through December, 1955.

X_{4t} Population of the Kansas City greater metropolitan area, monthly, January, 1944 through December, 1955.

X_{5t} Index of wholesale prices, monthly, January, 1944 through December, 1955.

X_{6t} Time in real numbers, each month numbered consecutively, January, 1944 through December, 1955.

X_{7t} Average prices paid by Kansas farmers for all mixed dairy feeds under 29 per cent protein, monthly, January, 1944 through December, 1955.

X_{10t} Kansas pasture conditions by crop reporting districts, average of northeast and east central districts, monthly, April, 1944 through November, 1955 (as a per cent of normal).

X_{11t} Population by age groups, monthly, January, 1944 through December, 1955.

X_{12t} Cash corn prices, Kansas City, monthly and annual averages of the daily high of No. 2 mixed corn, nominal quotations January, 1944 through December, 1955.

X_{13t} Price of top No. 1 alfalfa hay per ton, Kansas City, monthly. January, 1944 through December, 1955.

X_{14t} Top price of good butcher steers, 900-1100 pounds at Kansas City, monthly, January, 1944 through December, 1955.

X_{15t} Ratio of 3.8 per cent blend price of milk to price of top No. 2 mixed corn on the Kansas City market, monthly, January, 1944 through December, 1955.

X_{16t} Estimated monthly average milk production per cow for Kansas, January, 1944 through December, 1955.

X_{17t} Kansas hay equivalent of all roughage fed per milk cow, average pounds per day, monthly, October through May winter feeding period, 1944 through 1955.

X_{18t} Retail price index, monthly, January, 1944 through December, 1955, United States.

X_{19t} Cottonseed meal top prices Kansas City, monthly, January, 1944 through December, 1955.

Y_{1t} Estimated number of producing milk cows in the greater Kansas City metropolitan milkshed, monthly, January, 1944 through December, 1955.

Y_{2t} Average daily pounds of producers' deliveries of milk for the greater Kansas City market, monthly, January, 1944 through 1955.

Y_{3t} Average daily milk production per cow, per day, using weighted average Dairy Herd Improvement Association data from selected Kansas counties, monthly, January, 1944 through December, 1955.

Y_{4t} Grains and concentrates fed per milk cow, per day, in herds kept by dairy reporters in the west north central region of the United States, monthly, January, 1944 through December, 1955.

Y_{5t} Blend price paid farmers for 3.8 per cent milk, f.o.b., the Greater Kansas City milk market, including premiums paid, dollars per hundred-weight, monthly, January, 1944 through December, 1955.

Ratio of Blend Price of Milk to Price of Good Butcher Steers

This series (Appendix Table 17) was calculated by dividing the blend price of milk for each month (Appendix Table 18) by the price of good butcher steers for the same month (Appendix Table 9).

Farm Wage Rates, Kansas

Farm wage rates with board and without board, were available by quarters from the Bureau of Agricultural Economics, Division of Statistics, Kansas State Board of Agriculture.

To obtain a monthly series, straight-line interpolation was used between quarters. It was believed that labor costs on dairy farms were best represented by using wage rates with board (Appendix Table 2).

Consumer Income

The consumer income series of monthly data, for 1948 to 1955, represents the estimates of consumer effective buying power taken from Sales Management magazine. These data are for the metropolitan Kansas City area.

It was impossible to obtain any other direct estimate of consumer income for the Kansas City area. Data available were given in Sales Management starting January 1, 1948, on an annual basis. Straight-line interpolation could be used to estimate consumer income in intervening months. (Figures given are available on a per family or per capita basis.)

Population of Marketing Area

The population series of data is by month for 1944 through 1955 (Appendix Table 3). This is the population of people living in what the United States census defines as the Kansas City metropolitan area. This area coincides partially with the milk marketing area. The metropolitan area includes the four counties Wyandotte and Johnson in Kansas, and Clay and Jackson in Missouri, whereas the milk market area includes all territory in Jackson County, Missouri, that part of Clay County, Missouri, south of highway 92, beginning at the Platte County and Clay County line, east to west section line of Section 26, east to the Clay and Ray County line, Lee, Waldron, May, and Pettis Townships in Platte County, Missouri, Wyandotte County, Kansas, Shawnee and Mission Townships in Johnson County, Kansas, and Delaware, Leavenworth, and that part of Kickapoo and High Prairie Townships east of the 95 principal meridian in Leavenworth

County, Kansas.

It was impossible to obtain a population series which was taken yearly or monthly by actual census. The best data available were annual figures as of January 1 for each of the years between the decimal Federal census as given by Sales Management.[1] The monthly data prepared for this study were obtained by linear interpolation from annual figures as given by Sales Management. The yearly figures for 1950 were in agreement with the Federal census taken for that year, and figures before and after 1950 are measurement of population by factors calculated by the research department of Sales Management.

Index of Wholesale Prices, United States

The index of wholesale prices is taken from monthly data 1944 through 1955. It is used as an indication of change in the general price level. The figures were computed by the U. S. Department of Labor with 1947-49 = 100 as a base for all commodities (Appendix Table 4). The index of wholesale prices is compiled from national figures, and consequently is used with some reservation for the Kansas City market.

---

[1] Sales Management, "Survey of Buying Power," annual spring issue, published by Bill Brothers Publishing Corp., 34 North Crystal St., East Stroudsburg, Pa.

Average Prices Paid for All Mixed Dairy Feeds

This series is compiled from average prices which Kansas dairy farmers paid for all mixed dairy feeds each month of the year, January, 1944 through December, 1955 (Appendix Table 5). This is a Kansas average price as determined for all dairy feeds under 29 per cent protein by the Bureau of Agricultural Economics, Division of Statistics, Kansas State Board of Agriculture.

Pasture Conditions, Kansas

Kansas pasture conditions are available by crop reporting districts. Pasture condition is reported as a per cent of what is considered to be normal pasture conditions. Data were obtained from crop reporters. The series compiled for this study was obtained by averaging conditions reported for the northwest and east central crop reporting districts of Kansas. The Kansas City milkshed area lies partially in these districts. Data were compiled for the months of April through November in each of the years 1944 through 1955 (Appendix Table 6). In months when no pasture condition was reported, a value of 1.0 was inserted for purposes of computation.

Population by Age Groups

Population by age groups was available to a limited degree. Data were available for total recorded births in Kansas City.

Kansas and Kansas City, Missouri for the years 1941 through 1955 inclusive, as given by the Bureau of Vital Statistics for each of the two Kansas City's.

Population data showing distribution of population as a trend were available through records of the Kansas City, Kansas and Kansas City, Missouri school systems. These records show the number of school children in each of the grades, kindergarten through high school, for each year 1944 through 1955.

Corn Prices, Kansas City

Corn prices for each month of the years 1944 through 1955 were used as one of the cost factor indicators of the changing profitability of grade A milk production. These prices were nominal top cash No. 2 mixed corn taken from the Kansas City Board of Trade yearbook and the Kansas City Grain Market Review (Appendix Table 7).

Alfalfa Hay Prices, Kansas City

The alfalfa hay price series is for No. 1 alfalfa hay at Kansas City and is given as monthly averages from 1944 through 1955 inclusive (Appendix Table 8). These prices were compiled from records of the Grain Branch, Production and Marketing Division, USDA.

Prices of Good Butcher Steers, Kansas City

Top prices for good butcher steers, 900 to 1100 lbs, were used in inventory and/or supply functions. The butcher steer price series is by month, 1944 through 1955 inclusive, at the Kansas City Livestock Market (Appendix Table 9).

Ratio of Blend Price of Milk to Price of Corn

This series (Appendix Table 10) was calculated by dividing the blend price of milk (Appendix Table 18) for each month by the price of corn (Appendix Table 7) for the same month.

Kansas Monthly Average Milk Production per Cow

Monthly average production of milk per cow in Kansas is given by this data series 1944 through 1955 inclusive (Appendix Table 11). Data are not available for the Kansas City area as such. These data are the average production per cow per month as computed by the Kansas Crop Reporting Service.

Number of Cows in Milk in the Kansas City Milkshed

The average number of cows in milk for each month, 1944 through 1955, for the Kansas City milkshed was calculated by dividing average daily producer deliveries of milk by the average daily production of milk per cow per day (Appendix Table 13). Average daily milk production per cow was obtained from Dairy Herd Improvement Association records.

Average Daily Producer Deliveries of Milk

Average daily producer deliveries of milk in the greater Kansas City market were calculated by taking the sum of total daily delivery for that month and dividing this product by the number of days in the month (Appendix Table 14). This gives one figure as the average pounds of milk delivered per day by months, 1944 through 1955. This series was compiled and audited through the office of the Market Milk Administrator, Kansas City Milk Market, Federal Order Number 13.

Average Daily Milk Production per Cow

Average daily milk production per cow for each month was calculated from Kansas Dairy Herd Improvement Association records Appendix Table 15). Associations selected included counties which are a part of the Kansas side of the Kansas City milk market production area. These counties are Atchison, Brown, Doniphan, Douglas, Franklin, Jackson, Jefferson, Johnson, Leavenworth, Linn, Miami, and Shawnee.

The average daily milk production per cow could easily be obtained from these selected combined association reports for each of the months, 1944 through December, 1955, with the exception of the years 1944 and 1945. The data for the months in the years for which primary Dairy Herd Improvement Association data were not available were estimated by a method of straight linear interpolation from the monthly figures, 1942 to 1946, for each month respectively of 1944 and 1945. This was done since no Dairy Herd Improvement Association production data were available for these months.

Blend Price Paid Farmers for 3.8 Per Cent Milk

This price series begins January, 1944, and continues monthly through 1955, giving the blend price (including premiums) paid to farmers for 3.8 per cent milk (f.o.b.) Kansas City milk market (Appendix Table 18). These prices represent the actual history of the market in regard to blend prices farmers received for milk.

Grains and Concentrates Fed per Milk Cow

This price series gives the average pounds of grains and concentrates fed per milk cow per day for each month, 1944 through 1955 inclusive (Appendix Table 16). These were the average amounts fed per day as reported to the United States Department of Agriculture by crop reporters in the West North Central region of the United States. Lack of comparable data for the Kansas City area necessitated use of regional data.

Retail Price Series, Monthly,
United States, 1944 - 1955

A consumer price series is available by month, 1944 through 1955, with a base period of 1947 - 49 = 100. This series was computed by the United States Department of Labor.

Cottonseed Meal Price Series, 1944 - 1955

The price available is an average of the daily quotations of cottonseed meal on the Kansas City market, by month. The monthly average price is from January, 1944 through December, 1955.

Kansas Hay Equivalent

Total hay equivalent (Appendix Table 12) fed to milk cows, as given by Kansas dairy reporters, was available for the winter feeding period, October through May of each year, 1944 through 1955, as tons fed per cow. These figures were converted to pounds fed per cow and prorated as a daily average amount fed from the October to May winter feeding season for each of the years 1944 through 1955. Figures .001 were inserted only for purposes of computation.

PROPOSED EQUATIONS FOR ANALYSIS

Structural Equations Proposed

Logically there are several alternative forms of the various structural equations that can be considered. There is no way of determining the "best" equation without actually computing the various alternative forms. Selection of a particular equation ultimately depends on which equation conforms most closely with economic logic.

In the sections which follow, the various equations will be given in general form. Where lagged values of the variables are indicated, sub functions will be proposed indicating specific values of the lags. Since all observations are for monthly data, the lag notation refers to number of months in all cases.

Inventory Relation.[1] The following inventory equations were proposed as alternative inventory functions:

(1) $Y_{1t} = f_1(Y_{1t-i}, X_{1t-j})$

where
(1_a) $i = 12,\ j = 6$
(1_b) $i = 12,\ j = 12$
(1_c) $i = 24,\ j = 18$
(1_d) $i = 24,\ j = 24$
(1_e) $i = 36,\ j = 30$
(1_f) $i = 36,\ j = 36$

---

[1]Variables defined in the Inventory Section.

(2) $Y_{1t} = f_2(Y_{1t-i}, Y_{5t-k})$

where (2a) $i = 12, k = 6$

(2b) $i = 12, k = 12$

(2c) $i = 24, k = 18$

(2d) $i = 24, k = 24$

(2e) $i = 36, k = 30$

(2f) $i = 36, k = 36$

(3) $Y_{1t} = f_3 (Y_{1t-i}, X_{1t-j}, X_{2t-m})$

where (3a) $i = 12, j = 6, m = 6$

(3b) $i = 12, j = 12, m = 12$

(3c) $i = 24, j = 18, m = 18$

(3d) $i = 24, j = 24, m = 24$

(3e) $i = 36, j = 30, m = 30$

(3f) $i = 36, j = 36, m = 36$

(4) $Y_{1t} = f_4(Y_{1t-i}, Y_{5t-k}, X_{12t-n}, X_{13t-p})$

where (4a) $i = 12, k = 6, n = 6, p = 6$

(4b) $i = 12, k = 12, n = 12, p = 12$

(4c) $i = 24, k = 18, n = 18, p = 18$

(4d) $i = 24, k = 24, n = 24, p = 24$

(4e) $i = 36, k = 30, n = 30, p = 30$

(4f) $i = 36, k = 36, n = 36, p = 36$

(5) $Y_{1t} = f_5(Y_{1t-i}, X_{1t-j}, Y_{5t-k}, X_{2t-m}, X_{12t-n}, X_{13t-p})$

where (5a) $i = 12, j = 6, k = 6, n = 6, m = 6, p = 6$

(5b) $i = 12, j = 12, k = 12, n = 12, m = 12, p = 12$

(5c) $i = 12, j = 18, k = 18. n = 18, m = 18, p = 18$

(5d) $i = 24, j = 24, k = 24, n = 24. m = 24, p = 24$

(5e) $i = 36, j = 30, k = 30, n = 30, m = 30, p = 30$

(5f) $i = 36, j = 36, k = 36, n = 36, m = 36, p = 36$

As will be noted in the section in inventory of pertinent variables, direct estimates of number of milk cows in milk on farms of producers delivering in the Greater Kansas City milk-shed are not available. Indirect estimates of the number of cows were attempted for exploratory purposes. The technique of computing these numbers is discussed in the section dealing with inventory of variables. However, this method results in some confounding of numbers of milk cows and changes in output if the rate of production per cow differs sharply in the DHIA herds and the herds supplying the Greater Kansas City market.

In certain of the production equations which will be listed in the next section, the number of milk cows as computed above is used. Strong arguments can be made for merely using lagged output instead of the estimated cow numbers. However, for the present it is believed that there is merit in estimating a production function using the estimated cow numbers as a variable.

Production Relation. The following production equation is proposed:

$$(1) \quad Y_{2t} = f_1(Y_{1t}, Y_{4t}, X_{10t}, X_{17t}, X_{6t})$$

An outstanding difficulty in formulating the production equation was lack of data for important variables influencing the production process. Indexes of pasture conditions are crop reporters' estimates of available pasture as a per cent of normal, and at best are crude approximations of the quantity of pasture nutrients entering the milk production process. Roughage data (X_{17}) apply only to the winter feeding period and were prorated equally to each month of the winter feeding period. Logic for the above allocation was based on the notion that producers start the winter feeding period with a fixed quantity of roughage and try to distribute this equally over the winter feeding period. Errors will be introduced to the extent that supplemental supplies are purchased and pasture feeding reduces the quantity of roughage fed in certain months.

Grain and concentrate estimates are not available for the Greater Kansas City area and reliance has to be placed on the West North Central estimates for this variable.

Further, quantitative data are not available on the amount of labor entering the milk production process. In addition, estimates were not readily available for capital services used in this activity.

Demand for Milk Relation. Several alternative formulations of the demand for milk equation are proposed. No lags in the variables have been indicated although lags might well be considered in further alternative equations, particularly in the indexes of consumer income.

(1) $Y_{5t} = f_1(Y_{2t}, X_{3t}, X_{4t}, X_{5t}, X_{6t})$

(2) $Y_{5t} = f_2(Y_{2t}, X_{3t}, X_{11t}, X_{5t}, X_{6t})$

(3) $Y_{5t} = f_3(Y_{2t}, X_{4t}, X_{5t}, X_{18t}, X_{6t})$

Demand for Feed Grains Relation.

(1) $X_{12} = f_1(Y_{5t}, Y_{1t}, Y_{4t})$

(2) $X_{7t} = f_2(Y_{5t}, Y_{1t}, Y_{4t})$

(3) $X_{7t} = f_3(Y_{5t}, Y_{1t}, Y_{4t}, X_{13t}, X_{10t}, X_{19})$

Several alternative demand functions for feed grain seem desirable but are not adapted to a recursive model. For example, in the above equations for feed grains the assumption is made that pasture and roughage fed are equal to the quantity of milk produced. Concentrate prices are also unexplained. Additional equations for other types of models will be suggested in a later study and will include separate functions explaining the price of dairy concentrate mixes, pasture rental rates, and hay prices.

To summarize the above section, one equation from each of the structural relations was selected to form a recursive model that may be useful as a starting point in the analysis of the structural relations in the Greater Kansas City milk market. The selection presented below is merely for illustration purposes at this time as a final determination would be based on logic as well as a review of the estimates derived in the statistical computations.

$Y_{1t} = f_1(Y_{1t-i}, X_{1t-j}, X_{2t-m})$ inventory relation

$Y_{2t} = f_2(Y_{1t}, Y_{4t}, X_{10t}, X_{17t}, X_{6t})$ production relation

$Y_{5t} = f_3(Y_{2t}, X_{4t}, X_{5t}, X_{18t}, X_{6t})$ demand for milk relation

$X_{7t} = f_4(Y_{5t}, Y_{1t}, Y_{4t}, X_{13t}, X_{10t}, X_{19})$ demand for feed grains relation

Economic Logic for Independent Variables

The proposed equations for analysis presented in the preceding section were based on economic logic. Where these equations do not explain the market relationships satisfactorily, it may be due to several reasons. As will be pointed out in the graphic analysis, all factors or causes are intermingled so that there is not a simple, clear-cut relationship of cause and effect between two variables. Often, as in this model, many variables have mutually determining effects. There is the possibility of using wrong data series in an equation to represent the economic logic presented. For example, instead of corn prices at Kansas City being the appropriate measurement, it may be that total production of corn in the area would provide a better index. There is the possibility that variables representing the influential costs which a dairy farmer considers in his production plans are not included. Some of the data represent averages for regional, state, or for a particular segment of the economy, and thus might not be applicable to the Kansas City milk production area.

Many side influences may be greater than expected. Measurement data at present are incomplete and what are available may be subject to errors of observation.

In framing the right economic logic, there is involved economic and social phenomena, biological changes of cows coupled with the psychological expectations of the milk producer. There also may be other factors in the post-war period 1944-55 which have influenced the changing pattern of dairy production to an equal degree or to a greater degree than the selected economic variables.

The attempt is made in the present study to search out data which are thought best applicable to the economic premises: that dairy farmers are mobile in their ability to change from one enterprise to another; that technological development in dairying has not had any advantageous influences on basic economic allocation of resources that was not also equally shared by other farm enterprises; that farmers' main goals are to maximize their income; and that within a short period of time the effects of relative adverse cost conditions will cause the dairy producer to alter his plans for future production, either to increase it or to decrease it as cost conditions might dictate.

The major contribution that this study may make is to stimulate further effort in the gathering of necessary measurement data. Economic logic is difficult to refute, yet many relationships based on this logic may prove statistically insignificant. This indicates that not only is economic logic vital, but that its use is limited until the data which adequately represent this logic are known and made available.

This section of the analysis concerns itself with a discussion of the variables in the model as they appear in the equations postulated from economic logic.

The Inventory Relation. The first inventory function considered was:

$$(1)\quad Y_{1t} = f_1(Y_{1t-i},\ X_{1t-j})$$

where Y_{1t} = the number of producing milk cows in the Kansas City area

Y_{1t-i} = the number of producing milk cows at some previously stated period

X_{1t-j} = the ratio of 3.8 per cent blend price of milk to top price of 900- to 1100-pound good butcher steers

It was felt that if the number of producing cows was to be explained adequately, some provision should be made to take into account the number of cows in the area previously. It would seem logical that the number of cows today would to a degree explain the number in a future month or year. Let us first set up the proposed lags that will portray relationships such as are being sought, i = 12, i = 24, and i = 36. The number of milk cows in production changes seasonally; therefore to have a correct lag it was necessary to use 12-month intervals, or some multiple of 12. This in effect takes out seasonal change (Appendix Table 13). It will be noted that seasonal cycles occur at 12-month intervals.

Independent variable X_{1t-j} is the ratio of the blend price of milk to the top price of good butcher steers (Appendix Table 17). It is assumed that dairy farmers are influenced as to their future actions not only by the prices they receive and by costs, but also by the prices that are being paid to other livestock enterprises. The blend price to beef price ratio, if low, would encourage beef production and decrease milk production. If the ratio is high, economic logic would tell us that more producers would be in a better economic position by continuing the production of milk than they would by changing to any other farm enterprise. This assumes that beef production is the major alternative.

The number of milk cows at the t-time period has been the result of decisions made in some previous time period. Farmers become aware of favorable or unfavorable economic conditions for the production of milk and base their future plans on this present expectation concerning the future. Thus the number of animals on hand at the t-time period is dependent on past prices of livestock, past prices of feeds, and other factors affecting producers' expectations concerning the profitability of current milk production. In the inventory equations all independent variables have lagged values.

$$(2)\quad Y_{1t} = f_2(Y_{t-i}, Y_{5t-k})$$

This equation contains the prices farmers received for their milk at some time previous to the t-time period. Economic logic is that the price farmers receive in the previous time periods will influence their expectations as to the profitability of future milk production. Favorable prices would induce plans to increase future milk production, and conversely. Seasonal fluctuation is allowed for by selecting lags for k of 6-month intervals.

The 36-months lag would provide time for the milk producer to add to the producing herd by having saved back heifer calves. This assumes that this may be one of the important methods by which cow numbers are increased. This is not entirely true since favorable prices also induce farmers to cull cows less severely, or to go outside the production area and purchase producing cows.

$$(3)\quad Y_{1t} = f_3(Y_{1t-i}, X_{1t-j}, X_{2t-m})$$

Equation (3) contains the variables Y_{1t} and X_{1t} as does equation (1). The independent variable X_{2t}, farm wage rates with board (Appendix Table 2), brings into the function the cost of employing additional labor to increase production to the most profitable size of operation. Dairying, being a year around program, has a steady demand for labor. This labor may be supplied entirely by the farm family, or, as is quite likely during certain periods of the year, it is necessary to hire additional labor harvesting hay, silage, and grain for the winter feeding season. Thus labor costs may affect the amount of production either because of unprofitability of hiring help to maintain large dairy operations, or because the cost of help on a seasonal basis may be the factor cost which makes the dairy enterprise unprofitable. The question of what labor return the dairy producer himself should receive depends in part on the prevailing rate of labor charges. Economic logic for lags has been discussed above and is applicable to farm wage rates.

$$(4) \quad Y_{1t} = f_4(Y_{1t-i}, Y_{5t-k}, X_{12t-n}, X_{13t-p})$$

Independent variable X_{12t-n}, corn cash prices (Appendix Table 7), represents one of the major costs of a dairy ration. The dairy ration is composed primarily of grain, pasture, and/or hay and silage. Corn more nearly represents the grain cost of a dairy ration than does any other grain, especially in the Kansas City area. Thus corn prices were used as one indicator of the comparative cost relationships in the production of grade A fluid milk. The cost of grain, in this case No. 2 mixed corn, comprises the major cost in any ration fed to dairy cows. The principal variable cost of milk production is feed.

As the corn-hog ratio is an indication to farmers of the profitability of feeding hogs, it was felt that the price of corn may help explain inventory and production functions.

Price of No. 1 alfalfa hay baled per ton, 13_{t-p}, is used to indicate the roughage cost in a dairy ration as corn was used to indicate the grain cost. It is the cost of relationships of feed factors which at a price determined for fluid grade A milk determines the profitability of its production.

It was felt that alfalfa hay represented roughage used in the dairy ration better than other kinds of hay. The producer cannot withhold milk from the market once it is produced; however, the profitability of milk production, as determined by production costs, would be an important influence upon the decision of milk producers either to increase or reduce future output.

$$(5) \quad Y_{1t} = f_5(Y_{1t-i},\ X_{1t-j,5t=k},\ X_{2t-m},\ X_{12t-n}, X_{13t-p})$$

The final revised inventory equation contains all of the variables previously discussed. It is an inventory equation containing the variables, the numbers of cows in a previous time period, prices farmers receive for milk, opportunity costs comparing dairy and beef production, and the indications of profitability of milk production by including the cost of corn, farm wage rates, and alfalfa hay.

Production Relation. The production relation considered was:

$$Y_{2t} = f_1(Y_{1t},\ Y_{4t},\ X_{10t},\ X_{17t},\ X_{6t})$$

In this model production of milk in any given year is regarded as being primarily determined by the amount of feed fed to milk cows in that year and the number of cows on the farm. This implies a relation among three variables--production of milk, quantity of various feeds fed, and number of animals in the present time period inventory. It is recognized that there have been improvements in breeds of animals and feeding practices which have made possible a gradual increase in production from given herds and feed supplies. Logically, this gradual improvement in production could be considered to be a smooth function over time and could be allowed for in an empirical study by introducing time X_{6t} into the production relationship.

Demand for Milk Relation. The demand for milk relation was:

(1) $Y_{5t} = f_1(Y_{2t}, X_{3t}, X_{4t}, X_{5t}, X_{6t})$

(2) $Y_{5t} = f_2(Y_{2t}, X_{3t}, X_{11t}, X_{5t}, X_{6t})$

(3) $Y_{5t} = f_3(Y_{2t}, X_{4t}, X_{5t}, X_{18t}, X_{6t})$

These proposed relationships may contain the variables necessary to predict changes in the demand for milk. Unfortunately, however, much of the essential data is unavailable or, if available, only on an estimated annual basis. This is true for X_{3t}, X_{4t}, and X_{11t}. Economic logic would tell us that all of these variables are needed to predict correctly the demand for milk relationship.

STATISTICAL ANALYSIS

Graphic Analysis

As stated in the section on Problem and Objectives, one of the methods used in this study is graphic presentation of relationships between variables which are presumed to be associated. Merits of graphic analysis are simplicity and convenience of procedure. Unfortunately, this procedure is limited to two dimensions so that in any one graph the values of only two variables can be presented at a time. While techniques have been developed whereby correlation among more than two variables can be determined by graphic analysis, this requires the drawing of several graphs for each determination and naturally is more complicated than simple (2-variable) graphic analysis.[1] In this study graphic analysis was confined to two variables. Multiple relationships are shown by mathematical procedures in a later section entitled Statistical Analysis.

Changes in milk cow numbers by month for the Kansas City milk market area are shown in Plate I. To furnish background and perspective, data on milk cow numbers are shown from 1934 to 1955. The period studied was from 1944 to 1955. This chart shows that the number of milk cows was relatively stable from 1935 to 1940, but from 1940 to 1955 the general trend in numbers has been consistently upward. In so far as milk cow numbers are associated with time, in general, increases during the period studied appear to form a relationship which is practically linear. However, considerable variation is noted within years. The obvious regularity with which numbers increased during the mid-year period of each year and then declined, clearly reveals a seasonal tendency for milk cow numbers to increase during the months in which pasture is more abundant.

This study, as was mentioned in the discussion of the model, is concerned with isolating the factors which are associated with

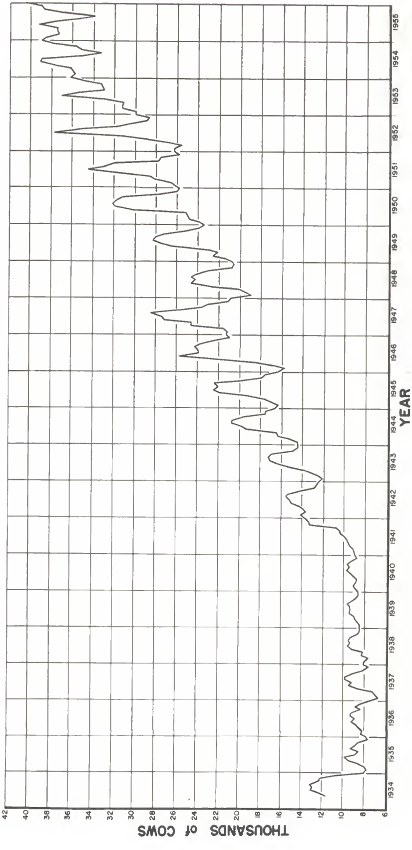
---

[1]Richard J. Foote, The Mathematical Basis for the Bean Method of Graphic Multiple Correlation, Journal American Statistics Association, No. 48:778-799, 1953.

EXPLANATION OF PLATE I

The change in the number of producing milk cows in the Kansas City milk market, monthly, April, 1932 through December, 1955.

PLATE I


THOUSANDS of COWS
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
YEAR
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955

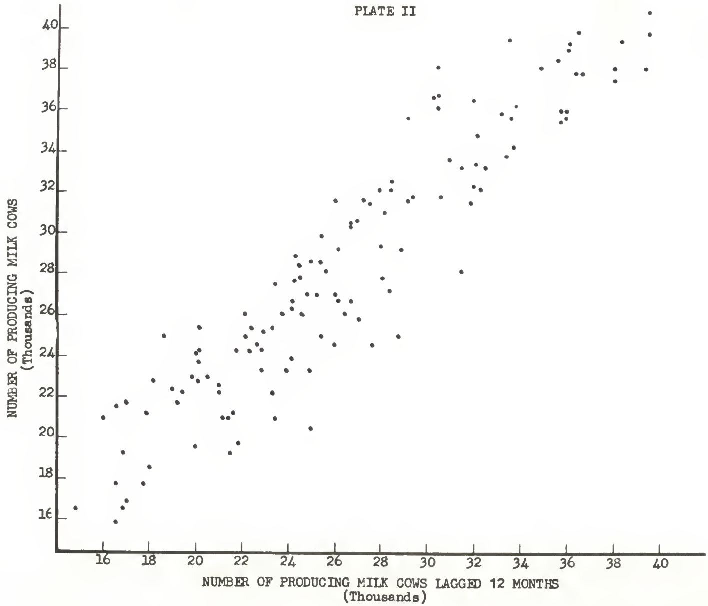
or responsible for these changes in milk cow numbers. This has been referred to as the inventory relationship. It is logical to expect that milk cow numbers at a given time are influenced by the number of milk cows in inventories at a previous time. To obtain a visual presentation of such a possible relationship, the number of cows at time t, i.e., Y_{t1}, was plotted against the number at time t-12, or twelve months earlier, i.e., Y_{t-12}. This is shown in Plate II. It is apparent from the graph that the number of cows at a given time is associated to a high degree with the number on hand 12 months earlier. This, of course, does not preclude other factors also influencing or being associated with milk cow numbers.

Another factor which might be presumed to influence cow numbers is the expected price of milk, or, more precisely, the price of milk relative to alternative products which a farmer might produce. In this study a measure of the relative price of milk was calculated by determining the ratio of milk price to the top price of good butcher steers (Appendix Table 17). In the decision making process farmers probably, either explicitly, or implicitly, project expectations into the future. If projected expectations of relative milk price could be obtained, they would be preferred. However, no such measures are available. In lieu of this, relative milk price at a given time is assumed to be that which farmers expect in the future, and hence the price upon which decisions are made in increasing or decreasing cow numbers. If this assumption is correct, an increase in cow numbers might logically follow a time of relatively favorable milk prices. In

EXPLANATION OF PLATE II

The relationship of the number of producing milk cows at a given time to the number of producing milk cows in inventories at a 12-months previous time for the Kansas City milk market, monthly, 1944 through 1955.

PLATE II


NUMBER OF PRODUCING MILK COWS
(Thousands)
40
38
36
34
32
30
28
26
24
22
20
18
16
16
18
20
22
24
26
28
30
32
34
36
38
40
NUMBER OF PRODUCING MILK COWS LAGGED 12 MONTHS
(Thousands)

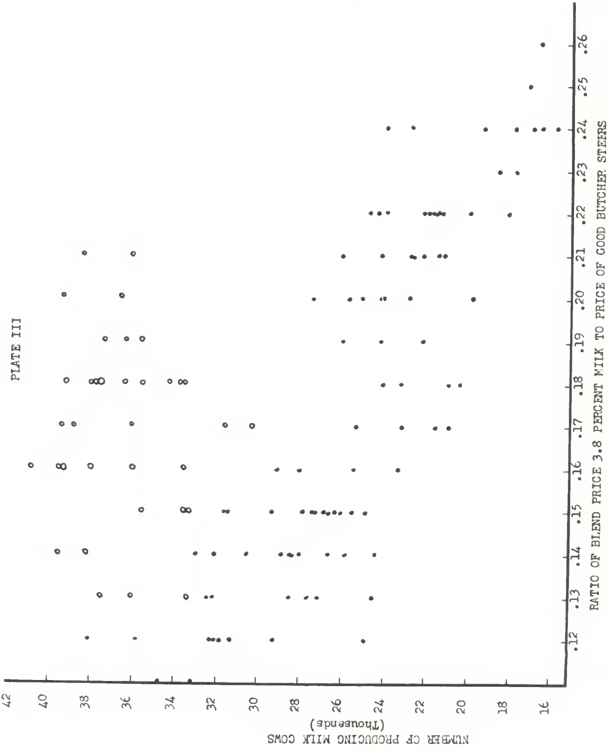
other words, as the ratio of milk price to price of good butcher steers increased, the number of milk cows might increase after the lapse of whatever time is needed to obtain more cows. The reverse procedure might follow a decline in the ratio. For analytical purposes a time lag of 12 months was chosen. Plate III shows the plotted values of cow numbers at a given time, i.e., Y_{1t}, and the ratio of milk prices to good butcher steers lagged 12 months, i.e., X_{1t-12}.

The anticipated relationship was not clearly revealed in this graph. The values falling in the lower part of the graph appeared to indicate an inverse relationship, while those in the upper part showed a fairly high degree of irregularity. This prompted a closer examination of the data to see if the two groups of values could be distinguished in any respect. It was found that the values in the lower part of the graph, shown as solid dots, were primarily from the period 1944 to 1951 inclusive, and that the values in the upper part were primarily from the years 1952 to 1955 inclusive. The apparent inverse relationship from 1944 to 1951 cannot be explained on a logical basis. It indicates that as the price of milk became more favorable relative to the price of good butcher steers, farmers tended to decrease the number of milk cows. The reverse would be expected. This suggests either that producers were economically irrational with respect to milk prices in making decisions regarding an increase or decrease in milk cow numbers, or that some other factor of greater magnitude in the decision making process was influencing their actions. Some factors which might enter such decisions are

EXPLANATION OF PLATE III

The ratio of the 3.8 per cent blend price of milk to top price of good butcher steers relative to the number of producing milk cows in the Kansas City milk market, monthly, 1945 through 1955.

PLATE III


NUMBER OF PRODUCING MILK COWS
(Thousands)
42
40
38
36
34
32
30
28
26
24
22
20
18
16
.12
.13
.14
.15
.16
.17
.18
.19
.20
.21
.22
.23
.24
.25
.26
RATIO OF BLEND PRICE 3.8 PERCENT MILK TO PRICE OF GOOD BUTCHER STEERS

costs of feed and costs of hired labor which may have changed even more than milk prices.

In the latter part of the period, which is indicated by circles in the upper part of the graph, there is no apparent relationship between these two variables. It may be concluded that a difference existed between these two periods but the reason for the difference is not apparent. However, it does suggest that possibly these two periods should be analyzed separately. It suggests also that the lagged value of the ratio of milk price to the price of good butcher steers used in aggregate in a statistical analysis will not explain cow numbers to a significant degree.

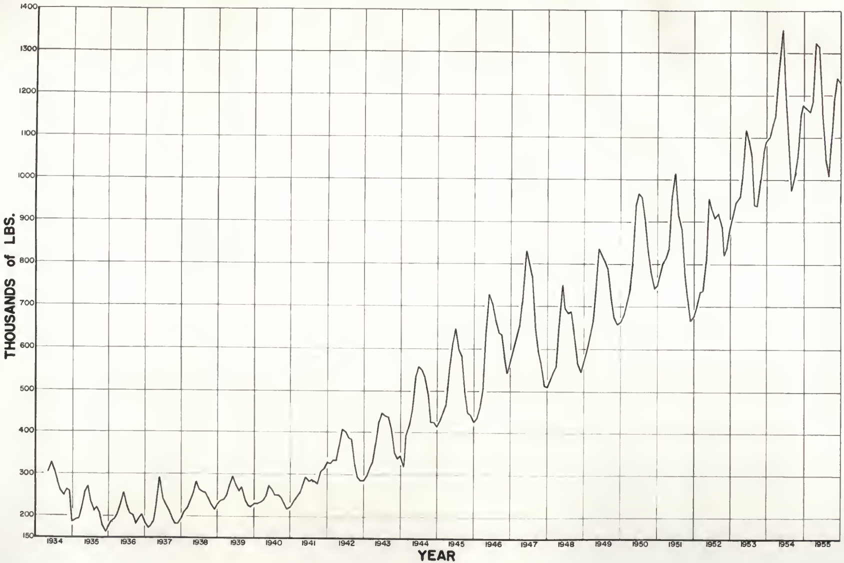
Milk production in the Kansas City milk market area followed essentially the same trend from 1934 to 1955 as did milk cow numbers (Plate IV). This was to be expected since milk production logically is presumed to be a function of milk cow numbers. However, milk production might also be expected to be associated with such things as rate of feeding, quality of ration, including pasture conditions, and progress in breeding programs. This reintroduces another aspect of the problem under study--namely, the production relationship.

Plate V is presented to show more precisely the relationship between milk production, i.e., Y_{3t}, and milk cow numbers, i.e., Y_{1t}. This diagram shows a high degree of relationship. Milk production appears to be a direct linear function of the number of milk cows. This is indicated by the apparent lack of curvilinearity in plotted values. Again, the relationship shown in a

EXPLANATION OF PLATE IV

The average daily pounds of producers' deliveries of milk for the Greater Kansas City milk market, by month, April, 1934 through December, 1955.

PLATE IV

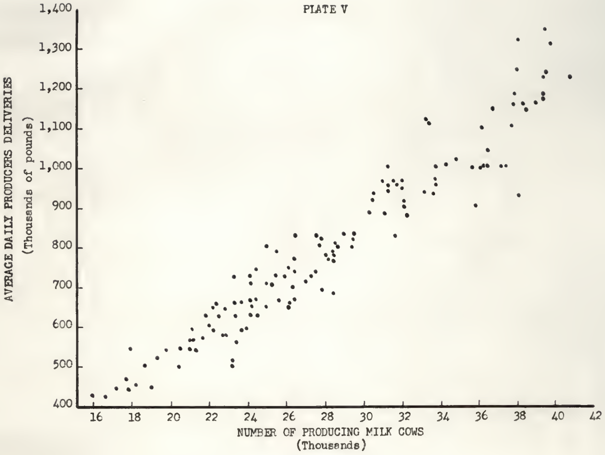


THOUSANDS of LBS.
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
150
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
YEAR

EXPLANATION OF PLATE V

The relationship of the average daily pounds of producers' deliveries of milk to the number of milk cows in the Greater Kansas City milk market, by month, 1945 through 1955.

PLATE V


AVERAGE DAILY PRODUCERS DELIVERIES
(Thousands of pounds)
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
16
18
20
22
24
26
28
30
32
34
36
38
40
42
NUMBER OF PRODUCING MILK COWS
(Thousands)

simple two-variable graph does not preclude the proposition that other factors may influence milk production.

The quantity of grain and concentrates fed is believed to be a factor which would influence milk production. Data available on grain and concentrates are on a per cow basis. Since cow numbers varied throughout the period, a valid comparison necessitates that milk production also be on a per cow basis. Plate VI was prepared to show the relationship between average daily milk production per cow, i.e., Y_{3t}, and grain and concentrates fed, i.e., Y_{4t}.

Inspection of this diagram reveals a rather broad tendency for milk production to increase as the quantity of grain and concentrates fed increases. The substantial scatter of plotted values indicates considerable variability and a weak relationship.

Pasture conditions also are presumed to influence milk production. As in the case of grain and concentrates fed, a valid comparison necessitates that pasture conditions, i.e., X_{10t}, be related to milk production per cow, i.e., Y_{3t}. Values of these two variables are plotted in Plate VII. Pasture conditions are reported only for the months of April through November; therefore only those months could be shown graphically.

The wide scatter of plotted values on Plate VII indicates no apparent relationship between pasture conditions and milk production. This raised the question as to the possibility that some other factor might have offset the influence of pasture conditions. The most logical assumption is that grain and

EXPLANATION OF PLATE VI

The relationship between average daily milk production per cow and grains and concentrates fed per cow, by month, 1945 through 1955.

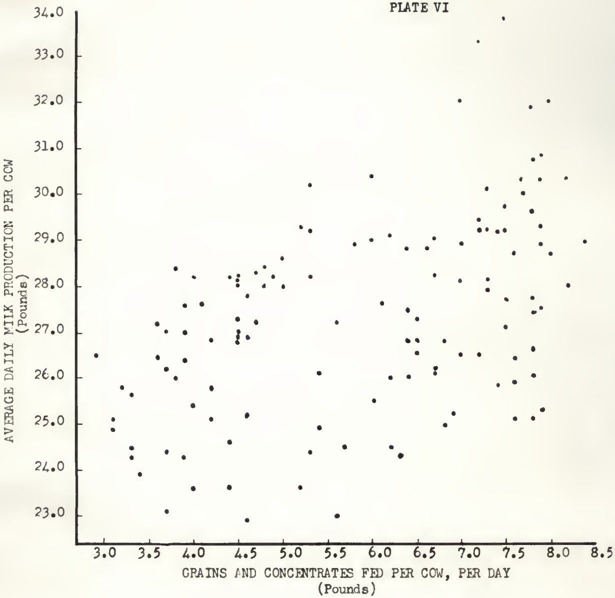
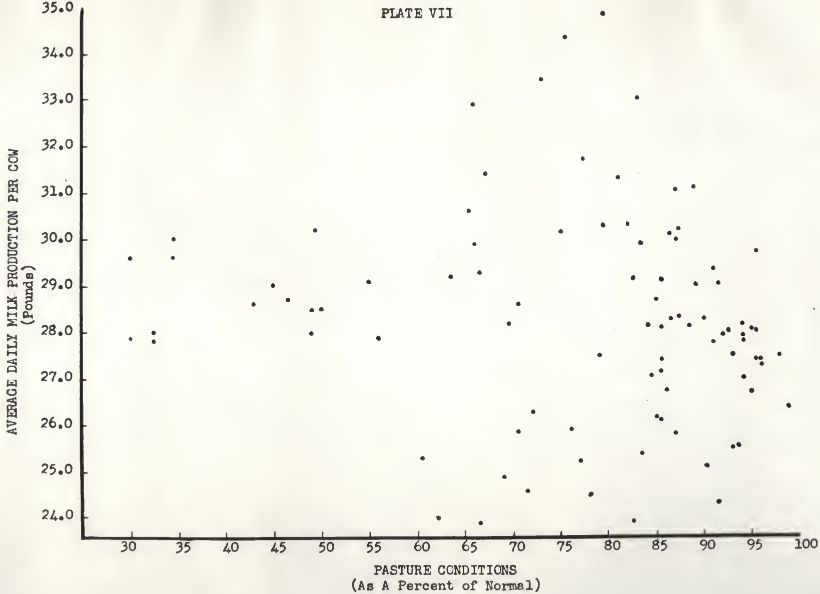


PLATE VI
34.0
33.0
32.0
31.0
30.0
29.0
28.0
27.0
26.0
25.0
24.0
23.0
AVERAGE DAILY MILK PRODUCTION PER COW
(Pounds)
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
GRAINS AND CONCENTRATES FED PER COW, PER DAY
(Pounds)

EXPLANATION OF PLATE VII

The relationship of pasture conditions to average daily milk production per cow for the months of April through November, 1945 through 1955.

PLATE VII


AVERAGE DAILY MILK PRODUCTION PER COW
(Pounds)
35.0
34.0
33.0
32.0
31.0
30.0
29.0
28.0
27.0
26.0
25.0
24.0
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
PASTURE CONDITIONS
(As A Percent of Normal)

concentrate feeding might have been varied inversely with pasture conditions in order to maintain milk production. If this were the case, one would expect to find an inverse relationship between pasture conditions, i.e., X_{10t}. and grain and concentrates fed, i.e., Y_{4t}. Plate VIII was prepared to test the relationship between these two variables.

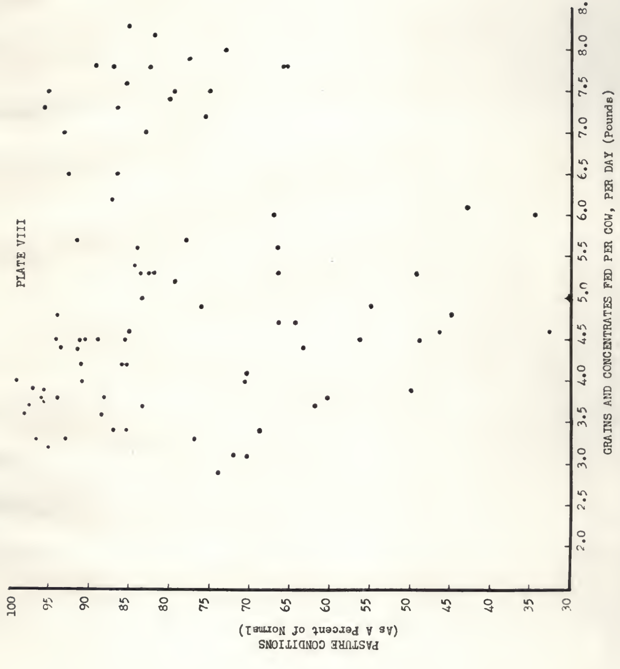
Observation of values plotted in Plate VIII indicates an almost complete lack of relationship. As mentioned in connection with discussion of other of these two-variable graphic presentations, it is recognized that other factors did not remain constant and may have been disturbing influences. For example, the cost of grain and concentrates may have varied in a manner to influence feeding regardless of pasture conditions. Hay or roughage feeding may have been varied instead of grain and concentrates.

Additional graphic relationships could be shown. Others were prepared which are not reported here. The graphic analysis includes only those relationships which economic logic indicated would be most closely associated with milk cow numbers and milk production in the Kansas City milk market area. This analysis indicates that milk cow numbers at a given time are closely associated with milk cow numbers 12 months earlier, and to a lesser extent with the relative price of milk 12 months earlier. Milk production appears to be closely associated with milk cow numbers (which, as just mentioned, are in turn influenced by milk prices), and to a minor extent by grain and concentrates fed.

EXPLANATION OF PLATE VIII

The relationship between pasture conditions (as a per cent of normal) and grains and concentrates fed for the months April through November, 1945 through 1955.

PLATE VIII


PASTURE CONDITIONS
(As A Percent of Normal)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
GRAINS AND CONCENTRATES FED PER COW, PER DAY (Pounds)

Estimation of Parameters

Regression Equations: Cobb-Douglas functions which are linear in the logarithms of observations were fitted to the data. The functions have the form $Y = aX_1^{B_1} X_2^{B_2} X_3^{B_3} \ldots X_n^{B_n}$. The dependent variable Y refers to the value of the output and the independent variables (the X's) refer to the value of resource inputs used.

The B's or the regression coefficients represent elasticities for the various independent variables, indicating the percentage increase in the dependent variable for each one per cent increase in the independent variables in question when other independent variables are held constant or ceteris paribus.

The following equations were estimated by least squares multiple regression analysis:

Inventory (1) $Y = 2.4384\ X_1^{.927125},\ X_2^{.046773}$

Inventory (2) $Y = 2.7357\ X_1^{.919435},\ X_2^{.067045}$

These two equations are the different forms of the inventory equation. In both equations cow numbers are related to cow numbers one year earlier. In both equations cow numbers are also related to the blend price-butcher steer price ratio. In equation one, cow numbers are related to the ratio existing 12 months earlier, while in equation two cow numbers are related to the ratio existing six months earlier.

Elasticity coefficients for the data along with associated statistics of analytical interest are presented in Table 1.

The elasticities have the following interpretation. A one

Table 1. Regression coefficients and associated statistics. Levels of significance for regression coefficients and multiple correlation coefficient, Kansas City milk market, 1944-1955.

Type of statistic	Function (1)	Function (2)
Value of a, log form	0.3871104	0.4370714
Value of a, arithmetic form	2.4384307	2.7357184
Value of b (elasticities)		
Y_{1t-12}	0.927125	0.919435
X_{1t-6}		0.067045
X_{1t-12}	0.046773	
Calculated t values		
Y_{1t-12}	24.140[a]	29.905[a]
X_{1t-6}		1.738[b]
X_{1t-12}	1.044[b]	
R, Multiple correlation coefficient	.9378	.9387

a-Significant at the one per cent level; b-non-significant at the 20 per cent level.

per cent increase or decrease in the number of cows in the inventory Y_{1t-12} will give .927125 per cent (equation 1), or .919435 per cent (equation 2) increase in cow numbers 12 months in the future.

A one per cent increase or decrease in the ratio X_{1t} blend price of milk to butcher steers can be expected to produce an increase or decrease of .046773 per cent in cow numbers 12 months in the future (equation 1), or a .067045 per cent increase or decrease in cow numbers six months in the future (equation 2).

These two inventory functions put the greater part of future change in producing milk cows on the 12 months previous inventory of producing milk cow numbers.

The standard errors of elasticities are shown in Table 1. The calculated t-values were significant at the one per cent level for X_{1t-12} in both equations (1) and (2). However, X_{2t-6} and X_{2t-12} were not significant at an acceptable level. Multiple correlation coefficients were both significant as presented in Table 1 at the one per cent level.

EVALUATION

To properly study the Greater Kansas City milk market, it was necessary to gain an understanding of the special characteristics of Federal Order milk markets. With this understanding it was possible to construct a model showing the structural relations that might characterize this market. The model consisted of four equations: inventory, production, demand for milk, and demand for feed grain. Alternative forms were presented for each relation.

These proposed relations are as follows:[1]

$Y_{1t} = f_1(Y_{1t-1}, X_{1t-j}, X_{2t-m})$ inventory relation

---

[1]For the definitions of these variables see the inventory section.

$Y_{2t} = f_2(Y_{1t}, Y_{4t}, X_{10t}, X_{17t}, X_{6t})$ production relation

$Y_{5t} = f_3(Y_{2t}, X_{4t}, X_{5t}, X_{18t}, X_{6t})$ demand for milk

$X_{7t} = f_4(Y_{5t}, Y_{1t}, Y_{4t}, X_{13t}, X_{10t}, X_{19t})$ demand for feed grains

The above system of equations is defined to be a recursive model and each of the relations can be solved one at a time in successive order, starting with the inventory relation. An important aspect of the analysis was to determine the causal relations that existed in a model similar to the one above of the Greater Kansas City milk market. By this means it is possible to establish logically the likely consequences of changes in important variables in the model, assuming that the structural relations do not change.

The model suggested the data necessary for an empirical solution. An important contribution of this study was to assemble and interpret these data. Many data were not immediately available in a form useful for the model. That made it necessary to construct certain series that were believed adequate for the analysis. In a few cases it was not even possible to construct some of the necessary series of data.

A survey of relevant information for suggested variables of the preliminary model is an important feature of studies of this type. That is, the model as finally used is always conditioned by the data available. In some cases the data restriction may be so severe that a logical model cannot be solved empirically. In such instances studies of this type have considerable significance in establishing criteria for the types of data to be collected by statistical agencies if solutions to economic problems of this nature are to be obtained. In general, certain of the sales and price data in the Greater Kansas City milk market are adequate for the analysis. However, there is a paucity of input data for fundamental production functions. A major program needs to be established by agricultural data collection agencies to obtain accurate estimates of the inputs of feed grains, hay, other roughages, pasture, labor, and capital services for specific market areas. Output data for the same areas need to be established. Moreover, outside of Federal Order markets, output data now collected for milk production is of little value. This is due to the fact that grade A output is pooled with manufacturing output, resulting in a meaningless economic aggregation.

Accurate inventory data on the number of milk cows by specific productive capacities need to be established for the market areas considered in the other data collection processes. Similar data problems exist for other relevant economic relations, such as the demand for milk.

One of the outstanding needs for studies of this type is an accurate description of the framework in which enterpreneurs develop their various decision processes.

At the present time data for a particular variable may be usable but its area of inference is totally unrelated to accurate data collected on another variable. That such a condition exists is to be expected since most of the present government data collecting services have not designed their programs to solve well conceived economic problems. However, recent studies likely will result in an improvement in these collection programs.

Estimated values for all the parameters in the proposed system of equations were desired. However, this analysis was restricted primarily to an appraisal of the inventory relation.

The inventory relation was first appraised by a graphic analysis technique. In many respects the inventory relation is more complex than the static production function considered in the model because dynamic influences are involved. The primary concern was with the inventory relation due to the fact that an estimate of cow numbers is required in the formulation of the aggregate proposed production function.

The basic notion involved in the inventory relation is that producers will vary the number of cows on farms from some previous base. The problem was proposing and estimating the expectation system by which these changes in cow numbers are brought about. A ratio of the price of milk to an assumed alternative price of good butcher steers was proposed as a measure of the factors which influence producers' inventory decisions.

During 1944 to 1951 there was inverse relationship between the expectation ratio and changes in inventory. This would not be expected on an a priori reasoning basis. Further explanations were not attempted in this study. From 1952 to 1955 a very irregular relationship was noted between the two variables.

Similarly, milk production was plotted against other variables presumed to be logically related. High association between milk production and cow numbers was noted. The graphic analysis indicated some relationship between rate of concentrate feeding and milk output. Little relationship was noted between milk output and pasture conditions. It was concluded that there would be considerable value in further graphic exploration of the relationship between variables proposed in the model before proceeding to an extensive statistical analysis.

Parameters for two alternative forms of the inventory equations were estimated by a Cobb-Douglas function. The results were consistent with the graphic analysis. There was no indication that other lags in the expectation variable would yield more logical results.

In addition to the limitations of the data, there are also conceptual and statistical limitations that need to be appraised.

Other types of equation systems need to be formulated. Further, other mathematical forms of the estimating equations need to be considered. Analytical techniques such as linear programming, input-output analysis would likely yield important insights into this problem.

ACKNOWLEDGMENTS

The author wishes to acknowledge his indebtedness to Professor Paul L. Kelley, major professor, for his suggestion of the problem and for his valuable advice and encouragement; to Dr. John H. McCoy, for his aid and interest in the project; and to Dr. Dale Knight, for his suggestions and encouragement.

LITERATURE CITED

Bakken, Henry H. and George Max Beal.
Fluid milk marketing. Madison, Wisconsin: Mimir Publishers, Inc. 1956.

Federal milk market orders and amendments.
United States Department of Agriculture. April 1, 1955.

Hildreth, Clifford, and F. G. Jarrett.
A statistical study of livestock production and marketing. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Limited. 1955.

Foote, Richard J.
The mathematical basis for the bean method of graphic multiple correlation. Jour. American Statistics Assn., 48:778-788, 1953.

APPENDIX

Table 2. Farm wage rates in Kansas with board, 1944 through 1955.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$ 62.25	$ 64.33	$ 66.42	$ 68.50	$ 70.50	$ 72.50	$ 74.50	$ 75.42	$ 76.33	$ 77.25	$ 77.42	$ 77.58
1945	77.75	79.33	80.92	82.50	83.00	83.50	84.00	84.33	84.67	85.00	83.42	81.83
1946	80.25	81.83	83.42	85.00	86.67	88.33	90.00	90.00	90.00	90.00	90.00	90.00
1947	90.00	90.00	90.00	90.00	92.67	95.33	98.00	98.67	99.33	100.00	98.67	97.33
1948	96.00	96.67	97.33	98.00	101.00	104.00	107.00	108.67	110.33	112.00	108.00	104.00
1949	100.00	99.67	99.33	99.00	100.00	101.00	102.00	102.00	102.00	102.00	100.33	98.67
1950	97.00	97.00	97.00	97.00	99.33	101.67	104.00	104.67	105.33	106.00	106.00	106.00
1951	106.00	106.67	107.33	108.00	109.67	111.33	113.00	115.00	117.00	119.00	117.67	116.33
1952	115.00	117.00	119.00	121.00	122.33	123.67	125.00	125.67	126.33	127.00	126.00	125.00
1953	124.00	123.67	123.33	123.00	124.33	125.67	127.00	127.00	127.00	127.00	124.67	122.33
1954	120.00	120.00	120.00	120.00	122.67	125.33	128.00	127.00	126.00	125.00	124.00	123.00
1955	122.00	122.00	122.00	122.00	124.67	127.33	130.00	129.00	128.00	127.00	125.67	124.33

[1] Quarterly figures given were interpolated linearly into monthly data.

Source: United States Department of Agriculture, Statistical Division, Kansas State Board of Agriculture, Kansas Crop and Livestock Reporting Service, Topeka, Kansas.

Table 3. Population of the Greater Kansas City metropolitan area, January 1944 through December 1955.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	716,100	715,092	714,083	713,075	712,067	711,058	710,050	709,042	708,033	707,025	706,017	705,008
1945	704,000	704,000	704,000	704,000	704,000	704,000	704,000	704,000	704,000	704,000	704,000	704,000
1946	704,000	705,825	707,650	709,475	711,300	713,125	714,950	716,775	718,600	720,425	722,250	724,075
1947	725,900	731,783	737,667	743,550	749,433	755,317	761,200	767,083	772,967	778,850	784,733	790,617
1948	796,500	798,817	801,133	803,450	805,767	808,083	810,400	812,717	815,033	817,350	819,667	821,983
1949	824,300	823,474	822,648	821,822	820,996	820,170	819,344	818,517	817,691	816,865	816,039	815,213
1950	814,387	814,888	815,389	815,890	816,391	816,892	817,393	817,895	818,396	818,897	819,398	819,899
1951	820,400	821,808	823,217	824,625	826,033	827,442	828,850	830,258	831,667	833,075	834,483	835,892
1952	837,300	839,808	842,317	844,825	847,333	849,842	852,350	854,858	857,367	859,875	862,383	864,892
1953	867,400	869,442	871,483	873,525	875,567	877,608	879,650	881,692	883,733	885,775	887,817	889,858
1954	891,900	893,692	895,483	897,275	899,067	900,858	902,650	904,442	906,233	908,025	909,817	911,608
1955	913,400	916,908	920,417	923,925	927,433	930,942	934,450	937,958	941,467	944,975	948,483	951,992

Source: Sales Management for January of each year; other months intropolated.

Table 4. Index of wholesale prices, all commodities, base period 1947-1949 = 100.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1944	67.1	67.3	67.5	67.5	67.6	67.8	67.7	67.5	67.6	67.7	67.8	68.0	67.6
1945	68.2	68.3	68.4	68.7	68.9	69.0	68.9	68.7	68.4	68.8	69.4	69.6	68.8
1946	69.6	70.0	70.8	71.6	72.1	73.3	81.1	83.9	80.6	87.2	90.8	91.6	78.7
1947	92.3	93.1	95.4	94.8	94.3	94.3	95.3	96.5	98.4	99.6	100.7	102.6	96.4
1948	104.5	102.5	102.5	103.3	103.8	104.6	105.5	106.2	106.1	105.0	104.7	104.0	104.4
1949	102.8	101.2	100.9	99.9	99.0	98.2	98.0	98.2	98.3	97.9	97.8	97.7	99.2
1950	97.7	98.3	98.5	98.5	99.6	100.2	103.0	105.2	107.1	107.7	109.3	112.1	103.1
1951	115.0	116.5	116.5	116.3	115.9	115.1	114.2	113.7	113.4	113.7	113.6	113.5	114.8
1952	113.0	112.5	112.3	111.8	111.6	111.2	111.8	112.2	111.8	111.1	110.7	109.6	111.6
1953	109.9	109.6	110.0	109.4	109.8	109.5	110.9	110.6	111.0	110.2	109.8	110.1	110.1
1954	110.9	110.5	110.5	111.0	110.9	110.0	110.4	110.5	110.0	109.7	110.0	109.5	110.3
1955	110.1	110.4	110.0	110.5	109.9	110.3	110.5	110.9	111.7	111.6	111.2	111.3	110.7

[1] United States Department of Labor Indexes, revised series.

Source: 1944-1946 – "Survey of Current Business," June 1952, page 24, United States Department of Commerce, Office of Business Economics.

1947-1951 – "Survey of Current Business," March 1952, page 22, United States Department of Commerce, Bureau of Foreign and Domestic Commerce, Office of Business Economics.

1952 – "Business Statistics," 1953 Biennial Edition, A Supplement to the Survey of Current Business, United States Department of Commerce, Office of Business Economics, page 27.

1953 – "Survey of Current Business," Annual Review Number, February 1954, page S-5, United States Department of Commerce, Office of Business Economics.

1954 – "Survey of Current Business," January 1955, page S-6, United States Department of Commerce, Office of Business Economics.

1955 – "The Handbook of Economic Statistics," January 16, 1956, Volume X, No. 1, page 22. Economic Statistics Bureau of Washington, D. C.

Table 5. Average prices paid by Kansas farmers for all mixed dairy feeds under 29% protein, January 1944 through December 1955.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	3.05	3.00	3.00	3.00	3.10	3.10	3.05	3.05	3.00	2.95	2.95	2.90
1945	2.90	2.85	2.90	2.90	2.90	2.90	2.90	2.95	2.95	3.00	3.00	3.00
1946	3.00	3.05	3.10	3.10	3.40	3.45	3.80	3.90	3.70	3.70	3.80	3.65
1947	3.45	3.44	3.65	3.80	3.70	3.90	3.95	4.15	4.35	4.40	4.40	4.55
1948	4.80	4.50	4.55	4.55	4.55	4.45	4.35	4.00	3.90	3.75	3.70	3.70
1949	3.65	3.55	3.55	3.65	3.60	3.55	3.55	3.50	3.50	3.40	3.35	3.35
1950	3.35	3.32	3.30	3.50	3.55	3.60	3.60	3.70	3.65	3.65	3.65	3.70
1951	3.85	4.00	4.10	4.10	4.20	4.15	4.10	4.10	4.10	4.15	4.20	4.30
1952	4.40	4.45	4.35	4.40	4.40	4.35	4.35	4.35	4.40	4.40	4.35	4.35
1953	4.35	4.15	4.10	4.10	4.05	3.95	3.90	3.90	3.80	3.75	3.70	3.75
1954	3.80	3.80	3.75	3.85	3.85	3.80	3.75	3.75	3.75	3.70	3.70	3.70
1955	3.70	3.70	3.65	3.60	3.60	3.60	3.60	3.55	3.50	3.50	3.45	3.45

Source: 1944–September 1950 – "Production Trends and Market Prices, Kansas Dairy Industry," Agricultural Economics Report, Number 46, Kansas Agricultural Experiment Station, Department of Agricultural Economics, Bureau of Agricultural Economics, United States Department of Agriculture in cooperation with the Extension Division, Kansas State College, Manhattan, Kansas, Table 26, page 34. (Original source: Bureau of Agricultural Economics, Division of Statistics, Kansas State Board of Agriculture.)

October 1950 to December 1955 – Bureau of Agricultural Economics, Division of Statistics, Kansas State Board of Agriculture, mixed dairy feeds all under 29% protein per 100 pounds.

Table 6. Kansas pasture conditions by crop reporting districts, average of Northeast and East Central districts, April 1944 to November 1955 (as a percent of normal).[1]

Year	Jan.[2]	Feb.[2]	Mar.[2]	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.[2]
1944	01.0	01.0	01.0	85.0	79.5	86.5	90.0	87.0	91.0	89.0	86.0	01.0
1945	01.0	01.0	01.0	95.0	93.0	90.5	95.0	93.0	77.0	71.5	78.0	01.0
1946	01.0	01.0	01.0	95.5	94.5	91.0	79.0	70.5	72.0	83.5	83.5	01.0
1947	01.0	01.0	01.0	82.5	82.0	91.5	96.5	87.0	69.0	62.0	66.5	01.0
1948	01.0	01.0	01.0	86.5	87.0	88.5	85.5	97.5	94.0	86.0	76.0	01.0
1949	01.0	01.0	01.0	89.0	86.5	94.0	95.5	91.0	85.5	85.0	84.5	01.0
1950	01.0	01.0	01.0	81.0	65.5	83.5	88.0	97.0	99.0	94.0	84.0	01.0
1951	01.0	01.0	01.0	85.0	75.0	89.0	98.0	96.0	95.5	93.5	90.5	01.0
1952	01.0	01.0	01.0	85.5	67.5	91.5	60.5	50.0	70.5	56.5	43.0	01.0
1953	01.0	01.0	01.0	77.5	73.0	82.5	63.5	49.0	32.5	30.0	34.5	01.0
1954	01.0	01.0	01.0	66.0	75.5	87.0	85.5	46.5	69.5	55.0	66.5	01.0
1955	01.0	01.0	01.0	79.5	83.0	79.5	85.5	66.5	45.0	49.5	67.0	01.0

[1]Source - Bureau of Agricultural Economics, Division of Statistics, Kansas State Board of Agriculture.

[2]Figures 01.0 in the months January, February, March and December were put in for purposes of statistical analysis only.

Table 7. Corn, cash prices, Kansas City, monthly and annual average of the daily high of No. 2 mixed corn, nominal quotations.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1944	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.09	1.14	1.14
1945	1.14	1.14	1.15	1.12	1.13	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.14
1946	1.15	1.15	1.18	1.18	1.35	1.43	2.12	1.88	1.83	1.84	1.50	1.34	1.50
1947	1.33	1.36	1.74	1.75	1.75	2.09	2.15	2.33	2.48	2.36	2.51	2.69	2.04
1948	2.75	2.30	2.35	2.32	2.33	2.33	2.14	1.96	1.72	1.47	1.39	1.42	2.04
1949	1.41	1.34	1.39	1.43	1.36	1.39	1.44	1.29	1.30	1.22	1.19	1.25	1.33
1950	1.26	1.27	1.32	1.43	1.50	1.50	1.55	1.47	1.47	1.44	1.51	1.61	1.44
1951	1.70	1.75	1.72	1.75	1.74	1.75	1.78	1.76	1.75	1.78	1.90	2.01	1.78
1952	2.01	1.91	1.93	1.93	1.93	1.92	1.91	1.86	1.83	1.66	1.61	1.64	1.84
1953	1.62	1.57	1.59	1.59	1.64	1.60	1.63	1.64	1.66	1.52	1.49	1.58	1.59
1954*	1.56	1.54	1.56	1.60	1.62	1.64	1.61	1.64	1.66	1.66	1.60	1.59	1.61
1955*	1.57	1.52	1.49	1.55	1.62	1.63	1.63	1.52	1.42	1.34	1.31	1.39	1.50

* No. 2 yellow daily prices were used when prices for No. 2 mixed were not quoted for the years 1954 and 1955.

Source: 1944-1945 Kansas City Board of Trade Yearbook.
1946-1955 Kansas City Grain Market Review.

Table 8. Price of average number 1 alfalfa hay baled, per ton, Kansas City, January 1944 through December 1955.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	33.50	32.90	32.50	32.50	32.50	21.00	22.00	23.00	26.00	30.50	30.50	30.90
1945	30.50	30.50	30.50	24.00	24.00	24.15	23.80	23.00	23.50	26.40	29.00	29.00
1946	29.00	29.00	29.00	29.00	32.50	31.25	29.60	29.40	31.00	32.00	34.50	35.00
1947	32.75	30.50	34.40	36.50	35.00	25.00	25.65	28.00	31.00	34.75	36.25	36.60
1948	36.25	35.50	34.50	35.60	30.70	25.00	25.00	25.00	25.00	27.40	27.50	30.00
1949	30.00	30.00	30.00	30.00	28.00	24.00	23.00	23.15	25.60	26.25	29.80	31.00
1950	29.10	27.00	27.00	28.50	30.00	26.00	24.00	24.00	24.75	26.80	29.50	30.70
1951	31.25	33.20	30.50	33.50	34.50	32.90	28.00	29.00	33.35	36.60	37.75	37.75
1952	37.60	36.80	35.00	35.00	35.00	33.20	34.00	35.00	36.00	37.75	37.75	37.75
1953	37.75	37.50	36.75	36.75	37.00	28.65	30.00	30.00	30.20	30.75	30.75	30.75
1954	30.75	30.75	30.75	30.75	30.75	24.00	25.00	28.00	28.00	28.80	31.25	31.25
1955	31.25	31.25	25.90	25.75	25.00	23.00	25.00	22.50	28.00	28.00	28.00	28.00

Source: January 1944 to December 1954 - "Grain and Feed Statistics Through 1954," Statistical Bulletin 159, United States Department of Agriculture, Agricultural Marketing Service, Agricultural Economic Division, Washington, D. C., March 1955, page 92. 1955 July listed in "The Feed Situation," FDS-153, page 2. August, September listed "The Feed Situation," FDS-154, page 2. October, November, December listed "The Feed Situation," FDS-155, page 2. January, February listed in "The Feed Situation," FDS-156, page 2. March, April listed "The Feed Situation," FDS-157, page 2. May, June listed "The Feed Situation," FDS-158, page 2.

Table 9. Price of good butcher steers, 900-1100 pounds at Kansas City, January 1944 through December 1955.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1944	14.70	15.10	15.30	15.40	15.75	16.00	15.90	16.40	16.30	16.45	15.60	15.35	15.69
1945	15.40	15.55	15.95	16.40	16.20	16.25	16.25	15.95	16.40	16.65	16.80	16.65	16.20
1946	16.50	16.45	16.45	16.55	16.60	17.15	21.15	23.05	19.75	23.45	26.85	26.95	20.07
1947	25.00	24.50	24.90	24.60	24.85	26.75	28.30	29.55	30.77	29.90	30.05	31.60	27.56
1948	32.30	28.65	27.80	28.85	31.85	35.70	37.00	36.85	36.55	34.10	32.45	29.30	32.61
1949	26.65	23.70	25.05	24.90	25.70	27.15	26.95	27.45	29.15	31.20	31.95	31.70	27.63
1950	31.90	29.80	28.85	28.80	30.07	30.76	31.30	30.51	31.60	31.15	32.25	34.25	30.94
1951	35.60	37.55	37.90	38.35	37.15	36.15[2]	36.00	36.55	37.40	36.80	36.60	35.40	36.79
1952	35.25	34.60	35.70	35.70	34.95	33.55	3[illegible].70	34.05	33.70	33.70	33.24	32.35	34.21
1953	29.40	25.95	23.43	22.56	23.05	22.50	24.99	25.78	26.25	26.08	25.17	24.88	25.00
1954	25.15	24.02	24.2[illegible]	24.80	24.73	24.42	24.23	24.26	25.21	25.91	26.44	27.23	25.06
1955	28.38	27.08	26.75	25.68	23.97	2[illegible].50	23.25	23.15	23.35	22.62	21.80	21.50	24.25

[1]Monthly average of daily top prices.

[2]Starting with June 1951 the weight was changed from 900-1100 pounds to 900-1000 pounds.

Source: 1944-1949 - "Production Trends and Market Prices, Kansas Dairy Industry," Agricultural Economic Report, Number 46, October 1950. Kansas Agricultural Experiment Station, Department of Agricultural Economics, Bureau of Agricultural Economics, United States Department of Agriculture in cooperation with the Extension Division, Kansas State College, Manhattan, Kansas. Table 72, page 100 (compiled by the Department of Agricultural Economics, Kansas State College, from Daily Livestock Market Reports of the Production Marketing Administration, United States Department of Agriculture).

1950-June, 1955 - Folder of data originally compiled from Kansas City Daily Market Reports, Production Marketing Administration, United States Department of Agriculture.

July 1955-December 1955 - Special letter from Kansas City Livestock Market.

Note: Effective December 29, 1950, the federal grade standards for steer carcasses were revised. The old Good grade is renamed Choice. Source: The Livestock and Meat Situation, July 1950 to December 1950, Bureau of Agricultural Economics, United States Department of Agriculture, December section, page 16.

Table 10. Ratio of 3.8% blend price of milk to price of number 2 mixed corn on the Kansas City market, January 1944 through December 1955.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	3.31	3.28	3.27	3.18	2.99	2.95	2.96	3.01	3.11	3.21	3.36	3.23
1945	3.22	3.22	3.17	3.17	3.06	2.91	2.96	2.99	3.09	3.08	3.14	3.17
1946	3.21	3.20	3.10	3.06	2.48	2.45	1.98	2.39	2.56	3.00	3.88	4.39
1947	4.03	3.58	2.58	2.49	2.12	1.65	1.63	1.73	1.98	2.22	2.12	2.01
1948	1.99	2.45	2.25	2.14	2.00	2.06	2.26	2.64	3.19	3.58	4.16	4.03
1949	3.60	3.59	2.98	2.73	2.57	2.51	2.43	2.96	3.45	4.00	4.14	3.91
1950	3.67	3.58	3.09	2.74	2.31	2.29	2.21	2.53	2.93	3.28	3.24	3.10
1951	2.94	2.98	2.82	2.73	2.48	2.41	2.38	2.55	2.91	3.08	3.13	3.07
1952	2.99	3.16	3.19	2.76	2.38	2.23	2.25	2.70	2.98	3.65	3.75	3.52
1953	3.09	3.06	2.98	2.53	2.29	2.30	2.33	2.82	2.98	3.67	3.53	3.18
1954	2.79	2.81	2.77	2.43	2.19	2.15	2.36	2.67	2.90	2.84	2.80	2.82
1955	2.74	2.81	2.77	2.45	2.34	2.39	2.48	2.92	3.25	3.43	3.38	3.17

[1]Ratios were figured from the actual figures of blend price of 3.8% milk that had not been rounded.

Table 11. Estimated monthly average milk production per cow for Kansas.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						(Pounds)						
1944	294	313	324	348	420	404	330	361	300	290	280	283
1945	289	285	330	380	441	436	410	380	316	290	275	284
1946	289	286	340	408	488	438	407	377	327	318	304	323
1947	326	321	363	415	506	500	440	392	322	301	286	292
1948	304	327	357	413	505	470	438	422	352	323	292	297
1949	306	305	355	415	505	480	435	406	342	326	315	315
1950	311	312	370	404	473	465	450	436	360	330	318	322
1951	325	319	370	404	477	465	435	422	350	312	295	307
1952	316	314	354	395	469	435	401	403	350	329	313	325
1953	332	325	382	414	482	455	430	406	356	360	360	379
1954	376	367	439	463	530	485	419	401	372	371	374	391
1955	384	365	426	460	518	476	440	422	372	376	390	403

Source: 1944-1949 "Production Trends and Market Prices," Kansas Dairy Industry, October 1950, Agricultural Economics Report Number 46, Kansas Agricultural Experiment Station, Department of Agricultural Economics, Bureau of Agricultural Economics, United States Department of Agriculture in cooperation with the Extension Division, Kansas State College, Manhattan, Kansas. Table 10, page 14. (Original source: Bureau of Agricultural Economics, United States Department of Agriculture, Division of Statistics, Kansas State Board of Agriculture.)

1950-1955 Special letter from Kansas Crop and Livestock Reporting Service, United States Department of Agriculture, Agricultural Marketing Service, Kansas State Board of Agriculture, Division of Statistics.

Table 12. Kansas hay equivalent of all roughage fed per milk cow, average pounds per day, October to May winter feeding period, 1944 through 1955.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	001	001	001	001	001	001	001	001	001	725	725	725
1945	725	725	725	725	725	001	001	001	001	600	600	600
1946	600	600	600	600	600	001	001	001	001	650	650	650
1947	650	650	650	650	650	001	001	001	001	725	725	725
1948	725	725	725	725	725	001	001	001	001	750	750	750
1949	750	750	750	750	750	001	001	001	001	725	725	725
1950	725	725	725	725	725	001	001	001	001	650	650	650
1951	650	650	650	650	650	001	001	001	001	700	700	700
1952	700	700	700	700	700	001	001	001	001	550	550	550
1953	550	550	550	550	550	001	001	001	001	575	575	575
1954	575	575	575	575	575	001	001	001	001	625	625	625
1955	625	625	625	625	625	001	001	001	001	700	700	700

[1]Hay plus one-third silage plus one-half other roughage, in herds kept by dairy reporters, representing mainly herds supplying some milk or cream for sale.

Source: Letter of October 4, 1956, from F. L. Collins, Agricultural Statistician, United States Department of Agriculture, Kansas State Board of Agriculture, Kansas Crop and Livestock Reporting Service, Topeka, Kansas.

Note: Figures 001 were put in for statistical computational purposes only.

Table 13. Number of producing cows in the Greater Kansas City Milkshed January 1944 through December 1955.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	14,766	15,510	16,597	16,809	19,571	20,130	21,068	21,051	20,069	17,822	17,772	16,927
1945	16,639	17,255	17,989	19,411	22,095	22,864	22,352	22,733	20,020	18,226	17,966	16,609
1946	15,981	17,037	18,760	22,203	26,159	24,265	24,351	24,567	24,168	22,869	21,318	21,650
1947	21,500	21,891	24,960	24,982	27,529	27,699	28,843	26,167	23,975	23,470	21,396	21,267
1948	19,336	19,806	20,552	23,375	24,940	24,676	25,095	24,520	23,437	21,116	21,033	21,116
1949	21,765	22,922	22,399	23,325	26,910	27,938	28,697	28,435	27,597	25,632	24,281	23,798
1950	24,328	25,251	25,420	25,526	30,677	32,289	32,559	32,193	31,560	28,149	26,446	26,258
1951	26,751	27,055	28,586	29,081	31,892	34,862	33,272	32,380	28,229	27,968	26,110	26,731
1952	26,735	25,982	27,279	29,287	31,556	38,124	35,930	32,191	31,033	29,405	29,240	30,372
1953	30,442	31,672	31,692	31,618	33,496	37,539	36,039	33,546	33,646	33,867	35,609	36,594
1954	36,169	36,498	36,712	38,088	39,559	39,492	35,661	33,767	35,758	36,201	38,528	39,480
1955	39,077	37,847	37,967	38,032	39,834	38,354	36,016	34,398	37,552	39,338	39,533	40,993

[1]Computation made from Kansas Dairy Herd Improvement Association records and average pounds of producer deliveries of milk by Agricultural Economics Staff, Kansas State College.

Table 14. Average daily pounds of producers deliveries of milk for the Greater Kansas City market, January 1944 through December 1955.

Month	1944	1945	1946	1947	1948	1949
January	367,815	432,439	432,614	597,913	522,836	597,441
February	393,023	450,194	457,262	628,926	543,869	631,506
March	418,233	468,731	505,024	655,451	558,199	665,921
April	454,860	544,672	645,435	708,734	660,340	738,947
May	533,102	608,496	728,267	830,274	750,448	836,891
June	553,164	647,958	708,297	804,663	694,884	821,096
July	547,346	598,146	670,639	770,686	681,578	804,364
August	530,916	580,597	635,538	650,774	686,811	789,913
September	489,087	505,503	631,498	596,265	632,809	720,286
October	425,230	448,718	580,641	565,399	565,277	670,786
November	422,252	441,414	540,842	511,139	544,537	657,517
December	414,039	423,530	574,584	509,564	569,063	661,834

Table 14 (concl.). Average daily pounds of producers deliveries of milk for the Greater Kansas City market, January 1944 through December 1955.

Month	1950	1951	1952	1953	1954	1955
January	677,549[1]	778,450	701,539	920,561	1,100,261	1,168,401
February	708,043	802,462	731,133	946,989	1,132,172	1,160,014
March	736,163	814,419	735,453	958,997	1,150,553	1,186,860
April	799,973	834,040	802,469	1,004,516	1,253,842	1,323,883
May	939,324	962,806	953,302	1,119,101	1,357,282	1,316,108
June	966,077	1,011,703	927,941	1,095,376	1,230,181[3]	1,162,130
July	957,238	915,989	908,676	1,053,074[2]	1,002,069	1,049,864
August	900,435	884,956	919,374	940,285	971,141[4]	1,008,563
September	833,495	773,745	888,153	937,375	1,008,728[5]	1,089,391
October	782,829	715,431	820,979	1,003,809	1,053,447[6]	1,188,788
November	744,988	665,807	837,137	1,069,686	1,151,214[7]	1,242,524
December	748,081	676,294	885,966	1,090,856	1,176,108[8]	1,230,207

[1]Audited figure given in February 1950 issue of Market Administrator Bulletin.
[2]Revised figure given in August 1953 issue of Market Administrator Bulletin.
[3]Audited figure given in June 1955 issue of Market Administrator Bulletin.
[4]Audited figure given in August 1955 issue of Market Administrator Bulletin.
[5]Audited figure given in September 1955 issue of Market Administrator Bulletin.
[6]Audited figure given in October 1955 issue of Market Administrator Bulletin.
[7]Audited figure given in November 1955 issue of Market Administrator Bulletin.
[8]Audited figure given in December 1955 issue of Market Administrator Bulletin.

Source: 1934-1949 "Production Trends and Market Prices, Kansas Dairy Industry," Agricultural Economics Report Number 46, October 1950. Kansas Agricultural Experiment Station, Department of Agricultural Economics, Bureau of Agricultural Economics, United States Department of Agriculture in cooperation with the Extension Division, Kansas State College, Manhattan, Kansas, Table 91, page 119, (calculations by the Department of Agricultural Economics, Kansas State College).

1950-1955 Market Administrator Bulletin, (annual bound copies of the monthly issues of the Market Administrator, Greater Kansas City Marketing Area, Bulletin). (All figures on original data have been rounded to whole numbers on this data.)

Table 15. Average daily milk production per cow, per day using weighted average Dairy Herd Improvement Association data from selected Kansas counties, January 1944 through December 1955.[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944[2]	24.91	25.34	25.20	27.06	27.24	27.48	25.98	25.22	24.37	23.86	23.76	24.46
1945[2]	25.99	26.09	26.06	28.06	27.54	28.34	26.76	25.54	25.25	24.62	24.57	25.50
1946	27.07	26.84	26.92	29.07	27.84	29.19	27.54	25.87	26.13	25.39	25.37	26.54
1947	27.81	28.73	26.26	28.37	30.16	29.05	26.72	24.87	24.87	24.09	23.89	23.96
1948	27.04	27.46	27.16	28.25	30.09	28.16	27.16	28.01	27.00	26.77	25.89	26.95
1949	27.45	27.55	29.73	31.68	31.10	29.39	28.03	27.78	26.10	26.17	27.08	27.81
1950	27.85	28.04	28.96	31.34	30.62	29.92	29.40	27.97	26.41	27.81	28.17	28.49
1951	29.10	29.66	28.49	28.68	30.19	29.02	27.53	27.33	27.41	25.58	25.50	25.30
1952	26.24	28.14	26.96	27.40	30.21	24.34	25.29	28.56	28.62	27.92	28.63	29.17
1953	30.24	29.90	30.26	31.77	33.41	29.18	29.22	28.03	27.86	29.64	30.04	29.31
1954	30.42	31.02	31.34	32.92	34.31	31.15	28.10	28.76	28.21	29.10	29.88	29.79
1955	29.90	30.65	31.26	34.81	33.04	30.30	29.15	29.32	29.01	30.22	31.43	30.01

[1]Calculated from Dairy Herd Improvement Association data.

[2]Computed by linear interpolation for each month from 1944 available data to 1946 data.

Table 16. Grains and concentrates fed per milk cow per day in herds kept by dairy reporters in the West North Central region of the United States, January 1944 through December 1955.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1944	6.2	6.8	7.4	7.3	6.9	3.9	2.7	2.8	2.8	3.3	4.9	5.5	5.07
1945	6.8	7.6	7.8	7.5	7.0	4.5	3.2	3.3	3.3	4.0	5.7	6.2	5.58
1946	6.7	7.4	7.6	7.3	6.5	4.0	2.9	3.1	3.1	3.7	5.3	6.0	5.31
1947	6.8	7.5	7.9	7.8	7.4	4.5	3.3	3.4	3.4	3.7	4.6	5.6	5.47
1948	6.2	6.5	6.7	6.5	6.2	3.6	3.4	3.7	3.8	4.2	5.4	6.4	5.26
1949	7.2	7.8	8.0	7.8	7.3	4.8	3.9	4.2	4.2	4.6	5.4	6.4	5.97
1950	7.3	8.2	8.4	8.2	7.8	5.0	3.8	3.9	4.0	4.5	5.6	6.4	6.09
1951	7.0	7.6	7.9	7.8	7.5	4.5	3.6	3.8	3.9	4.4	5.7	6.3	5.83
1952	6.9	7.5	7.8	7.6	7.2	4.4	3.8	3.9	4.1	4.5	6.1	6.7	5.89
1953	7.3	7.9	7.9	7.9	8.0	5.3	4.4	4.5	4.6	5.0	6.0	6.6	6.28
1954	7.2	7.7	7.9	7.8	7.2	5.3	4.5	4.6	4.7	4.9	5.8	6.4	6.16
1955	7.0	7.5	7.7	7.5	7.0	5.2	4.5	4.7	4.8	5.3	6.0	6.7	6.18

Source: 1944-1948 – "Rations Fed to Milk Cows, 1949," United States Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C., January 1950, Table 4, page 10.

1949 – "Rations Fed to Milk Cows, 1950," United States Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C., January 1951, Table 7, page 12.

1950 – "Rations Fed to Milk Cows, 1951," United States Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C., January 1952, Table 4, page 9.

1951 – "Rations Fed to Milk Cows, 1952," United States Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C., January 1953, Table 6, page 8.

1952-1954 – "Rations Fed to Milk Cows, 1954," United States Department of Agriculture, Agricultural Marketing Service, Washington, D. C., January 1955, Table 5, page 8.

1955 – "Milk Production," March issue, page 10, United States Department of Agriculture, Agricultural Marketing Service, Crop Reporting Board.

Table 17. Ratio of 3.8% blend price of milk to price of 900-1100 pound good butcher steers, Kansas City, January 1944 through December 1955.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	.26	.25	.24	.24	.22	.21	.21	.21	.22	.22	.23	.24
1945	.24	.24	.23	.22	.21	.21	.21	.22	.22	.21	.21	.22
1946	.22	.22	.22	.22	.20	.20	.20	.19	.24	.24	.22	.22
1947	.21	.20	.18	.18	.15	.13	.12	.14	.16	.18	.18	.17
1948	.17	.20	.19	.17	.15	.13	.13	.14	.15	.15	.18	.20
1949	.19	.20	.17	.16	.14	.13	.13	.14	.15	.16	.15	.15
1950	.15	.15	.14	.14	.12	.11	.11	.12	.14	.15	.15	.15
1951	.14	.14	.13	.12	.12	.12	.12	.12	.14	.15	.16	.17
1952	.17	.17	.17	.15	.13	.13	.13	.15	.16	.18	.18	.18
1953	.17	.19	.20	.18	.16	.16	.15	.18	.19	.21	.21	.20
1954	.17	.18	.18	.16	.14	.14	.16	.18	.19	.18	.17	.16
1955	.15	.16	.15	.15	.16	.17	.17	.19	.20	.20	.20	.21

Table 18. Blend price paid farmers for 3.8% milk f.o.b. the Greater Kansas City milk market. (including premiums paid) (dollars per cwt.)[1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	3.77	3.74	3.73	3.63	3.41	3.36	3.38	3.43	3.54	3.66	3.66	3.68
1945	3.67	3.67	3.64	3.55	3.46	3.35	3.40	3.44	3.55	3.54	3.61	3.65
1946	3.69	3.68	3.66	3.61	3.35	3.50	4.20	4.49	4.68	5.53	5.82	5.88
1947	5.36	4.87	4.49	4.35	3.71	3.44	3.50	4.02	4.90	5.25	5.31	5.42
1948	5.48	5.63	5.29	4.97	4.65	4.79	4.83	5.18	5.49	5.26	5.78	5.72
1949	5.08	4.81	4.14	3.91	3.49	3.49	3.50	3.82	4.49	4.88	4.93	4.89
1950	4.63	4.55	4.08	3.92	3.47	3.44	3.43	3.72	4.30	4.73	4.89	4.99
1951	5.00	5.21	4.85	4.78	4.32	4.21	4.23	4.48	5.10	5.48	6.04	6.17
1952	6.01	6.04	6.16	5.32	4.60	4.28	4.30	5.02	5.45	6.06	6.04	5.77
1953	5.00	4.81	4.74	4.02	3.75	3.68	3.79	4.63	4.94	5.58	5.26	5.02
1954	4.35	4.33	4.32	3.89	3.55	3.52	3.80	4.38	4.82	4.71	4.48	4.49
1955	4.30	4.27	4.13	3.80	3.79	3.90	4.04	4.44	4.62	4.59	4.43	4.41

[1]Data on this sheet have been averaged where needed and all figures have been rounded to 2 decimals.

AN ECONOMIC ANALYSIS OF THE
GREATER KANSAS CITY MILK MARKET

by

LLOYD LESLIE WISEMAN

B. S., Kansas State College
of Agriculture and Applied Science, 1949

AN ABSTRACT OF
A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics and Sociology

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1957

To properly study the Greater Kansas City milk market, it was necessary to gain an understanding of the special characteristics of Federal Order milk markets. With this understanding it was possible to construct a model showing the structural relations that characterize this market. The model consisted of these four main relations: inventory, production, demand for milk, and demand for feed grains. Alternative forms were presented for each relation.

The model suggested the data necessary for an empirical solution. An important contribution of this study was to assemble and interpret these data. Many data were not immediately available in a form useful for the model. That made it necessary to construct certain series that were believed adequate for the analysis. In a few cases it was not even possible to construct some of the necessary series of data.

Studies of this type have considerable significance in establishing criteria for the types of data to be collected by agencies if solutions to economic problems of this nature are to be obtained. In general, certain of the sales and price data in the Greater Kansas City milk market are adequate for analysis. However, there is a paucity of input data for fundamental production functions. Data needed were accurate estimates of inputs of feed grains, hay, other roughage, pasture, labor, and capital services for specific market areas. Output data for the same areas need to be established. Moreover, outside of Federal Order Markets, output data now collected for milk production is of little value. This is due to the fact that grade A output is pooled with manufacturing output resulting in a meaningless economic aggregation.

Accurate inventory data on the number of milk cows by specific productive capacities need to be established for the market areas considered in the other data collection processes. Similar data problems exist for other relevant economic relations such as the demand for milk.

Estimated values for all the parameters in the proposed equations were desired. However, this analysis was restricted primarily to an appraisal of the inventory relation.

The inventory relation was first appraised by a graphic analysis technique. In many respects the inventory relation is more complex than the static production function considered in the model because dynamic influences are involved. The primary concern was with the inventory relation due to the fact that an estimate of cow numbers is required in the formulation of the aggregate proposed production function.

The basic notion involved in the inventory relation is that producers will vary the number of cows on farms from some previous base. The problem was proposing and estimating the expectation system by which these changes in cow numbers are brought about. A ratio of the price of milk to an assumed alternative price of good butcher steers was proposed as a measure of the factors which influence producers' inventory decisions.

During 1944 to 1951 there was inverse relationship between the expectation ratio and changes in inventory. This would not be expected on an a priori reasoning basis. Further explanations were not attempted in this study. From 1952 to 1955 a very irregular relationship was noted between the two variables.

Similarly, milk production was plotted against other variables presumed to be logically related. High association between milk production and cow numbers was noted. The graphic analysis indicated some relationship between rate of concentrate feeding and milk output. Little relationship was noted between milk output and pasture conditions. It was concluded that there would be considerable value in further graphic exploration of the relationship between variables proposed in the model before proceeding to an extensive statistical analysis.

Parameters for two alternative forms of the inventory equations were estimated by a Cobb-Douglas function. The results were consistent with the graphic analysis. There was no indication that other lags in the expectation variable would yield more logical results.