AN ECONOMIC ANALYSIS OF THE FEEDER CATTLE INDUSTRY

by

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INTRODUCTION

Purpose

The purpose of this study was to present an analysis of the year to year level of feeder cattle prices. Inasmuch as price is the result of supply and demand, the study falls into two major sub-divisions, namely, the factors affecting the actions and decisions of the sellers, and the factors affecting the decisions of the buyers. The consideration on the seller's side of the market deals with the factors that determine the quantity that sellers will be willing to offer at all possible prices during a specified period of time. On the buyer's side of the market, the problem is to determine the factors that account for the quantity that buyers are willing to take at all possible prices at any one instant of time.

The results of this study are pertinent to the planning of farm policy as well as to the cattle feeder and cattle producer. The effectiveness of agricultural policy will depend upon the accuracy and amount of knowledge available on price and quantity relationships of all agricultural products.

The cattle feeder and the cattle producer are interested in knowing the nature of price and quantity relationships for feeder cattle as well as slaughter cattle, so that they can adequately plan their feeding and production program.

Nature and Scope

This study is presented in two main parts. The first division is a deductive analysis of the relationships that exist between price and quantity of feeder cattle. The second division is a statistical analysis of the relationships developed in Part I. Statistical analysis is very useful in economic research but cannot be used as the sole research method. The value of mathematical measurements rests on the soundness of the reasoning on which the measurements were based. Significant results can be obtained from mathematical measurement of factors which actually have no cause and effect relationship. Therefore, the basis of any study becomes sound reasoning.

The practice of feeding cattle is carried on mainly in twenty-six states of the North Central and Western regions of the United States. However, for all practical purposes this area can be limited to eight Corn Belt states. Over two-thirds of the cattle on feed January 1 are held on farms in Ohio, Indiana, Illinois, Minnesota, Iowa, Missouri, Nebraska and Kansas. Therefore, conditions existing in these eight states will have greater effect on the market than conditions of any other single area.

All price data and some quantity data were taken from the daily government livestock market reports on the Kansas City, Kansas central livestock market. The Kansas City market was used under the assumption that the prices at this market would most likely represent the conditions of the entire cattle feeding in-

dustry. Kansas City ships almost twice as many feeder cattle annually as any other central livestock market.

Table 1. Number of feeder cattle shipped from leading central livestock markets for period 1923-1942.

Market	No. shipped (000 omitted)
Kansas City, Kansas	590
Omaha, Nebraska	348
Denver, Colorado	241
Sioux City, Iowa	232
So. St. Paul, Minnesota	165
Chicago, Illinois	163
Fort Worth, Texas	162

Source of Data: Livestock, Meats and Wools; 1942 edition; p. 20.

A significant proportion of the feeder cattle purchased today are purchased direct from the range producer. Price data are not available on any direct purchases of livestock; quantity data are available only for certain states, and only since 1938. Therefore, central livestock markets are the only source of information and the assumption must be made, that these data are representative of conditions throughout the entire industry. With modern means of communication and transportation, which facilitate arbitrage, it is impossible for prices to stay far out of line in different areas of the country over a long period of time.

Limitations

Five distinct factors limit the accuracy and degree of accomplishment of this study. First, the feeder cattle industry is so closely interrelated with general farming practices and the slaughter cattle industry that many relationships could not be isolated for measurement. Secondly, the data available for this study were incomplete, and in some cases not comparable at all periods of time. Price-data were not available for years prior to 1926 and data on the numbers of cattle on feed January 1 were not available for years prior to 1930. Some relationships could not be studied for years later than 1942 because of price controls, which interrupted normal relationships. Therefore, most of the study can only cover a 16-year period which is equal to only one normal beef cattle cycle. Thirdly, the feeder cattle market has decentralized to a significant degree since 1926. Data are not available to accurately measure and compensate for this trend of decentralization. The accuracy of measurements of time series data are definitely limited because of this decentralization. The fourth limitation results from having many small relatively insignificant factors affecting demand and supply, such as, availability of credit or unusual weather conditions. These insignificant factors taken individually cannot be isolated or measured, yet variation due to their combined action represents a significant proportion of variation which must be left unexplained. The fifth limitation is due to the im-

possibility of measuring subjective factors, such as, the conjecture of profit.

PART I. FACTORS DETERMINING PRICE

General

Feeder cattle prices are determined by supply and demand. This statement is true when properly qualified, and has meaning only when the true nature of the particular supplies and demands applicable to feeder cattle prices are understood. In the case of feeder cattle prices, the competitive characteristic of demand explains in a large part, the general level of feeder cattle prices. Because of the importance of this one characteristic, attention will first be directed toward the role of demand in the determination of feeder cattle prices.

Feeder Demand--a Competitive Demand

The supply of cattle for the cattle feeding industry is not separate and distinct from the supply of cattle for immediate slaughter. Rather, the cattle purchased for a feeding program are purchased in a competitive market in which the major demand is the demand for cattle for slaughter.[1] The supply of feeder cattle consists of that portion of the total market supply that is desirable for a feeding program.

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[1] Approximately 75 percent of total saleable receipts at livestock markets are purchased by slaughter buyers.

The feeder buyer is in direct competition with slaughter buyers in his purchasing activities. Cattle desirable for feeding purposes will also have considerable value for immediate slaughter. The desirability of cattle for immediate slaughter varies directly with the degree of finish in relation to age, size, quality and conformation. The desirability of cattle for the feeding program will vary inversely with the degree of finish in relation to age, size, quality and conformation.[1] The economic contribution of the cattle feeder is one of increasing the finish of an animal, thereby, increasing its value for slaughter.

Two-way Cattle. On the basis of this relationship, the total market supply can be divided into three separate types. A certain portion of the cattle on the market carry a relatively high degree of finish.[2] Cattle of this type are already finished or very nearly finished and would not add weight efficiently in the feed lot. The value of this type animal is greater for slaughter purposes than for the feeding program. Cattle of this type are demanded only by slaughter buyers. This category of market supply is generally represented by the price quotations for choice and good slaughter cattle. A second portion of the market supply of cattle is comprised of stock cows, bulls, dairy stock or beef cattle of very poor quality and conformation. Cat-

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[1] There are, of course, exceptions in both cases at the extremes. An animal could either be too fat or of too poor a finish.

[2] This percentage of finished cattle will depend on range conditions and the extent of the cattle feeding operations the preceding year.

tle of this type are not efficient utilizers of feed and therefore, are not sought by feeder buyers. This type of market cattle is purchased by the slaughter buyers on the basis of their value for meat and by-products. The third type of market cattle consists of steers or heifers of the beef breeds; either calves, yearlings or two-year-olds, and of common to choice quality and conformation, but lacking in finish. Cattle of this type make very efficient gains in the feed lot and represent the supply of feeder cattle. This group of two-way[1] cattle also have considerable value for immediate slaughter. The intensity of the competition will depend on the quantity demanded by the feeder buyers, the total market supply and the percentage of the total market supply that qualify as two-way cattle.

Reservation Price. Under competitive conditions, the feeder buyers must be willing to pay at least what slaughter buyers are willing to give, if he is going to buy any feeder cattle at all. From the viewpoint of the slaughter buyer, competition exists only for a part of the total supply; therefore, the slaughter buyer is not forced to meet the feeder buyer's price in order to obtain some cattle.[2] Secondly, the slaughter buyer is furnished with a definite "reservation price" (maximum price). No matter how intense the feeder competition, the slaughter buyer would

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[1] Designated as two-way cattle on the basis of their potential market disposition. They may be sold to either slaughter buyers or feeder buyers.

[2] This does not mean that the feeder demand has no effect on the general level of price. It means that conditions affecting slaughter demand exert the greatest total influence on the general level of cattle prices.

not pay more than the reservation price. The degree of information available to the meat packer, plus the fact that their ultimate demand is practically the current demand for meat for consumption, enables them to calculate within relatively accurate limits, a maximum price that can be paid without suffering a loss on the purchase. The feeder buyers generally will be willing to pay as much as, or more than the slaughter buyer for two-way cattle, for the potential value of such cattle is greater for the feeding industry than for immediate slaughter.

In summary, five observations should be noted:

1. The market supply of cattle is composed partially of cattle that can be classed as "two-way" cattle; for which, feeder and slaughter buyers are in direct competition.

2. Generally the potential value of the two-way cattle is higher for the feeding industry than for immediate slaughter.

3. The slaughter demand represents approximately 75 percent of the total market demand; therefore, factors determining slaughter demand will have much more influence on price than factors of the cattle feeding industry.

4. The feeder buyer is not as well informed as to market conditions as the slaughter buyer.

5. The ultimate demand for the slaughter buyer is practically the current demand for meat for consumption, thereby, allowing him to calculate accurately marginal productivity in dollars and cents.

On the basis of these five observations, it can be concluded that the general level of feeder cattle prices is determined to a

large extent by the slaughter demand and total market supply of cattle. Furthermore, it can be concluded that the slaughter demand determines the "floor" under feeder cattle prices.

The competitive nature of the demand for two-way cattle has explained the general level of feeder cattle prices. This then gives rise to two questions. If the feeder buyer must pay a price at least equal to the value of the cattle for immediate slaughter, what determines the quantity that will be taken? Secondly, if slaughter demand places a floor under feeder cattle prices, what determines how much feeders actually will pay above this floor? To answer these questions a more intensive study of the nature and characteristics of feeder cattle demand is necessary.

Other Characteristics of Feeder Cattle Demand

Derived Demand. Cattle feeders buy cattle, not for immediate use, but rather to feed and resell hoping to realize a profit on their operation. In this way the feeder demand becomes a derived demand with the ultimate demand being the demand for beef for consumption at some future time; this time depends largely upon the particular feeding system used. In the deferred system of feeding cattle, from 10 to 12 months are required to finish the cattle for market. The full-feed system requires from 45 days to seven or eight months depending upon the size, age and finish of the cattle at the time of purchase. Some feeders may buy grass fat cattle and "warm them" on grain for 30 days and then sell them, but this practice represents a very small portion of

the industry.

Because feeder cattle are purchased as a factor of production rather than to satisfy immediate wants, marginal utility bears no relationship to the quantity taken. Therefore, one would not expect to find the normal relationship between price and quantity; that is, quantity taken would not vary inversely with price. Such a demand curve would be one of perfect inelasticity; cattle feeders would take the same quantity at any price[1] if other factors remained constant. The year to year variation in numbers of feeder cattle taken will result from factors other than price. These factors are dependent on the characteristics of the individual feeding program.

The Feeding Program. The cattle feeding industry cannot be divorced from general farming operations. The practice of feeding cattle is by, and large, one phase of an over-all farm program.

Two types of feeders are found in the feeding industry. The first type of feeder, feeds cattle year in and year out. This type of feeder bases his farm operations on the practice of feeding cattle. The land is utilized to produce feed grains and roughages which are marketed through livestock. Because the feeding program is the base of the farm program, the practice of feeding cannot be discontinued in any particular year without seriously interrupting the entire farm program. Therefore, price has little or no effect on this type feeder in the short run.

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[1] That is within the normal price range in which cattle prices fluctuate.

The quantity taken by this type feeder will depend upon the quantity of feed and roughage he is able o produce.

The second type of feeder tries to "hit the market". In years in which he anticipates the future price for slaughter cattle to be favorable, he will expand his operations and in years in which he anticipates an unfavorable price, he will not feed. To this feeder the anticipation of profit due to favorable price trends is the motivating factor. Another factor that has some effect on the speculative type of feeder is the relationship between the price of corn and the price of beef. In years in which corn is relatively high in relation to the price of beef, the speculative feeder would be more inclined to market his corn through cash market channels than through livestock. Roughly, it requires the feed equivalent of 12 bushels of corn to produce 100 pounds of beef. Therefore, if the beef-corn ratio was less than 12-1, speculative feeders would not be inclined to feed as many cattle as they would if the beef-corn ratio was greater than 12-1.

Summary. In summary two factors can be pointed out as having the greatest influence on the quantity of feeder cattle taken in any specific year by cattle feeders. First, the quantity of feed produced will determine the quantity taken by the feeder who feeds year in and year out. The amount of corn produced will also have a decided affect on the beef-corn ration and therefore, will indirectly affect the speculative type feeder. Secondly, the conjecture of profits resulting from price movements will motivate much of the activity of the speculative type feeder.

The net change in quantity taken from year to year is determined by and large by these two factors.

Factors Causing Variation in Price Between Slaughter and Feeder Cattle

The second question that presents itself in regard to price relationships between feeder and slaughter cattle is, what determines just how much feeder buyers will pay over the reservation price of the slaughter buyer? No actual comparison can be gained from reported price data as to what a slaughter buyer would have been willing to pay for cattle purchased by feeder buyers. Some idea can be gained of this relationship by studying the price differential between comparable grades of slaughter and feeder cattle. If the price of feeder cattle is high relative to the price of slaughter cattle, evidently the feeders are paying relatively more than the value of the cattle for immediate slaughter.

The most important factor accounting for variation in the price differential between slaughter and feeder cattle prices is the relationship between the quantity of two-way cattle on the market, and the quantity demanded by the feeder buyers. In years in which the quantity demanded by feeder buyers is relatively large in relation to the existing supply, the competition between feeder buyers is more intense and the feeder buyers will bid up the price of the two-way cattle. This relationship could exist because of a larger than normal demand for feeder cattle or a less than normal quantity of two-way cattle on the market. The highest relative price for feeder cattle will result from a com-

bination of a high demand and short supply.

PART II. MEASUREMENT OF THE FACTORS

Relationship Between Slaughter Cattle Price and Feeder Cattle Prices

The data for this analysis were taken from the daily government livestock market reports on the Kansas City central livestock market. The slaughter cattle prices used are yearly averages of daily prices for the three grades; common, medium and good. The feeder cattle prices used are yearly averages of daily prices for four grades; common, medium, good and choice. The choice grade slaughter prices were not included because cattle of this grade would not fall in the two-way cattle classification. The comparison covers the 18 year period from 1926-43. Feeder cattle prices were not available for years prior to 1926, and price controls affected the normal relationship after 1943.

Figure 1 shows the yearly movement of both price series.[1] In every year except 1929, 1934 and 1938 the movement of the two series was quite uniform. The deviations of the three years mentioned are not great enough to discredit the hypothesis; that the general level of feeder cattle prices is determined largely by slaughter cattle prices. These three years are merely illustrations of the widening and narrowing of the differential between slaughter and feeder prices.

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[1] Appendix, Table 3.

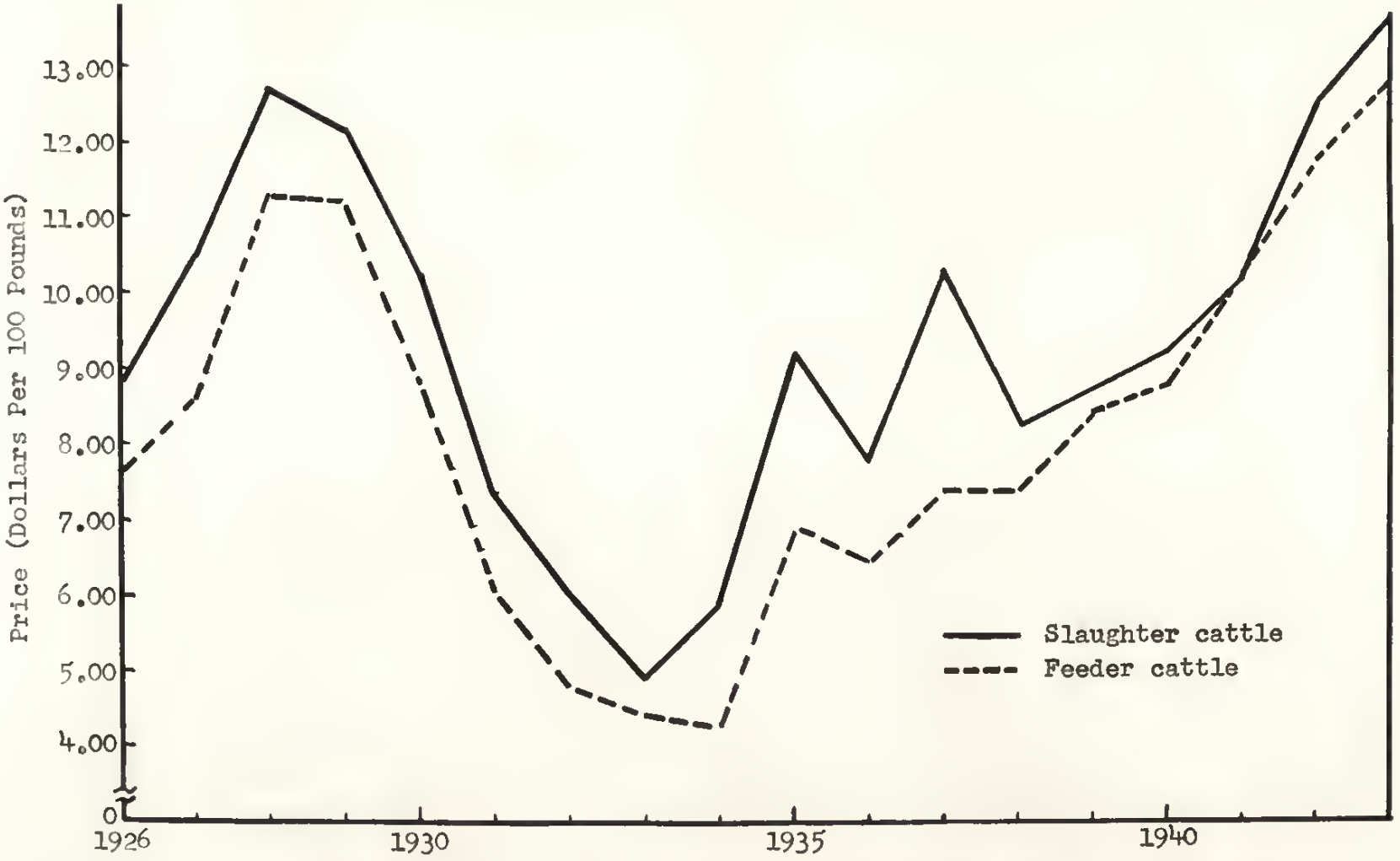

Fig. 1. Yearly average prices for feeder and slaughter cattle at Kansas City, 1926-43.

Figure 2 shows the regression of feeder cattle prices on slaughter cattle prices.[1] Here again the relationship is very close. Feeder cattle prices were relatively high in comparison to slaughter cattle prices in the three years of 1939, 1940 and 1941. Feeder cattle prices were relatively low in relation to slaughter cattle prices in the three years 1927, 1935 and 1937. The deviation of any of these six years is not great. Again this deviation illustrates the fluctuation of the spread between feeder cattle and slaughter cattle prices.

The coefficient of correlation between these two price series is .96. With 16 degrees of freedom, this coefficient is very highly significant. A coefficient of .59 is significant at the 1 percent level with 16 degrees of freedom, therefore, the correlation between these two series is well above the 1 percent level. This indicates a high degree of relationship between the two price series. Expressing this correlation coefficient as a coefficient of determination, the statement can be made, that 92 percent of the variation of feeder cattle prices is caused by fluctuations in slaughter cattle prices. This highly significant correlation between feeder cattle prices and slaughter cattle prices bears out the hypothesis developed in Part I; that the general level of feeder cattle prices is determined by the factors that determine slaughter cattle prices.

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[1] Appendix, Table 3.

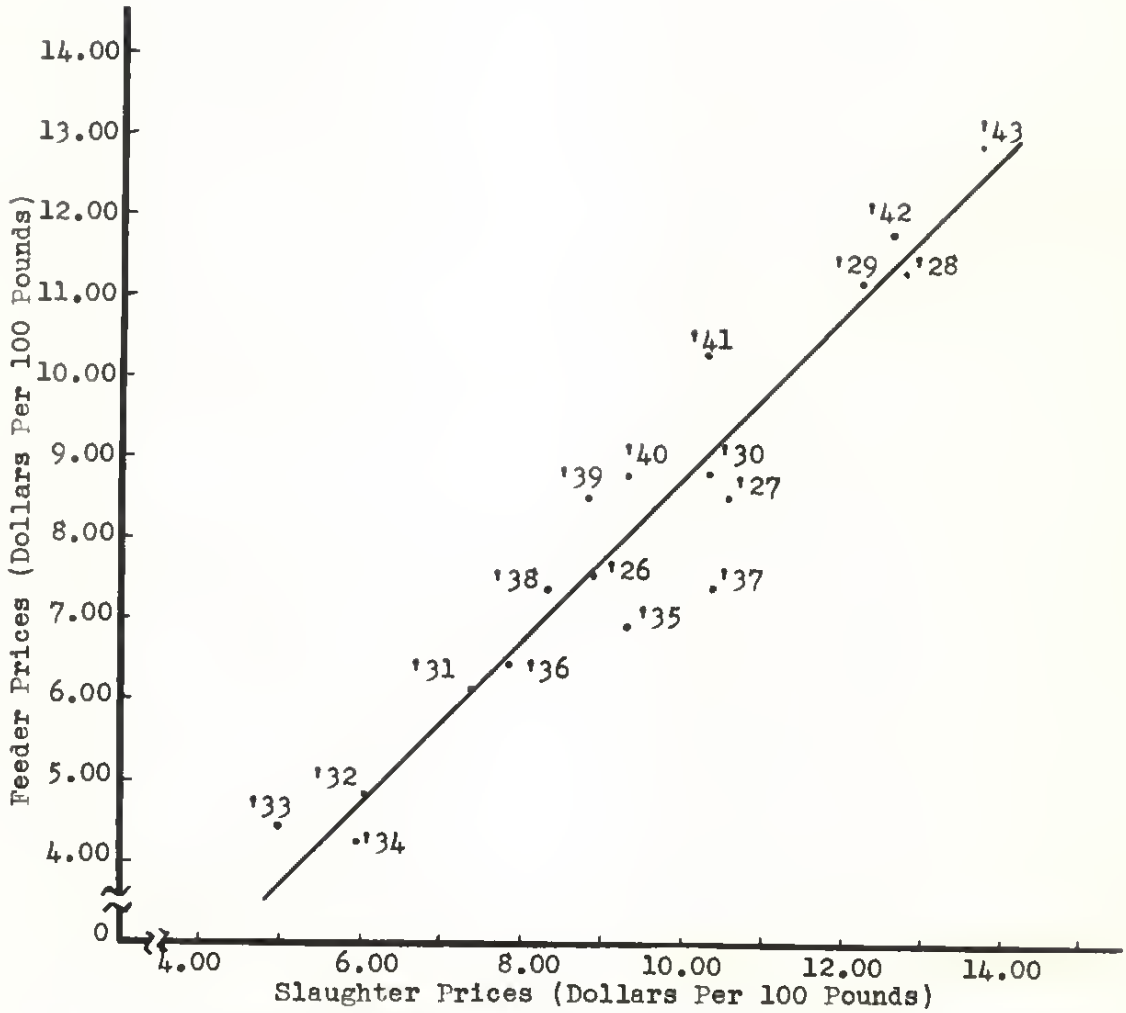

Fig. 2. Relationship between slaughter and feeder cattle prices at Kansas City, 1926-43.

Factors Determining the Quantity Taken

Elasticity of Demand. The elasticity of demand can be measured on the basis of two different series; on the basis of shipments of feeder cattle from public livestock markets, or on the basis of number of cattle on feed January 1.

The market for feeder cattle has generally been decentralizing during the last twenty years or more. Therefore, before the elasticity of demand can accurately be measured on the basis of purchases at public livestock markets, data for the central markets must be adjusted for the trend of decentralization.[1]

The relationship between adjusted shipments of feeder cattle and price is illustrated in Fig. 3.[2] The line of regression for these two variables has a positive slope.[3] If price had a direct effect on the quantity of feeder cattle taken, the slope of the regression line should be negative.

The quantity of feed available will have some effect on the quantity of cattle purchased. Therefore, if the effect of variation in production of feed is held constant, the relationship will more accurately indicate the effect of price on quantity. Figure 4 shows this relationship after the series for shipments of feeder cattle has been adjusted by an index for quantity of

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[1] See Appendix for the method of correction for decentralization.

[2] Appendix, Tables 2 and 3.

[3] This line of regression cannot be called the demand curve for actually it could be classified as a reversible supply curve.

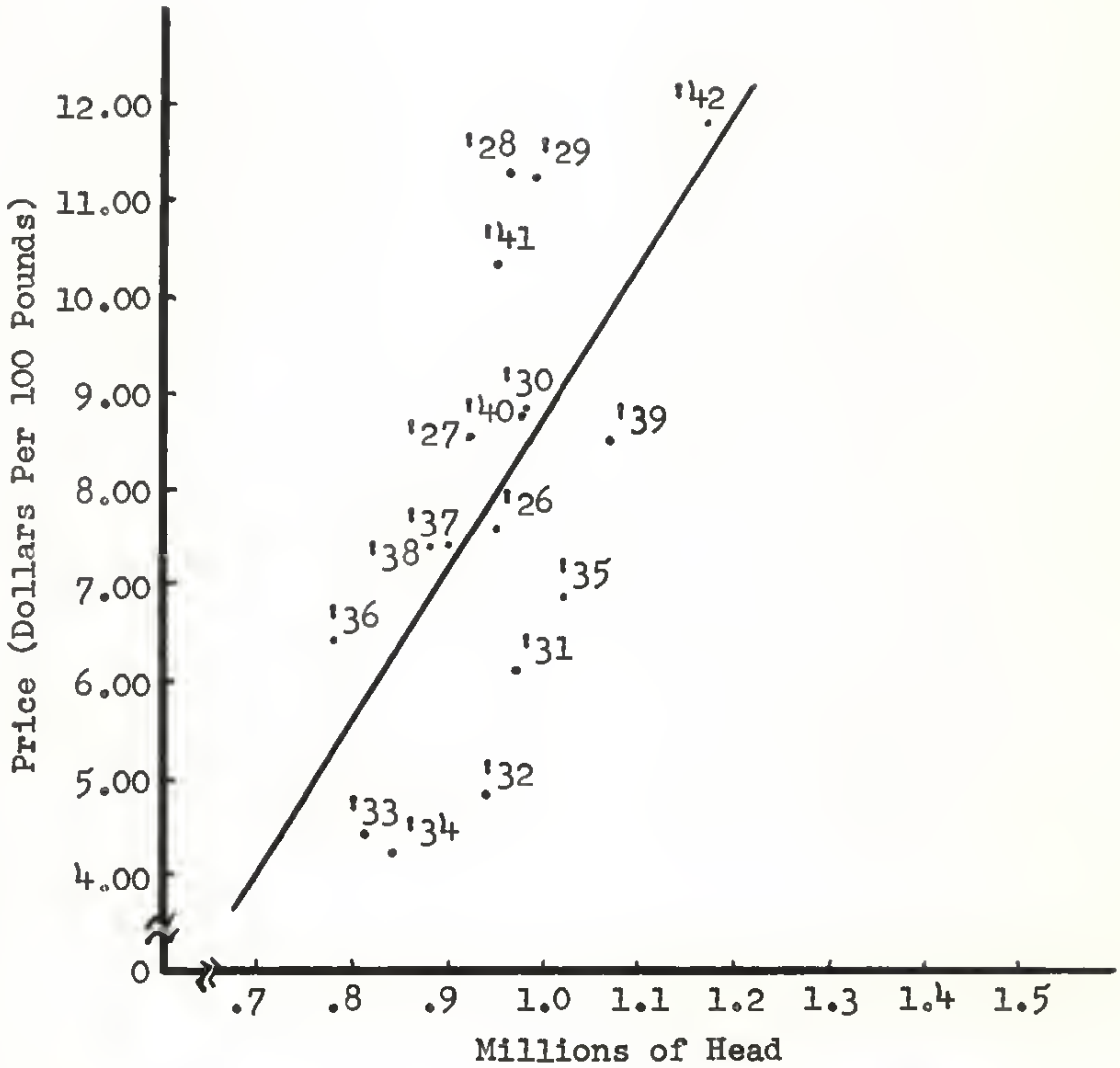

Fig. 3. Relationship between price and shipments of feeder cattle (corrected for decentralization) from Kansas City, 1926-42.

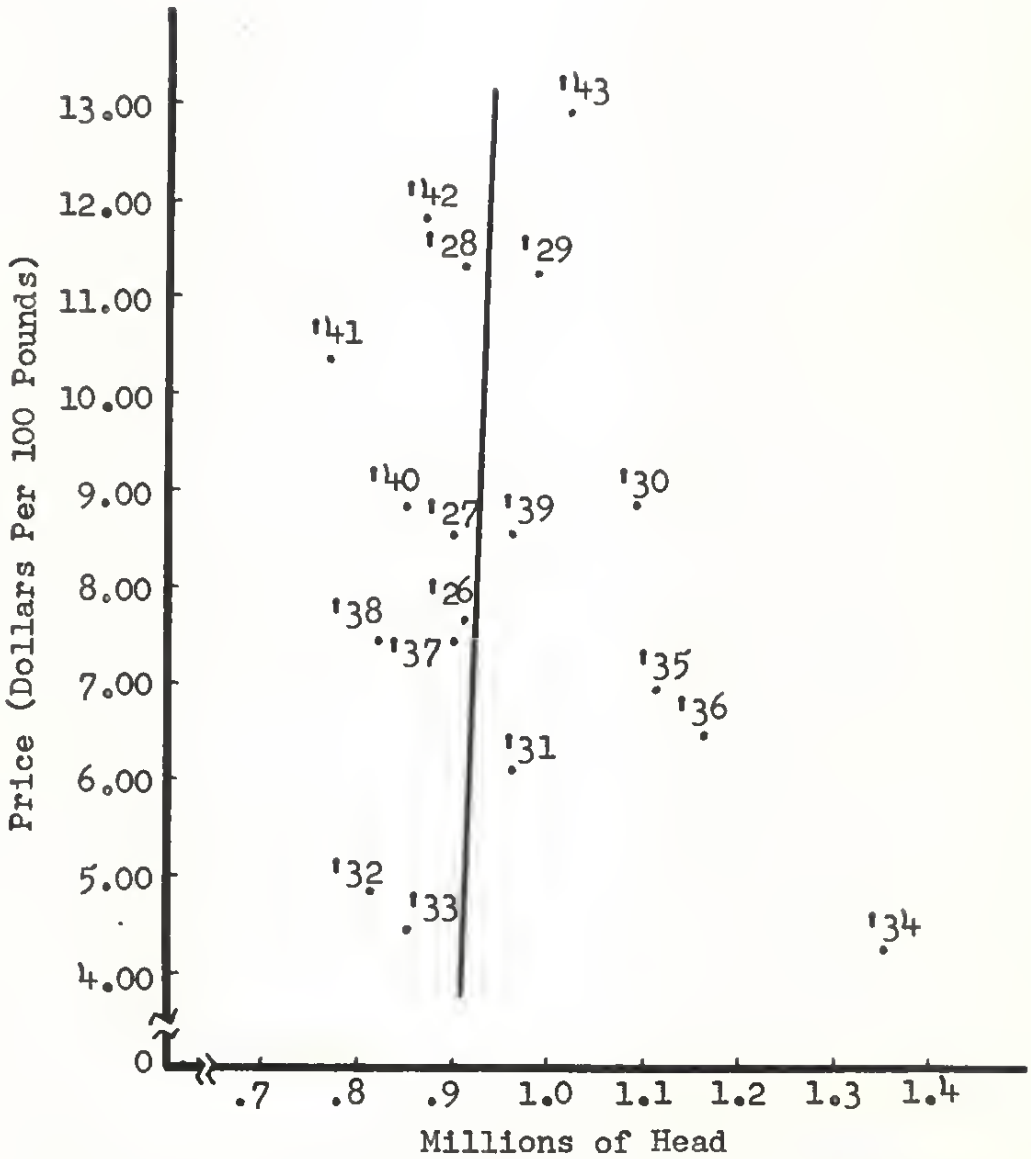

Fig. 4. Relationship between price and shipments of feeder cattle (adjusted for decentralization) weighted for production of feed grains.

feed grains produced.[1] The positive slope has been taken out of the regression line and the scatter more nearly resembles that of a perfectly inelastic demand.[2] The important point is that no definite negative slope can be detected.

The relationship is much clearer when measured on the basis of the number of cattle on feed January 1. Figure 5 shows the relationship between price of feeder cattle during the three fall months of September, October and November, and the number of cattle on feed the following January 1.[3] Figure 6 shows this relationship after the series representing demand has been adjusted to hold constant the effect of variation in production of feed grains.[4] Another illustration is given in Fig. 7, in which the adjusted series for demand is plotted against the spread between feeder and slaughter cattle prices.[5] In each of the three cases the relationship indicates a demand curve of perfect inelasticity. In other words, the quantity of cattle on feed January 1 is not affected directly by price.

Availability of Feed. Two factors apparently are responsible for most of the variation in the numbers of cattle fed annually. These two factors are the quantity of feed produced in the case of the permanent type cattle feeder and the anticipation of

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[1] Appendix, Tables 3 and 7.

[2] The year 1934 was not included in calculating the regression because of the extreme conditions existing in that year.

[3] Appendix, Tables 3 and 4.

[4] Appendix, Tables 3 and 7.

[5] Appendix, Tables 6 and 7.

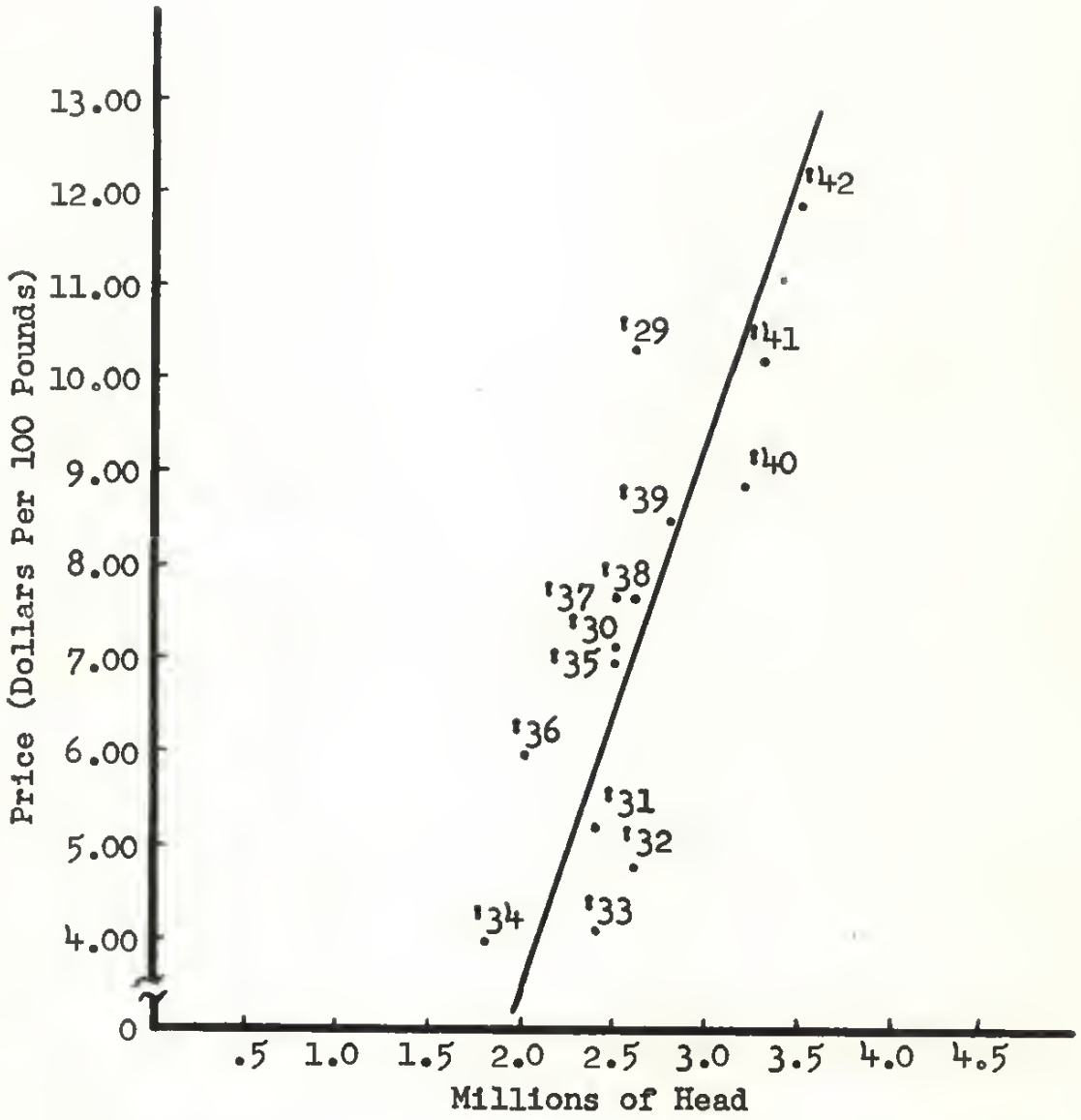

Fig. 5. Relationship between price of feeder cattle for September, October and November at Kansas City, and number of cattle on feed January 1 in North Central States.

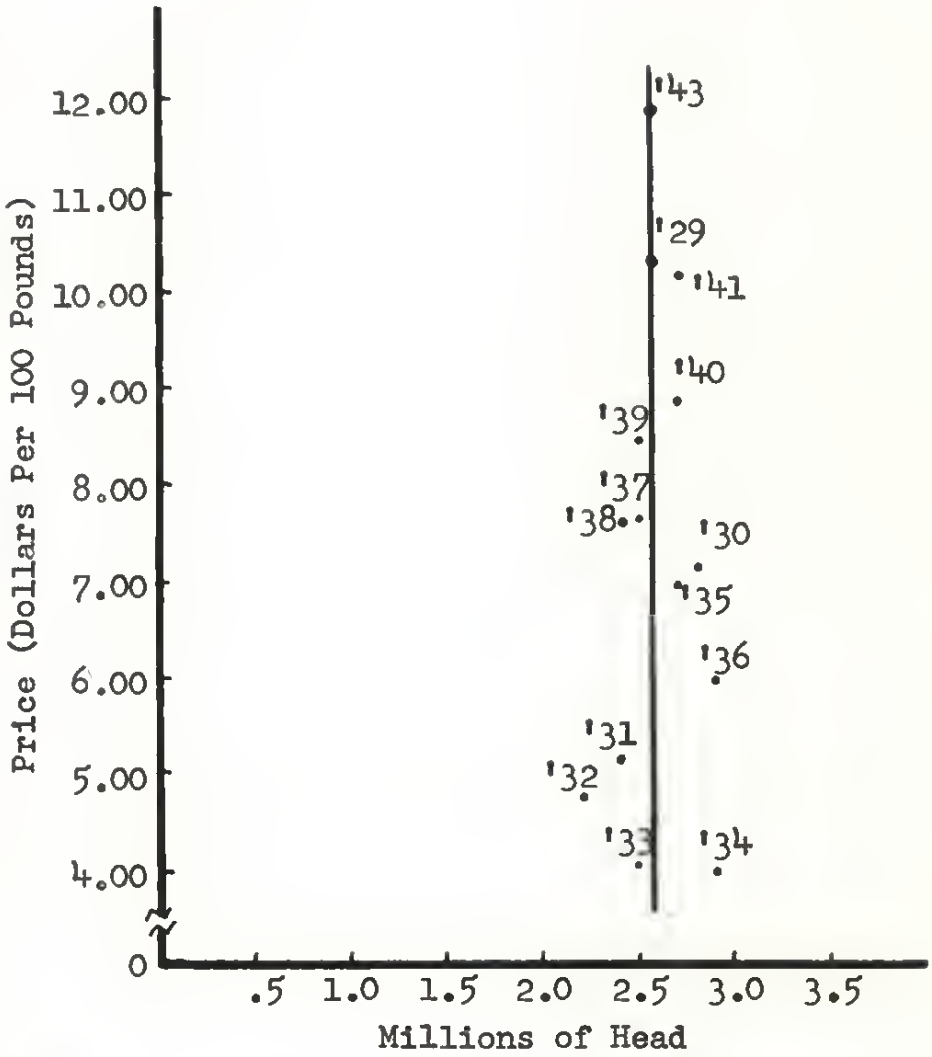

Fig. 6. Relationship between price of feeder cattle at Kansas City and numbers of cattle on feed January 1 in the North Central States weighted for production of feed grains.

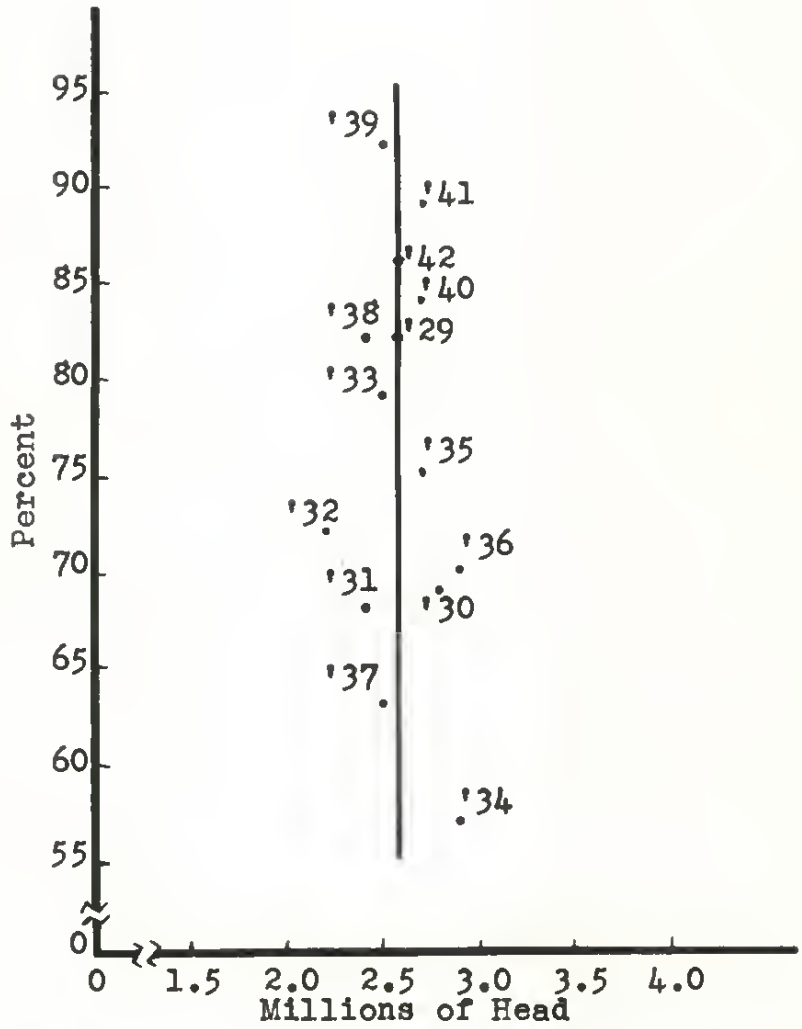

Fig. 7. Relationship between number of cattle on feed January 1, in North Central States, and feeder cattle prices as percent of slaughter cattle prices.

profits in the case of the speculative type feeder. Many permanent cattle feeders produce their own cattle for the feeding program. The cattle fed by the speculative feeder are all purchased on the market. Therefore, to show the relationships for the industry in its entirety, it is necessary to use a series of numbers of cattle on feed January 1;[1] to show the relationships of the speculative feeder, shipments from public markets are used.

Figure 8[2] shows the number of cattle on feed January 1 and the supply of feed grains available the preceding year.[3] The year to year movement of the two series is quite uniform for every year except 1932, 1939 and 1945. The cattle industry was in a period of expansion both in 1932 and 1939. Therefore, many heifers that would ordinarily be held on feed would be included in the breeding herd rather than be classified as cattle on feed. This would account for the relatively low numbers of cattle on feed in relation to the amount of feed produced in these years. The quantity on feed in 1945 was affected by the unfavorable prices existing during the period of price control.

Figure 9 shows the regression of cattle on feed January 1,

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[1] The seasonal high for purchases of feeder cattle is during the three fall months of September, October and November. Therefore, numbers of cattle on feed January 1 will reflect the market demand for feeders as well as the feeder cattle produced by the feeder.

[2] Appendix, Tables 4 and 5.

[3] The supply of feed grains consists of the feed grains produced plus the carry-over at the end of the crop year. The crop year ends October 1 for corn and July 1 for oats and barley. Therefore, the cattle feeder knows how much feed is available before actually starting his feeding program.

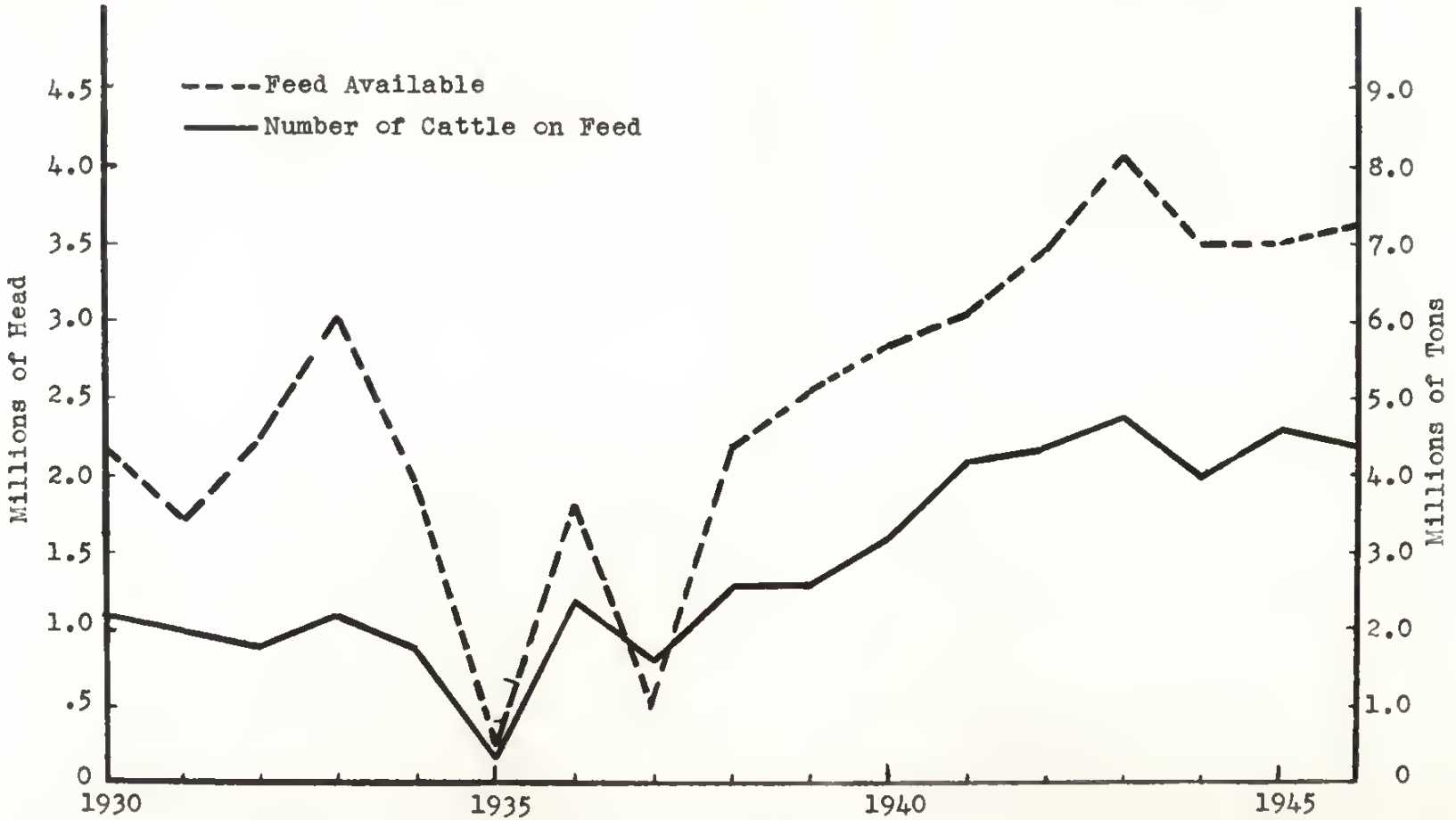

Fig. 8. Feed grains available and number of cattle on feed January 1 for United States.

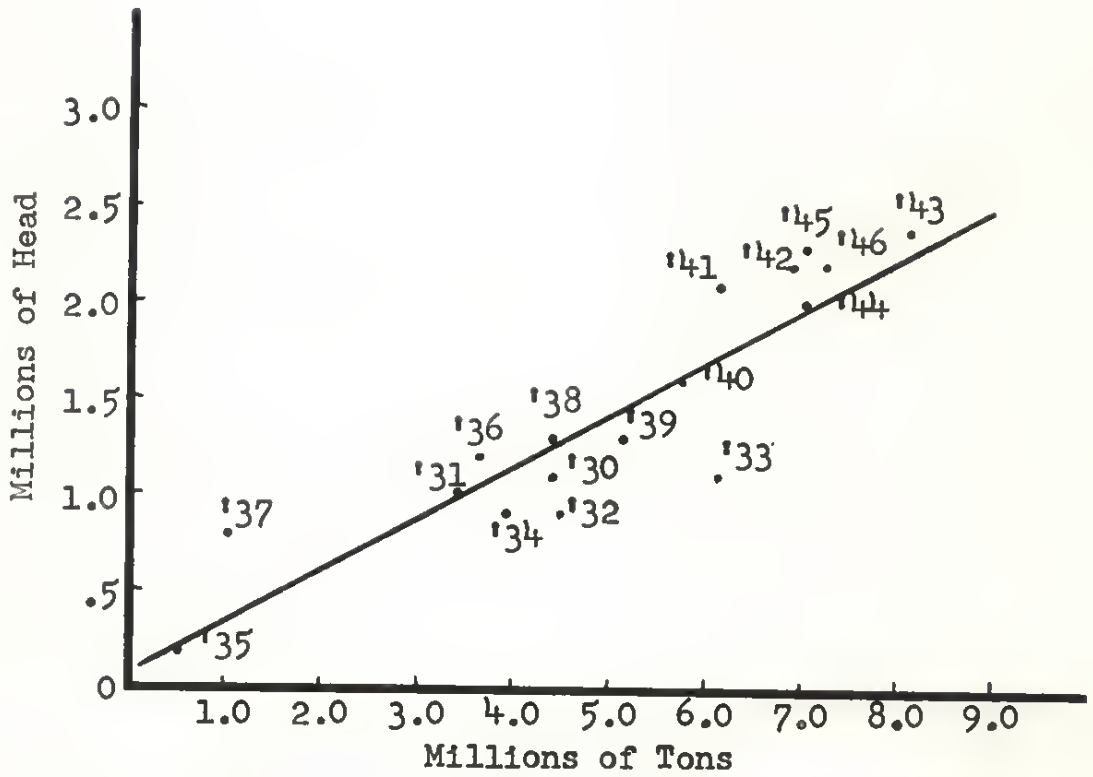

Fig. 9. Relationship between the quantity of feed grains available and number of cattle on feed January 1, for the United States.

on the quantity of feed grains available.[1] The coefficient of correlation for this relationship is .93. With 15 degrees of freedom, a coefficient of this size is highly significant. With 15 degrees of freedom, a coefficient of .61 is significant at the 1 percent level, therefore, a coefficient of .93 with 15 degrees of freedom is highly significant. Expressing this correlation coefficient as a coefficient of determination, the statement can be made, that 86 percent of the variation in numbers of cattle on feed January 1 is caused by the fluctuation in amount of feed grains produced. The average slope of the regression line is 80 percent, therefore, a 10 percent change in the quantity of feed produced, other factors remaining constant, will produce approximately a similar change of 8 percent in the number of cattle on feed January 1.

The anticipation of profit is purely a subjective factor and cannot actually be measured. However, certain relationships can be noted that will give some indication of the relationship of this factor on the quantity of cattle taken. The cattle fed by the speculative feed are all purchased on the market. Therefore, some indication can be gained as to the activities of this type of feeder by comparing the correlation between the quantity of feed grains available and number of feeder cattle purchased, to the correlation between feed available and cattle on feed January 1.

Figure 10 shows the regression of a series of feeder cattle

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[1] Appendix, Tables 4 and 5.

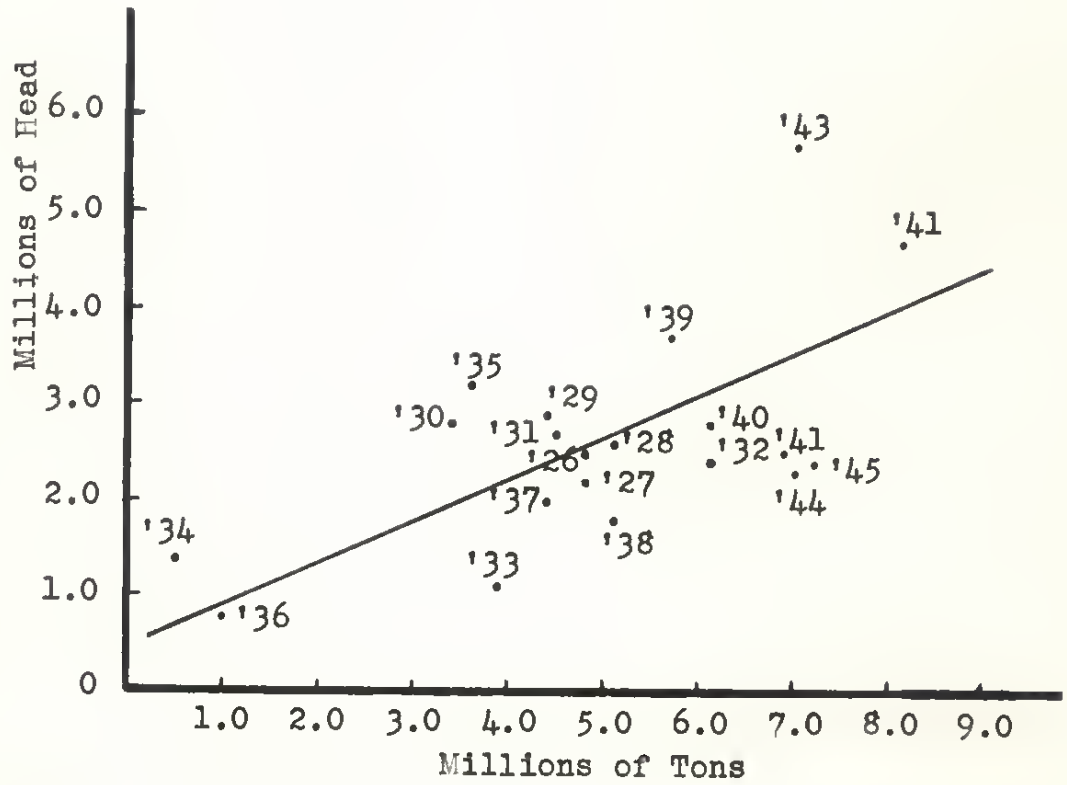

Fig. 10. Relationship between the amount of feed grains available and the estimated shipments of feeder cattle from Kansas City, 1926-45.

shipments from Kansas City, adjusted for decentralization, on the quantity of feed available.[1] The coefficient of correlation for this relationship is .62; a highly significant coefficient. With 18 degrees of freedom, a coefficient of .56 is significant at the 1 percent level. There is some error in this measurement due to the inaccuracy of the measurement of the decentralization of the market.[2]

Rising prices will present possibilities of profit to the speculative feeder, whereas, falling prices will appear unfavorable. Therefore, the quantity of feeder cattle purchased on the market will tend to fluctuate directly with price as a result of the actions of the speculative feeder. This relationship was noted in the section treating the nature of the elasticity of feeder cattle demand. The coefficient of correlation for this relationship is .64 over a 17 year period from 1926-42. With 15 degrees of freedom, this correlation is significant at the 1 percent level. This relationship supports the hypothesis that feeder cattle demand tends to vary directly with price and is probably due to the conjecture of profits.

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[1] Appendix, Tables 2 and 5.

[2] Actual data are available for purchases of feeder cattle, both direct and from public stockyards, for Iowa since 1938. The correlation between the actual purchases for Iowa and the quantity of feed available is .7353. With 7 degrees of freedom the correlation is almost significant at the 2 percent level. A correlation of .7498 is necessary to be significant at the 2 percent level with only 7 degrees of freedom. Much more accurate work can be done on this problem in the future when longer series of actual data are obtained. Even with this very short series of data, the relationship is significant.

Two factors have a significant relationship to the quantity of feeder cattle purchased. The quantity of feed available, and quantity of feeder cattle purchased are correlated at .62; the price of feeder cattle and quantity purchased at .64. The multiple correlation coefficient for these two factors is .716. With 14 degrees of freedom, a multiple correlation coefficient of this size is significant at the 1 percent level. The coefficient of determination for these two factors is .51 or the two factors taken together explain 51 percent of the variation in number of feeder cattle purchased on the market.

There are other factors that affect the quantity of feeder cattle that will be purchased in any one year. These factors, however, remain normal most of the time and only have a decided influence in specific years. Therefore, the effect of these factors cannot be measured on time series data. The availability of credit is a factor that has some influence during depression years. A significant proportion of the purchases of feeder cattle are financed by a credit transaction. If credit is difficult to obtain, some feeders who are willing and have the desire to purchase feeder cattle, are not actually able to enter the market. Another such factor is an early killing frost. An early killing frost would result in a soft corn crop, which could only be marketed through livestock, thus creating a large demand for feeder cattle in that particular year. The frost damage to a late corn crop resulted in a greater demand for feeder cattle than other factors would indicate in 1935 and again in 1947.

Another important market observation should be mentioned at this point. Not all animals shipped as feeder cattle actually enter a feeding program. There are traders on every market, buying cattle to send to some other market, or to hold over in anticipation of a higher price in the near future. The cattle taken by the scalpers will be reported as feeder shipments, but the actions of the scalpers may not vary in the same relation to all the factors that cause fluctuation in the cattle feeding industry.

Measurement of the Variation in Spread Between Feeder and Slaughter Cattle Prices

To show the relative degree to which feeder buyers bid over the reservation price of slaughter buyers, the price for feeder cattle is expressed as percent of slaughter cattle prices. Figure 11 shows the differential for all four grades of feeder cattle for the 16 year period from 1916-1941.[1] In general, the year to year fluctuation is quite uniform for all four grades. It is interesting to note that the differential is the least for common feeder steers.

To measure the factors causing the fluctuation in price spreads, an average figure was calculated for all four grades of feeder cattle on the basis of the daily price quotations for the three fall months of September, October and November. The fluctuation of this annual average of all four grades is pictured

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[1] Appendix, Table 6.

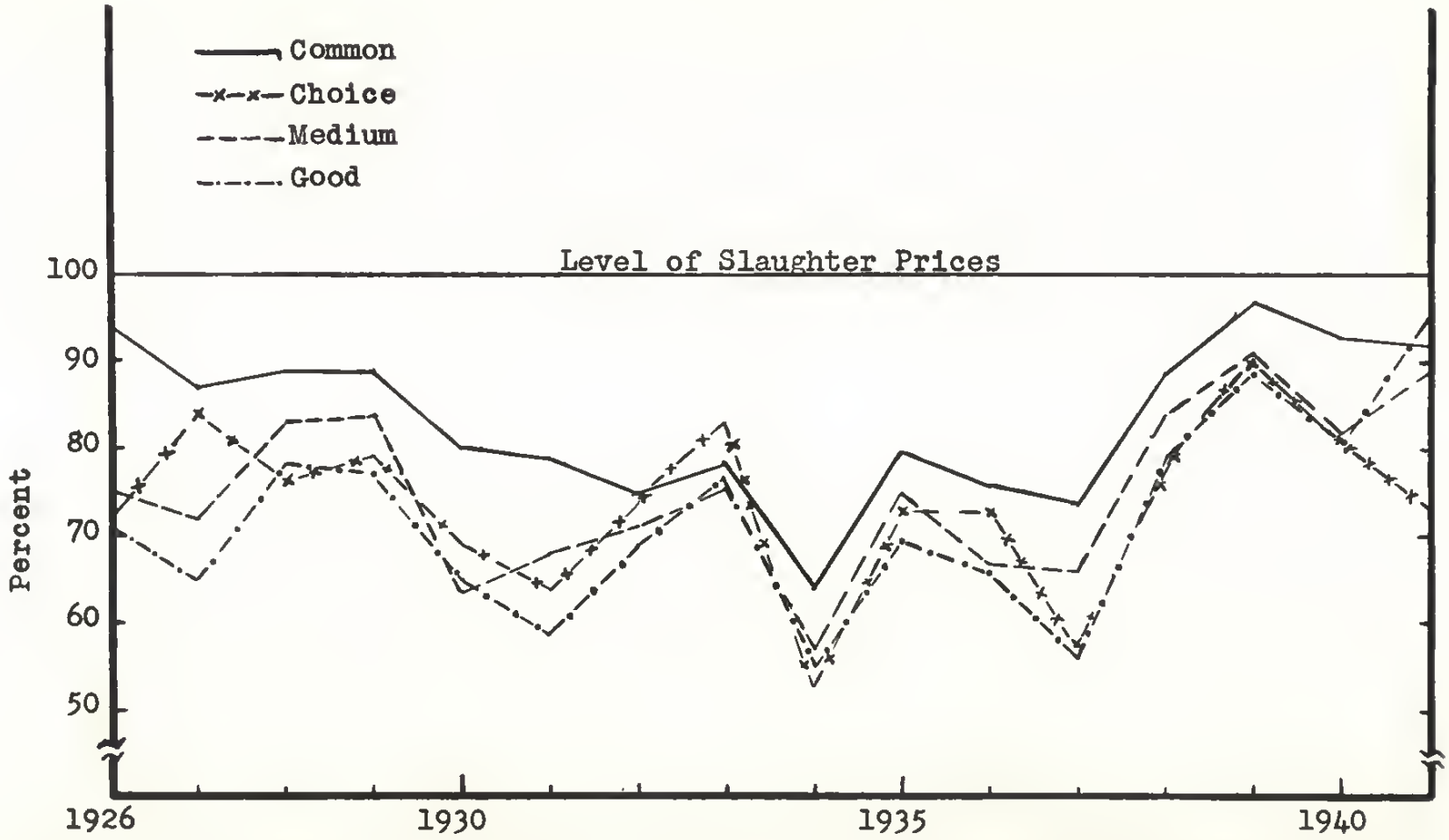

Fig. 11. Feeder cattle prices as percent of slaughter cattle prices at Kansas City, for each individual grade, 1926-41.

graphically in Fig. 12.[1]

The combined effect of demand and supply can be illustrated graphically by plotting a scatter graph of the price differential, against the quantity of cattle on feed January 1 in the North Central Region of the United States. This relationship is pictured in Fig. 13.[2] It has been shown that the demand for feeder cattle is one of perfect inelasticity. Therefore, when quantity remains unchanged, demand must be identical. Fluctuations in price differentials in years when demand is constant is due entirely to supply.[3] Demand was approximately the same in 1929, 1938 and 1932; in 1930, 1935 and 1937; and in 1931 and 1933. The years 1934 and 1936 indicate an appreciable decrease in the demand for feeder cattle, whereas, the years 1939 through 1942 indicate a sizeable increase in feeder demand. The relationship between changes in numbers of cattle on feed January 1 and the price spread is .77. With 12 degrees of freedom, a coefficient of correlation of .77 is highly significant. Expressing this coefficient as a coefficient of determination, the statement can be made, that fluctuations in demand cause 59 percent of the variation in the spread between feeder and slaughter prices.

It is impossible to show any mathematical value for the relationship between supply and the fluctuation of the price spread. Series of data are not available as indicators of supply.

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[1] Appendix, Table 6.

[2] Appendix, Tables 4 and 6.

[3] The supply of feeder cattle can vary as a result of changes of actual numbers of cattle on the market or due to changes in composition of the total market supply.

Fig. 12. Feeder cattle prices as percent of slaughter cattle prices--average of all four grades.

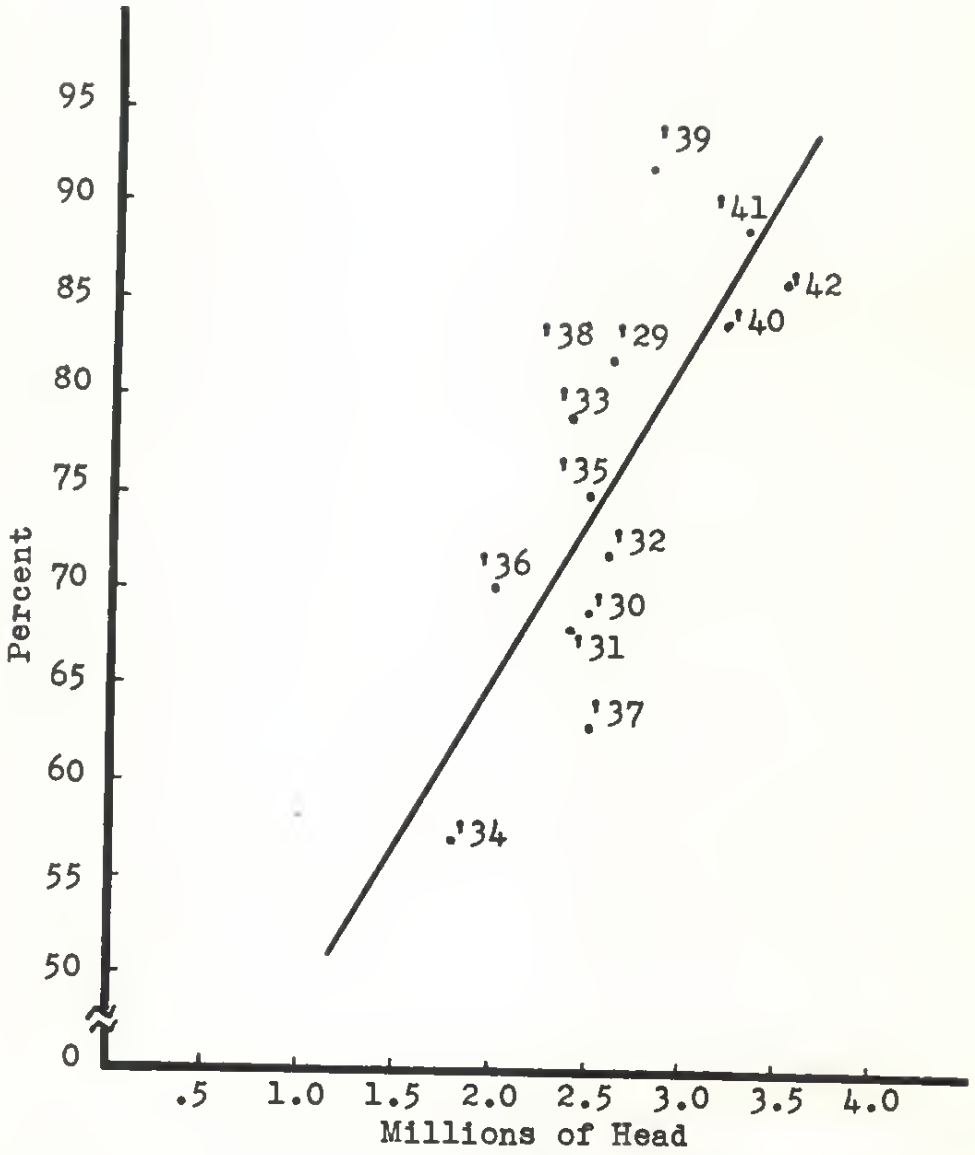

Fig. 13. Relationship between feeder cattle price as percent of slaughter cattle price and number of cattle on feed January 1 in the North Central States.

However, if demand and supply are the only two factors affecting this price spread, and the effect of demand has been accurately measured, then supply could account for a maximum of 41 percent of the variation.

SUPPLY

Up to this point very little mention has been made of supply or its effect on price. In the case of feeder cattle, two separate considerations must be made in connection with supply.

The total market supply of cattle affects feeder cattle price indirectly, inasmuch as total supply of cattle in connection with total demand for beef for consumption determine to a large extent the price of slaughter cattle, and the price of slaughter cattle in turn determines the general level of feeder cattle prices.

Secondly, the portion of total market supply that will qualify as two-way cattle will affect the spread between feeder and slaughter prices. Should the quantity of two-way cattle be relatively small in relation to the quantity of feeder cattle sought by cattle feeders, competition between feeder buyers will have a greater effect on the price of two-way cattle than on the price of slaughter cattle, thereby, resulting in feeder prices being relatively high in relation to slaughter cattle prices.

SUMMARY AND CONCLUSIONS

Feeder buyers on the market are in competition with slaughter buyers. Therefore, if feeder buyers are to buy cattle, they must be willing to pay at least what their competitors are willing to offer for the same cattle. The feeder will be willing to buy cattle under these conditions because the value of a steer, desirable for feeding purposes, is greater than the value of that steer for immediate slaughter. Since the major demand for total market supply of cattle comes from slaughters and since feeder buyers must bid two-way cattle away from slaughterers, the general level of feeder cattle prices is determined largely by the factors determining slaughter cattle prices. This hypothesis is substantiated by statistical measurement of the relationships. The series of feeder and slaughter cattle prices at Kansas City from 1926-1943 were correlated at .96, which is highly significant.

The feeder cattle demand, based on numbers of cattle on feed January 1, is perfectly inelastic. This is to say that the number of cattle on feed on January 1, varies as the result of factors other than current price. The argument may be put forth, that during periods of high prices, feeders are hesitant to buy cattle for fear of financial loss due to a price drop in the future. The answer here is that it is the anticipation of the price in the future rather than the current price that influences the cattle feeder. A graphical illustration of the numbers of

cattle on feed January 1, against price supports this hypothesis.

Many factors affect the decisions of the cattle feeder. Most of the factors are too unimportant by themselves to produce significant relationships by correlation. These factors acting together either counteract or supplement the more important factors, thus leaving a wide margin of variation unaccounted for by statistical analysis. The two most important factors upon which cattle feeders base their operations are: (1) the quantity of feed produced, and (2) the conjecture of profits. By the time the permanent type feeder actually starts his feeding program, he has an accurate estimate of the amount of feed available for his feeding program. If the quantity of feed produced is small; the feeder relying on his own feed supply will have to adjust his feeding program accordingly. Under these conditions the price of feed would ordinarily be high in relation to the price of beef, thereby, discouraging the feeder from buying feed. The conjecture of profits will affect the decisions of the speculative type feeder. This type feeder tries to "hit the market"; therefore, when he expects favorable prices in the future, he enters the market, and in years of anticipated unfavorable price movements, he will not enter the market. The conjecture of profits is purely a subjective factor and cannot be measured. The net increase or decrease in the number of cattle on feed from year to year results from the action of both the speculative and the permanent cattle feeder. Each type of feeder is motivated by a different factor; therefore, the number of cattle fed depends largely upon the relative importance of the two important factors

in that particular year.

The third problem dealt with in this study was the variation in the price spread between comparable grades of feeder and slaughter cattle. In general, the year to year fluctuations of all four grades were quite uniform. To measure the factors causing the year to year variation, an average figure for all four grades was used. The price spread in any one year is dependent largely on the relationship between the demand for, and supply of feeder cattle in that particular year. Demand was measured as being responsible for 59 percent of the variation. Data were not available for supply, therefore, it was impossible to measure mathematically the effect of supply but supply would be responsible for the remaining 41 percent of the variation.

Very little research has been done in the field of feeder cattle prices. This study was not intended to give the answer to all the questions on the economics of the cattle feeding industry but was to point up some of the factors that affected quantity and price of feeder cattle. This study gives rise to several interesting and pertinent questions on the cattle feeding industry. One of the limitations of this study was the lack of data on supply, therefore, a study should be made of the market to attempt to determine just what constitutes feeder cattle supply. Other problems deal with the seasonal nature of the feeder cattle industry, the relationship between the value of an animal for slaughter and the market value of the same animal as a feeder, and the measurement of the decentralization of the feeder cattle market.

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APPENDIX

Measurement of the Decentralization of the Feeder Cattle Market

A mathematical curve was fitted to the annual values for shipments of feeder cattle from Kansas City for the period 1916-46. The yearly values were expressed as a percent of the trend value. This index for each year was multiplied by the initial value of the trend series to convert the index to estimated numbers purchased each year, thus correcting for trend. Figure 14 shows the original data, the calculated trend and yearly estimates of purchases.[1]

The Curve. The curve was a second degree parabola calculated from the formula, $Y = a + bX + C(X)^2$. The original data, plotted on arithmetic scale indicated that the trend was not constant, therefore, a first degree parabola could not be used. The data exhibited curvature in only one direction, therefore, it was assumed that a second degree parabola would fit the data most accurately.

The Original Series. To correct yearly values of shipments by this method, it is essential that the measurement should start in a year before decentralization started. Accurate data for all public markets were not available for years prior to 1922; by this time the market had decentralized considerably. The most accurate data available were data on shipments of feeder cattle from the Kansas City market. By using these data it was possible

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[1] Appendix, Table 2.

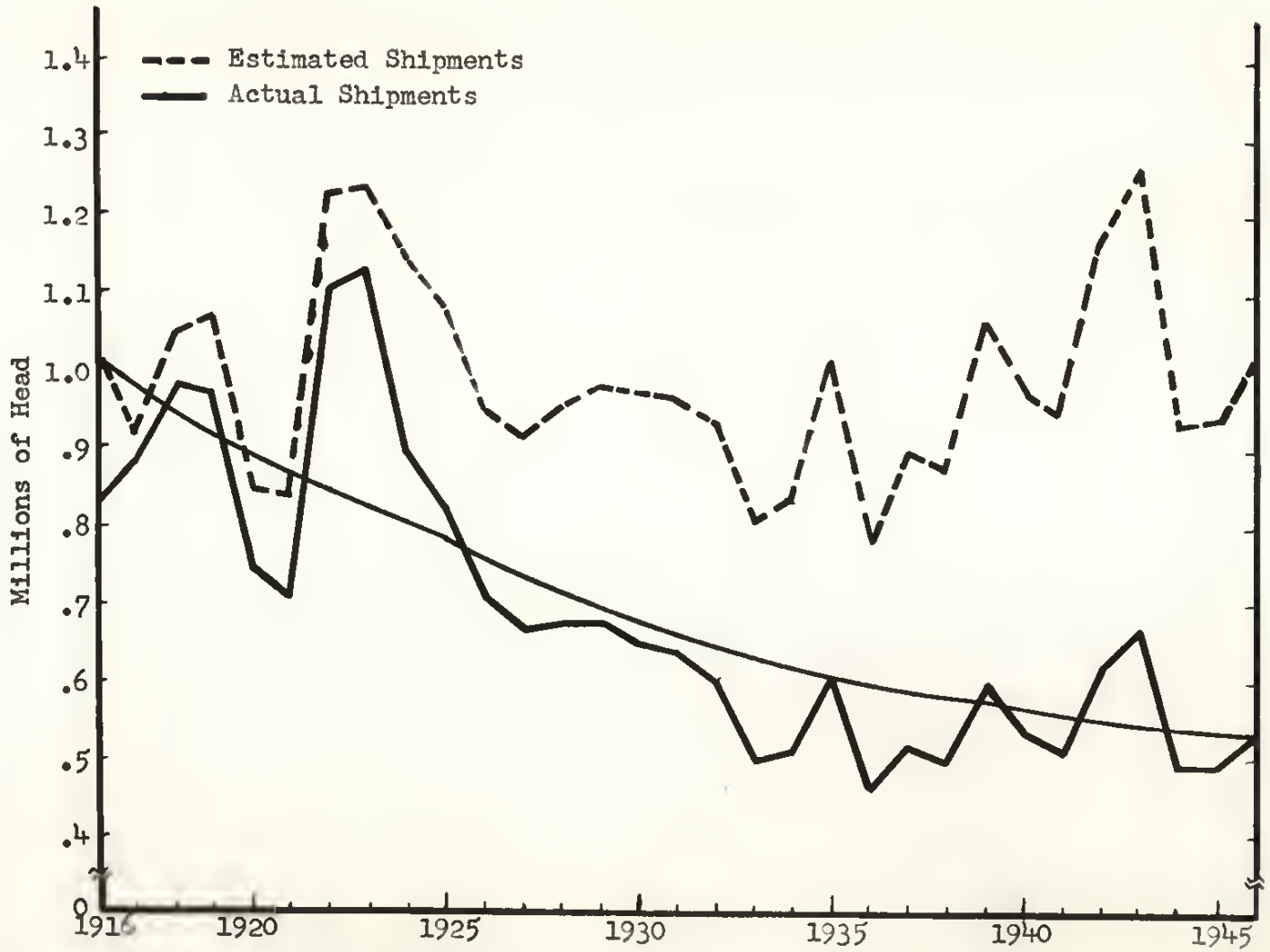

Fig. 14. Inspected shipments of feeder cattle from Kansas City and estimated shipments to correct for decentralization.

to start the measurement in 1916, thereby, affording somewhat more accuracy in the measurement.

The Assumption. This method of measuring decentralization must be qualified by four basic assumptions. The accuracy of the measurement is dependent largely on the reliability of the assumptions.

1. The variation of shipments of feeder cattle, and the degree of decentralization at Kansas City were representative of the entire market.

2. The trend measured by the mathematical curve was due entirely to the decentralization of the market.

3. The trend value for 1916 was approximately the normal value for feeder cattle shipments for several years prior to 1916.

4. No technological changes occurred which would have resulted in an increase of the cattle feeding industry.

Of the four assumptions, the first is probably the most accurate. Kansas City has always been the leading feeder cattle market in the United States. Data are not available to estimate the reliability of the second and third assumptions. There are indications that might possibly discredit the fourth assumption because the number of cattle on feed January 1 has been increasing in recent years.

The accuracy of the measurement can be checked to some degree by comparing the percent of decentralization as measured here to the actual percent of decentralization given for more recent years by the U. S. Department of Agriculture. Since 1938,

the U. S. Department of Agriculture published relatively accurate figures on the number of feeder cattle purchased direct, and from public markets in certain Corn Belt States.

Using the data given for Iowa by the U. S. Department of Agriculture, the measurement used here seems to be fairly accurate. Thirty seven percent of the feeder cattle shipped into Iowa for 1938 were purchased direct. According to the method described here, shipments of stockers and feeders from Kansas City were 43 percent smaller than they would have been had there been no decentralization. For 1940, 45 percent of the cattle shipped into Iowa were purchased direct and the degree of decentralization at Kansas City measured by this study was 45 percent. For 1945 the actual degree of decentralization in Iowa was 30 percent, whereas, for the Kansas City market the estimate was 47 percent. The degree of error is greater for the eastern Corn Belt states. The greater the distance between the great plains area and the area of demand, the less tendency there is to purchase feeder cattle direct.

Conclusions. Measuring decentralization by compensating for trend alone is not accurate for every year or for all areas of the feeder cattle industry. The trend will overvalue the degree of decentralization in the more removed areas and also in the very recent years. This method was considered accurate enough for the purpose of this study. It is necessary to remove trend in order to study year to year variation in time series data.

DATA

The tables that are given on the following pages list the figures from which the various graphs were constructed and also give the primary source of the data.

Table 2. Shipments of feeder and stocker cattle from Kansas City, and shipments adjusted to compensate for decentralization.

Year	Actual shipments : Number	Actual shipments : Millions of head	Adjusted shipments : Millions of head
1916	834,000 1/	.83	1.02
1917	889,000	.89	.92
1918	994,000	.99	1.05
1919	977,000	.98	1.08
1920	751,463	.75	.85
1921	707,613	.71	.84
1922	1,106,022	1.11	1.33
1923	1,138,407	1.14	1.40
1924	900,873	.90	1.15
1925	824,868	.82	1.09
1926	705,975	.71	.95
1927	560,907	.67	.92
1928	684,090	.68	.96
1929	679,968	.68	.99
1930	649,763	.65	.98
1931	634,780	.63	.97
1932	594,667	.60	.94
1933	503,609	.50	.81
1934	511,375	.51	.84
1935	608,277	.61	1.02
1936	459,563	.46	.78
1937	516,195	.52	.90
1938	498,392	.50	.88
1939	598,392	.60	1.07
1940	538,793	.54	.98
1941	510,476	.51	.95
1942	616,917	.62	1.17
1943	669,681	.67	1.27
1944	493,016	.49	.93
1945	490,815	.49	.94
1946	524,595	.53	1.02

Source: Yearbook of Agriculture, 1925, page 1044; Agricultural Statistics, 1941, page 348; Livestock Market News, 1946, page 20.

1/ The first four years were only given in thousands of head.

Table 3. Yearly average price of feeder and slaughter cattle and average feeder cattle price for September, October and November at Kansas City, 1926-1943.

Year	Slaughter cattle	Feeder cattle	Average feeder cattle price for September, October and November
	Dollars per 100 pounds		
1926	8.85	7.62	7.46
1927	10.54	8.59	9.05
1928	12.78	11.32	11.33
1929	12.20	11.27	10.30
1930	10.30	8.89	7.12
1931	7.35	6.11	5.18
1932	6.04	4.86	4.77
1933	4.96	4.45	4.04
1934	5.94	4.24	3.98
1935	9.29	6.93	6.98
1936	7.84	6.47	5.98
1937	10.37	7.43	7.69
1938	8.29	7.44	7.63
1939	8.79	8.54	8.43
1940	9.29	8.85	8.88
1941	10.26	10.37	10.18
1942	12.59	11.88	11.83
1943	13.71	12.95	

Source: B.A.E., Kansas City Daily Market Report.

Table 4. Cattle on feed January 1, for United States and for North Central States, 1930-1946.

Year	United States		North Central States	
	Millions	Coded	Millions	Coded
1930	3.1	1.1	2.6	1.6
1931	3.0	1.0	2.5	1.5
1932	2.9	0.9	2.4	1.4
1933	3.1	1.1	2.6	1.6
1934	2.9	0.9	2.4	1.4
1935	2.2	0.2	1.8	0.8
1936	3.2	1.2	2.5	1.5
1937	2.8	0.8	2.0	1.0
1938	3.3	1.3	2.5	1.5
1939	3.3	1.3	2.6	1.6
1940	3.6	1.6	2.8	1.8
1941	4.1	2.1	3.2	2.2
1942	4.2	2.2	3.3	2.3
1943	4.4	2.4	3.5	2.5
1944	4.0	2.0	3.2	2.2
1945	4.3	2.3	3.5	2.5
1946	4.2	2.2	3.3	2.3

Source: Agricultural Outlook Chart 1947, page 90.

Table 5. Feed grain available at beginning of cattle feeding program, United States, 1926-1946.

Year	Feed grain available	Coded
	1,000 tons	
1926	108,178	4.8
1927	107,802	4.7
1928	110,202	5.0
1929	104,099	4.4
1930	93,785	3.3
1931	104,948	4.4
1932	121,397	6.1
1933	99,403	3.9
1934	64,959	0.4
1935	95,797	3.5
1936	70,196	1.0
1937	103,939	4.3
1938	111,096	5.1
1939	116,466	5.6
1940	121,446	6.1
1941	128,708	6.8
1942	141,145	8.1
1943	130,178	7.0
1944	130,345	7.0
1945	132,105	7.2
1946	137,723	7.8

Source: Agricultural Outlook Charts, 1947, page 74.

Table 6. Feeder cattle prices for September, October and November expressed as percent of slaughter prices for each grade and an average of all grades, 1926-1942.

Year	Choice	Good	Medium	Common	Average
1926	72	71	75	94	78
1927	84	65	72	87	79
1928	76	78	83	89	82
1929	79	77	84	89	82
1930	69	65	64	80	69
1931	64	59	68	79	68
1932	74	69	71	75	72
1933	83	77	76	79	79
1934	53	55	57	64	57
1935	73	70	75	80	75
1936	73	66	67	76	70
1937	57	56	66	74	63
1938	78	79	84	89	82
1939	90	89	91	97	92
1940	81	81	82	93	84
1941	73	95	89	92	89
1942	88	87	82	86	86

Source: Computed from B.A.E., Kansas City Daily Livestock Market Reports.

Table 7. Index of feed grain production from 1926-1946, estimated shipments from Kansas City and cattle on feed January 1 in North Central Region weighted by index of feed grain production.

Year	Index of feed grain production (Arithmetic mean=100)	Cattle on feed weighted for feed grain production	Estimated shipments from Kansas City weighted for feed production
			Millions of head
1926	103.8	--	0.91
1927	103.3	--	0.90
1928	103.6	--	0.91
1929	99.8	2.6	0.99
1930	89.9	2.8	1.09
1931	100.6	2.4	0.96
1932	116.4	2.2	0.81
1933	95.3	2.5	0.85
1934	62.2	2.9	1.35
1935	91.9	2.7	1.11
1936	67.3	2.9	1.16
1937	99.6	2.5	0.90
1938	106.5	2.4	0.82
1939	111.7	2.5	0.96
1940	116.4	2.7	0.85
1941	123.4	2.7	0.77
1942	135.3	2.6	0.87