December 1, 1965

To the Graduate Council:

I am submitting herewith a thesis written by Johnny Dale Braden entitled "Time Series Analysis of Prices Received by Tennessee Farmers, 1910-64." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science with a major in Agricultural Economics.

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TIME SERIES ANALYSIS OF PRICES RECEIVED BY TENNESSEE FARMERS, 1910-64

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

Johnny Dale Braden

December 1965

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CHAPTER I

INTRODUCTION

The operation of any modern economic organization requires instruction as to how the various productive services are to be used. In an essentially free enterprise system such as ours, the operation of the economy is directed, for the most part, by a market price system.

I. ROLE OF PRICES IN AN ENTERPRISE ECONOMY

Determination of what is to be produced. Within limits set by law, consumers may spend their incomes in any way they wish. They will pay relatively higher prices for things they desire most, and relatively lower prices for things they desire least. Each dollar of expenditure is a "vote" for some particular good or service. An individual's influence over production, therefore, is limited by the size of his income. Since entrepreneurs are chiefly motivated by the desire for profits, they will devote their production efforts to those commodities whose prices are highest relative to costs of production. It is said, therefore, that an enterprise system can be characterized as a system of "consumer sovereignty."

The allocation of resources. Concurrent with being told what to produce, an economic system must be instructed also as how to allocate

the resources needed to produce the proper amounts of desired goods. In an enterprise economy, the price system performs this function also. Managers of an enterprise will use the technical data of production and factor prices as guides in selecting the most efficient (least cost) methods of production.

Distribution of the income. The amount of income which any individual receives is determined by the amount of resources which he can put in the productive process and the price which he receives for them. Income differences result from differences in resource ownership among individuals, differences in prices set by factor markets, and possibly from improper channeling of resources. If there are no barriers to resource mobility, income differences arising from improper channeling tend to be self-correcting. In the presence of these barriers, the income distortions will persist.

Rationing in the short run. An economic system must provide for rationing of commodities whose supplies are fixed during a given period of time. Prices perform this function in an enterprise economy. During periods of shortages, prices will increase, and consumers will buy smaller amounts. During periods of surplus, prices will decrease, and consumers will purchase more.

Price will also ration goods over time. If the entire supply of a farm product is placed on the market at harvest time, prices fall and consumption will increase somewhat in response to the lower

price. Prices will rise as the next harvest approaches because of the decline in available supply. Expecting higher prices in the latter part of the marketing season, speculators will buy up part of the supply available in the early part of the marketing season in order to sell later at higher prices. This tends to raise prices in the early part of the marketing season and to decrease consumption purchases somewhat. In the latter part of the marketing cycle, releases from storage will reduce prices, and therefore, encourage consumption purchases.[1] In this way, the actions of the speculators even out the flow of products to consumers over time.

II. NEED FOR ACCURATE KNOWLEDGE OF PRICE

"When price analysts investigate prices, they necessarily investigate prices that have happened. Most price analysts, however, do their work not merely because they want to explain what has happened in the past, but because they believe that their explanations will have some usefulness in meeting current and future problems."[2] Accurate price information is needed, therefore, at all levels of the marketing system for farm products--from the point of first sale at the farm through the various channels and stages in the wholesale and processing stages, to the retail level where goods are sold to the consumer.

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[1]Richard H. Leftwich, The Price System and Resource Allocation (New York: Holt, Rinehart, and Winston, 1963), pp. 14-20.

[2]Geoffrey S. Shepherd, Agricultural Price Analysis (Iowa: Iowa State University Press, 1963), p. 200.

As explained above, allocations of resources in the marketing system, as in all other parts of the economy are directed largely by a system of market prices. Resource buyers and sellers analyze present and expected future prices and make decisions accordingly. If expectations are correct, resources will be allocated in such way as to maximize returns to resource owners. When accurate knowledge of prices is lacking, expectations are faulty and resources are allocated inefficiently.

Need for price information by farmers. Farmers and other individuals who are unable to influence prices in an appreciable degree must take prices as they are and adjust their operations accordingly. Price information is, therefore, necessary not only for determining when to buy and sell products, but also for long-range planning of farming operations.

The farmer's need for price information starts before he buys or rents his farm and plans the general organization of its commodity enterprises. For example, it would be foolish to purchase a dairy operation without considering the conditions relating to the future prices and costs of producing milk. With any type of farm organization, before planning the acreage to be planted or livestock to be raised, the farmer should consider the probable market situations to be encountered when the products are ready for market. In addition land values in a particular location are determined largely by the prices of farm products that can be produced in that location.

Farmers can affect their net incomes by expanding and contracting their various operations in response to changes in the price situation. No matter how much a farmer tries to avoid considering the effect of product prices in his farm planning, the product price situation still affects him. He will need this price information when making decisions regarding the purchase of and the sale of products.[3]

Marketing agencies. Like farmers, it is obviously important for marketing agencies to have as complete knowledge as possible of the price situation. Many dealers appreciate the value of timely price information and use it constantly. Such data are necessary in both purchasing and inventory control. Price information is needed to give marketing firms accurate bases on which to answer questions regarding what, where, and when to buy and sell. This information is necessary, also, in reducing risk and uncertainty in making long range planning decisions.[4]

Public agencies. Price information is needed also by all kinds of government agencies. The United States Department of Agriculture buys, sells, stores, transports, and directly influences prices of a large volume of commodities. Without accurate market information, price supports and other government programs would be in serious trouble.

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[3]Frederick Lundy Thomsen, Agricultural Prices (New York: McGraw-Hill Book Company, 1936), pp. 1-7.

[4]Frederick Lundy Thomsen, Agricultural Prices (New York: McGraw-Hill Book Company, 1951), p. 283.

Operations of such size require constant reference to market information of all kinds.[5]

Consumers. Consumers benefit also from accurate price information. Using accurate price and related information, marketing agencies can offer consumers a more stable supply of goods throughout the year, at prices that do not fluctuate violently over time. Adequate knowledge of price information also allows consumers to evaluate the government programs and policies which can be quite important for economic growth and stability.

III. TIME SERIES DATA MADE UP OF FOUR COMPONENTS

Price information is considered quite frequently in a temporal framework. That is, observations are made of variations in price variables over time, i.e., in form of time series. Any time series consists of a set of observations made at different periods of time.[6] Three types of systematic elements are said to influence the behavior of agricultural commodity prices: "trend," "cycle," and "seasonal." In addition to the three systematic elements, there is a "random" or "irregular" element. The identifying factor in each component is the length of time involved.

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[5] Ibid., p. 284.

[6] Ernest Kurnow and others, Statistics for Business Decisions (Illinois: Richard D. Irwin, Inc., 1959), p. 447.

Secular trend. Trend is the resultant of such long-term, slow-moving forces as changes in population, technology, incomes, and customs and habits. The trend is the general direction in which the data appear to be moving over a period of time--up, down, or horizontal. This occurs over a long period of time, during which iterated cyclical and seasonal movement patterns also occur.[7]

Cyclical variations. Cycles are oscillations of more than one year in length which occur as "swings" about a trend line. These movements are associated with such factors as the business cycle, the production cycle, or with any other regular changes in general business conditions. Almost any regular recurring movement lasting more than one year, may be referred to as a cycle. A complete movement from low prices to high prices and back to low prices constitutes one complete cycle.

Seasonal variations. Variations in commodity prices which appear to follow identical patterns during corresponding months of successive years are referred to as seasonal variations. Such movements are due to events that recur annually. The prices of most farm commodities exhibit such a more-or-less regular movement within a given season--from a low during periods of greatest supply to a peak when supply is lowest.

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[7] Ibid., p. 453.

Random fluctuations. Non-repetitive patterns of price movement which follow no particular pattern are referred to as "random" fluctuations. They result from such chance forces as floods, strikes, or wars. The duration of any one of these variations is uncertain, and it is difficult or impossible to identify any systematic pattern of movement in them.

IV. PURPOSE OF STUDY

The purpose of this study is to analyze the secular trend, cyclical variations, and seasonal price movements and any apparent change therein for selected farm commodities important to Tennessee Agriculture. Similar studies of prices received by farmers have been done in other states.[8] Some price analysis work that has been done in Tennessee needs to be up-dated and refined.[9] Procedures used in the analysis

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[8]For some work done in other states see: Lonnie L. Fielder, Seasonal Patterns of Price and Production for Louisiana Farm Products, Agriculture and Mechanical College Bulletin No. 567 (Louisiana State University, May, 1963); Milton C. Hallberg and Vincent I. West, Seasonal Pattern of Price Variation for Illinois Farm Products, Research Report AERR-43 (Urbana: University of Illinois, June, 1961); Morris White and B. R. McManus, Seasonal Variations in Prices of Selected Farm Commodities, Agriculture Experiment Station Bulletin No. 350 (Auburn: Auburn University, November, 1963); Maurice C. Taylor, Farm Price Index Trends, Montana, 1948-1962, Agriculture Experiment Station Bulletin No. 588 (Bozeman: Montana State University, June, 1964); J. H. Armstrong and R. L. Kohls, Seasonal Variations in Indiana Farm Prices, Research Bulletin No. 766 (Lafayette: Purdue University, September, 1963).

[9]For some previous work done in Tennessee see: Craig M. Smith, "Prices of Farm Products" (unpublished Master's thesis, The University of Tennessee, Knoxville, 1936); Frank J. Walrath, Tennessee Farm Prices in War I and War II Periods, Special Circular No. 288 (Knoxville: University of Tennessee, May, 1947); Frank J. Walrath, Farm Prices Received

are set forth in the appropriate chapters that follow.

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by Tennessee Farmers, 1910-38 (with comparison of prices during 1910-14) Special Circular No. 112 (Knoxville: University of Tennessee, November, 1939).

CHAPTER II

COMMODITIES STUDIED AND DATA USED

I. COMMODITIES SELECTED

In 1964, cash receipts from farming in the state amounted to about 589.0 million dollars, exclusive of government payments and the value of products used in home consumption.[1] The commodities covered in the present study were selected on the basis of their importance as a source of these cash receipts to Tennessee farmers. Ten products were selected as shown in Table I. These ten items accounted for 87.5 per cent of the cash receipts for farm commodities in Tennessee in 1964. The remaining 12.5 per cent was accounted for by (33) commodities, no single one of which accounted for more than 3.2 per cent of total receipts. Of this group broilers contributed the largest share, approximately 3.2 per cent of cash receipts from farming. However, this product was not included in this study because a large per cent of broilers were produced under contract. None of the other products excluded from the analysis contributed more than 1 per cent to cash receipts.

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[1] United States Department of Agriculture, Farm Income State Estimates, 1949-1964, Supplement to Farm Income Situation, July, 1965 (Washington: Government Printing Office), p. 31.

TABLE I

CASH RECEIPTS FOR FARM COMMODITIES IN TENNESSEE, 1963-64

Commodity	Value		Percentage of all commodities	
	1964	1963	1964	1963
	$1,000	$1,000		
Cotton lint	105,182	103,408	17.9	18.5
Cattle and calves	92,655	99,044	15.7	17.9
Milk, Wholesale	84,218	82,137	14.3	14.8
Tobacco	99,769	75,467	16.9	13.2
Hogs	48,165	49,579	8.2	9.9
Soybeans	32,509	27,467	5.5	4.9
Eggs	25,743	24,597	4.4	4,4
Cottonseed	12,187	12,426	2.1	2.3
Corn	14,724	12,426	2.5	2.2
Other Crops[a]	73,593	67,069	12.5	12.9
Other	588,745	553,951	100.0	100.0

[a]Other crops were composed of 33 commodities.

Source: United States Department of Agriculture, Farm Income State Estimates of 1949-1964 (Supplement to Farm Income Situation, July, 1965), p. 97.

II. SOURCES OF DATA

The data used in this study were the average prices received by farmers within the state of Tennessee as reported by the Nashville, Tennessee Office of the U. S. Department of Agriculture's Statistical Reporting Service. The prices reported are the average prices received by farmers for individual commodities at the point of first sale, which is usually a local market, on or near the 15th of each month. However, for some items including milk, the prices are average for the entire month.

The prices are based on a concept of estimating the average price which would be obtained if the total dollars received by farmers for the product were divided by the total quantity sold. Thus, it represents the average price received for all grades sold, and so, does not refer to any specific grade or quality. The price data are estimates based largely on reports made by voluntary price reporters throughout Tennessee. Market data from other state and federal agencies are also used by the Statistical Reporting Service in determining average prices, as well as data from special enumerated sources.[2]

III. PERIODS OF ANALYSIS

The period of 1910-64 has been one of both rising and declining general price levels of prosperity, depression, war, and peace; and

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[2] Letter from Robert Hobson, Statistical Reporting Service, United States Department of Agriculture, Nashville, Tennessee, August 12, 1965.

during this long period, farmers have experienced all kinds of price situations. To focus attention on the relation of these broad general influences to specific kinds of farm price movements, the indicated price data were analyzed to determine if any changes occurred in their behavior patterns among the following periods: 1910-19; 1920-29; 1930-40; 1946-64; and 1955-64.

The prosperous years, 1910-19. During 1910-14 American agriculture passed through the end of what has come to be called its "Golden Years." The country was growing, the frontier had been advancing, and American farmers had been helping to supply the needs of Europe for all kinds of farm products. In 1915, the orders of European nations for war materials and supplies began to pour in and to augment domestic demands for all kinds of farm products. Aggregate farm production expanded considerably in response to those expanded demands.[3]

The average value of the Index of Prices Received by farmers for all farm products (on a 1910-14 base) during the years 1915-19 was 164 per cent.[4] During the same period, the Index of Prices Paid, including interest and taxes, farm wage rates averaged 148 per cent of

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[3]George Soule and Vincent P. Carosso, American Economic History (New York: Holt, Rinehart, and Winston, 1957), p. 446.

[4]United States Department of Agriculture, Agriculture Prices--1959 Annual Summary (Washington: Government Printing Office, 1960), p. 6.

the 1910-14 base period value.[5] Net income to persons on farms rose from $4,395 million in 1915 to $9,877 million in 1919.[6]

Deflation and struggle, 1920-29. By 1920, the war stimulated increase in the demand for farm products had receded. Yet, farm production--with a favorable season--increased 5 per cent over the 1919 level.[7] But the United States government had stopped financing European purchases of American farm products. Our former allies, therefore, had less dollar exchange to use for food purchases in the United States. And they were beginning to get more output from their own farms as they recovered from war devastation. At the same time, American consumer purchasing power declined. War plants were closed down, leaving many unemployed workers without income. Factories and mines curtailed production, but farmers could not do the same.

The Index of Prices Received by farmers for all products in the United States fell 93 points between 1919 and 1921--from 217 to 124 per cent.[8] During the same period, prices which farmers paid fell only 42 points--from 197 to 155 per cent.[9]

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[5] Ibid., p. 9.

[6] Soule and Carosso, op. cit., p. 447.

[7] United States Department of Agriculture, Farm Production Practices Costs and Returns, Statistical Bulletin No. 83 (Washington: Government Printing Office, 1949), p. 6.

[8] United States Department of Agriculture, Agriculture Prices--1959 Annual Summary (Washington: Government Printing Office, 1960), p. 6.

[9] Ibid., p. 9.

The recession passed quickly for the non-farm sector, but agriculture did not regain its wartime, or even its prewar, prosperous position. Agricultural prices remained relatively low throughout the 1920's, and farm property values began a long and steady decline.[10] Foreclosure rates on the land and machinery purchased during years of prosperity increased and many farmers were forced into bankruptcy.

Farmers did benefit, however, from increases in productivity by producing more per man. Net income to persons on farms rose from $3,795 million in 1921 to about $6,000 million in the last years of the decade.[11] As the farm population declined, the increased farm income was divided among fewer farmers, and some farmers enjoyed bigger incomes even with the relatively lower prices.

Disaster and recovery, 1930-40. Farmers were only beginning to recover completely from the post-war deflation of the 20's when they were struck by the economic storms of the 30's. Both farm and non-farm purchasing power was swept away. Many in the cities did not have money with which to buy food and those who could spend money for food could not pay prices as high as those paid before the Great Depression struck.

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[10] Soule and Carosso, op. cit., p. 449.

[11] Ibid., p. 451.

The Index of Prices Received by farmers fell 78 points--from 148 in 1929 to 70 in 1933.[12] Farm prices in 1933 were only about one-third of what they were during World War I, and less than half of what they were in the late 20's. During the same year (1933) physical output of farm production fell less than 5 per cent.[13]

In 1933, direct programs aimed at raising farm prices (and incomes) were initiated. The measures were aided by the drought that occurred in many producing areas and which served to reduce agricultural producing by almost 16 per cent during the period 1932-36.[14] But production was higher in 1937 than ever before.[15] The Parity Ratio,[16] which had declined to 58 per cent in 1932, rose steadily until it reached 93 per cent just before the 1937 recession. The ratio then declined until 1941, when the American preparedness and defense programs began to swell the purchasing power of the American consumer, and the Lend-Lease Act enabled the allied nations to finance needed imports. Another boom period had started.[17]

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[12]United States Department of Agriculture, Agriculture Prices--1959 Annual Summary (Washington: Government Printing Office, 1960), p. 6.

[13]United States Department of Agriculture, Farm Production Practices Costs and Returns, Bureau of Agriculture Economics Statistical Bulletin No. 83 (Washington: Government Printing Office, 1949), p. 6.

[14]Ibid.

[15]Ibid.

[16]Parity Ratio = Index of Prices Received ÷ Index of Prices Paid x 100.

[17]Soule and Carosso, op. cit., pp. 446-468.

Period of prosperity and growth. The period, 1946-64,[18] generally has been one of economic stability and growth. Purchasing power generated by World War II initiated a vast and largely uninterrupted post-war prosperity. In 1955, it was estimated that the American economy was producing 50 per cent of the world's output of goods.[19] Standards of living in the United States rose steadily, and per capita consumption expenditure, even after correcting for price increases rose 30 per cent from 1948-63, or an average of 2 per cent a year. Private consumption expenditures plus government and civilian outlays have increased every year, even during the four brief post-war recessions.[20]

But while non-farm prices continued to rise, farmers were faced with declining product prices. The Parity Ratio fell from 115 per cent in 1947 to 76 per cent in 1964. During the first post-war recession, (1949-50) net farm incomes declined from $17.8 billion in 1948 to $12.9 billion in 1949.[21] But in the early 50's, the Korean War stimulated the demand for farm products and the Index of Prices Received

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[18]The war period (1941-45) was omitted from the statistical analysis because of the price controls and other regulations that were imposed to prevent run-away inflation and to assure that adequate resources were available to produce the goods and services needed to prosecute the war.

[19]John D. Hicks, and others, The American Nation (Boston: Houghton Mifflin Company, 1963), p. 787.

[20]Alvin H. Hansen, The Post-War American Economy (New York: W. W. Norton & Company, Inc., 1964), p. 5.

[21]W. S. and E. S. Woytinsky, Lessons of the Recession (Washington, D. C.: Public Affairs Institute, 1959), p. 63.

rose to 302 per cent in 1951, and the Parity Ratio was 107 per cent. Never since this time has the Parity Ratio been greater than 100. For the 10 year period, 1955-64, the ratio fluctuated between 76 and 85.

CHAPTER III

SECULAR PRICE TRENDS

Factors affecting farm prices continue in operation over long periods of time and can cause a rise or decline in price. Among the factors to be considered are increases in population, consumer income, and changes in production. During long periods, changes in the direction and/or intensity of the long-term price movements may occur. To determine the nature of the long time price trend of the commodities and to establish statistically the changes in the direction and/or intensity of any of these prices, least squares trend lines were fitted to the price data for the following selected periods: 1910-64 (the entire period of the data), 1910-19, 1920-29, 1930-40, and 1946-64. The least squares regression values were examined to determine if there were any significant difference in the price trend for the products considered for these periods: 1910-19 against 1920-29; 1920-29 against 1930-40; 1930-40 against 1946-64; and 1946-64 against the long time 1910-64 period.

I. PROCEDURE

The average annual prices of the products included in this study were analyzed by least squares regression methods to obtain estimates of the coefficients of the linear trend lines for the periods

indicated.[1]

The statistical significance of the b coefficients for each trend line was tested at the 95 per cent level of probability. The hypothesis tested in all cases was that the "true" slope was zero. In addition, the statistical significance of the difference between the b coefficients for selected pairs of trend equations was tested at the 95 per cent level of probability. The latter test was used to determine if any change had occurred in the trend from one period to another.

II. RESULTS: LIVESTOCK AND LIVESTOCK PRODUCTS

Table II gives the estimates made of the intercept and slope of each of the trend equations for prices of livestock and livestock products. Also, shown are the t variables computed to test the hypothesis that:

1. The slope is zero.

2. There is no significant difference in slopes of the pairs of trend lines compared.

The trends of prices in livestock and livestock products have been slightly upward during the long period, 1910-64, and the coefficients measuring these long term trends are all significantly different

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[1]All regression lines were of the form $Y = a + bx$, where Y = annual average price for the commodity in question, X = time in years, a is the Y-intercept, and b is the slope (or rate of change in Y with respect to X).

TABLE II

REGRESSION COEFFICIENTS OF TREND LINES OF PRICES RECEIVED BY TENNESSEE FARMERS FOR SPECIFIED LIVESTOCK AND LIVESTOCK PRODUCTS DURING SELECTED PERIODS, 1910-64

Period	Coefficient[a]	Commodity[b] Beef Cattle	Calves	Hogs	Milk, wholesale	Eggs
1910-19	a_1	-1.864	-1.672	-5.629	.792	-0.098
	b_1	.521	.594	1.028	.127	0.023
	t_{b1}	9.469	7.572	3.816	2.866	4.345
1920-29	a_2	-1.288	- .984	9.396	6.281	.439
	b_2	.285	.343	- .001	- .125	- .006
	t_{b2}	*1.917	*1.891	* .006	3.436	*1.073
	t_{b1-b2}	*1.484	*1.270	2.891	*1.625	3.631
1930-40	a_3	-1.426	-4.613	3.315	1.686	.141
	b_3	.186	.317	.093	.005	.001
	t_{b3}	*1.576	2.135	* .422	* .158	* .369
	t_{b2-b3}	* .524	* .110	* .648	* .897	*1.164
1946-64	a_4	19.313	20.802	38.936	5.646	.618
	b_4	- .032	.030	-0.376	- .024	- .004
	t_{b4}	* .207	* .155	3.847	*1.764	3.046
	t_{b3-b4}	* .680	* .711	*1.994	* .857	*1.526
1910-64	a_5	-1.331	-2.041	3.864	1.817	.176
	b_5	.307	.399	.223	.038	.003
	t_{b5}	9.848	10.364	6.305	5.406	4.418
	t_{b4-b5}	2.123	3.379	3.779	3.020	2.155

[a] a = y intercept

b_i = slope

subscripts of b coefficients refer to period indicated in first column:

$$t_{bi} = \frac{b_i = 0}{\sigma_{b_i}}$$

$$t_{bi-1-bi} = \frac{b_{i-1-bi}}{\sigma_{b_{i-1-bi}}}$$

[b] Asterisk indicates significance at the 95 per cent level of probability.

from zero. In respect to the shorter periods delineated, however, the results were different. There was an upward trend for each commodity, during at least one of the relatively shorter periods indicated. According to the test made, there was an upward trend in prices of all of the livestock and livestock products (1910-19) which was significantly different from zero. Since that period none of the slopes of the short period trend lines were significantly different from zero except for wholesale milk during 1920-29, and hogs and eggs during 1946-64. There was no significant difference in the slopes of the price trends for any commodity from one period to another except for prices of eggs and hogs between 1910-19 and 1920-29. There was a significant difference, however, between the slopes of the trend lines for 1946-64 and 1910-64 periods.

III. RESULTS: CROPS

Estimates are given in Table III for the intercept and slope of each of the trend equations for crop prices. Also shown are the t variables computed to test the same general hypothesis for trends in prices of crops that were tested in respect to trends in prices of livestock and livestock products.

Trends in the prices of cotton lint, cottonseed, and corn are significantly upward for the entire 1910-64 period. Trend was also significantly upward for tobacco during the 1920-64 period and for soybeans

TABLE III

REGRESSION COEFFICIENTS OF TREND LINES OF PRICES RECEIVED BY TENNESSEE FARMERS FOR SPECIFIED CROPS DURING SELECTED PERIODS, 1910-64

Period	Coefficient	Commodity				
		Cotton lint	Tobacco[a]	Soybeans[b]	Cottonseed	Corn
1910-19	a_1	-10.315	--	--	-38.177	-0.666
	b_1	1.830	--	--	5.137	.115
	t_{b1}	3.208	--	--	4.963	4.510
1920-29	a_2	38.342	.055	--	59.307	1.422
	b_2	- .746	.004	--	- .921	- .016
	t_{b2}	* 1.192	*1.037	--	* .885	* .483
	t_{b1-b2}	3.040	--	--	4.128	3.172
1930-40	a_3	8.058	- .075	--	- 9.034	.548
	b_3	.041	.006	--	.934	.004
	t_{b3}	* .189	*1.503	--	* 1.199	* .242
	t_{b2-b3}	* 1.273	* .287	--	* 1.453	* .561
1946-64	a_4	33.259	- .302	4.477	146.785	3.601
	b_4	- .016	.015	- .035	- 1.660	- .039
	t_{b4}	* .138	10.807	2.920	3.935	4.946
	t_{b3-b4}	* .552	.589	--	2.693	2.149
1910-64[c]	a_5	7.069	-2.119	1.890	23.732	.717
	b_5	.386	.013	.040	.476	.011
	t_{b5}	5.921	15.011	4.341	3.523	3.578
	t_{b4-b5}	* 1.359	* .089	* .527	7.773	3.647

[a] Prices were available for tobacco only since 1920.

[b] Prices were available for soybeans only since 1933.

[c] Coefficients a_5 and b_5 are for the period of 1920-64 for tobacco, and the period of 1933-64 for soybeans. These periods are compared with the 1946-64 period.

during the 1933-64 period.[2] During the 1910-19 period, the slopes in trends of the prices of the three crops for which data were available were significantly upward. However, during the two short periods between 1920 and 1946, none of the slopes of the price trends were significantly different from zero. During 1946-64 slopes of the trend lines were negative for all crops studied except tobacco, which was positive. All slopes except cotton lint were significantly different from zero.

There were significant differences between the slopes of the 1930-40 and 1946-64 price trends for cottonseed and corn. These differences were not significant, however, for cotton lint and tobacco.

Finally, there was a significant difference between the slopes of the trend lines for 1946-64 and 1910-64 for cottonseed and corn. The difference between these two slopes was not significant in cotton lint, tobacco or soybeans.

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[2] Data were only available for tobacco since 1920 and for soybeans since 1933.

CHAPTER IV

CYCLIC PRICE MOVEMENTS

Prices of some farm commodities follow fairly regular cyclic patterns, regardless of the general level of business activity or the general price level. Price cycles are largely the results of lagging adjustments of farm production to changes in price. When price changes indicate a change in output, farm production cannot change immediately, and this lag between price changes and production adjustments creates a cyclical movement in prices of many farm commodities.

I. PROCEDURE

The influence of trend is eliminated first, by expressing each average annual price as a per cent of the straight-line trend. The trend values used in this part of the analysis are those determined by the regression method described in Chapter III. An example of how the trend influcence was eliminated is as follows: using the least square regression line for beef for the period 1910-64, the estimated price of beef for 1930 would have been $7.87. The ratio of the actual price, $6.63, to the trend price was 84 per cent ($6.63 ÷ $7.87 = .84 x 100 = 84 per cent). The actual price fell to $4.77 in 1931, but the price estimated from the trend rose to $8.18, giving a ratio of 58 per cent. The method described eliminates trend and plotting the percentages over time points out any movements in the series. Since annual data are

used, seasonal movements are eliminated as are any irregular fluctuations of less than one year's duration. Therefore, the resulting trend-adjusted series represents largely cyclical movements, and any irregular fluctuations of more than one year's duration.

II. RESULTS: LIVESTOCK AND LIVESTOCK PRODUCTS

Beef cattle. Figure I shows the cyclic and irregular movements of beef cattle prices since 1910 with trend removed. Five prominent peaks, from 8 to 15 years apart, appear. From trough to trough, the cycle length has ranged from 10 to 12 years. The two peaks which occurred during 1928 and 1943 were 15 years apart; however, from trough to trough each cycle was 10 years in length. This long time period between peaks was due to the upward movements which took 9 years, prior to the 1943 peak. During this period demand was abnormal because of influence first of the depression of the 30's and later the influence of World War II. The "average" cycle appears to be about 12 years in length with no apparent change since 1910.

The length of the cattle cycle is largely a result of the nature of cattle production. Beef prices increase when the number of beef cattle marketed is low relative to quantities demanded. Producers respond to this price increase by holding animals off the market for breeding purposes, in order that their production might be expanded. This, in turn, temporarily decreases market supply and leads to further price increase. As herds are expanded and marketings subsequently

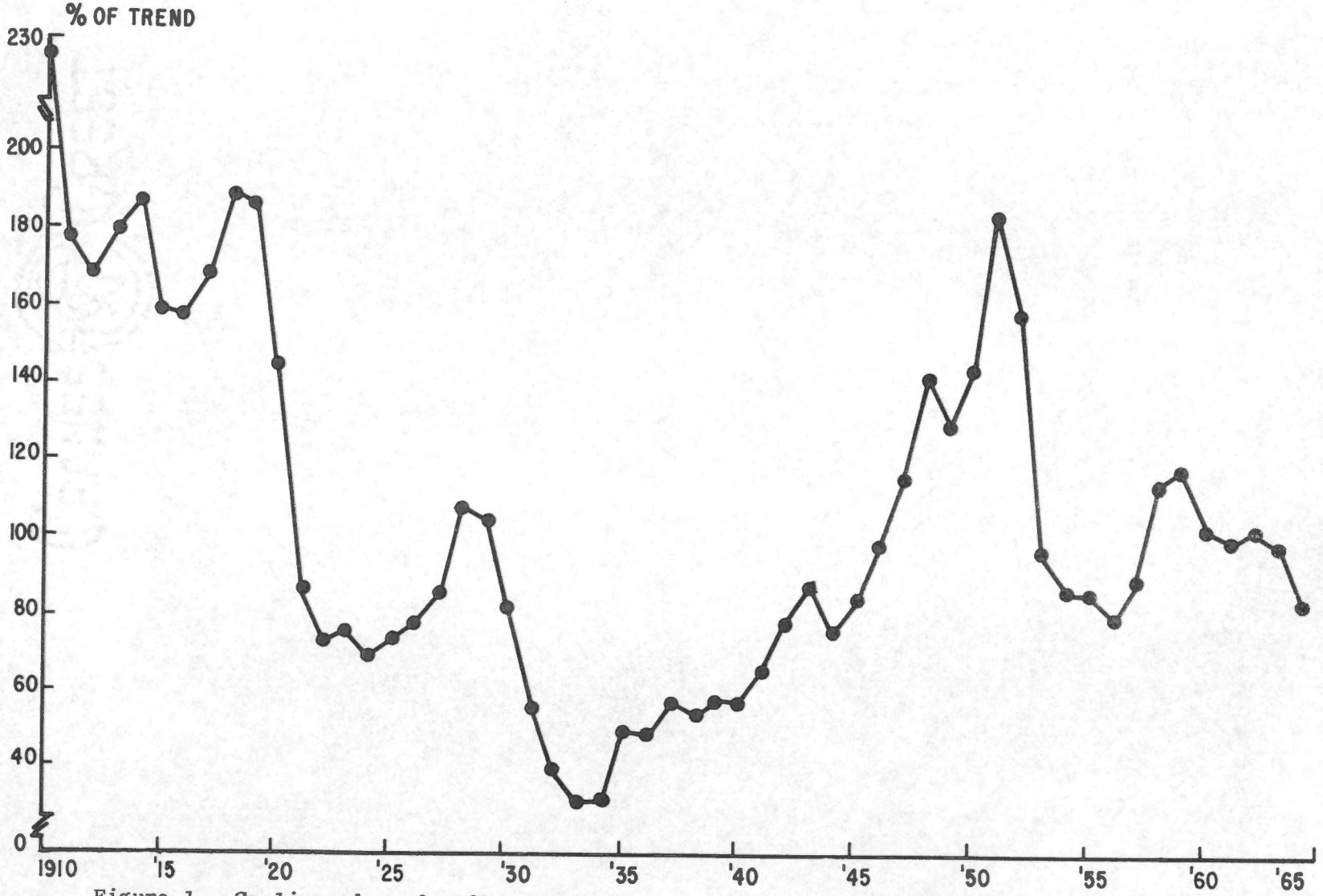


Figure 1. Cyclic and random fluctuations in prices received for beef cattle in Tennessee, 1910-64.

increase, both beef prices and production incentative declines. This results in herd liquidation, temporary increases in quantities supplied, and a decline in price. After quantities supplied decline, cattle prices once again begin to rise, and the cycle begins again. And so, farmers making long-term production plans should watch two important factors:

1. Movement of the production cycle.
2. Changes in business situations which tend to alter demand.

Calves. Figure 2 shows the cyclic movements of calf prices. As would be expected, calf prices very closely follow the cyclic movements in beef cattle prices. Five prominent peaks appear, 8 to 15 years apart. The range from trough to trough is 10 to 12 years. Cyclic movements in calf prices were affected also by the depression of the 30's and by World War II. The "average" cycle appears to be about 12 years in length.

Hogs. Cycles in hog price movements are shown in Figure 3. The price cycle is considerably shorter than for beef because of the shorter gestation and growth periods of the hog. The hog cycle has ranged from 3 to 7 years from peak to peak--with the "average" cycle running from 3 to 4 years. Also, cycles can be divided into what is termed alternating major and minor cycles; a long cycle being followed by a cycle of a lesser duration. Hog price cycles were relatively uniform except during the depression years of the 30's and during World War II.

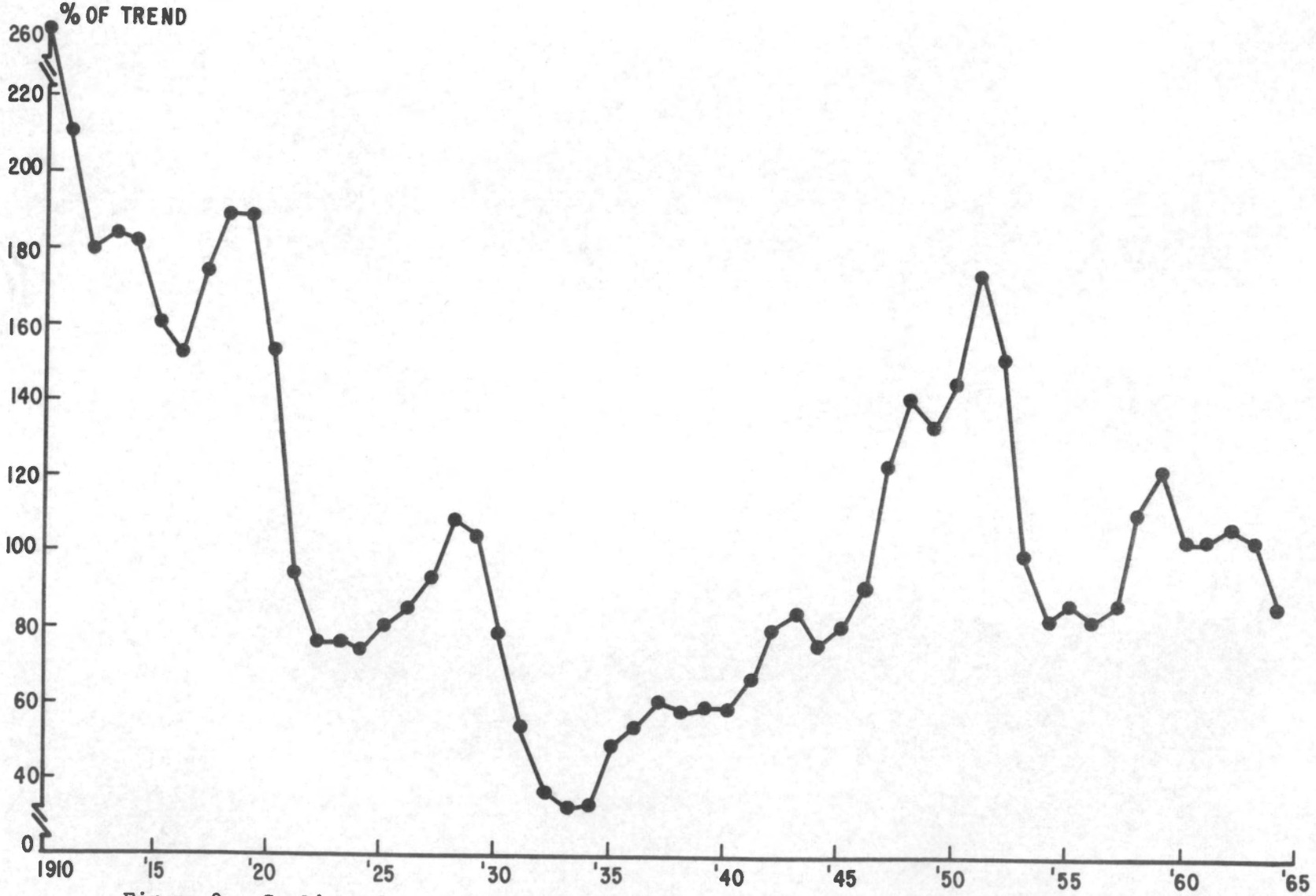


Figure 2. Cyclic and random fluctuations in prices received for calves in Tennessee, 1910-64.

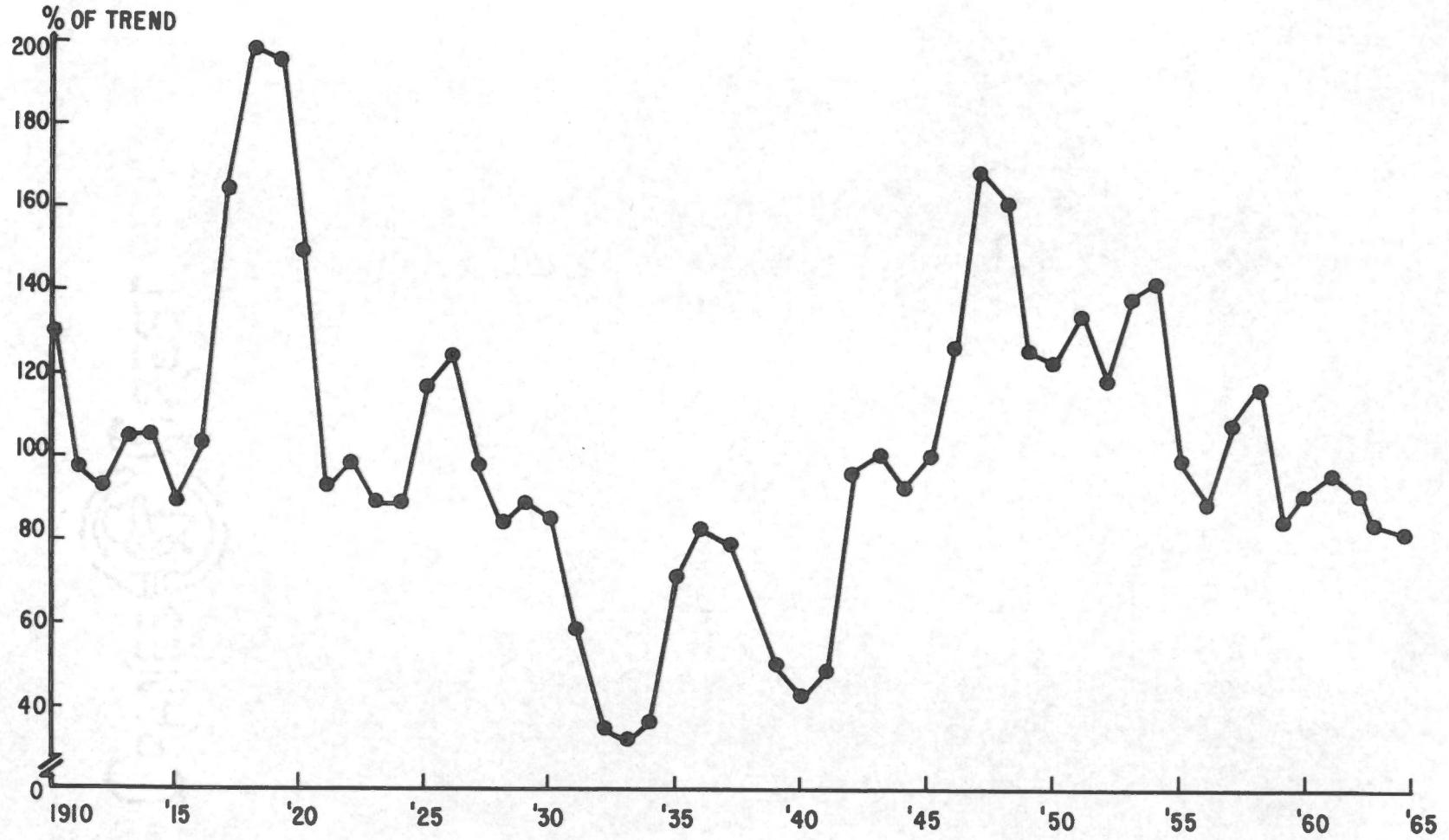


Figure 3. Cyclical and random fluctuations in prices received for hogs in Tennessee, 1910-64.

The time from peak to peak was considerably longer during these two periods.

Wholesale milk. Figure 4 shows cyclical movements of wholesale milk prices since 1910. No well-defined regular movements appeared before the mid-1930's. Since 1937, there have been four prominent peaks, from 4 to 6 years apart appear, and also, two less prominent peaks 4 years apart. In more recent years, the cycle appears to be shorter from peak to peak, averaging about 4 years in length. The downward movement has been about the same duration for all cycles, and the variations in the length of the cycles has been due to variations in the duration of the movement from the trough to peak of the cycles.

Eggs. Cyclic movements in egg prices are shown in Figure 5. There has been 13 apparent cycles in egg prices; with the interval between peaks ranging from 2 to 8 years. Since 1948, the apparent cycles have been considerably shorter with the interval between peaks ranging from 2 to 3 years.

III. RESULTS: CROPS

There were no apparent cyclic movements in the prices of the crops included in this study. Fluctuations in crop prices tended to be irregular probably because yield fluctuations limit the control that producers can exercise over production and any adjustment changes

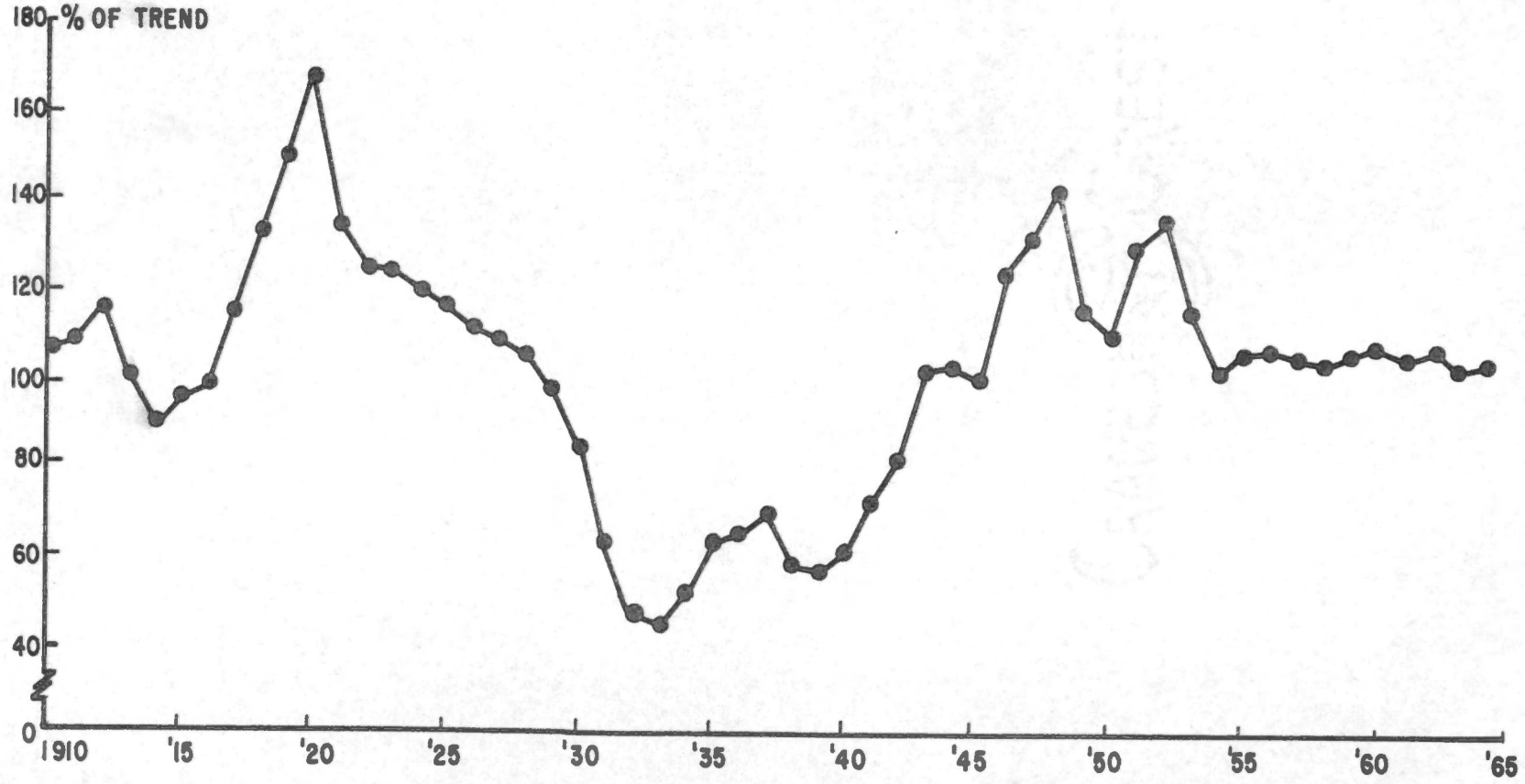


Figure 4. Cyclical and random fluctuations in prices received for wholesale milk in Tennessee, 1910-64.

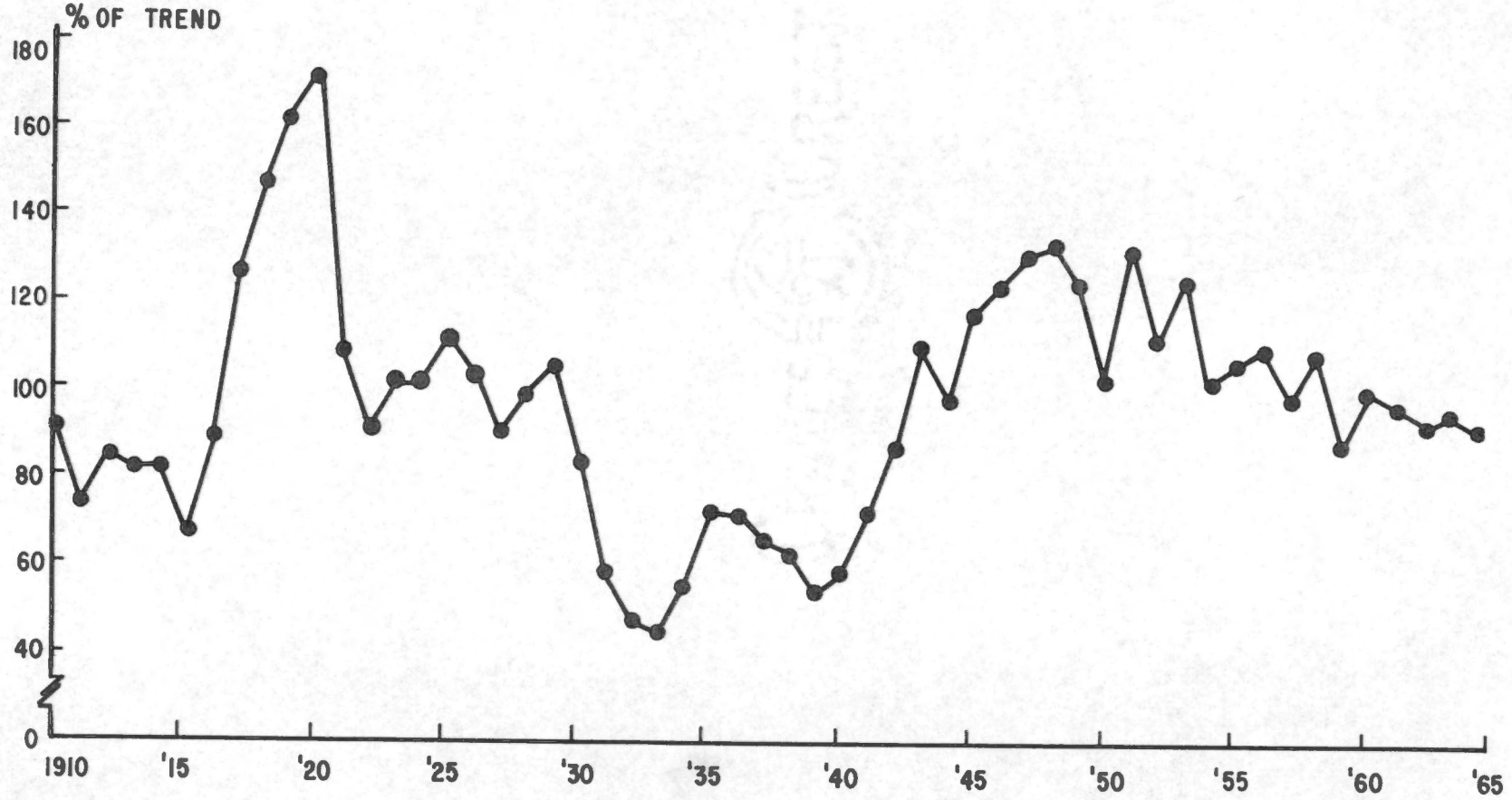


Figure 5. Cyclical and random fluctuations in prices received for eggs in Tennessee, 1910-64.

in prices received. In addition, most crops require only one growing season to increase or decrease production. And so, there would be little basis on which to expect cyclic movements in the prices of commodities when they are considered by themselves. If cyclic movements did appear, they would be reflections of the effects of livestock production cycles, such as the hog cycle.

CHAPTER V

SEASONAL PRICE VARIATIONS

I. PROCEDURE*

Statistical methods for estimating seasonal variation patterns seek to eliminate the trend, cyclical, and irregular "components" from the original data so that the only influence remaining is the seasonal element. The method used in this study was the "ratio to 12-month centered moving average." The moving average first eliminated the seasonal and irregular components, leaving the trend and cycle. The trend and cycle were removed and the seasonal restored by expressing the price for each month as a percentage of its corresponding moving average value.

The greatest disadvantage of the ratio to 12-month moving average method is that some data at the beginning and end of each series are "lost." In this study two-ten year series of data covering the periods 1930-39 and 1955-64 were used to estimate two sets of seasonal price patterns. And so, seasonal price ratios for each ten-year period could be calculated only for a 108-month period,

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*The method of calculating the seasonals was that outlined by R. J. Foote and K. A. Fox, Seasonal Variation: Methods of Measurement and Test of Significance, USDA Agricultural Handbook 48 (Washington: Government Printing Office, September, 1952), p. 2. Also, see J. H. Armstrong and R. L. Kohls, Seasonal Variation in Indiana Farm Prices, Research Bulletin No. 766 (Lafayette: Indiana University, September, 1963).

although, they were generated by ten years of data.

The means of the price ratios for each month (January through December) were determined for both periods. Each set of 12 means was adjusted so that the average for the 12 months was 100. This adjustment eliminates irregular fluctuations. The extent of seasonality in each series of data was determined by plotting the ratios for each month against time. The more the values fell above or below the 100 per cent line, the greater was the seasonal pattern.

The Statistical Reporting Service reports prices only for months in which more than one-half of one per cent of annual sales of the commodity are made. And so, for months in which no price was reported, for a particular commodity, an "estimated" price was used in the seasonal computations. The price was estimated as follows: A ratio was calculated between the average price for the month during either the closest preceding or the closest subsequent 10-year period and the average price for the same 10-year period. This ratio was then multiplied by the average annual price reported for the year in which the data were missing. This derived value was used in place of the "unreported" price.

A standard deviation of the mean for each month was calculated. Approximately 68 per cent of the price ratios for any given month during a period for which a set of seasonals have been estimated would be expected to fall within the range of plus or minus one standard deviation of the monthly price average for the particular month. A

range including approximately 68 per cent of monthly price ratios during the 10-year period has been calculated by adding the value of one standard deviation to the seasonal index to get an upper limit, and by subtracting one standard deviation from the seasonal index to get a lower limit. The standard deviation is termed the "index of irregularity" in the discussion that follows.

II. RESULTS: LIVESTOCK AND LIVESTOCK PRODUCTS

Beef cattle. Figure 6 and Tables IV and V show the seasonal patterns of beef cattle in Tennessee for the 1930-39 and 1955-64 periods. Beef cattle prices for both periods were relatively high in the spring--peaking during April and May. Prices were relatively lowest in the fall and very early winter with a November-December low.

The major significant difference between the seasonal patterns during the two periods was the reduced amplitude of the 1955-64 pattern and the absence of a November-December upswing during the more recent period. Also, the index of irregularity indicated that there was considerably more variation around the indices for the 1930-39 period than the 1955-64 period. These changes may have been due in part to the increase in chain store and packer feed lot operations which would have tended to stabilize prices, and also to adjustments made at the farm level to even out supplies of beef cattle reaching the market.

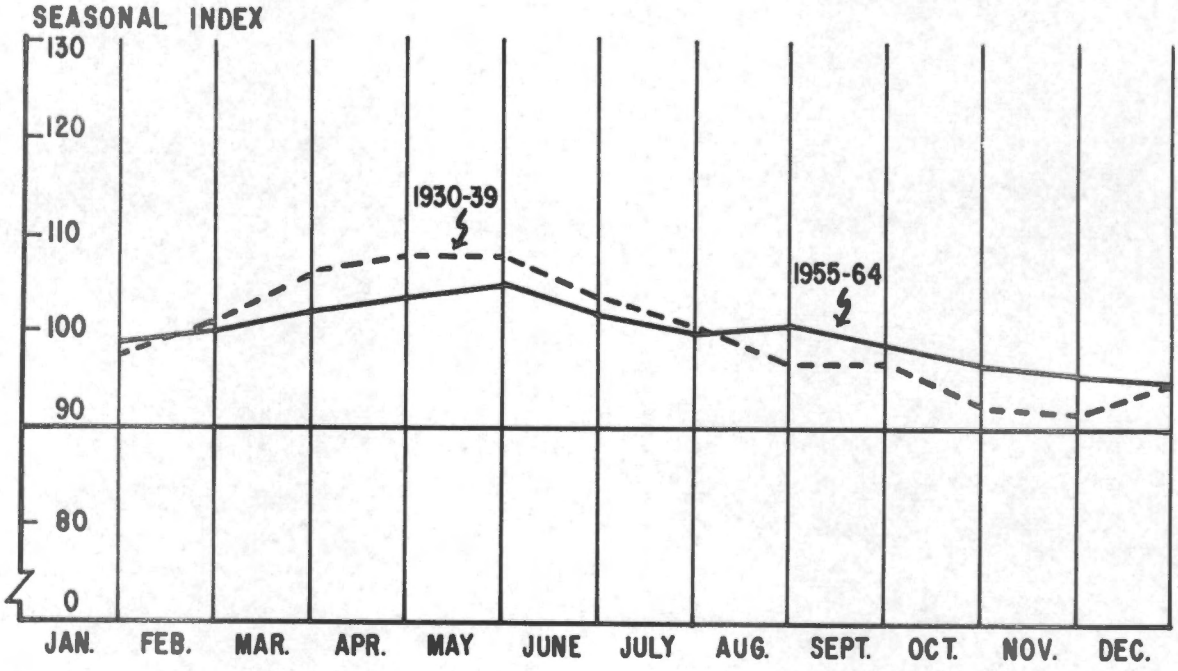


Figure 6. Index of seasonal variation of Tennessee farm prices received for beef, 1930-39 and 1955-64.

TABLE IV

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR BEEF CATTLE, 1930-39

Month	Seasonal index	Index of irregularity[a]	Range over which index fell 2/3 of time		Movement from previous month		
			Limit				
			Upper	Lower	Times up	Times down	Times same
January	98	5.6	104	92	6	3	0
February	101	5.3	106	96	6	2	1
March	106	5.8	112	100	9	0	0
April	108	6.9	115	101	7	2	0
May	108	4.7	113	103	5	4	0
June	104	5.7	110	98	1	8	0
July	101	6.3	107	95	3	6	0
August	97	7.5	105	90	2	7	0
September	97	6.9	104	90	6	3	0
October	93	3.0	90	96	1	8	0
November	92	6.1	98	86	5	4	0
December	95	8.4	103	87	5	4	0
Total	1200						
Average	100						

[a]The "index of irregularity" was computed as plus or minus one standard deviation. The following tables may be interpreted similarly.

TABLE V

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR BEEF CATTLE, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	99	1.7	101	97	9	0	0
February	100	1.9	102	98	7	2	0
March	102	2.3	104	100	9	0	0
April	104	1.6	106	102	7	2	0
May	105	2.9	108	102	5	4	0
June	102	2.2	104	99	1	8	0
July	100	1.3	101	99	9	0	0
August	101	1.9	103	99	5	4	0
September	99	2.2	101	98	1	8	0
October	97	3.4	100	94	1	8	0
November	96	2.4	98	94	5	4	0
December	95	3.1	98	92	4	5	0
Total	1200						
Average	100						

Calves. Figure 7 and Tables VI and VII show the seasonal patterns of calf prices for the two periods. For both periods the seasonal patterns indicate relatively higher prices during winter and early spring. Some shift in seasonal patterns of calf prices occurred between the two periods. During the 1930-39 period, a second peak in calf prices occurred in early fall. This peak occurred in all of the nine 12-month periods for which the ratios to moving averages were calculated. In the later period this second peak did not occur. This shift has taken place partly because relatively more lower quality (and lower priced) calves were marketed during the fall months. There was also more variation around the indices for most months during the 1955-64 period as is indicated by the index of irregularity.

Hogs. Figure 8 and Tables VIII and IX show the seasonal patterns of hog prices for the two periods. Seasonal variations in hog prices were greater than in the case of either beef cattle or calf prices. The amplitude of variation in hog prices was reduced during the 1955-64 period.

The seasonal pattern of hog prices has changed in recent years. During 1930-39, there was a rather pronounced early price rise during March. A fall peak occurred during August and September. In more recent years management programs have been such that sows have been farrowed four times per year. This tended to distribute supply more evenly throughout the year. And in the 1955-64 period, the early spring peak was absent and the peak for the year occurred earlier--in

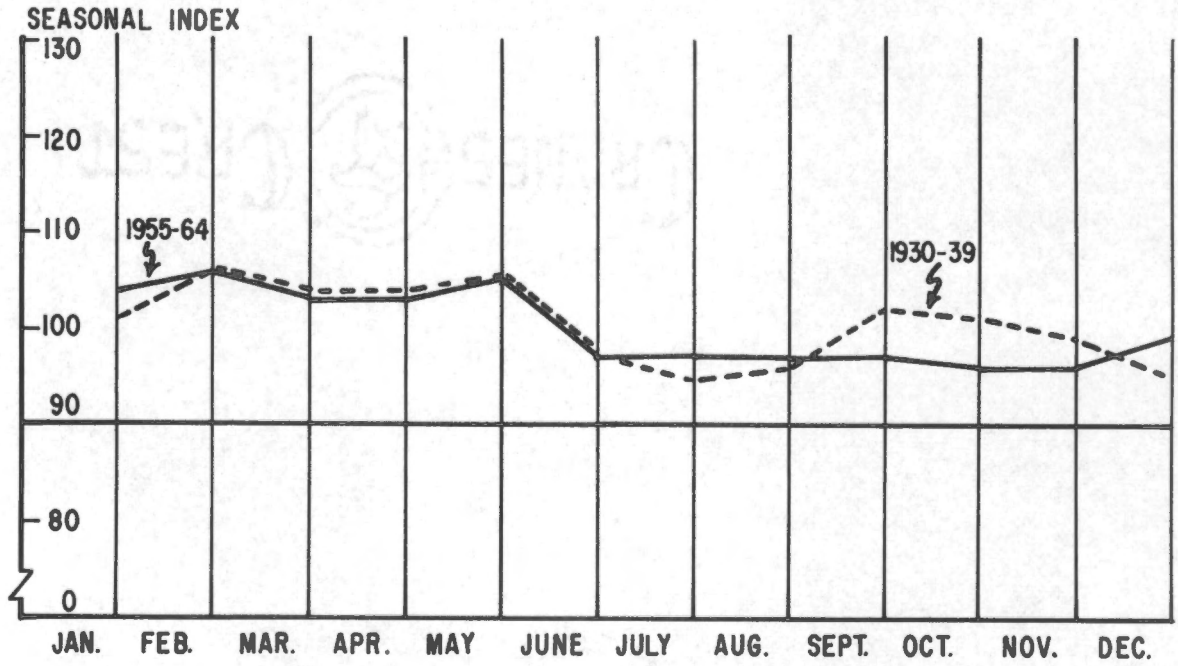


Figure 7. Index of seasonal variation of Tennessee farm prices received for calves, 1930-39 and 1955-64.

TABLE VI

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR CALVES, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	101	8.0	109	93	7	2	0
February	106	2.9	109	103	6	3	0
March	104	2.9	107	101	5	4	0
April	104	4.1	108	100	4	5	0
May	100	5.2	105	95	1	8	0
June	97	4.3	101	93	3	6	0
July	95	4.7	100	90	3	6	0
August	96	6.7	103	89	4	5	0
September	102	4.4	106	98	9	0	0
October	101	2.3	103	99	3	6	0
November	99	4.5	104	95	3	6	0
December	95	5.8	101	89	0	9	0
Total	1200						
Average	100						

TABLE VII

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR CALVES, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	104	6.1	110	98	9	0	0
February	106	7.1	113	99	6	3	0
March	103	8.4	111	95	2	7	0
April	103	9.7	113	93	3	6	0
May	105	8.3	113	97	4	5	0
June	97	8.0	105	89	1	8	0
July	97	5.6	102	91	4	5	0
August	97	6.1	103	91	6	3	0
September	97	6.3	103	91	4	5	0
October	96	9.3	105	87	3	6	0
November	96	7.0	103	89	5	4	0
December	99	8.3	107	91	8	1	1
Total	1200						
Average	100						

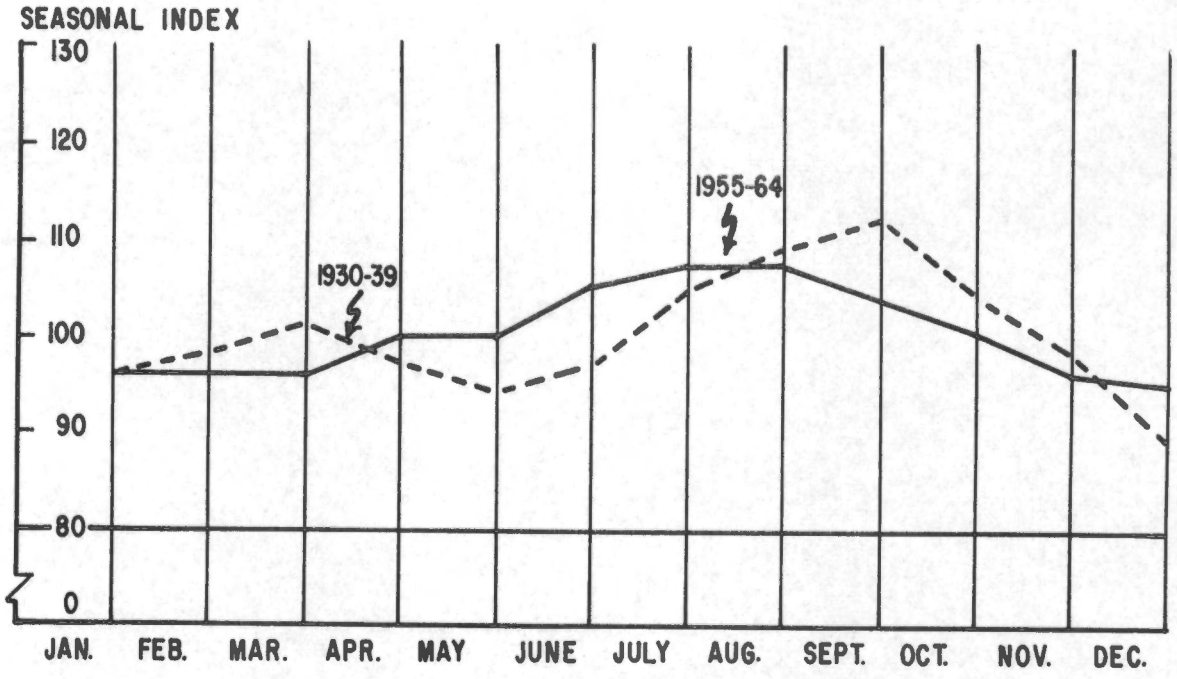


Figure 8. Index of seasonal variation of Tennessee farm prices received for hogs, 1930-39 and 1955-64,

TABLE VIII

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR HOGS, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	96	6.8	103	89	7	2	0
February	98	5.8	104	92	5	4	0
March	101	4.9	106	96	7	2	0
April	97	5.0	102	92	2	7	0
May	94	7.3	101	87	2	7	0
June	97	9.7	108	87	5	3	1
July	105	9.2	114	96	7	2	0
August	109	9.8	119	99	6	3	0
September	112	4.6	116	107	3	6	0
October	104	4.3	108	98	1	8	0
November	98	4.6	103	93	0	9	0
December	89	12.9	102	76	1	8	0
Total	1200						
Average	100						

TABLE IX

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR HOGS, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	96	6.5	103	90	3	6	0
February	96	4.2	100	92	6	3	0
March	96	5.9	102	90	3	6	0
April	100	3.0	103	97	6	3	0
May	100	5.7	106	94	5	4	0
June	105	5.1	110	100	9	0	0
July	107	5.1	112	102	6	3	0
August	107	4.1	111	103	5	4	0
September	104	4.0	108	100	6	3	0
October	100	3.8	104	96	8	1	0
November	96	5.2	101	91	1	7	1
December	95	7.3	102	88	1	8	0
Total	1200						
Average	100						

mid-summer rather than early autumn.

Wholesale milk. As shown in Figure 9 and Tables X and XI, for both periods the seasonal pattern of milk is such that the average price of milk was relatively low during May, June, and July--the flush production period. Prices were higher during the fall and winter months, when production was lower and less fluid milk had to be diverted to manufacturing purposes.

There was a range of about 21 percentage points between seasonal high and low during both periods. During the 1955-64 period, the index of irregularity was relatively less for each month, except July. There was no apparent change in the seasonal pattern.

Eggs. Figure 10 and Tables XII and XIII show the seasonal patterns of egg prices for the two periods. Egg prices for both periods were lowest during the spring and summer and highest in December. During both periods there were consistently more month to month changes in egg prices than in the case of the other commodities studied.

Variations in egg prices followed the same seasonal pattern as did milk prices but with considerably more amplitude of variation between high- and low-price periods. During the 1930-39 period there was a difference of 76 percentage points between the high and low price periods. During the 1955-64 period this variation was reduced to 33 points. The amplitude of fluctuation of egg prices is greater than for any other commodity studied. In more recent years variation around the

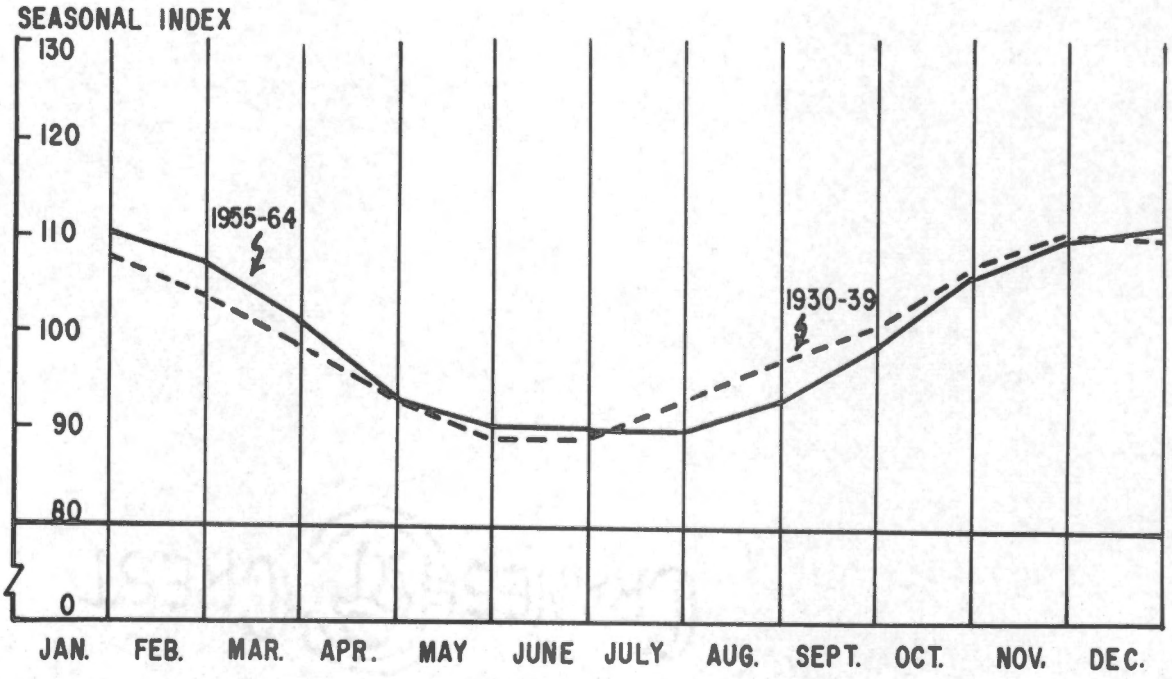


Figure 9. Index of seasonal variation of Tennessee farm prices received for wholesale milk, 1930-39 and 1955-64.

TABLE X

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR WHOLESALE MILK, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	108	3.7	112	104	3	6	0
February	104	3.6	108	100	1	8	0
March	99	4.7	104	94	0	9	0
April	93	4.6	98	88	1	8	0
May	89	3.2	92	86	2	7	0
June	89	3.0	92	86	3	6	0
July	93	3.1	96	90	8	1	0
August	97	3.2	94	100	9	0	0
September	101	3.3	104	98	8	1	0
October	107	4.5	111	103	9	0	0
November	110	5.1	115	105	1	8	0
December	110	5.0	115	105	4	5	0
Total	1200						
Average	100						

TABLE XI

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR WHOLESALE MILK, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of limit		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	110	1.2	111	109	4	5	0
February	107	2.5	110	105	1	8	0
March	101	2.8	104	98	1	8	0
April	93	1.7	95	91	0	9	0
May	90	1.7	92	88	1	8	0
June	90	2.1	92	88	2	6	1
July	90	3.7	94	86	5	4	0
August	93	1.7	95	91	8	0	1
September	99	2.2	101	97	8	1	0
October	106	1.7	108	104	9	0	1
November	110	2.2	112	108	9	0	0
December	111	1.5	113	110	6	3	0
Total	1200						
Average	100						

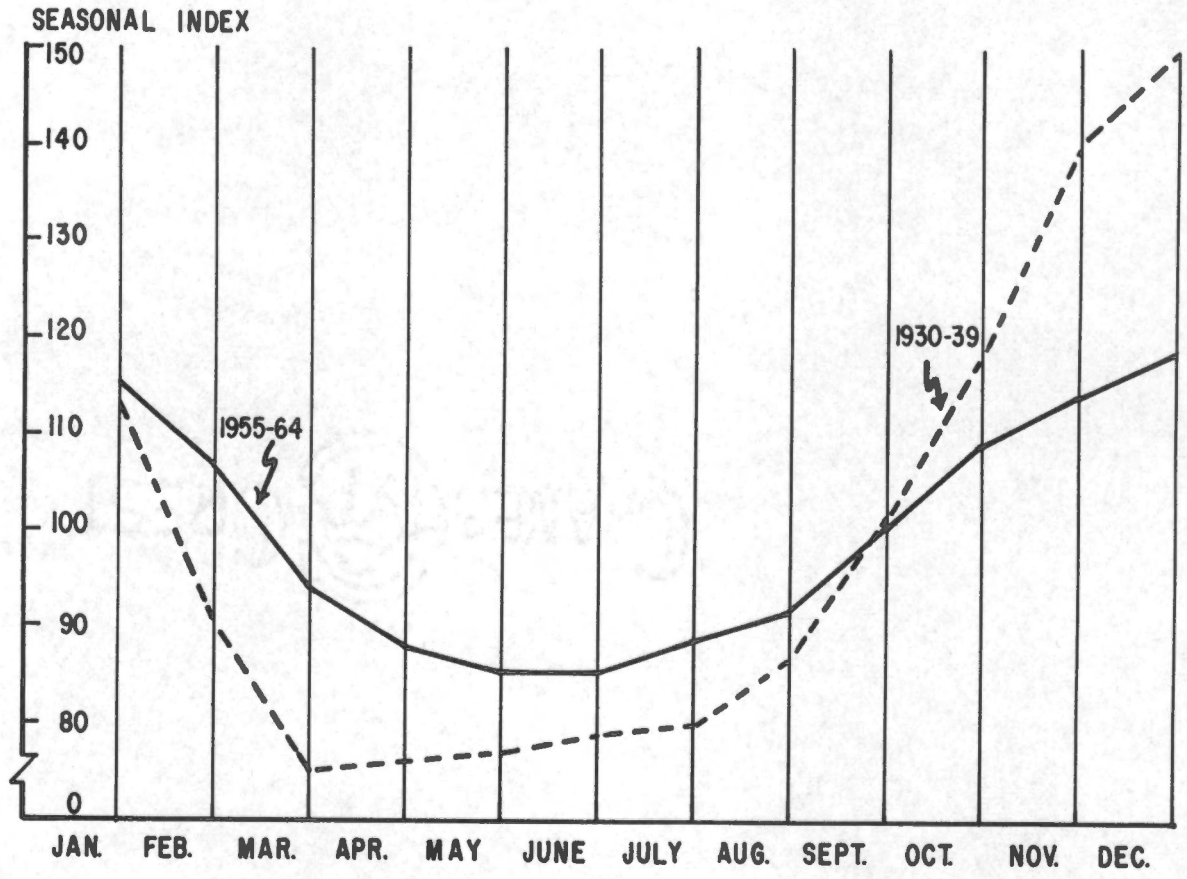


Figure 10. Index of seasonal variation of Tennessee farm prices received for eggs, 1930-39 and 1955-64.

TABLE XII

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR EGGS, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	113	14.3	127	99	0	9	0
February	90	19.6	110	70	1	8	0
March	75	12.7	88	62	2	7	0
April	76	9.4	85	67	5	4	0
May	77	5.8	83	71	6	3	0
June	79	7.7	87	71	6	3	0
July	80	6.0	86	74	6	3	0
August	87	7.9	95	79	9	0	0
September	112	4.1	116	108	9	0	0
October	119	5.8	125	113	8	1	0
November	141	11.0	152	130	9	0	0
December	151	17.9	169	133	8	1	0
Total	1200						
Average	100						

TABLE XIII

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR EGGS, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	115	5.3	120	110	6	3	0
February	106	5.3	111	101	0	9	0
March	94	4.4	98	90	1	8	0
April	88	5.3	93	83	1	8	0
May	86	4.0	90	82	3	6	0
June	86	4.1	90	82	5	4	0
July	89	2.9	92	86	2	6	1
August	92	3.1	95	89	8	1	0
September	101	3.8	105	97	9	0	0
October	110	2.7	113	107	9	0	0
November	115	5.0	120	110	9	0	0
December	119	6.3	125	113	9	0	0
Total	1200						
Average	100						

indices for egg prices has also been reduced.

III. RESULTS: CROPS

Corn. The seasonal pattern of corn prices showed a low during the October and December months and a seasonal high during July and August in both the 1930-39 and 1955-64 periods (Figure 11 and Tables XIV and XV). The lowest price generally occurred at harvest time, and rose gradually as the next harvest approached. The seasonal index tended to drop as much during the three months of harvest as it rose in nine months since the previous harvest. Part of this price increase may be associated with improvements in quality resulting from moisture content decreases during storage.

The index of irregularities indicated considerably more variation around the season indices for the 1930-39 than for the 1955-64 period. The amplitude of fluctuation between high and low periods was also greater during the 1930-39 period.

Cotton lint. Figure 12 and Tables XVI and XVII show the seasonal patterns of cotton lint prices for the two periods. The seasonal low has occurred fairly consistently during December and January in both periods. The seasonal high occurred most frequently during July in the 1930-39 period and during September and October in the 1955-64 period.

The index of irregularity was somewhat greater during the 1930-39 period, but the amplitude of the seasonal fluctuations was greater

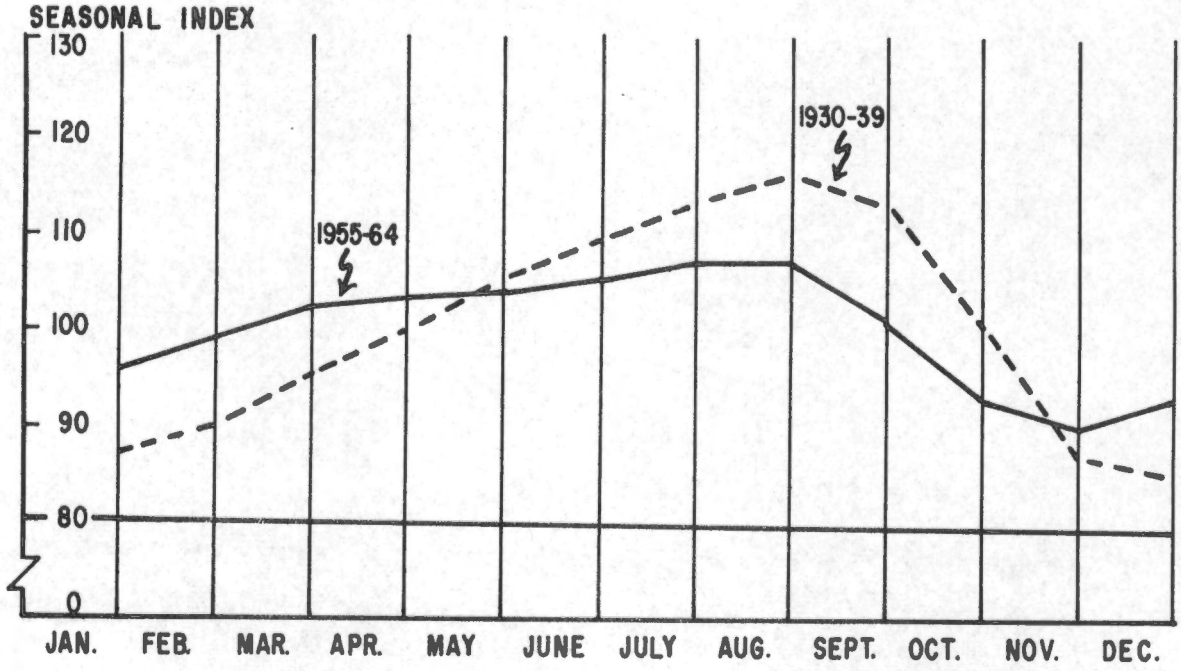


Figure 11. Index of seasonal variation of Tennessee farm prices received for corn, 1930-39 and 1955-64.

TABLE XIV

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR CORN, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movements from previous month		
			Limit				
			Upper	Lower	Times up	Times down	Times same
January	87	7.8	95	79	6	3	0
February	90	8.1	98	82	7	2	0
March	95	7.9	103	87	8	1	0
April	100	6.4	106	94	7	2	0
May	105	8.1	97	113	7	2	0
June	109	9.8	119	99	8	1	0
July	113	13.3	126	100	5	4	0
August	116	8.5	125	108	6	3	0
September	113	6.8	120	106	4	5	0
October	100	11.2	111	89	0	9	0
November	87	10.2	107	77	0	9	0
December	85	9.3	94	76	3	6	0
Total	1200						
Average	100						

TABLE XV

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR CORN, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movements from previous month		
			Limit		Times up	Times same	Times same
			Upper	Lower			
January	96	4.4	104	92	9	0	0
February	99	2.3	101	97	9	0	0
March	102	4.9	107	97	9	0	0
April	103	1.7	105	101	6	3	0
May	104	1.9	106	102	6	3	0
June	105	2.9	108	102	6	2	1
July	107	3.0	110	104	6	3	0
August	107	2.8	110	104	3	6	0
September	101	2.2	203	99	0	9	0
October	93	2.1	95	91	0	9	0
November	90	3.8	94	86	1	8	0
December	93	4.0	97	89	9	0	0
Total	1200						
Average	100						

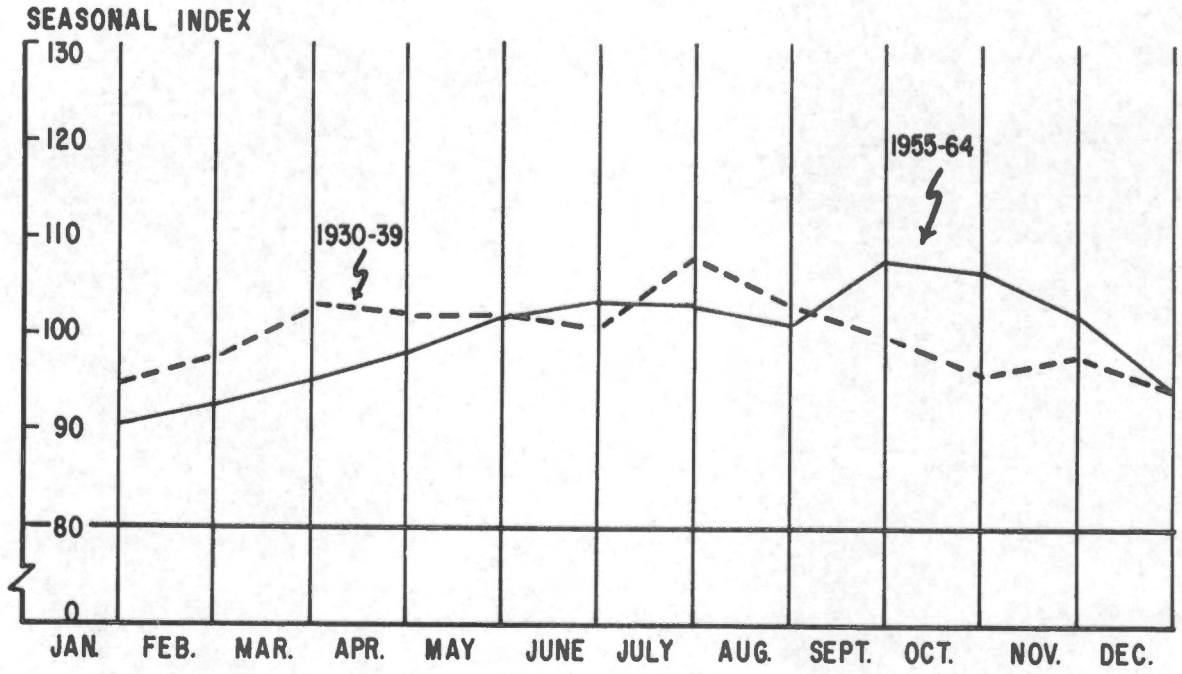


Figure 12. Index of seasonal variations of Tennessee farm prices received for cotton lint, 1930-39 and 1955-64.

TABLE XVI

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR COTTON LINT, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movements from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	95	6.4	101	89	3	6	0
February	98	7.9	106	90	8	1	0
March	103	8.6	112	94	6	3	0
April	102	8.8	111	93	4	5	0
May	102	7.9	110	94	4	5	0
June	101	8.6	110	92	4	5	0
July	108	11.1	119	97	7	2	0
August	103	7.3	110	96	3	6	0
September	100	13.2	113	87	6	3	0
October	96	10.8	107	85	3	6	0
November	98	6.0	104	92	4	5	0
December	94	7.1	101	87	1	8	0
Total	1200						
Average	100						

TABLE XVII

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR COTTON LINT, 1955-64

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movements from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	91	3.4	94	88	2	7	0
February	92	4.6	97	87	8	1	0
March	96	4.6	101	91	7	2	0
April	98	4.4	102	94	6	3	0
May	103	3.5	107	100	7	2	0
June	104	3.5	108	101	4	4	1
July	103	3.6	106	99	6	3	0
August	102	4.0	106	98	3	5	1
September	108	2.6	111	105	9	0	0
October	107	4.6	112	102	5	4	0
November	102	5.4	107	97	0	9	0
December	95	3.1	98	92	0	9	0
Total	1200						
Average	100						

during the more recent period.

Cottonseed. Figure 13 and Table XVIII show the seasonal patterns of cottonseed prices during the 1930-39 period.* During this period cottonseed prices reached two seasonal peaks--one in May and one in July. Prices were lowest in October. Seasonal highs occurred most frequently in May. The range between high and low periods was 19 percentage points. In recent years, less than .5 per cent of the crop was marketed in any of the months in which the seasonal highs occurred during 1930-39.

Soybeans. During the 1955-64 period,** soybean prices rose seasonally from a low in September and October to a high in April and May (Figure 14 and Table XIX). Prices gradually declined to a low in September and October. Prices then rose until the seasonal peak was reached again. Differences between the peak period and low period were about 15 percentage points. The index of irregularity for soybeans was relatively high, indicating that year-to-year variation in prices has been large.

Tobacco. No seasonal pattern exists for tobacco. Each type of tobacco is marketed during its own particular season, and any seasonal

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*Since 1957 less than .5 per cent of any one year's crop has been marketed in either April, May, June, or July. No prices were reported, and no seasonal pattern is shown for the 1955-64 period.

**Soybean prices were not available for computing a 1930-39 seasonal pattern.

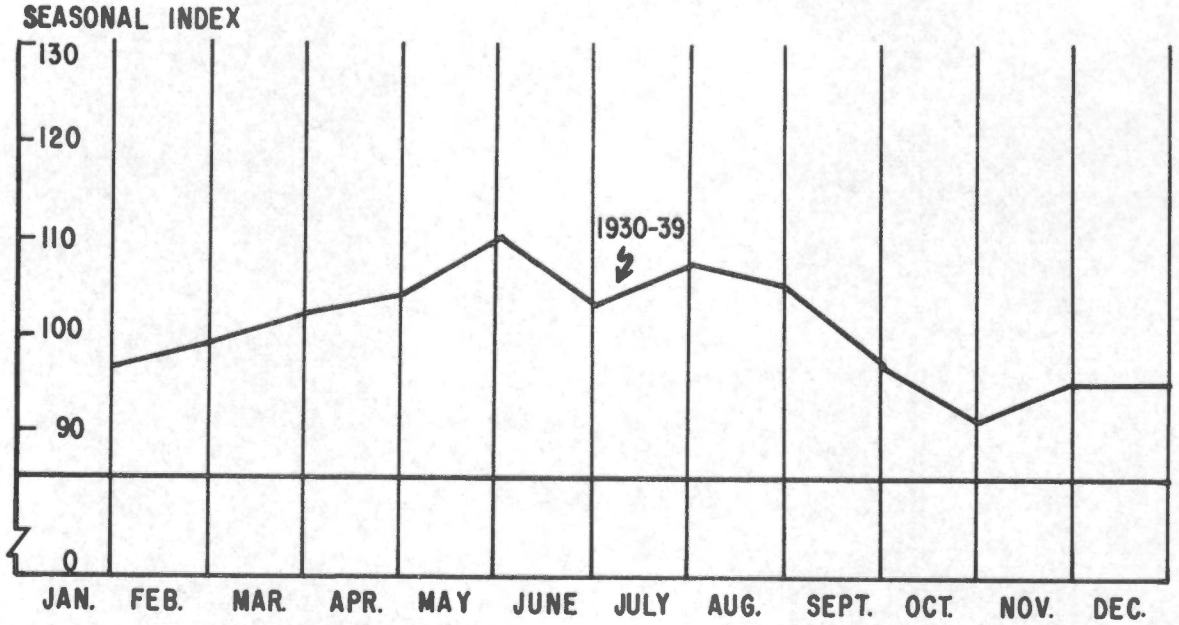


Figure 13. Index of seasonal variation of Tennessee farm prices received for cottonseed, 1930-39.

TABLE XVIII

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR COTTONSEED, 1930-39

Month	Seasonal index	Index of irregularity	Range over which index fell 2/3 of time		Movements from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	97	9.4	106.4	88	6	3	0
February	99	8.6	108.0	93	5	3	1
March	102	9.2	111.0	93	5	4	0
April	104	8.6	113.0	95	5	4	0
May	110	10.1	112.0	100	7	2	0
June	103	11.6	115.0	91	0	9	0
July	107	15.0	122.0	92	5	4	0
August	105	8.4	113.0	97	4	5	0
September	92	20.6	113.0	71	3	6	0
October	91	19.4	110.0	72	4	5	0
November	95	11.6	107.0	83	6	3	0
December	95	10.0	105.0	85	6	3	0
Total	1200						
Average	100						

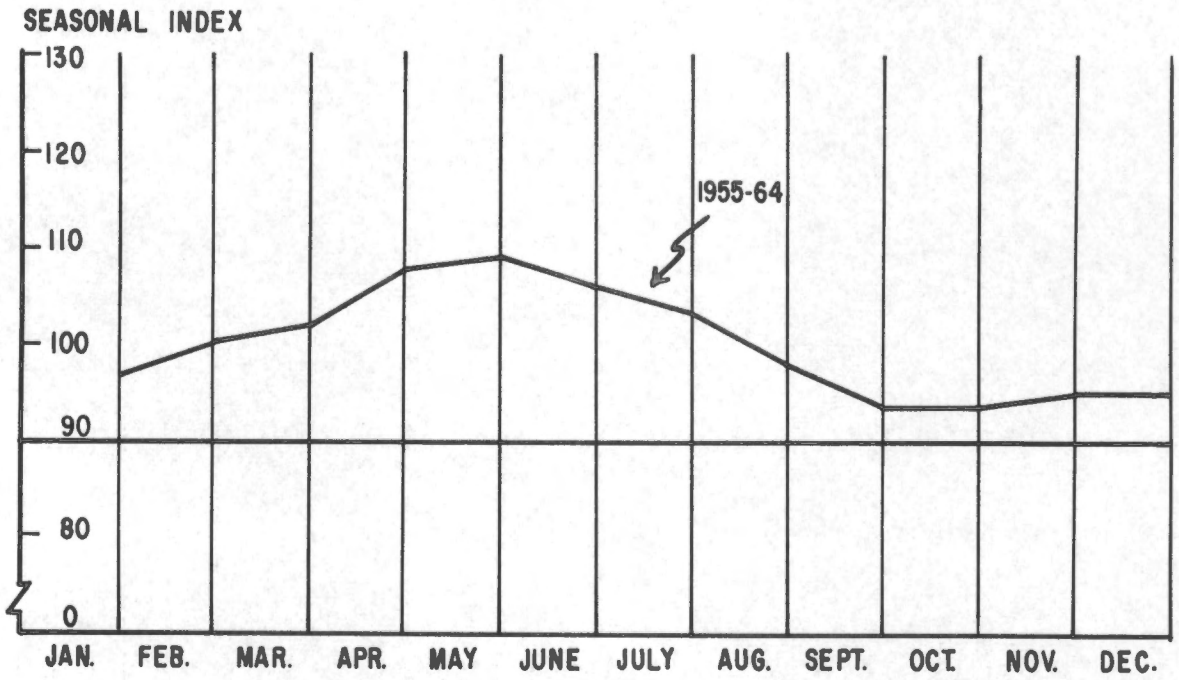


Figure 14. Index of seasonal variation of Tennessee farm prices received for soybeans, 1955-64.

TABLE XIX

SEASONAL MOVEMENTS OF TENNESSEE FARM PRICES RECEIVED FOR SOYBEANS, 1955-64

Month	Seasonal Index	Index of irregularity	Range over which index fell 2/3 of time		Movement from previous month		
			Limit		Times up	Times down	Times same
			Upper	Lower			
January	97	4.1	101	93	8	1	0
February	100	2.6	103	97	8	1	0
March	102	2.8	105	99	5	3	1
April	108	6.0	114	102	8	1	0
May	109	7.5	117	102	6	3	0
June	106	5.5	112	101	1	8	0
July	103	2.4	105	101	4	5	0
August	98	3.2	101	95	1	8	0
September	94	3.5	98	91	1	8	0
October	94	4.1	98	90	3	6	0
November	95	4.1	99	91	6	3	0
December	95	4.2	99	91	6	3	0
Total	1200						
Average	100						

price difference would reflect mainly differences in the types of tobacco being marketed.

CHAPTER VI

CONCLUSIONS AND IMPLICATIONS

Farm product prices received by Tennessee farmers have varied widely since 1910. The general trend in the 10 selected commodity prices has been upward. Within the long 1910-64 period, there have been shorter period trends that have varied in length, direction, and intensity. Prices of all commodities studied (those for which data were available) trended significantly upward during the 1910-19 period. During the 1946-64 period, prices of hogs, eggs, and all crops except tobacco trended significantly downward. For all commodities, the differences between slopes of trends for the 1910-64 and 1946-64 periods were significant.

There were definite cyclical patterns in the prices of livestock and livestock products all through the period 1910-64. There were no apparent changes in the beef, calf, and pork price cycles, but the price cycles for wholesale milk and eggs have been of shorter duration in more recent years. Also the milk price cycles were more pronounced since World War II than previously. In general, the length of a price cycle depends upon the production characteristics of the commodity and by any changes in the production cycle. Finally, many different "irregular" influences may arise, such as unusual spurts in demand or changes in supply, can retard, accelerate, or otherwise upset a given cyclical pattern.

In general, seasonal variations in prices received for Tennessee farm products tended to follow about the same general pattern from year to year. However, there may be variations in the pattern from year to year and over time as well, generally in response to non-repetitive disturbances. Over time, seasonal price patterns change because of changes in such factors as consumer tastes, seasonal marketing patterns, government price programs, and production techniques. In general, the amplitude of the seasonal variations in prices of the Tennessee farm products included in this study have declined in recent periods, except in the case of wholesale milk and cotton lint. A more uniform flow of products to market has been the major factor in reducing the magnitude of seasonal price variation. Product flow marketings of many commodities can be controlled either by product planning or by storage. In the more recent period studied, shifts occurred in the seasonal patterns of calves, hogs, and cotton lint. The seasonal pattern of cottonseed disappeared.

Prices of some products displayed greater seasonal variations than did prices of others. Seasonal price fluctuations were greater for products which are most difficult to store without deterioration in quality. As a result storage costs are higher. Costs of production and marketing, and duration of high price periods are factors which also influence time of marketing.

While systematic movements are important factors affecting price movements, prices are also affected by irregular price movements.

Prediction of these movements is both difficult at best and impossible at worst.

Since prices which farmers receive are influenced by production and time of marketing, further study is needed in the following areas:

1. The relation of production cycles to price cycles.

2. The impact of production and marketing cycles on marketing costs during different times of the year.

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APPENDIXES

APPENDIX A

BASIC PRICE DATA FOR LIVESTOCK AND LIVESTOCK PRODUCTS

TABLE XX

PRICES RECEIVED FOR SELECTED LIVESTOCK AND LIVESTOCK PRODUCTS IN TENNESSEE, ANNUALLY, 1910-64

Year	Commodities				
	Beef Cattle	Calves	Hogs	Milk, wholesale	Eggs
	$ per 100 lb.				¢ per doz.
1910	3.97	5.23	8.08	2.338	.194
1911	3.94	5.03	6.11	2.419	.162
1912	4.06	5.03	6.10	2.628	.187
1913	5.04	5.89	7.06	2.314	.183
1914	5.68	6.57	7.32	2.093	.188
1915	5.41	6.42	6.42	2.268	.180
1916	5.72	6.77	7.67	2.372	.028
1917	6.76	8.34	12.60	2.826	.302
1918	8.08	9.84	15.62	3.349	.354
1919	8.45	10.26	15.82	3.803	.395
1920	7.09	9.23	12.39	4.384	.427
1921	4.54	6.08	7.87	3.501	.274
1922	4.09	5.27	8.56	3.303	.233
1923	4.51	5.60	7.11	3.289	.260
1924	4.31	5.80	7.32	3.276	.265
1925	4.81	6.52	10.93	2.654	.295
1926	5.41	7.24	12.02	3.000	.281
1927	6.22	8.31	9.73	3.059	.243
1928	7.98	10.02	8.48	3.025	.273
1929	8.11	10.14	9.20	2.829	.296
1930	6.63	7.99	8.89	2.508	.237
1931	4.77	5.78	6.30	1.900	.168
1932	3.54	4.17	3.72	1.388	.137
1933	3.06	3.74	3.47	1.375	.131
1934	3.17	4.10	4.11	1.588	.165

TABLE XX (continued)

Year	Commodities				
	Beef Cattle	Calves	Hogs	Milk, wholesale	Eggs
	$ per 100 lb.				¢ per doz.
1935	5.03	6.14	8.20	1.950	.219
1936	5.26	6.96	9.10	2.033	.220
1937	6.04	7.87	9.44	2.196	.205
1938	5.83	7.88	7.52	1.841	.195
1939	6.36	8.32	6.24	1.825	.171
1940	6.48	8.49	4.32	1.996	.187
1941	7.72	9.95	8.85	2.371	.233
1942	9.33	11.92	12.70	2.742	.285
1943	10.69	12.86	13.52	3.450	.361
1944	9.52	12.05	12.68	3.496	.325
1945	10.68	13.01	13.94	3.479	.394
1946	12.93	15.26	17.80	4.342	.388
1947	15.58	20.69	24.25	4.704	.445
1948	19.33	24.38	23.52	5.109	.459
1949	18.13	23.74	18.67	4.083	.437
1950	20.53	26.42	18.42	4.021	.360
1951	26.62	32.29	20.38	4.779	.467
1952	23.42	28.97	18.43	5.063	.405
1953	14.82	19.32	21.80	4.250	.454
1954	13.43	16.68	22.65	3.867	.371
1955	13.72	17.54	16.08	4.067	.389
1956	13.02	17.08	14.37	4.113	.409
1957	14.75	18.16	17.79	4.088	.372
1958	19.09	23.85	19.60	4.088	.414
1959	20.15	26.64	14.37	4.200	.340
1960	18.00	22.97	15.48	4.296	.386
1961	17.79	23.46	16.75	4.246	.378
1962	18.44	24.46	16.17	4.171	.365
1963	17.94	24.22	15.11	4.180	.375
1964	15.50	20.50	14.80	4.330	.363

APPENDIX B

BASIC PRICE DATA FOR CROPS

TABLE XXI

PRICES RECEIVED FOR SELECTED CROPS IN TENNESSEE, ANNUALLY, 1910-64

Year	Commodity				
	Corn	Cotton lint	Cottonseed	Soybeans[a]	Tobacco[b]
	$ per bu.	¢ per lb.	$ per 100 lb.	$ per bu.	$ per lb.
1910	.765	14.0	22.25	--	--
1911	.612	12.4	22.77	--	--
1912	.790	10.8	20.86	--	--
1913	.733	12.8	24.56	--	--
1914	.832	10.5	21.82	--	--
1915	.765	8.9	24.62	--	--
1916	.815	13.7	40.26	--	--
1917	1.483	22.2	58.28	--	--
1918	1.596	28.3	62.59	--	--
1919	1.715	28.8	62.13	--	--
1920	1.708	29.7	51.17	--	.114
1921	.757	11.8	23.91	--	.181
1922	.740	19.0	35.88	--	.181
1923	,992	27.4	47.60	--	.146
1924	1.082	25.1	44.38	--	.171
1925	1.121	21.6	37.58	--	.128
1926	.842	14.7	25.22	--	.105
1927	.826	15.4	26.88	--	.213
1928	1.122	18.3	38.79	--	.211
1929	1.130	17.6	35.92	--	.183
1930	.983	12.2	25.67	--	.144
1931	.697	7.2	16.63	--	.073
1932	.334	5.7	9.72	--	.097
1933	.537	7.9	12.10	1.021	.104
1934	.669	11.8	25.98	1.449	.127

TABLE XXI (continued)

Year	Commodity				
	Corn	Cotton lint	Cottonseed	Soybeans[a]	Tobacco[b]
	$ per bu.	¢ per lb.	$ per 100 lb.	$ per bu.	$ per lb.
1935	.818	11.4	36.33	1.354	.144
1936	.893	11.5	33.83	1.604	.251
1937	.992	10.8	30.17	1.675	.157
1938	.567	8.1	22.24	1.196	.141
1939	.640	8.5	22.82	1.100	.147
1940	.769	9.4	24.97	1.271	.147
1941	.723	13.1	33.34	1.304	.243
1942	.946	18.5	46.04	1.942	.323
1943	1.278	19.6	47.67	2.167	.396
1944	1.445	20.1	51.50	2.471	.386
1945	1.409	20.9	50.46	2.438	.374
1946	1.653	28.0	57.83	2.863	.352
1947	1.971	32.0	83.25	3.167	.417
1948	1.953	31.7	80.25	3.082	.438
1949	1.240	28.1	45.08	2.163	.403
1950	1.521	34.0	58.46	2.427	.505
1951	1.740	39.7	81.00	2.871	.469
1952	1.925	37.3	67.58	2.828	.481
1953	1.744	33.4	60.62	2.659	.470
1954	1.559	33.0	56.50	2.903	.522
1955	1.432	33.1	51.92	2.368	.555
1956	1.319	32.1	45.50	2.326	.537
1957	1.360	32.1	49.14	2.243	.604
1958	1.363	30.4	46.14	2.168	.544
1959	1.179	32.0	40.38	2.093	.587
1960	1.153	30.8	40.57	1.999	.653
1961	1.158	30.6	45.43	2.431	.651
1962	1.178	32.8	47.13	2.309	.666
1963	1.229	34.0	48.12	2.490	.605
1964	1.270	30.1	48.30	2.600	.615

[a]Data were only available since 1933 for soybeans.

[b]Data were only available since 1920 for tobacco.