June 5, 1970

To the Graduate Council:

I am submitting herewith a thesis written by William Jerry Bomar entitled "Corn Price Differentials in Tennessee, 1961 to 1968." 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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Major Professor

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CORN PRICE DIFFERENTIALS IN TENNESSEE, 1961 TO 1968

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

William Jerry Bomar

August 1970

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ABSTRACT

The purpose of this study was to determine if there were particular patterns of geographical price differentials for corn in Tennessee over time and to identify casual factors for price spreads.

The period covered by the study was from 1961 to 1968, and secondary data were used in the analysis.

A price mapping technique was employed whereby average annual and semi-annual county prices were mapped using seven price ranges--a four-cent price differential for each range. In addition, iso-price lines were fitted for four time periods--1961-62, 1963-65, 1966-68, and 1961-68.

Iso-price lines for the chosen periods generally revealed the following geographical price patterns: Prices were lowest in Extreme West Tennessee and highest in the Central Basin (Midstate) and Extreme East Tennessee. Prices advanced from west to east reaching a high in the Central Basin; prices then declined slightly reaching a low in the Cumberland Plateau area; and thereafter prices advanced reaching a high in Extreme Northeast Tennessee. Price maps for the four time periods generally followed the same price patterns and iso-price lines encompassed approximately the same general geographical area.

Important factors contributing to geographical price variations in Tennessee were found to be areas of surplus or deficit production, intrastate and interstate transportation costs, and the presence of grain elevators in the state. Lower prices in Extreme West Tennessee could be

accounted for chiefly by the joint effects of surplus production and low transportation costs. Corn prices in the area between Memphis and Nashville were regulated by lower prices in Extreme West Tennessee and higher prices in Nashville. Corn prices in Middle Tennessee were attributed to transportation costs and the added expense of services from grain elevators in the area. Lower prices in the Cumberland Plateau area relative to adjacent areas were attributed to savings in elevator fees. The uniform advancement in prices from the Cumberland Plateau area to Extreme East Tennessee was the result of higher transfer costs, deficit corn production and a rather uniform distribution of grain handling facilities.

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CHAPTER I

INTRODUCTION

In a free enterprise economy, reliance is placed on price as a predominant indicator of what goods and services are or are not wanted, i.e., what goods and services will be produced. The interacting forces of supply and demand determine the price at which consumers will buy and producers will sell some quantity of a good or service. The full benefits of efficiencies in the market system will be enjoyed, however, only to the extent that prices reflect, with a minimum of distortion, the demands of consumers and the conditions of production. Individuals are supposed to make economic decisions on the basis of prices, price relationships, and price changes. Thus, the pricing mechanism plays a highly important, though imperfect, role in guiding and organizing economic activity.

Because of the nature of the agricultural industry and the peculiar problems associated with the imperfect agricultural market structure, knowledge of prices can be inadequate. As a result, quite frequently resources are misallocated, marketing activity is sometimes less than optimal, and efficiency of factor utilization is often decreased. This can lead to a situation of reduced benefits for consumers and/or producers. Development of better price information is a positive approach toward understanding the agricultural economy and providing a basis for economic adjustment.

Agricultural prices are determined by a variety of factors. Not all of these factors are static. Many are dynamic in nature, thus complicating their understanding. In a perfect market, supplies should be allocated in such a manner as to cause the price differences between regions to be less than or equal to differences in transfer cost between them. Accordingly, price differences between the various regions should be less than or equal to the differences in transfer cost.[1] In an imperfect market, geographical price differentials exist which cannot be explained by transfer cost alone.

In order to analyze factors contributing to geographical price differentials, it is often useful to first isolate geographical areas of homogeneous prices or "price mapping" as the technique is called. Price variations between geographical areas which cannot be explained by transfer cost must be attributed to other factors. Over time the degree of price variation, both in magnitude and direction, represents one important economic indicator of imperfections in the market structure of a geographical area.

Price analysts are interested in differentials in prices over geographical areas as well as time. Time series data can be used to explain price relationships for changing conditions. In this study particular attention was directed to the construction of price lines designating areas of homogeneous prices under static conditions and changes in the areas which occur over time.

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[1]Buddy Dillman and Donald Farris, Arkansas' Competitive Position in Marketing Tomatoes, Arkansas Agricultural Experiment Station Bulletin 663 (Fayetteville: University of Arkansas, February, 1963), p. 3.

Price mapping aids in the identification of price patterns and in the analysis of factors contributing to these price patterns. A knowledge of price differentials and an understanding of their causal factors should give producers and consumers added information on which to base decisions. The added information should lead to better decisions thus helping the market system to become more efficient. A more efficient market will result in increased profits to the producer and marketing sectors of the Tennessee economy.

I. STATEMENT OF THE PROBLEM

Corn is the major feed grain in Tennessee and, as such, is vitally important to the agricultural economy of the state (Table I). Tennessee is a state in which wide fluctuations in corn prices exist from one area of the state to another. Production of corn remains concentrated in certain areas as are grain handling facilities. However, there was no reason to suppose that regions, while having similar agriculture, would also be regions of homogeneous prices for one agricultural commodity (corn). In an agricultural region, price remains a guiding influence in determining production, and the price paid producers has an important effect on the economic well being of the producer.

Price variations of five cents exist between and within fairly small geographic regions. If these price spreads can be economically justified, then the marketing and producing sectors may be operating efficiently. In contrast, those producers in areas where price spreads cannot be economically justified are operating in an inefficient

TABLE I

ACREAGE, YIELD, PRODUCTION, PRICE AND VALUE OF CORN IN TENNESSEE, 1960-68

	Corn for Grain				
Year	Acreage Harvested (000 Acres)	Yield Per Acre (Bushels)	Total Production (000 Bushels)	Season Average Price (Dollars)	Total Value (000 Dollars)
1960	1,354	39	52,806	1.12	59,143
1961	1,002	43	43,086	1.17	50,411
1962	882	41	35,162	1.18	42,671
1963	856	53	45,368	1.20	57,442
1964	852	49	41,748	1.25	52,185
1965	792	53	41,976	1.26	52,890
1966	768	48	36,864	1.38	50,872
1967	783	57	44,631	1.15	51,326
1968	658	47	30,926	1.17	36,183

Source: United States Department of Agriculture and Tennessee Department of Agriculture, Tennessee Agricultural Statistics, Annual Bulletin, 1969 (Nashville: Tennessee Crop Reporting Service, 1969), p. 17.

marketing system incurring losses for themselves and the economy as a whole.

Important factors causing price spreads are surplus and deficit production for an area, seasonality of production, transportation costs, and other factors such as time of marketing, quality, customs of feeding, and human consumption. Another important factor, economic maladjustment, allows for abnormal price variation. Abnormal price variation (as measured by some appropriate economic indicator) denotes inefficiency within the marketing sectors. Isolations of geographical areas of homogeneous prices is a first step toward analysis of which areas are in fact areas of "abnormal prices."[2] In turn, this is a step toward identifying causal factors for price spreads. Knowledge of these causal factors is an aid in eliminating less than optimum economic conditions.

II. OBJECTIVES OF THE STUDY

The purpose of this study is to present information relative to the nature and extent of regional differences in the farm price of corn in Tennessee by areas and point out some of the causal factors contributing to these differences. A primary objective of the study is to determine if there are particular patterns of geographical price differentials for corn in Tennessee over time. Secondary objectives are:

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[2]Abnormal prices refers to a geographical area which is either high or low in prices relative to adjacent geographical areas and the price spread cannot be explained by ordinary price variation factors common to the geographical area.

(1) to map prices for a designated time period and repeat the practice for extended time periods to isolate patterns of iso-price line movement over time; (2) to determine if iso-price line movements are uniform or erratic; and (3) to isolate and explain the factors for detected changes (seasonal or annual) in the price maps described above.

III. DATA

Data for the study were obtained from the Tennessee Crop Reporting Service which divides the state into six regions for purposes of recording and analyzing agricultural statistics. Instead of regional data, county data were used in order to determine homogeneous geographic price areas.[3]

IV. LIMITATIONS OF THE DATA

The sampling technique employed was a form of judgment and, to a lesser extent, convenience sampling. Judgment sampling "calls for an expert in the subject matter--e.g., purchasing or economics--to decide on which elementary units should be included in a study."[4] When employing a convenience sampling technique "convenience" is the only criterion for selection.[5]

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[3]Any publication, reproduction, or other use of the material or survey data used in this thesis is prohibited unless permission is granted by the Tennessee Crop Reporting Service, Nashville, Tennessee.

[4]Gerald J. Glasser and Ernest Kurnow, Statistics for Business Statistics (Homewood, Illinois: Richard D. Irwin, Inc., 1959), p. 102.

[5]Ibid., p. 103.

The Crop Reporting Service[6] chose those farmers and grain handling firms in each county whom they considered "typical" or "representative" and who would report accurately and promptly mid-month corn prices. Many of the individuals and grain and livestock dealers were well known to the Crop Reporting Service.

Observations for the study are limited. However, observations were obtained generally from the same reporters over the study years lending continuity to the study. Not all counties are represented because some failed to report prices over the years. This limitation does make price mapping analysis less effective since it cannot be ascertained into what price range these counties fell.

Different sampling techniques and a greater number of observations would have allowed the use of more sophisticated types of price analysis in addition, though not in lieu of, price mapping. It should be mentioned, also, that the questionnaire listed only "corn"--unspecified as to grade, delivery, or terms of trade. However, the questionnaire stated that the reported prices should reflect premiums and discounts for test weight and moisture for grains, and other quality factors for each commodity for which a price was reported.

V. PROCEDURE

As previously mentioned, data for the study were furnished by the Tennessee Crop Reporting Service. The United States Department of

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[6]The sampling technique used by the Crop Reporting Service was explained via personal correspondence with Robert Hobson, Agricultural Statistician, Nashville, Tennessee, October, 1969.

Agriculture in cooperation with the Tennessee State Department of Agriculture, conducts monthly price surveys of agricultural commodities including grain. Corn price statistics used in the study consisted of mid-monthly prices of corn received by farmers for the years 1961-68. Individual surveys[7] were examined and all corn prices reported via survey from 1961-68 were recorded for use as raw data.

A simple average price for each available county in each month for the study period was computed for use in price mapping. Annual average prices were computed from monthly average prices for each county for the eight-year period. Iso-price line movements were determined as was degree of variation.

Average six-month prices for periods March through August and September through February were also computed to check the effect of seasonal variations. Price maps were constructed for each time period to readily observe change by inspection.

With the aid of the price maps particular areas of homogeneous price concentration were discovered and areas of price shifts were detected for further analytical consideration. Examination of causal factor contributing to price shifts were noted. These included concentrated areas of corn production, distribution of grain handling facilities and related capacity for the state, flow of grain from external sources to principal Tennessee market areas, related transportation costs and changes in transportation costs, and other factors.

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[7]Permission for use of confidential individual surveys was granted by Glenn D. Simpson, Chairman of the Crop Reporting Board, Statistical Reporting Service, United States Department of Agriculture, Washington, D. C.

VI. REVIEW OF RELATED LITERATURE

Several studies of geographic price differences have been conducted in various states and regions including two such studies in Tennessee. An initial study observed price differences by counties and by ten price regions.[8] A later study delineated price variation only within the ten price regions. Results of the study were that prices generally increased in Tennessee from west to east.[9]

In 1958, Ecker and Sharp[10] examined historical corn price data in Ohio with the objective of actually determining the extent of price differentials. Price spreads between terminal and local elevation prices were computed monthly for the period 1951-55. Price mapping was not used to depict changing patterns of iso-price line movement over time. Instead the authors used price lines to show average prices for one five-year period. Using this technique five price regions of homogeneous prices were detected. The authors concluded that geographical price differences did exist but the differentials could be economically justified in most instances.[11]

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[8] Charles E. Allred and others, "Regional Differences in Farm Prices of Corn, Tennessee and United States," Rural Research Series, Monograph No. 31 (Knoxville: University of Tennessee, March 20, 1937), pp. 5-13.

[9] Charles E. Allred and others, "Regional Differences in Farm Prices of Corn, Tennessee and United States," Rural Research Series, Monograph No. 110 (Knoxville: University of Tennessee, August 15, 1940), pp. 5-6.

[10] H. J. Ecker and J. W. Sharp, Price Spreads for Corn and Oats, Ohio Agricultural Experiment Research Circular 55 (Columbus: Ohio State University, 1958).

[11] Ibid., pp. 1-8.

South Carolina corn prices were examined by Wiley and Garrison[12] during the period 1956-65. Emphasis was placed on the determination of the optimum time of year to sell corn. Price mapping was not used as emphasis was placed on state averages rather than on geographical price variations within the state. Comparisons were made with national price averages and South Carolina corn prices averaged approximately 20 cents per bushel above the United States average for the ten-year period.[13]

Storey and Farris[14] focused their attention on corn price variations for one county in Indiana. The study was designed to determine variations in corn buying practices among county elevators and the influence of these variations on actual prices paid to farmers in various areas of the state. Price differences among elevators were usually attributed to differences in elevators' operating margins. Why these margins differed, however, was undetermined.[15]

Anderson and Amick[16] conducted a study on the supply, price, and utilization of corn in Georgia. Average annual Georgia corn prices were

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[12] O. B. Garrison and W. H. Wiley, An Analysis of South Carolina Corn Prices, Agricultural Experiment Station Bulletin 308 (Clemson, South Carolina: Clemson University, November, 1967).

[13] Ibid., pp. 1-23.

[14] P. L. Farris and D. A. Storey, Corn Price Variations in One Indiana County, Indiana Agricultural Experimental Research Bulletin 694 (Bloomington: Indiana University, 1960).

[15] Ibid., pp. 1-15.

[16] R. F. Anderson and R. J. Amick, Supply, Price, and Utilization of Corn in Georgia with Regional and United States Comparisons, Georgia Experiment Station Mimeograph Series NS 181 (Athens: University of Georgia, November, 1963).

usually found to be higher than prices in the Corn Belt and the United States as a whole. Price differentials over time were found to be more uniform than erratic. Seasonal indices revealed the farm price of corn in the state usually was lowest in November and December following the harvest season and highest in July, the month preceding the availability of the new crop.[17]

Several textbooks dealing with agricultural prices depict the mechanics of price mapping and the advantage of using this type of an approach when dealing with agricultural price analysis. For example, Shepherd[18] presented a price map which showed the average farm price of corn during the interwar years 1924-39, over the Corn Belt. With the aid of price maps, he revealed the price surface for the maps contained a general slope in the iso-price lines upward from west to east, except for a depression in Eastern Illinois and Western Indiana, where large supplies were produced. Lowest prices were found to be concentrated in the northwest corner of the Corn Belt for the study period.[19]

Price mapping has been applied in price analysis of commodities other than corn and grain commodities, such as oats and soybeans. Prices of perishables such as eggs, milk, and tomatoes; meats such as beef and pork and certain other items have been analyzed using this

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[17] Ibid., pp. 1-44.

[18] Geoffrey S. Shepherd, Agricultural Price Analysis (Ames, Iowa: Iowa State University Press, 1963), p. 212.

[19] Ibid., p. 213.

procedure. The importance of these commodities and their homogeneous quality within their commodity class make them highly susceptible to price mapping. Shepherd[20] points out that although price analysts are interested in differentials in price over geographical areas, there are technical difficulties in using price maps or geographical price surfaces for spatial commodity problems. He states that often price mapping is used in conjunction with other techniques. He states, "They (price analysts) are interested in prices with respect to space and form as well as time."[21]

Stubblefield[22] compared prices of feeder cattle at selected markets in the United States during the period 1957-61. Prices were mapped for eleven markets for each of the five study years. Changing price patterns were generally attributed to changes in demand and time lag for supply adjustments.[23]

Lasley[24] observed the geographic structure of milk prices for the period 1964-65. Iso-price lines were drawn on a price map of the Continental United States. Dealers' buying prices for fluid milk tended to increase with distance from the major supply areas. During the

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[20]Shepherd, op. cit., p. 211.

[21]Ibid., p. 211.

[22]T. M. Stubblefield, An Analysis of Prices for Stocker-Feeder Cattle at Selected Markets in the United States, Arizona Agricultural Experiment Station Technical Bulletin 172 (Tucson, Arizona: The University of Arizona, March, 1962).

[23]Ibid., pp. 1-52.

[24]Floyd A. Lasley, Geographic Structure of Milk Prices, 1964-65, United States Department of Agriculture Economic Research Service 258 (Washington: Government Printing Office, September, 1965).

period 1964-65, prices increased an average of 18.2 cents per 100 pounds with each 100 mile increase in distance from Eau Claire, Wisconsin--the zero price line.[25]

Some recent studies include research covering tomatoes,[26] beef,[27] grain,[28] and grocery items.[29] Regional studies included strawberries,[30] peas,[31] and hogs.[32] Other studies involved analytical procedures and modifications of the price mapping procedure.[33]

Other studies not using price mapping but dealing with grain movement in response to regional price variation and use of grain in

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[25] Ibid., pp. 1-7.

[26] Dillman and Farris, op. cit., p. 3.

[27] D. B. Erickson, Are Beef Price Differences Real, South Dakota Farmers Home Research Vol. 3 (Brookings: University of South Dakota, October, 1965).

[28] J. R. Hurst and B. R. Miller, Price Mapping Determines Grain for Economical Feeding, Relative Price of Substitutable Grains, and Identified Most Profitable Ration Ingredients, Highlights Agricultural Research (Auburn: Alabama Station, Fall, 1966).

[29] L. Gorman and H. Mori, "Economic Theory and Explanation of Differences in Price Levels Among Local Retail Markets," Journal of Farm Economics, 48:1492-1496, December, 1966.

[30] C. C. Dennis, "Interregional Competition in the Frozen Strawberry Industry" (unpublished Doctoral dissertation, University of California, Berkeley, California, 1959).

[31] H. M. Hutchings, "An Economic Analysis of the Competitive Position of the Northwest Frozen Pea Industry" (unpublished Doctoral dissertation, Oregon State University, Portland, 1962).

[32] Geoffrey S. Shepherd, Marketing Farm Products (Ames: The Iowa State College Press, 1964), p. 101.

[33] T. H. Ellis, Price Mapping on the IBM-650, Alabama Agricultural Experiment Station Bulletin (Auburn: Auburn University, 1961).

Tennessee have been conducted recently. Fuller and Robertson[34] pointed out that Tennessee is deficit in the production of corn, and that the state must rely on external sources to meet its requirements. Althouse[35] conducted a study to determine the seasonal effect which various economic factors had on corn prices in the six Tennessee crop reporting districts. Strawn[36] investigated the effects of alternative modes of transportation on the optimum number, sizes, and locations of major corn handling facilities in the Southeast including, of course, Tennessee. Robertson[37] developed a transportation acquisition model for corn in Tennessee for the years 1959 and 1960.

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[34]Cecil E. Fuller and Joe K. Robertson, The Sources and Disposition of Grain in Tennessee, The University of Tennessee Agricultural Experiment Station Bulletin No. 377 (Knoxville: The University of Tennessee, April, 1964), p. 4.

[35]Joseph Althouse, Jr., "An Intrastate Analysis of Seasonality in Corn Prices in Tennessee, 1954-64" (unpublished Master's thesis, The University of Tennessee, Knoxville, June, 1967).

[36]Harry Strawn, "The Effects of Alternative Modes of Transportation on the Optimum Number, Sizes, and Locations of Major Corn Handling Facilities in the Southeast" (unpublished Doctoral dissertation, The University of Tennessee, Knoxville, December, 1969).

[37]Joe Kenneth Robertson, "A Transportation Acquisition Model for Corn" (unpublished Master's thesis, The University of Tennessee, Knoxville, November, 1963).

CHAPTER II

THEORETICAL FRAMEWORK

Modern price theory states that price in the market is determined by the interaction of supply and demand forces. Due to a variety of factors, different geographical areas face hetergeneous demand and supply functions. Consequently, geographical price differentials exist which allow trade to occur. These price differentials cause the flow of the product from the surplus-producing areas to the deficit areas through facilities designed to handle the flow. The purpose of this section is to delineate the theoretical framework for the existence of geographical price differentials and the flow of commodities from region to region.

I. CONCEPTUAL FRAMEWORK

The classical approach to interregional trade centered around what has come to be called the "law of comparative advantage." Developed more than a century ago by David Ricardo, John Stuart Mill, and other English followers of Adam Smith, the theory of comparative advantage has become firmly entrenched in economic doctrine. Adam Smith outlined the idea as "absolute advantage."[1] Ricardo's conception of Smith's idea

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[1]Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations (New York: The Modern Library, 1937), p. 424.

centered on what he termed "comparative advantage."[2] Later Mill, drawing from the others, refined the theory calling it "comparative cost."[3] Essentially the law states "that a region will tend to specialize in the production of those products where its ratio of advantage with other products is greatest or where its ratio of disadvantage is least."[4]

Earlier Johann Heinrich von Thunen in 1826 advanced one of the first analysis of the relationship between differences in spatial location and land--utilization patterns. In his model von Thunen assumed:[5] (1) an isolated state, (2) a village type of settlement, (3) homogeneous climate, soils, and topography, (4) uniform transportation facilities, and (5) constant technology. By his analysis differences in land use could be attributed directly to variations in transportation costs. These in turn were dependent upon such factors as distance to market, ease of transportation, bulk, weight, and perishability of the products sent to market. Thunen derived a series of concentric circles of production around the central market

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[2]David Ricardo, The Principles of Political Economy and Taxation (London: J. M. Dent and Laws, Ltd., 1948), pp. 77-93.

[3]John Stuart Mill, Principles of Political Economy with Some of Their Applications ot Social Philosophy, Revised Edition (New York: The Colonial Press, 1960), II, p. 94.

[4]Paul A. Samuelson, Economics, An Introductory Analysis (New York: McGraw-Hill Book Company, Inc., 1961), p. 719.

[5]Raleigh Barlowe, Land Resource Economics (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1958), p. 33.

with intensity of land use decreasing as distance from the market increased.[6]

Other writers expressed similar ideas on the location of production, factor utilization, geographical price differences, and initiation of interregional trade.[7] Simply, the classical approach stated that people from one region trade with people of another region for mutual advantage. The basic advantage of trade is that it makes possible specialization and division of labor. This in turn leads to efficiency in factor utilization.[8] Price differences for identical products exist in various geographical locations, however, because of differences in the degree of efficiency:

> A major factor accounting for price differentials is a difference in ability. As far as nations (regions) are concerned, differences in ability depend basically upon differences in the endowment of factors of production, broadly interpreted. These factors include (1) climate, (2) natural resources, (3) labor, and (4) capital.[9]

II. MODERN THEORY

Profit is the principal motive for production and trade in a purely competitive market. This profit arises through regional

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[6]Melvin L. Greenhut, Plant Location in Theory and Practice: The Economics of Space (Chapel Hill: The University of North Carolina Press, 1956), pp. 5-7.

[7]Actually among the classical writers diverse opinions existed more than this discussion implies. However, the emphasis of this brief discussion is placed on the synthesis of relatively similar ideas.

[8]Howard S. Dye, Fred J. Holly, and John R. Moore, Economics, Principles, Problems, and Perspectives (New York: McGraw-Hill Book Company, Inc., 1961), p. 556.

[9]Ibid.

differences in demand and costs of production. While profit remains the principal motive, other assumptions are necessary for the development of a modern theory of price differentials and movement of factors and products.

Williams[10] asserts that necessary assumptions are: (1) conditions of pure competition with an atomistic structure in all markets, (2) perfect or near-perfect knowledge, and (3) homogeneity of both products and factors. Given these assumtions, trade will take place where price differences among regions exceed transfer costs.

> This condition allows for the inducement of trade between regions to secure profit, provided there is a reciprocity of demand on the part of participating regions. These conditions provide the theoretical basis for dealing with the reasons, factors, and circumstances responsible for price differences sufficient to induce trade, and effects arising out of the initiation and conduct of trade.[11]

There are two broad sets of factors which determine regional prices. The first are those affecting the level and shape of demand and the second are the conditions of supply and of production.

For any given commodity, demand for that commodity is considered to be a function "of the structure of consumer's taste and preferences, the price of the commodity, income of the consumer, the population, and the prices of the related goods."[12] Demand for corn is a derived

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[10]Willard F. Williams, "Interregional Competition--The Relevant Theory," Workshop on Interregional Competition (Stillwater: Oklahoma State University, November, 1962), p. 8.

[11]Ibid., pp. 8-9.

[12]Richard H. Leftwich, The Price System and Resource Allocation (New York: Holt, Rinehart, and Winston, 1962), p. 27.

demand--derived from consumer demand for the product of the corn-consuming livestock.

Cost differentials are primarily responsible for the existence of different supply functions among regions. Vincent states:

> Principal factors responsible for cost differentials are: (1) shifts in a segment of a function resulting from changes in the price of inputs used, (2) change in variable input prices, (3) changes in the price of one input relative to another, (4) technological developments, and (5) factors contributing to specialization and enterprise combinations.[13]

Each region faces given supply and demand conditions which determine the price of a commodity. Regional differences in these supply and demand functions among regions allow for regional variations in the price of the commodity. These variations in price allow trade to occur under certain conditions.

Suppose two geographical areas face hetergeneous demand and supply functions and price differences. If there are no institutional barriers, trade will take place when the price differential between the regions is greater than the transfer cost. An equilibrium between the two regions is reached when the cost of transporting the product becomes equal to the new equilibrium price for both regions. This equilibrium price for each region is attained because supply increases relative to demand in the importing region while supply decreases relative to demand in the exporting region. The transfer cost remains the same for both regions.[14]

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[13]Warren A. Vincent, Economics and Management in Agriculture (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), pp. 140-142.

[14]Paul Samuelson, "Spatial Price Equilibrium and Linear Programming," American Economic Review, 42(3):286, June, 1952.

When supply and demand functions for two regions are the same, there is no price differential and no trade will occur. If, however, one or more of the factors which make up one area's supply and demand functions change, then the functions themselves are altered, resulting in short-run disequilibrium. This change is reflected in regional price differences. "Trade between the regions depends upon the extent of the change in regional price differences, the transfer cost between the two regions, and the demand in one region and the reciprocal demand for imports."[15] According to Williams:[16]

> Transfer costs and changes in these costs also affect regional price differences. The reason is that these are necessary costs that practically determine both (1) the derived supply function at destination and (2) the derived demand function at shipping point. An increase in transfer costs will tend to reduce shipping point prices or to increase receiving point prices.

Additionally, for agricultural products, transportation increases are ordinarily reflected in shipping point prices rather than receiving point prices.

Marketing firms and producers in areas most distant from the principal consuming centers, bear the full significance of the level and rigidity of transfer costs.[17]

Williams states:[18]

> With much of the effect of transfer costs falling upon supply area prices, differential advantage in production,

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[15] Williams, op. cit., pp. 9-10.

[16] Ibid., p. 21.

[17] Ibid., p. 21.

[18] Ibid., p. 22.

marketing, or both may be required in distant areas. Otherwise, the distant area may be unable to compete in the long-run with those located more advantageously with respect to markets. In the short-run, they can accept lower net returns, but an inducement for relocation, as a result, may exist.

III. INITIATION OF TRADE AND EQUILIBRIUM

Assuming the previous prescribed conditions, interregional trade is a function of technology and factor costs which affect regional supply, mobility of factors and products, factor-product price relationships, factors affecting shifts of the demand function, and any change in transport technology, pricing policies, or processing activity. In general, effects of trade are toward an equilization of product prices, factor prices, or both leading to market equilibrium. Trade is induced by and tends to compensate for inequality and disequilibrium in factor supplies and prices as well as product prices.[19]

IV. QUALIFICATIONS OF THE GENERAL THEORY

The modern theory of interregional trade presented in this chapter as a conceptual model is limited by assumptions and restrictions. By assuming perfect competition many variables which affect regional price and cost differences are eliminated. "The theory disregards all stickiness of prices and wages, all transitional inflationary and deflationary gaps, price discrimination, institutional barriers and imperfection in the market structure."[20] Knowledge is not perfect,

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[19] Ibid., pp. 21-22.

[20] Samuelson, op. cit., p. 724.

factors are not homogeneous, demand and supply functions can only be estimated, and transfer costs are often affected by variables difficult to measure.

In spite of its oversimplification, the theory is indeed a logical one. Moreover, it provides an important glimpse of real world situations and provides a theoretical basis for attacking deviations from theory in the real world and making an appropriate economic adjustment.[21]

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[21] Ibid., p. 724.

CHAPTER III

PRICE DIFFERENTIALS IN TENNESSEE BY YEAR, 1961-68

Data used in this analysis were corn prices recorded from individual surveys for each available county for the years 1961-68. The average price was computed by the summation of the average monthly county prices for the year divided the number of months. This procedure allowed for an average weighted price as opposed to the alternative of dividing the sum of reported prices for the year by the total number of observations (since county observations varied by months). On the basis of regional data,[1] it was hypothesized that there would be a general price pattern of increasing prices from west to east across the state.[2] Table II reveals that prices tend to advance from west to east. In this chapter attention is focused on patterns of price movement within the state and the isolation of geographical areas of homogeneous prices.

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[1]Data for Table II was on the basis of the six crop reporting districts set up by the Tennessee Crop Reporting Service where the first district represents the extreme western part of the state and the sixth district represents the extreme eastern portion of the state.

[2]Previous studies (Charles E. Allred and others, "Regional Differences in Farm Prices of Corn, Tennessee and United States," Rural Research Series, Monograph No. 31 (Knoxville: University of Tennessee, March 20, 1937), pp. 5-13; Charles E. Allred and others, "Regional Differences in Farm Prices of Corn, Tennessee and United States," Rural Research Series, Monograph No. 110 (Knoxville: University of Tennessee, August 15, 1940), pp. 5-6) and state statistics suggest a general rise in prices from west to east.

TABLE II

AVERAGE YEARLY PRICE DIFFERENTIALS BETWEEN REGIONS, TENNESSEE, 1961-68

Year	Regions														
	1-2	1-3	1-4	1-5	1-6	2-3	2-4	2-5	2-6	3-4	3-5	3-6	4-5	4-6	5-6
	(Dollars per bushel)														
1961	.03	.09	.15	.13	.21	.06	.12	.10	.18	.06	.04	.12	-.02	.06	.08
1962	.04	.09	.17	.16	.23	.05	.13	.12	.19	.08	.07	.14	-.11	.06	.07
1963	.03	.04	.15	.11	.16	.01	.12	.08	.13	.11	.07	.12	-.04	.01	.05
1964	.01	.04	.11	.07	.15	.03	.10	.06	.14	.07	.03	.11	-.04	.04	.08
1965	.01	.07	.13	.08	.14	.06	.12	.07	.13	.06	.01	.07	-.05	.01	.06
1966	.02	.04	.15	.06	.11	.02	.13	.04	.09	.11	.02	.07	-.09	-.04	.05
1967	.07	.09	.18	.11	.16	.02	.11	.04	.09	.09	.02	.07	-.07	-.02	.05
1968	.07	.13	.20	.14	.17	.06	.13	.07	.10	.07	.01	.04	-.06	-.03	.03
1961-68	.04	.07	.16	.11	.17	.04	.12	.07	.13	.08	.03	.09	-.05	.01	.06

Source: Calculated from data provided by the Agricultural Statistician, Tennessee Department of Agriculture, Nashville, Tennessee.

County price data showed the price differential between the county with the lowest and the highest average price per year to be between 21 and 28 cents per bushel for each of the study years. For price mapping purposes, prices were grouped into seven ranges of four cents each for each year from 1961 to 1968. Each annual map therefore contained seven "homogeneous price areas" whereby each county with adequate observations was within one of the seven price ranges.

I. 1961-68 HOMOGENEOUS PRICE AREA MOVEMENT

1961 Annual Price Areas

Figure 1 illustrates the seven price categories for 1961. The lowest level of prices, as expected, included the extreme West Tennessee counties of Lake, Dyer, Lauderdale, Tipton, and Haywood. These counties have historically received the lowest prices in the state. Other counties included in this price range were Hardeman, McNairy, Henderson, and Decatur.

A second homogeneous price area ran from north to south containing Obion, Weakley, Gibson, Madison, and Chester counties which bordered each other. Also within this price range were the counties of Shelby and Fayette in the southwestern section of the state.

Overton County was the only county to be included in the third price area which was geographically distant from the other counties making up this price range. This price area, the 8-11 cent differential, included a 14-county area geographically known as the Western Highland Rim and West Tennessee Plateau.

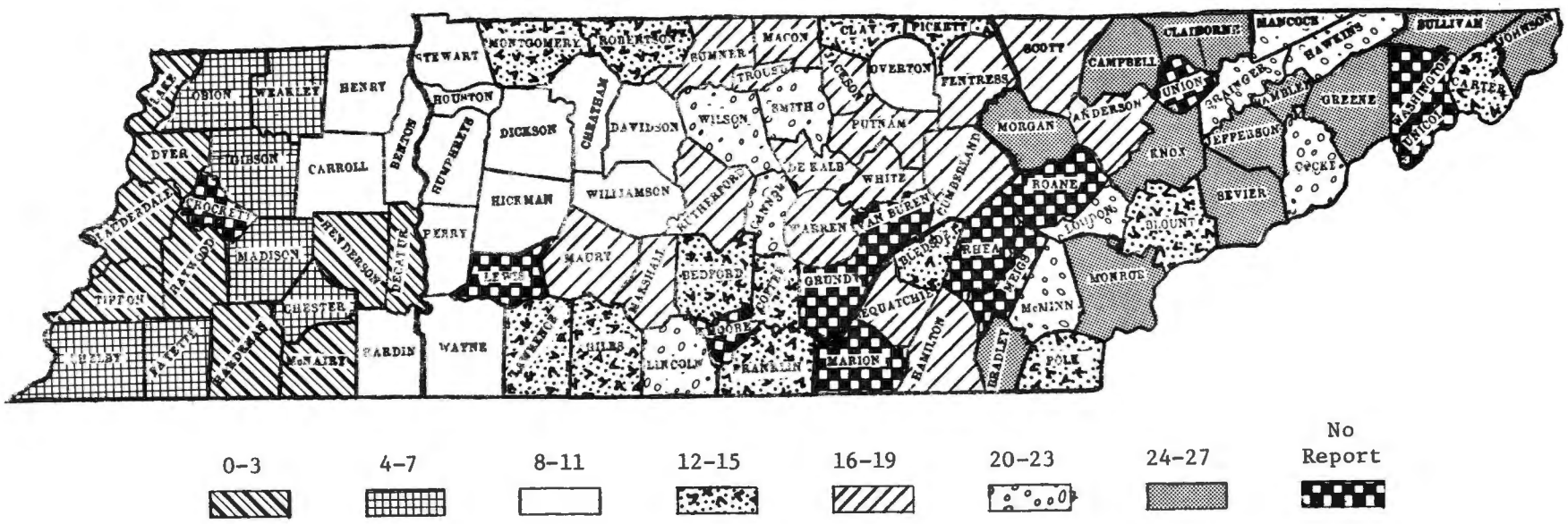


Figure 1. Price differential map for corn in cents per bushel, Tennessee, 1961.

The fourth homogeneous price area, the 12-15 cent differential, as shown on the price map runs east to west at both the northern and southern boundaries of the state. Counties within this price range included Montgomery, Robertson, Clay, and Pickett counties in the northcentral part of the state. In the southcentral part of the state Lawrence, Giles, Bedford, Coffee, Franklin, Bledsoe, and Polk counties fell into this price range. Also included in this price range was Carter County in extreme Northeast Tennessee.

An area consisting of 18 counties composed price area five with price differentials of 16-19 cents per bushel. The area covered by this price range included what is geographically referred to as the Central Basin (midstate) and Cumberland Plateau regions.

Nearly all counties in East Tennessee (east of the Cumberland Plateau) were within the two highest price ranges (20-27 cent differential). Other counties reporting high prices were Lincoln, Wilson, Cannon, and Smith in the Midstate Region. Counties not included in the 1961 iso-price map due to inadequate data were Crockett, Lewis, Moore, Grundy, Marion, Van Buren, Rhea, Ross, Union, Washington, and Unicoi. The counties of Lincoln, Overton, Polk, Blount, and Carter were not geographically close to the homogeneous price range of which they were a part.

1962 Annual Price Areas

Annual county prices in 1962 conformed to the same 28 cent price differential as was the occurrence in 1961. Accordingly, the four cent differential for each range remained the same, i.e., from zero to

three, inclusive, for the lowest price range to 24-27, inclusive, for the highest price range.

Referring to Figure 2, price line movement was slight for the first three sets of differentials when compared to the price map for 1961. In fact they are practically identical. There were eight counties in the low price range, five in the second price range, and thirteen in the third price grouping. Eight counties were included in the fourth price range (12-15 cent differential). Only Montgomery and Robertson counties fell within these price ranges in 1962 as well as in 1961.

Price range five, as depicted in Figure 2, was very similar to the same range in 1961 although there was a slight westerly movement. In 1962 there were 31 counties in the two highest price ranges, the 20-27 cent differential. The counties of Polk, Marshall, Bedford, Coffee, Rutherford, Warren, Sequatchie, Sumner, Macon, and Putnam were in the lower price ranges in 1961 than in 1962 but this was a modest price change (four cents per bushel or less). Statewide, price maps for 1961 and 1962 were very similar. A noteworthy exception was a greater concentration (twelve versus four) of counties in the highest two price differentials (20-27 cents) in the Midstate Area.

1963 Annual Price Areas

In 1963 a smaller price differential existed between the lowest and the highest average corn price for counties in the state. The aggregate effect of this smaller differential was that more counties became part of the area encompassed by price ranges two through four

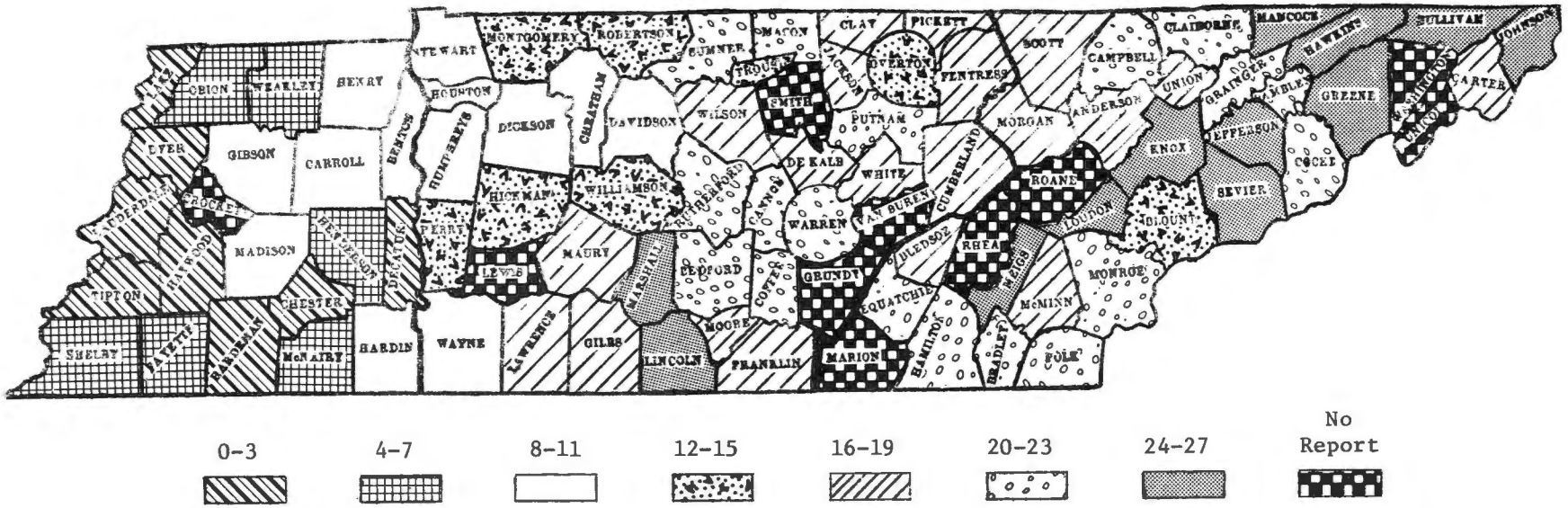


Figure 2. Price differential map for corn in cents per bushel, Tennessee, 1962.

(four to fifteen cent differential) and less for the area encompassed by price ranges five through seven (16-27 cent differential). As expected, Figure 3 reflected this change as can be easily detected by the "face" of the map.

Six counties in the West Tennessee Plateau which were in price ranges three and four for 1961 and 1962 were a part of the second price range in 1963. With the exception of seven counties, all counties in the Midstate and Cumberland Plateau areas became a part of the third and fourth price categories, five were in the fifth price range and Lincoln County was in the highest price range. Counties in extreme East Tennessee fell within the fifth and sixth price categories except for Polk (range four), Carter (range three), and Johnson (range seven).

1964 Annual Price Areas

The 1964 price map bore a close resemblance to the one for 1963 (see Figure 4). Extreme West Tennessee counties were in the lowest differential while West Tennessee Plateau and the Western Highland Rim counties were either in price range two or three, i.e., the four to seven or eight through eleven cent differential.

Nine Midstate counties were in the fourth price range. Cumberland County was also in this range while all other Cumberland Plateau counties except Fentress and Roane were in the third price category. In extreme East Tennessee, Bradley and Polk counties were part of the fourth price range (12-15 cent differential) and Carter and Blount counties a part of the third price range (8-11 cent differential).

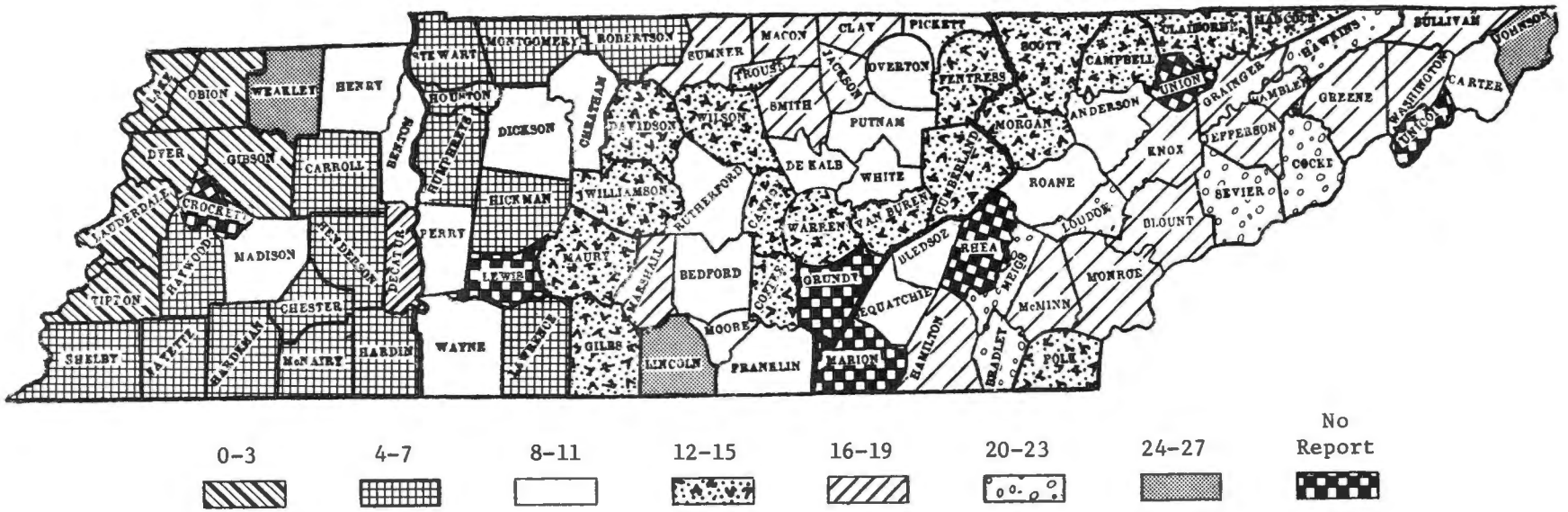


Figure 3. Price differential map for corn in cents per bushel, Tennessee, 1963.

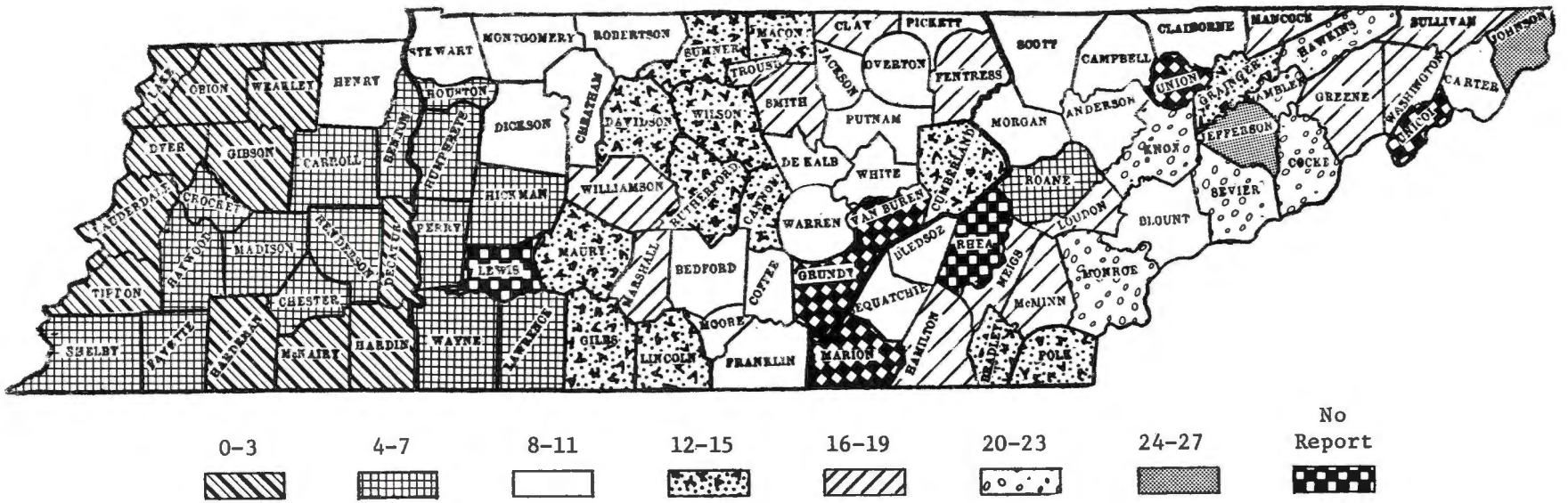


Figure 4. Price differential map for corn in cents per bushel, Tennessee, 1964.

Other counties in this area were in the fifth, sixth, and seventh price ranges (16-27 cent differential).

1965 Annual Price Areas

The price differential between the lowest and highest corn prices received by farmers for 1965 was 28 cents per bushel as was the instance in 1961 and 1962. However, the price map for 1965 more closely resembled the ones for 1963 and 1964 when the differential between highest and lowest prices was less than 28 cents.

Price category one and two remained relatively unchanged from the previous years. Price range three included four counties in the Northern Cumberland Plateau in addition to the usual Western Highland Rim counties in this same price range. For the fourth price category there were two distinct price surface areas as depicted on the price map--a Midstate Area and an East Central-Western Cumberland Plateau Area.

There were three price areas for the 16-19 cent per bushel differential. As in previous years, several Midstate counties fell into this price range. A southeastern sector contained Meigs, McMinn, and Monroe counties. Hancock, Grainger, Hamblen, Greene, and Sullivan counties fashioned a northeastern sector. There were only five counties in price range six (20-23 cent differential) and three counties in price range seven (24-27 cent differential), a deviation of some consequence since Extreme East Tennessee counties usually composed a significant portion of these price ranges (see Figure 5).

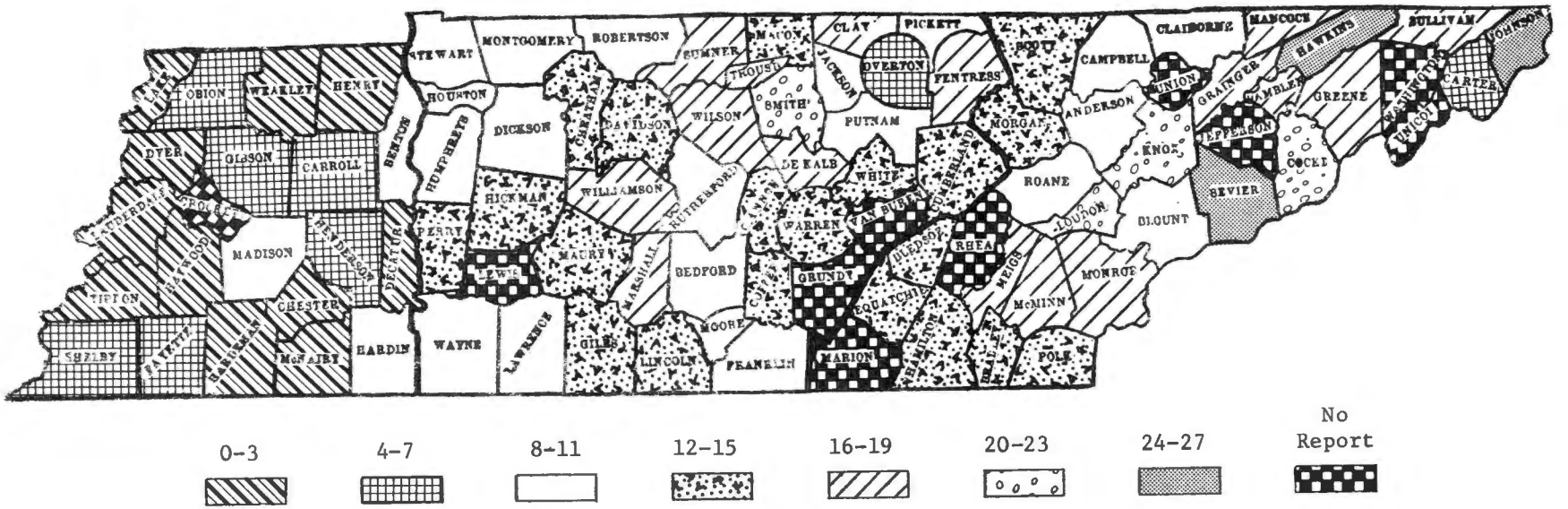


Figure 5. Price differential map for corn in cents per bushel, Tennessee, 1965.

1966 Annual Price Areas

The price differential between the lowest and highest average corn prices received by farmers in 1966 was 28 cents per bushel. The face of the price map revealed a continuation of the shift to fewer counties in the highest price ranges, a movement towards a high price Midstate area, and less price range variability in the Extreme East as shown in Figure 6.

Northwestern counties composed price area one while the price surface area for category two remotely resembled the surface area of 1962 (Figure 2, page 29) containing some "standard" counties. Category three, where the differential was between 8-11 cents, as depicted on the price maps revealed two distinct areas of homogeneous price concentration. Western Highland Rim and West Tennessee Plateau counties composed one area while Cumberland Plateau counties made up the second area which was geographically distant from the first.

Counties in the Central Basin and counties in Central and Northern East Tennessee made up the 16-19 cent differential area. A Midstate high price area, the 20-23 cents per bushel differential, which had not appeared in price maps since 1962, was apparent in the 1966 price map. Hawkins and Johnson counties in the Extreme Northeast were the only counties in the highest price categories. Both were normally high corn price counties.

1967 Annual Price Areas

Corn prices differed by a 28 cent margin for the year 1967. For 1967 price groupings one, two, and three were very similar to the

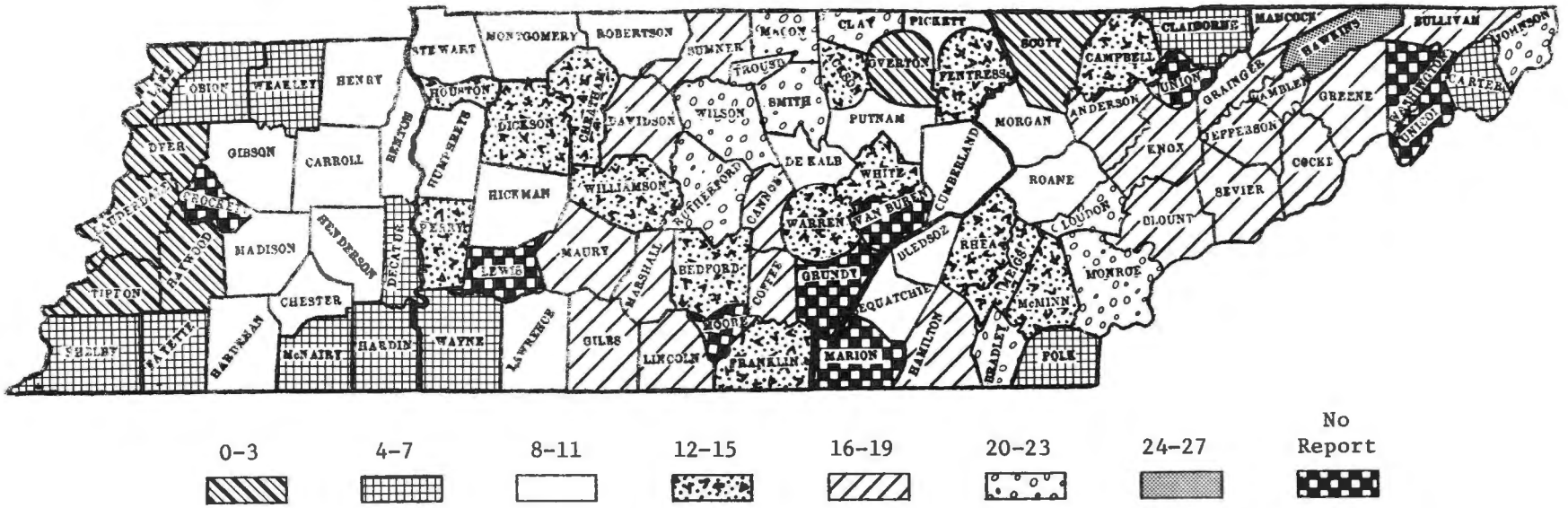


Figure 6. Price differential map for corn in cents per bushel, Tennessee, 1966.

area of the price map for 1966 (Figure 7). Differences worth noting were that only five counties fell into price range two; adjacent counties were absorbed into the third price range. In 1966, the Cumberland Plateau counties were in price range three but showed prices in range four (12-15 cent differential) during 1967.

The 16-19 cent differential area contained three geographical areas of concentration. The first area runs north to south and contained the counties of Sumner, Robertson, Dickson, Davidson, Maury, and Giles. The second concentrated area runs northeasterly and contained the counties of Franklin, Coffee, Warren, White, and Fentress. An Eastern area of concentration housed the counties of Loudon, Knox, Sevier, Cocke, Hamblen, and Greene.

In the center of the state bordered by counties in the 16-19 cent per bushel differential lay a 12-county area with average prices in the two highest price ranges (20-27 cent per bushel differential). Also bordering the counties in the Central East in the fifth price zone was an 11-county area running northeasterly. Carter County was the only county in this area with a low price.

1968 Annual Price Areas

Price patterns for 1968 were not nearly as well defined as in previous years (Figure 8). Price ranges one and three were much like previous years except there were not as many counties in price range three as there had been in 1966 and 1967. Only three Western counties fell in category two. Eastern counties of McMinn, Blount, Anderson, Sevier, Hamblen, Greene, and Carter were part of the area of price

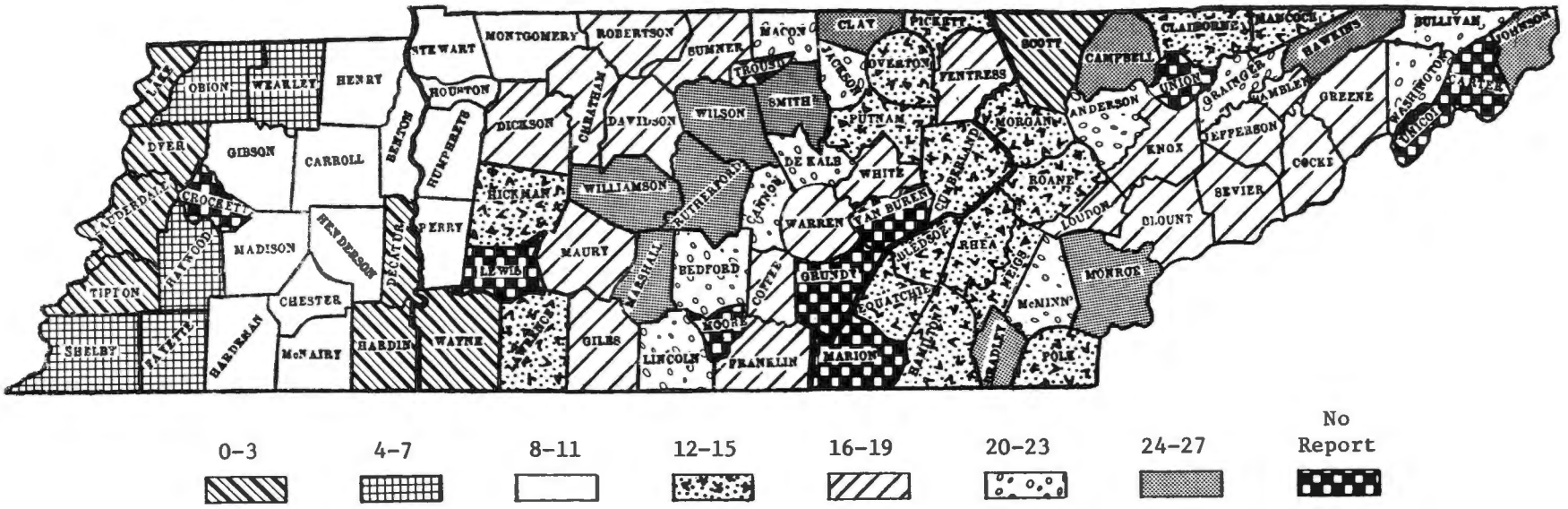


Figure 7. Price differential map for corn in cents per bushel, Tennessee, 1967.

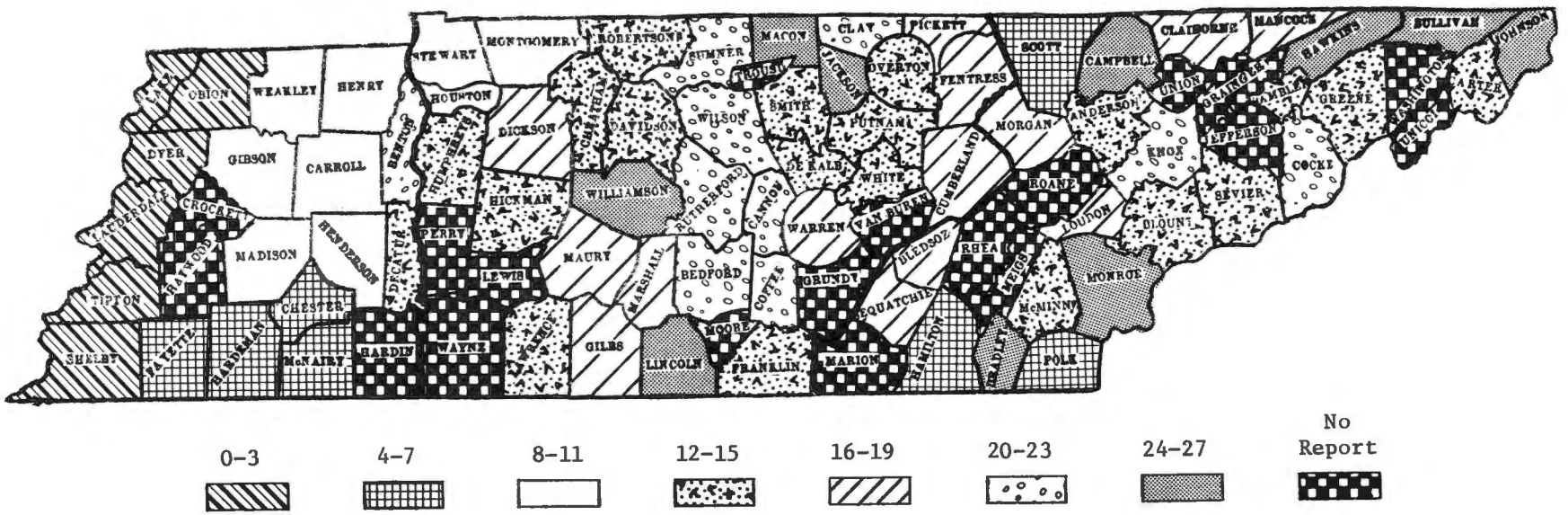


Figure 8. Price differential map for corn in cents per bushel, Tennessee, 1968.

range four. In previous years (1961-65) these counties most frequently were in the two highest price ranges and more recently (1966-67) they had fallen within range five. As in 1966 and 1967, the Central Basin Area received higher prices relative to previous periods as did the Cumberland Plateau counties.

II. REGIONAL DIFFERENTIALS

The eight-year average demonstrated that the farm price of corn in Tennessee varies considerably across the state. For the years 1961-68 (Figure 9) the lowest average price was $1.15 for Dyer County and the highest average price was $1.40 for Hawkins County. This represents a 25 cent differential for the eight-year period. Table III lists the counties and state averages for the eight-year period. In West Tennessee prices generally fell into ranges one and two (zero to seven cent differential). In Middle Tennessee prices generally fell into range three, four, and five (8-11, 12-15, or 16-19 cent per bushel differential) and to a lesser extent price range six. In East Tennessee, prices fell into ranges five and six (16-23 cent differential) with Hawkins and Johnson counties composing price range seven (24-27 cent differential).

III. DEGREE OF VARIATION

Price maps for the years 1961-68 show the following points of difference:

1. East Central Basin counties (Midstate) experienced price differentials in the higher ranges for the years 1961-62 and 1966-68 and prices in the medium range for the years 1963-65.

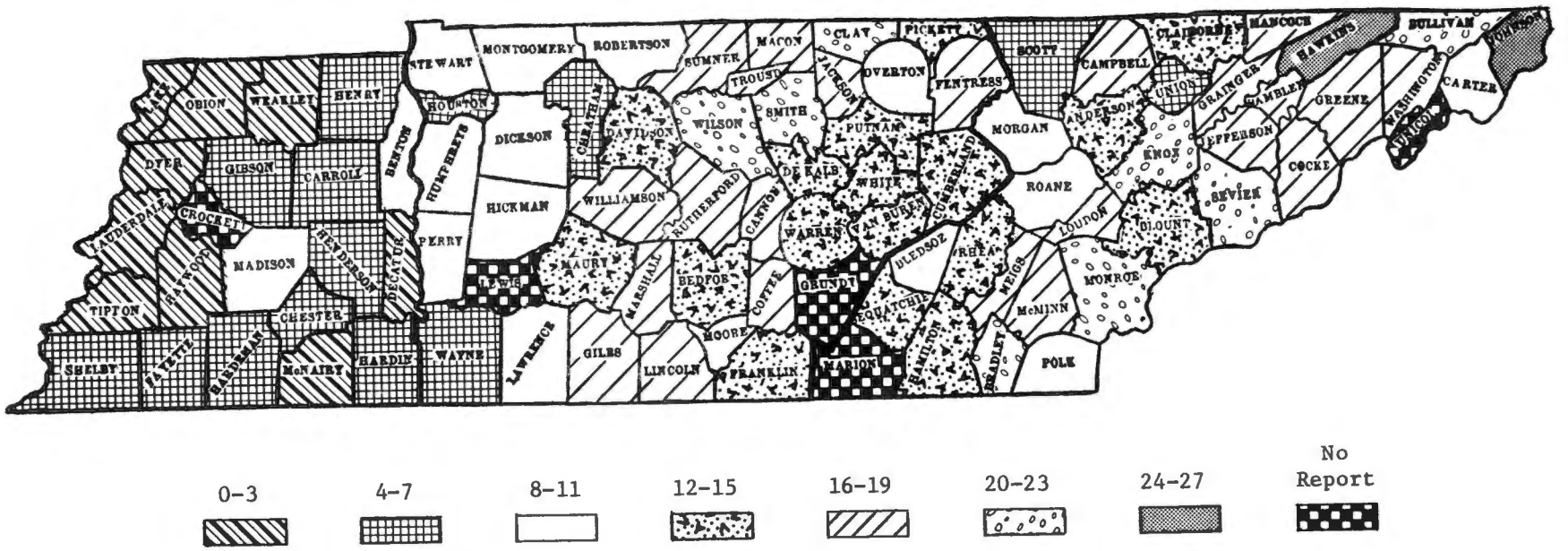


Figure 9. Price differential map for corn in cents per bushel, Tennessee, 1961-68.

TABLE III

CORN: AVERAGE FARM PRICE BY COUNTIES AND PERCENT OF THE TENNESSEE AVERAGE PRICE, 1961-68

County	Average Price	Percent of Tennessee Average Price
Anderson	1.29	101
Bedford	1.30	102
Benton	1.27	99
Bledsoe	1.26	98
Blount	1.30	102
Bradley	1.37	107
Campbell	1.33	104
Cannon	1.33	104
Carroll	1.23	96
Carter	1.26	98
Cheatham	1.23	96
Chester	1.20	94
Claiborne	1.29	101
Clay	1.36	106
Cocke	1.35	105
Coffee	1.32	103
Crockett	a	a
Cumberland	1.29	101
Davidson	1.28	100
Decatur	1.14	89
DeKalb	1.29	101
Dickson	1.27	99
Dyer	1.15	89
Fayette	1.21	95
Fentress	1.32	103
Franklin	1.28	100
Gibson	1.21	95
Giles	1.32	103
Grainger	1.35	105
Greene	1.34	105
Grundy	a	a
Hamblen	1.34	105
Hamilton	1.31	102
Hancock	1.33	104
Hardeman	1.20	94
Hardin	1.21	95
Hawkins	1.40	109
Haywood	1.17	91
Henderson	1.22	95

TABLE III (continued)

County	Average Price	Percent of Tennessee Average Price
Henry	1.23	96
Hickman	1.26	98
Houston	1.22	95
Hymphreys	1.23	96
Jackson	1.32	103
Jefferson	1.34	105
Johnson	1.40	109
Knox	1.36	106
Lake	1.16	91
Lauderdale	1.16	91
Lawrence	1.26	98
Lewis	a	a
Lincoln	1.35	105
Loudon	1.35	105
McMinn	1.33	104
McNairy	1.19	93
Macon	1.33	104
Madison	1.25	98
Marion	a	a
Marshall	1.36	106
Maury	1.31	102
Meigs	1.34	105
Monroe	1.39	109
Montgomery	1.26	98
Moore	1.20	94
Morgan	a	a
Obion	1.19	93
Overton	1.24	97
Perry	1.27	99
Pickett	1.28	100
Polk	1.27	99
Putnam	1.29	101
Rhea	1.30	102
Roane	1.26	98
Robertson	1.26	98
Rutherford	1.33	104
Scott	1.23	96
Sequatchie	1.29	101
Sevier	1.38	108
Shelby	1.20	94
Smith	1.36	106
Stewart	1.25	98

TABLE III (continued)

County	Average Price	Percent of Tennessee Average Price
Sullivan	1.38	108
Sumner	1.33	104
Tipton	1.16	91
Trousdale	1.32	103
Unicoi	a	a
Union	1.23	96
Van Buren	1.28	100
Warren	1.30	102
Washington	1.35	105
Wayne	1.22	95
Weakley	1.19	93
White	1.29	101
Williamson	1.34	105
Wilson	1.36	106
State	1.28	100

Source: Calculated from monthly county prices from individual schedules furnished by the Tennessee Crop Reporting Service in cooperation with United States Department of Agriculture Crop Reporting Service, Washington, D. C.

[a]Inadequate data.

2. Cumberland Plateau counties fell primarily into price range five (16-19 cent) during 1961-62, and 1968; into price four (12-15 cent) primarily in 1963, 65, and 1967; and into price ranges two and three (4-11 cent) in 1964.

3. Extreme East Tennessee counties received generally high prices 1961-62 (20-27 cent differential), somewhat lower prices (16-23 cent differential) for 1963-67, and average prices (12-15 cent differential) in 1968.

4. Hamilton County (Chattanooga) reported high prices 1961-64, and 1966; average prices 1965 and 1967; and low prices in 1968.

5. Fewer counties fell into the highest price ranges during the years 1963-65 than during the years 1961-62, and 1966-68.

The price maps also show these points of similarities:

1. Northwestern section of the state reported the lowest prices for the years 1961-68.

2. Shelby and Fayette counties in the Extreme Southwest fell into price range two each year except for Shelby County in 1968.

3. Western Highland Rim and West Tennessee Plateau counties fell into price ranges two and three for the years 1961-68.

4. Decatur County in the West and Carter and Polk counties in the East received low prices relative to their geographic location.

5. Madison County (Jackson) recorded higher prices than adjacent counties.

6. Price ranges one and two varied little from year to year geographically.

7. Cumberland Plateau counties received lower prices than counties to the immediate east or west.

Price differentials for the years 1961-62 and 1965-68 approximated a 28 cent per bushel differential between the lowest and highest average county price. For the years 1963 and 1964, the differential was slightly less resulting in only two counties in price range seven for each of these two years. Iso-price movement was more apparent in Midstate and Eastern sectors. Extreme West Tennessee counties with the exception of Shelby experienced the lowest prices for each of the eight years. Also within this area Hardin, McNairy, and Decatur counties reported low prices. For the years 1963-64, the West Tennessee Plateau contained quite a few counties with price differentials of four to seven cents (range two). This same area in 1961-62 and 1965-68 was generally absorbed by the third price range. During 1963 and 1964 the Cumberland Plateau was also a part of the area covered by the third price range or the 8-11 cent differential.

From 1961-68 price range four varied geographically within the larger geographical area of Middle Tennessee. The 1968 price map illustrated that this price range (12-15 cent differential) also included seven counties in East Tennessee in addition to eleven in Middle Tennessee. Prior to 1968 there were never more than two Eastern counties in this range. Considerable variation existed within Middle Tennessee. Counties which had been a part of the price area four in some years became part of the price area five other years and vice versa. A shift to a higher or lower price range represented a four-cent increase or decrease in the differentials.

For the years 1961-62 and 1966-68, there was a geographical area in the center of the state which experienced prices in the highest two ranges. Also during the years 1961-62 prices in Northern and Central East Tennessee were within these two highest ranges. However, from 1963-67 this same area predominantly experienced prices in lower ranges (five and six) and in 1968 for the first time seven of the counties composing Central East Tennessee became part of price area five. Three sets of price maps appeared to be most similar. The first set was the 1961 and 1962 maps; the second set was the 1963, 1964, and 1965 maps; and the third set was the 1966, 1967, and 1968 maps.

IV. SEASONAL PRICE VARIATIONS, 1961-68

Because of the seasonality of production, prices of corn relative to other grains, storage cost, and other factors, corn prices are normally highest in June, July, and August prior to the harvesting period and lowest from October to December. Price maps were drawn for the months September through February, and March through August for the years 1961-68. The purpose of this undertaking was to observe price movement for the eight years. By mapping prices in this manner, changes other than seasonal were hypothesized to be detected for the study years.

Price maps revealed that the 1961-62 September-February (fall-winter) and the 1962 March-August (spring-summer) average prices differed only slightly from the annual maps of 1961 and 1962. Prices were higher for the spring and summer months than for the fall and winter months, not only for the particular years mentioned above, but

for all the years studied. There was a large concentration of counties in the Midstate area in high price ranges (16-27 cents per bushel price differential) for the fall-winter period of 1962-63. The annual map for 1963 and the spring-summer map for the same year, showed no such concentration, whereas, the annual maps for 1961 and 1962 had also shown this area of concentration.

The fall-winter map of 1963-64, the spring-summer map of 1964, and the 1964 annual maps were all similar; the same situation generally existed for the spring-summer and annual maps for 1966. However, the fall-winter map for 1965-66 differed from the spring-summer or annual 1966 maps. The fall-winter map revealed all counties in West Tennessee to be in the lowest price differential. Considerable variation existed in the Midstate area and in the Cumberland Plateau counties.

The fall-winter 1966-67, spring-summer 1967, and the annual map for 1967 closely resembled each other. This pattern was not true for the same maps for 1968. The fall-winter price map for 1967-68 was considerably different from the spring-summer map for 1968. The 1968 annual price map tended to minimize the difference between the fall-winter and spring-summer maps.

Results of Chapter III suggest that homogeneous price regions in Tennessee are most similar for the periods 1961-62, 1963-65, and 1966-68. September-February and March-August price maps tend to reinforce this observation. The only price map variation of any large magnitude between low seasonal prices, high seasonal prices, and annual prices was for the year 1968.

CHAPTER IV

FITTED ISO-PRICE LINES FOR SELECTED TIME PERIODS

In the previous analysis detailed price maps for each of the years under consideration were presented. It is difficult, however, to carry several price maps for individual years in the mind's eye at the same time for comparison. The variability of the price areas from one time period to another can be shown more clearly by sacrificing some detail and fitting iso-price lines in much the same manner as contour lines are fitted on a topographical map. This approach helps to bring out the "character" of the price surface over the geographical area. Naturally some local ridges, plateau, and basins will be eliminated but this restriction is superseded by the advantage of gaining an overall picture of the geographical price surface.

I. ISO-PRICE LINES FOR CORN IN TENNESSEE, 1961-62

Figure 10 illustrates the iso-price map for the study period 1961-62. The zero iso-price line was located at the extreme left passing through Dyer and Lauderdale counties where corn prices were lowest. The five cent iso-price line separated the counties in Extreme West Tennessee from West Tennessee proper. Counties between iso-price lines five and ten included the geographical area known as the Western Highland Rim; while the area between iso-price lines 10 and 15 is known as the West Tennessee Plateau. Eastern Central Basin counties were located between iso-price line 15 and 20.

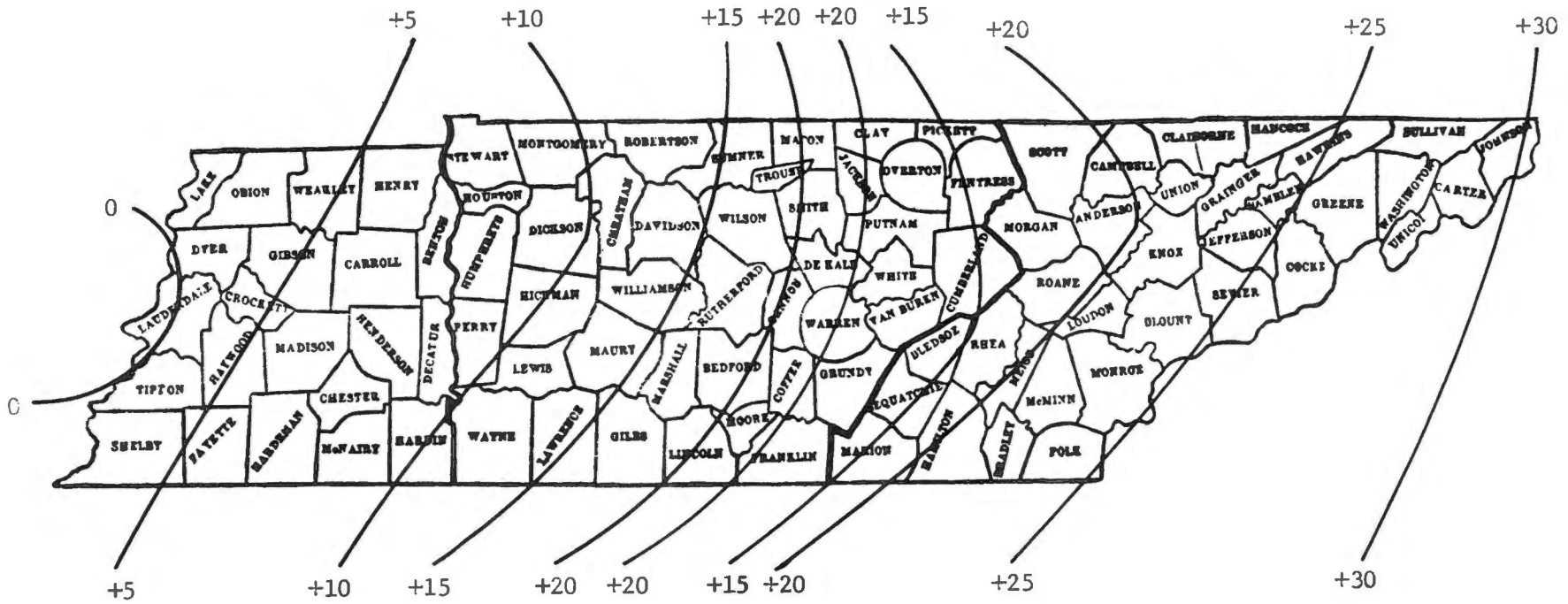


Figure 10. Fitted iso-price lines for corn in Tennessee, 1961-62, with corn price differentials in cents per bushel.

There was a "ridge" between the two "20" iso-price lines. This represented an area where prices "peaked" or the differential between lowest and highest corn prices was greatest. Thereafter prices declined in the Eastern Cumberland Plateau (area between iso-price lines 20 and 15 from left to right), reached a low at iso-price line 15, and began to advance toward the Western Cumberland Plateau counties (area between price line 15 and 20). Prices continued to advance from west to east. The last iso-price line, 30, passed through Johnson County, the county with the highest corn prices for the time period. Price lines for the period were convex with a general slope west to east to the Midstate Area, a downward slope to the Cumberland Plateau, followed by a general slope upward to the extreme east.

II. ISO-PRICE LINES FOR CORN IN TENNESSEE, 1963-65

For this period, the zero iso-price line (Figure 11) had the identical fit as did the one for 1961-63. Iso-price line five assumed a different contour (concave) from the one for 1961-63, and encompassed a few more counties. The geographical area between price lines five and ten was approximately the same as in the earlier period. There was a small strip of five counties between price lines 10 and 15. Between the two "15" iso-price lines was a nine-county area denoting a ridge in the price map just east of the ridge line in Figure 10. For this period prices had peaked at a five-cent lower differential than the previous period.

Prices then declined from Middle Tennessee to the Cumberland Plateau and then advanced to a high in the extreme east following the same price pattern as before.

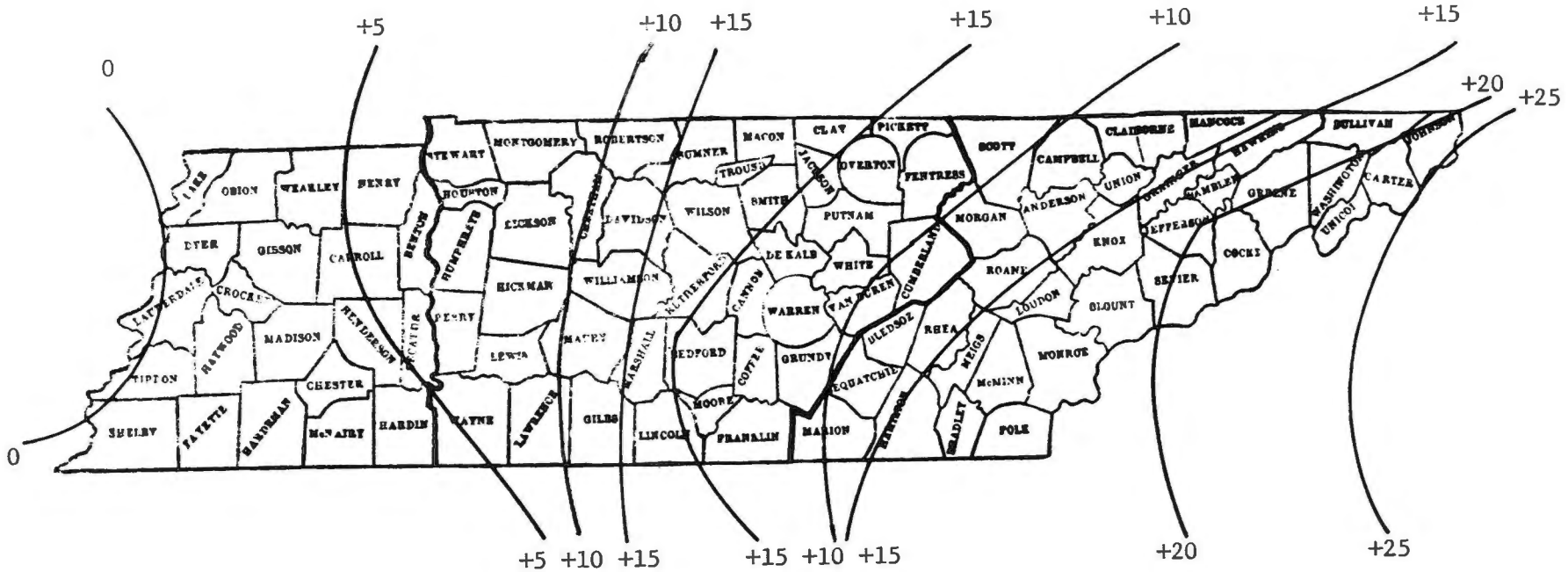


Figure 11. Fitted iso-price lines for corn in Tennessee, 1963-65, with corn price differentials in cents per bushel.

All iso-price lines were concave in contour except the zero price line. Price lines were uniform and approximately equal distance except for the first two (0-5 and 5-10). The price pattern was practically the same as for the 1961-62 period although the differential was greater.

III. ISO-PRICE LINES FOR CORN IN TENNESSEE, 1966-68

Figure 12 depicts the price areas for corn in Tennessee during the period 1966-68. Iso-price line zero was identical to those of the previous periods. The area between price lines zero and five included all the Extreme West Tennessee counties. Counties in the Western Highland Rim fell between iso-price lines five and ten. Prices advanced from west to east reaching a high in the Central Basin Area (Midstate). Some ten counties formed a ridge between the "two" 20 iso-price lines.

Prices then declined from Middle Tennessee to the Cumberland Plateau Area in approximately the same location as during the previous period. Prices then advanced from west to east reaching a second high in Northeastern Tennessee. Claiborne and Hancock counties represented a depression in the price map. Actually the differential for these counties was only 12 and 13 cents per bushel, respectively--not 16 to 20 as implied by the price map.

The only notable difference between this price map and the two previous ones was in the contour of the last two iso-price lines as they sloped left to right rather than up and down. Again, the price lines were uniform and approximately equal distance apart. Price lines for this period were both concave and convex. The differential

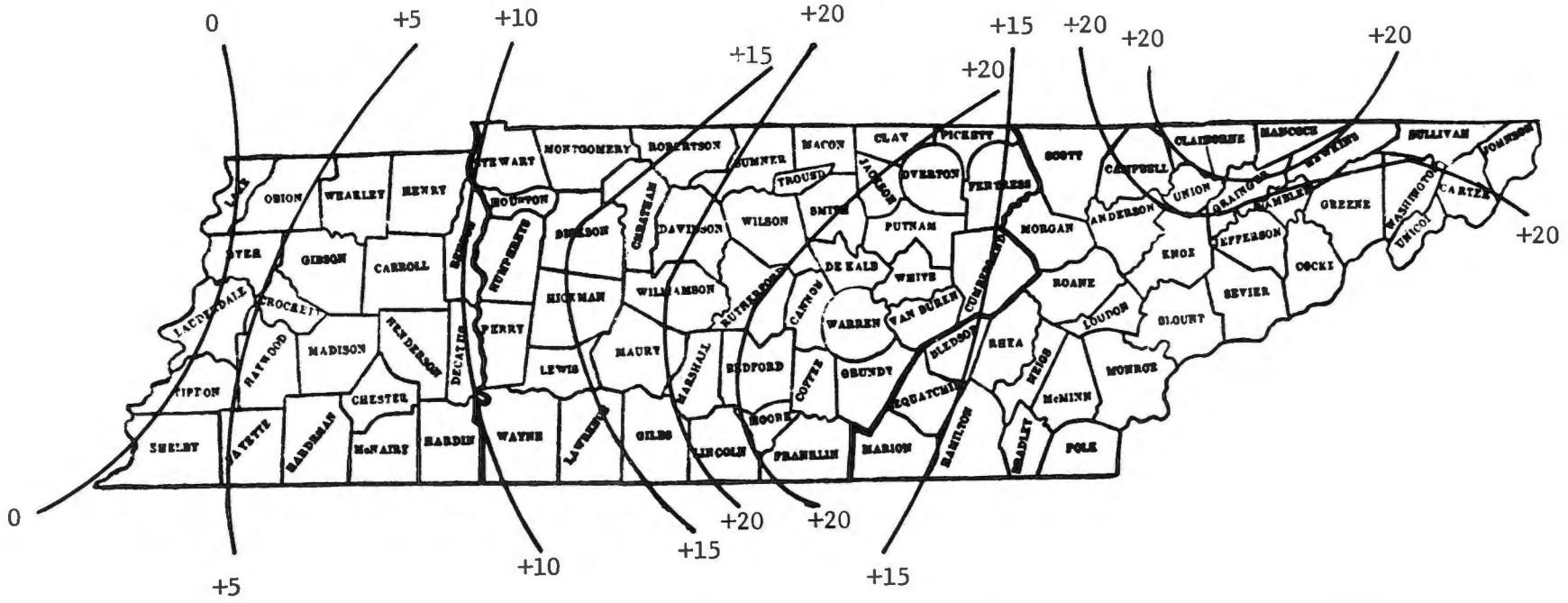


Figure 12. Fitted iso-price lines for corn in Tennessee, 1966-68, with corn price differentials in cents per bushel.

for counties composing the first ridge line (Midstate) was the same as for the counties in the Northeast.

IV. ISO-PRICE LINES FOR CORN IN TENNESSEE, 1961-68

Figure 13 depicts the price areas for corn in Tennessee for the entire period 1961-68. As in the three previous maps, iso-price line zero passed through the Extreme Northwest counties. The area between price line zero and price line five included all of the Extreme Northwest counties plus Fayette, Hardeman, and McNairy counties. Prices advanced from west to east reaching a high in the Central Basin Area (Midstate). Approximately 12 counties formed a ridge between the two 15-cent iso-price lines.

Prices then declined from the Midstate Area to the Cumberland Plateau Area where the price differential approached 10 cents per bushel. Prices then rapidly advanced from west to east where some eight counties formed a ridge where the price differential was in excess of 20 cents per bushel.

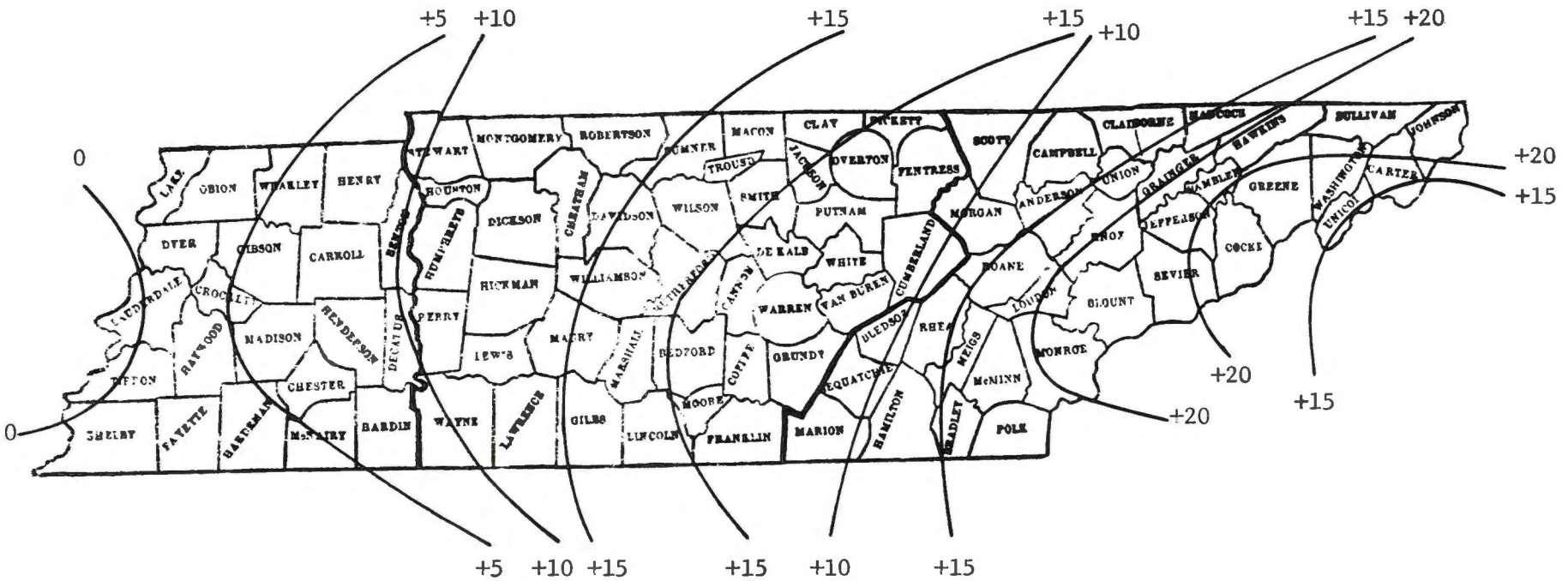


Figure 13. Fitted iso-price lines for corn in Tennessee, 1961-68, with corn price differentials in cents per bushel.

CHAPTER V

FACTORS AFFECTING REGIONAL PRICES OF CORN

Average prices received by farmers for corn vary considerably from one area of Tennessee to another. Tennessee, as a state and subsequently a large geographical and marketing entity, is composed of numerous sub-marketing areas--each area made up of different components of supply and demand. Corn prices in each geographical area in Tennessee are influenced by both the prices established in the major grain producing regions of the United States and local supply-demand factors.[1] An analysis of these factors aids in the understanding of regional price spreads and provides a focal point for the initiation of programs and practices designed to remedy economic inefficiency. The purpose of this chapter is to identify and suggest factors contributing to corn price differentials in Tennessee.

I. SURPLUS AND DEFICIT PRODUCTION

Tennessee is deficit in the production of feed grains including corn.[2] Corn flows from the surplus producing regions in the Midwest

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[1]The discussion in Chapter II identified theoretical factors for price differentials. In an imperfect market structure, factors other than transportation costs influence price to various extents though transportation costs remain a major factor in regional price spreads.

[2]Joe Kenneth Robertson, "A Transportation Acquisition Model for Corn" (unpublished Master's thesis, The University of Tennessee, Knoxville, November, 1963), p. 18. Robertson showed this deficit to be 21,063,000 bushels in 1959 and 46,545,000 bushels in 1960.

Corn Belt, where over 80 percent of the United States' domestic supply of corn is produced (Table IV) to deficit regions including Tennessee. In a deficit region, the farm price increases as the distance to the central market increases. In contrast in a surplus region the farm price of corn decreases as the distance to the central market increases. Corn prices established in the major terminal markets of the surplus region are a dominant force influencing prices in the deficit region. Of course local factors tend to offset the surplus-deficit effect to various extents.

Since 1960 production of corn in Tennessee has declined from 52,806,000 bushels for that year to 30,926,000 bushels in 1968--a decrease of 41 percent. For the same period, cropland devoted to corn production declined from 1,354,000 to 658,000 acres (Table I, page 4). This represents a decrease in corn acreage of 51 percent. Production per acre has increased slightly for the state as a whole (45 bushels per acre 1960-64; 52 bushels per acre 1965-68). According to Strawn,[3] "The supply of corn available for utilization during a given period consists of total production during that period plus net changes in storage inventories plus net imports."

Production of Tennessee corn is concentrated in West and West Central Tennessee (see Figures 14 and 15). All West Tennessee counties except Shelby, Crockett, and Chester rank in the top 20 counties with the highest total production of corn in the state. Also included are

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[3]Harry Strawn, "The Effects of Alternative Modes of Transportation on the Optimum Number, Sizes, and Locations of Major Corn Handling Facilities in the Southeast" (unpublished Doctoral dissertation, The University of Tennessee, Knoxville, December, 1969), p. 86.

TABLE IV

UNITED STATES CORN PRODUCTION BY PRICE REGION,[a] AVERAGE REGIONAL PRICES, PERCENT REGIONAL PRICE IS OF NATIONAL AVERAGE,[b] PERCENT REGIONAL PRODUCTION IS OF NATIONAL PRODUCTION 1961-65[c]

Region	Average Price ($ per bu.)	Total Production (000 bu.)	Ratio Average Regional Price to Average National Price	Ratio Regional Production to National Production
I	1.01-1.10	1,546,841	92.9	41.20
II	1.11-1.20	1,647,880	101.8	43.80
III	1.21-1.30	375,048	110.6	10.00
IV	1.31-1.40	78,094	119.5	2.10
V	1.41-1.50	9,540	128.3	.30
VI	1.51-1.60	1,018	137.2	.03

Source: United States Department of Agriculture, Agricultural Statistics, 1968 (Washington: Government Printing Office, 1968), p. 29.

[a]Regions I and II represent corn belt, Region III represents Southern states and Regions IV, V, and VI represent all other states.

[b]Average United States price 1961-65 is $1.13 per bushel.

[c]Ratios calculated from statistics from same source.

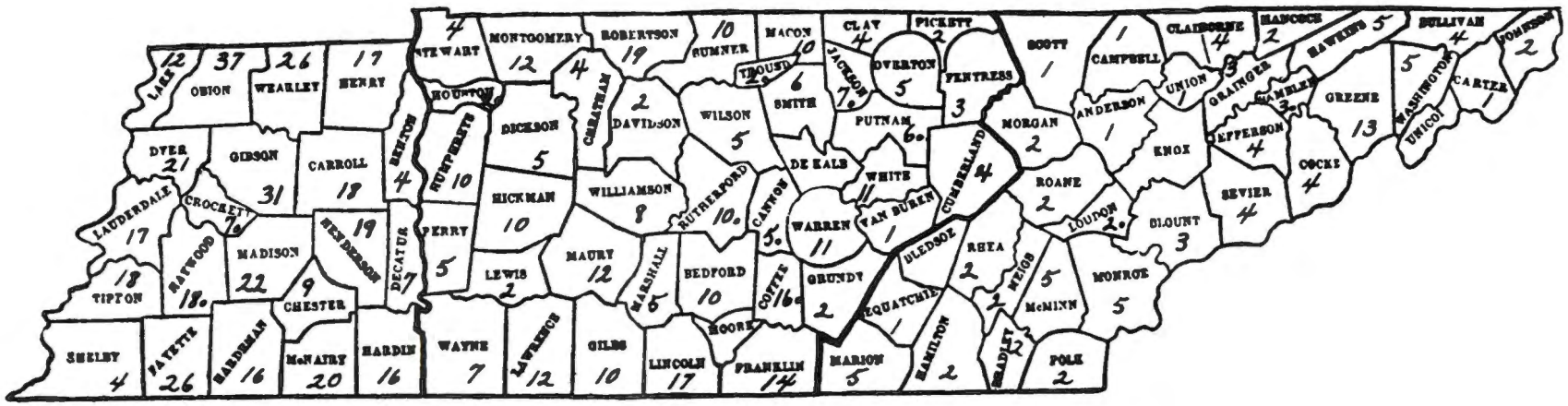


Figure 14. Average acreage devoted to corn in Tennessee by counties, 1961-68 (100,000 bu.).

Source: Calculated from data published in Tennessee Agricultural Statistics, Annual Bulletin, 1966 (Nashville: Tennessee Department of Agriculture, September, 1966), pp. 50-51; Tennessee Agricultural Statistics, Annual Bulletin, 1969 (Nashville: Tennessee Department of Agriculture, August, 1969), pp. 64-65.

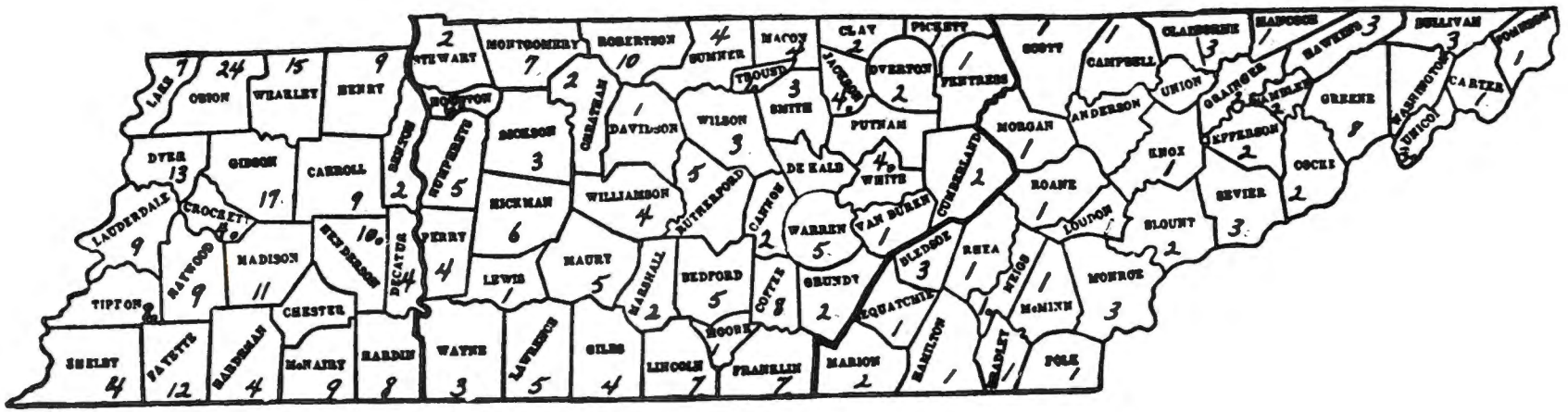


Figure 15. Average production of corn by Tennessee counties, 1961-68 (100,000 bu.).

Source: Calculated from data published in Tennessee Agricultural Statistics, Annual Bulletin, 1966 (Nashville: Tennessee Department of Agriculture, September, 1966), pp. 50-51; Tennessee Agricultural Statistics, Annual Bulletin, 1969 (Nashville: Tennessee Department of Agriculture, August, 1969), pp. 64-65.

Montgomery, Robertson, Lincoln, Franklin, and Coffee counties in Middle Tennessee (Table V). Extreme West Tennessee is a surplus corn producer with corn moving south to terminal elevators in Shelby County, and west into Arkansas.

II. PRICE DIFFERENTIALS EXPLAINED BY TRANSPORTATION COSTS

Transportation cost influences the regional price of corn. The difference between Tennessee prices and prices in grain surplus regions tend to be regulated by transportation costs. Within Tennessee transfer costs are especially important because of the additional costs of transporting corn to eastern sectors of the state. According to Malott,[4] "Grain, unlike other commodities, cannot be shipped direct from its point of origin to place of consumption. It must first move to one or more intermediate points." In Tennessee, these intermediate points are the four principal Tennessee cities--Memphis, Nashville, Chattanooga, and Knoxville.

> Nashville and Knoxville markets are primarily terminal markets, in that most of the volume received (grain) at these points is distributed within the deficit marketing areas they serve. Memphis and Chattanooga play a slightly different role, principally because of their access to barge facilities. As well as serving as terminal distributors for their respective deficit marketing areas, both Memphis and Chattanooga serve as important supply points for some of the deficit areas of Mississippi, Alabama and Georgia, as well as other distant points. Knoxville also acts as a supply point, to a small extent, for the western portion of the Carolinas and Virginia, but this role of supplier is only seasonal and is not of the same magnitude as the supplier role assumed by the Memphis and Chattanooga market centers.[5]

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[4] Dean W. Malott (editor), Grain and Its Marketing (5th edition, Chicago: Grain Exchange Institute, Inc., 1962), p. 211.

[5] Robertson, op. cit., p. 30.

TABLE V

THE 20 TENNESSEE COUNTIES WITH THE HIGHEST TOTAL PRODUCTION OF CORN 1961-68

County	1961	1962	1963	1964	1965	1966	1967	1968
	(Thousands of bushels)							
Obion	1,778	1,917	2,457	2,373	2,671	1,970	2,506	2,401
Gibson	1,406	1,284	1,791	1,697	1,719	1,679	2,117	1,549
Weakley	1,295	1,196	1,523	1,303	1,385	1,274	1,802	1,198
Madison	1,283	998	1,215	1,131	1,261	950	1,372	881
Dyer	1,127	1,043	1,362	1,397	1,419	1,128	1,482	1,346
McNairy	1,122	1,022	1,029	920	957	682	1,008	739
Robertson	1,048	1,019	1,254	980	1,059	791	1,140	939
Fayette	1,039	905	1,259	1,050	1,275	1,078	1,789	1,108
Lauderdale	1,034	857	905	860	955	709	1,117	795
Henderson	1,010	747	1,133	1,025	1,102	864	1,101	751
Carroll	957	856	1,040	970	1,024	676	1,028	649
Henry	944	709	991	816	907	786	1,104	765
Haywood	900	756	1,091	849	996	827	1,280	855
Hardin	893	724	974	844	738	652	713	409
Tipton	866	840	967	957	832	720	937	564
Franklin	791	605	--	837	781	800	810	--
Lake	732	704	894	842	742	504	--	612
Montgomery	761	657	815	--	--	613	775	572
Lincoln	716	670	920	824	756	761	796	472
Coffee	--	--	842	918	836	1,085	1,168	599
Hardeman	824	622	796	775	736	--	863	585

Source: Tennessee Agricultural Statistics, Annual Bulletin, 1967 (Tennessee Department of Agriculture, August, 1967), pp. 50-57; Tennessee Agricultural Statistics, Annual Bulletin, 1968 (Tennessee Department of Agriculture, 1968), pp. 64-65.

Corn flows from the Midwest Corn Belt to principal Tennessee cities by rail, barge, and truck. The cost of transporting corn from the Corn Belt to market areas within Tennessee is reflected in the price received for corn within the area. Western Tennessee has lower rates because it is nearer the surplus regions while the opposite situation exists for East Tennessee. Table VI reveals that the actual price differential for corn between Memphis and the other three principal marketing areas of Tennessee is equal to or less than transfer costs[6] except for the transfer cost between Memphis and Knoxville for the years 1961, 1962, and 1965. Assuming the estimated transfer costs to be representative of the actual costs, corn could not profitably be shipped from Memphis (West Tennessee) to eastern sectors of the state. According to Robertson,[7] no such shipments occur and this conforms to theory since price differentials must exceed transfer costs to induce trade between regions.

Theory also dictates that the price differential between external sources and Tennessee cities exceed transportation costs. Assuming this is the instance (since these corn shipments in fact do occur), the differential in transfer costs from external sources to West, Middle, and East Tennessee should not exceed the price spread between the three Tennessee areas. Estimates of transportation costs (Table VII) reveal that these costs (Midwest to Tennessee) are higher in Middle and East Tennessee than in the Memphis area for corn moving

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[6]Estimated trucking costs based on an equation derived by Strawn, op. cit., p. 148.

[7]Robertson, op. cit., p. 30.

TABLE VI

PRICE DIFFERENTIALS AND DISTRIBUTION COSTS IN CENTS PER BUSHEL BY TRUCK FOR CORN BETWEEN MEMPHIS AND PRINCIPAL TENNESSEE CITIES, 1961-68

Year	From Memphis to Nashville		From Memphis to Chattanooga		From Memphis to Knoxville	
	Price Differentials	Trucking Costs	Price Differentials	Trucking Costs	Price Differentials	Trucking Costs
1961	.06	.12	.14	.15	.20	.18
1962	.06	.12	.15	.15	.23	.18
1963	.06	.12	.13	.15	.13	.18
1964	.07	.12	.11	.15	.15	.18
1965	.10	.12	.09	.15	.19	.18
1966	.11	.12	.12	.15	.10	.18
1967	.12	.12	.09	.15	.13	.18
1968	.10	.12	.03	.15	.17	.18
1961-68	.09	.12	.11	.15	.16	.18

Source: Harry B. Strawn, "The Effects of Alternative Modes of Transportation on the Optimum Number, Sizes, and Locations of Major Corn Handling Facilities in the Southeast" (unpublished Doctoral dissertation, The University of Tennessee, Knoxville, 1969), pp. 148 and 188.

TABLE VII

ASSEMBLY COST IN CENTS PER BUSHEL FOR TRANSPORTING CORN BY MOTOR TRUCK FROM EXTERNAL SOURCES TO PRINCIPAL TENNESSEE CITIES, 1964

Origin	Destination			
	Memphis	Nashville	Chattanooga	Knoxville
Henderson, Kentucky	.13	.09	.14	.13
Cincinnati, Ohio	.14	.16	.19	.13
Evansville, Indiana	.13	.10	.31	.15
Indianapolis, Indiana	.18	.14	.28	.16
Peoria, Illinois	.19	.18	.35	.23
Davenport, Iowa	.21	.21	.25	.27
Omaha, Nebraska	.26	.29	.31	.36
Kansas City, Kansas/ Missouri	.19	.22	.27	.29
St. Louis, Missouri	.14	.14	.36	.21

Source: Harry B. Strawn, "The Effects of Alternative Modes of Transportation on the Optimum Number, Sizes, and Locations of Major Corn Handling Facilities in the Southeast" (unpublished Doctoral dissertation, The University of Tennessee, Knoxville, 1969), p. 185.

by truck but the difference is considerably less than the observed price differentials. This observation ordinarily would tend to suggest that price differentials cannot be totally explained by transfer costs. However, this discrepancy is greatest from external sources to Memphis than to other marketing areas.

Price maps reveal that the zero price line runs through all of the Extreme West Tennessee counties except Shelby (Memphis). These counties are areas of surplus production for corn. Trucking costs to these areas would approximate the estimated trucking cost to Nashville since the distance from exporting regions of the Midwest is approximately the same. The observed price differential between the two regions is 10 to 20 cents per bushel higher in Nashville than in Extreme West Tennessee. However, since Extreme West Tennessee counties are surplus-producing areas for corn, this region does not bear the transportation cost that is imposed upon other regions of Tennessee such as Nashville. The aggregate effect is that the added cost of transportation, which is reflected in the price of corn for other regions in Tennessee, is not an important influence for the Extreme West Tennessee region. Transportation costs are important for this region as these costs impose a limit on the easterly movement (to Nashville) of corn. Surplus corn from this area can most profitably be transported west to Arkansas and south to Memphis because of the proximity and the demand for corn of these two market areas.

Trucking cost to Memphis and Nashville from external sources are approximately equal. However, much of the corn moving to Memphis

from the Midwest is transported by barge rather than truck. In addition, trucking cost to Memphis from other Northwest Tennessee counties is considerably less than trucking costs from the Midwest to Nashville. The influence of these two factors coupled with the fact that Memphis has a smaller corn deficit[8] than other market areas in Tennessee tend to supress the price of corn in Memphis accounting for the 10 to 15 cent per bushel price differential between Memphis and Nashville. The price of corn in Memphis, quite naturally, is higher than the price in other Extreme West Tennessee counties because of transportation costs since Shelby County is a deficit county while the other four counties are not.

The price of corn in the area between Extreme West Tennessee and Nashville is regulated by transfer costs (distance). Corn prices in this region must exceed those in Extreme West Tennessee (export area) but must be less than the price of corn in the Nashville market. Prices are lowest close to the export area and generally advance uniformly toward Nashville. The surplus-producing area tends to lower prices while the influence of transfer cost from the Midwest tends to raise prices. The aggregate effect is a rather uniform advance in price from west to east into Nashville.

For the year 1964, the cost of transporting corn from external sources to Knoxville by truck was around four or five cents per bushel higher than the cost of transporting to Nashville. Price spreads

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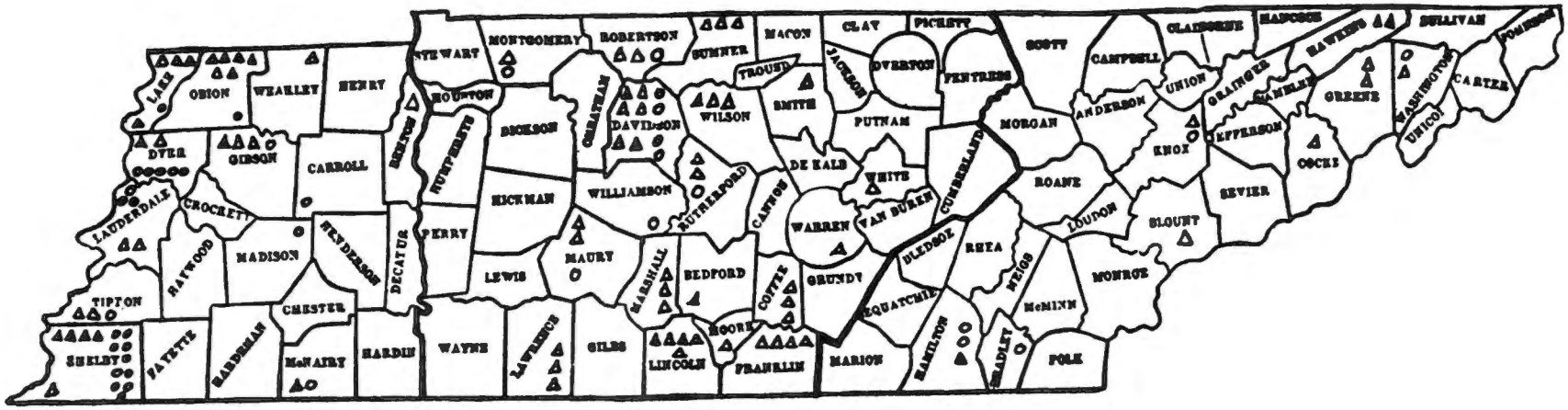
[8]Strawn, op. cit., p. 95.

between the two areas were about the same as these differences in transfer costs. However, the cost of transporting corn to Chattanooga by truck from most external sources was considerably higher than the cost of transporting to Nashville or Knoxville although the price of corn was about the same in Knoxville as in Chattanooga. Much of the corn flowing to Chattanooga is moved by barge rather than truck so trucking costs alone would not reflect the actual transfer costs as much for Chattanooga as for Knoxville or Nashville (since corn moves to these two areas by truck and rail).

III. PRICE DIFFERENCES AND THE PRESENCE OF ELEVATORS

Considering transportation costs alone, price differentials should, theoretically, show a general advancement from Nashville toward Extreme East Tennessee. Price maps revealed, however, that to the immediate east of Nashville a ridge formed representing an area where prices peaked; prices then declined reaching a low in the Cumberland Plateau before showing a uniform advancement toward the extreme east. One possible explanation for this deviation from the explanation of theory is the presence or absence of grain elevators within a geographical area.

Figure 16 illustrates the concentration of grain handling facilities in Tennessee as of 1969. This concentration, quite normally, follows areas of greatest production (Figure 15, page 61) and the four largest Tennessee cities--destinations for shipments of grains from external sources. Grain handling facilities are concentrated in West and Middle Tennessee and a few are sprinkled throughout East



▲ 20,000 - 99,999 bu.

o 100,000 - 999,999 bu.

▲ 1,000,000 or more bu.

Figure 16. Tennessee grain handling facilities and capacity, 1969.

Tennessee. Grain elevators perform various services for farmers such as shipping and receiving grain, performing custom services, grinding and mixing, corn shelling, grain storage, cleaning, drying, and trucking. Within the high priced area east of Nashville as depicted by the price maps, swine, poultry, and dairying are principal livestock enterprises. Within a geographical area, the cost of grinding and mixing of poultry, dairy, and hog feeds plus the cost of services mentioned above are reflected in the price of corn in the area.

For the Central Basin Area, grain elevators with storage capacity greater than 20,000 bushels are located in all counties within this region except Clay, Jackson, Macon, and Trousdale. The presence of these elevators suggest that there is a demand for services rendered by the elevators and farmers within the area are willing to bear the higher price of corn in return for the services.

In contrast, in the Cumberland Plateau Area there is a complete absence of elevators with a storage capacity greater than 20,000 bushels and this area has lower prices relative to adjacent areas both east and west. This observation tends to suggest that while farmers in the Central Basin are willing to pay for services rendered by county elevators, those in the Cumberland Plateau are not. In this area, the corn fed probably moves from the Midwest directly to the farm without going through a Tennessee elevator.[9]

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[9]Actually the Cumberland Plateau area is one of little commercial agriculture. Little is known of the conditions of supply and demand for this region. While the absence of elevators in this area may be an inadequate explanation of the price behavior of corn in the region, it was the best explanation that could be offered in lieu of the available information.

In Extreme East Tennessee, elevators are scattered throughout the region but with a lesser degree of concentration than in the Central Basin. The influence of elevators in this area upon the price of corn would undoubtedly be less than for the Central Basin Area but greater than for the Cumberland Plateau Area. For the most part, the uniform advancement in prices from the Cumberland Plateau to Extreme Northeastern Tennessee can be contributed to deficit production and increased transportation costs in addition to the presence of elevators.

CHAPTER VI

SUMMARY

Average prices received by farmers for corn in Tennessee vary considerably from one area of the state to another. For the years under consideration in this study, 1961-68, the price differential between the lowest and highest average county price for corn varied between 21 and 28 cents per bushel.

The primary objectives of the study were to determine if there were particular patterns of geographical price differentials for corn in Tennessee over time and to identify causal factors for price spreads. A price mapping technique was employed whereby average annual county prices were mapped using seven price ranges--a four-cent price differential for each range. Semi-annual price maps were also constructed to determine the effects of periods of high seasonal prices (March-August) and low seasonal prices (September-February) on geographical price patterns and to compare them with annual price maps. In addition, iso-price lines were fitted for four time periods--1961-62, 1963-65, 1966-68, and 1961-68.

Annual price maps revealed that geographical price patterns were most closely related for the periods 1961-62, 1963-65, and 1966-68. For the period 1961-62, the following price pattern appeared: Lowest prices occurred in Extreme Northwest Tennessee; prices were in the second price differential (4-7 cents per bushel) for counties in the Western Highland Rim; prices fell in the third and fourth price

differential (8-15 cents per bushel) in the West Tennessee Plateau Area; counties in the Central Basin (Midstate) were part of the fifth and sixth price differential (16-23 cents per bushel); prices were in the fifth price differential for Cumberland Plateau Area; and prices were in the two highest price ranges (20-27 cents per bushel) for Extreme East Tennessee.

Annual price maps for 1963, 1964, and 1965 revealed the following general pattern: Extreme West Tennessee experienced the lowest prices; Western Highland Rim counties were in the area composed by the second price differential (4-7 cents per bushel) while West Tennessee Plateau counties fell within the second and third price differential area (4-11 cent differential). Midstate counties were within price ranges four and five (12-19 cent differential); Cumberland Plateau counties were also in the fourth and fifth price differential area; and Extreme East Tennessee generally fell into the fifth and sixth price ranges (16-23 cents per bushel).

Annual price maps for 1966, 1967, and 1968 generally depicted the following price patterns: Lowest prices were in Extreme Northwest Tennessee; Western Highland Rim counties were in the second price differential (4-7 cent differential); West Tennessee Plateau counties fell into a price area where differentials varied from 4-11 cents per bushel; Midstate counties were in price ranges five and six (16-23 cent differential); Cumberland Plateau counties were in the third and fourth price differential area (8-15 cent differential) and Extreme East Tennessee fell into price ranges five and six (16-23 cent differential)

except during 1968 when seven counties in this region were in the fourth (12-15 cent per bushel differential) price category.

Semi-annual price maps generally supported the patterns revealed by the annual price maps. Variability existed in two geographical areas, the West Tennessee and Cumberland Plateau, for the March-August period in 1965 and the September-February period for 1967-68.

Iso-price lines were drawn for the periods 1961-62, 1963-65, 1966-68, and 1961-68. The price lines were drawn in intervals of five (five cents per bushel) from the zero price line which represented the geographical area with the lowest average corn price for each period. Iso-price lines for the chosen periods generally revealed the following geographical price patterns. Prices were lowest in Extreme West Tennessee and highest in the Central Basin (Midstate) and Extreme East Tennessee. Prices advanced from west to east reaching a high in the Central Basin; prices then declined slightly reaching a low in the Cumberland Plateau Area; and thereafter prices advanced reaching a high in Extreme Northeast Tennessee. Price maps for the four time periods generally followed the same price patterns and iso-price lines encompassed approximately the same general geographical area. The magnitude of the differential varied somewhat for each of the time periods.

Tennessee is deficit in the production of corn and Tennessee corn prices are dominated by prices in the surplus-producing sections of the Midwest Corn Belt. Important factors contributing to geographical price differentials in Tennessee are: (1) areas of surplus and deficit production within the state, (2) transportation costs, and (3) presence of grain elevators.

For the study years, corn prices in Tennessee were lowest in Extreme West Tennessee. This can be accounted for chiefly by the joint effects of surplus production of corn within the area and transportation costs. This region does not bear the transportation costs imposed upon other regions within Tennessee and the lower cost of transportation is reflected in the price of corn.

The price of corn in the area between Extreme West Tennessee and Nashville is regulated by two factors. One factor is the influence of the export area (Extreme West Tennessee) which tends to lower prices; the other factor is the influence of transfer cost from the Midwest which tends to raise prices. The aggregate effect is that prices are lowest near the export area and generally advance uniformly toward Nashville where prices are higher due to the added expense of transportation costs.

Because of transportation costs, price differentials should, theoretically, show a general advancement from Nashville toward Extreme East Tennessee. Price maps for the study period revealed that to the immediate east of Nashville a ridge formed representing an area where prices peaked; prices then declined reaching a low in the Cumberland Plateau before showing a uniform advancement toward the Extreme East. Corn prices for these two areas were probably influenced by the presence or absence of grain elevators. Farmers in the Central Basin had a need for the services rendered by the large number of elevators in the area and were willing to pay for these services which, subsequently, was reflected in the higher price of corn. The absence of grain elevators

in the Cumberland Plateau Area suggested that the corn fed in this region probably moved from the Midwest directly to the farm without going through grain elevators.

In Extreme East Tennessee grain elevators were scattered throughout the region but with a lesser degree of concentration than in the Central Basin. For the most part, the uniform advancement in prices from the Cumberland Plateau to Extreme Northeastern Tennessee could be attributed to deficit production and increased transportation costs in addition to the presence of elevators.

Generally, it could be concluded from this study that there are areas of homogeneous prices for corn in Tennessee, and that these price differences are generally consistent with theoretical considerations with the possible exception of the Cumberland Plateau area where there is little commercial agriculture.

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