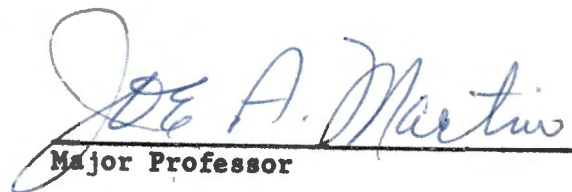


July 25, 1968

To the Graduate Council:

I am submitting herewith a thesis written by Horace Allen Mitchell, Jr. entitled "A Study of the Causes of the Lag in the Rate of Increase in Net Income Per Farm in Tennessee Compared with other South-eastern States." 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 Agriculture Economics.

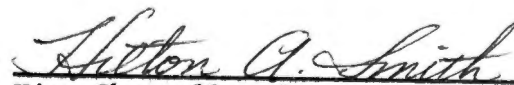

Major Professor

We have read this thesis and
recommend its acceptance:





Accepted for the Council:


Vice Chancellor for
Graduate Studies and Research

A STUDY OF THE CAUSES OF THE LAG IN THE RATE OF INCREASE
IN NET INCOME PER FARM IN TENNESSEE COMPARED
WITH OTHER SOUTHEASTERN STATES

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
Horace Allen Mitchell, Jr.

August 1968

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ABSTRACT

The increase in net income per farm in Tennessee has not kept pace with the rate of increase occurring in other Southeastern states in recent years. Tennessee's percent increase in net income per farm from 1954 to 1964 was only 24 percent, which was quite low when compared to the 150 percent increase that occurred in Mississippi. The primary purpose of this study was to determine some of the causes of Tennessee's lag.

The changes that occurred in eight Southeastern states in gross sales, farm acreage, cost, and the combination of crop and livestock products produced were examined to determine the relationship between these trends and net income per farm. Rank correlation was used to measure the degree of relationship. Stepwise multiple regression was used to measure the relationship between the variability in net income and changes in enterprise. The data were secured from the Census of Agriculture, Agricultural Statistics, and Farm Income, States Estimates.

The analysis revealed that several factors appear to have influenced Tennessee's slow rate of increase in net income. Most important was the fact that Tennessee lagged in its rate of increase in gross returns per farm. This was evident from its slowest rate of increase in gross receipts per farm of any state and was influenced by its slow increase in farm size. This slow rate of growth from 1954 to 1964 in Tennessee was accompanied by the largest increase of any state in the

percent that cost occupied of gross receipts.

Enterprise shifts appear to have had an important effect on net farm income. Enterprise shifts in Tennessee have moved generally toward small increases in those enterprises that experienced rapidly increasing returns per man hour and rapid increases in enterprises that experienced the smallest increases in returns per man hour. These shifts were also away from those enterprises which were correlated to net income increases and toward those enterprises that were not correlated to net income increases.

Tennessee lies in the northern portion of the study area, which did not experience the expansion in farm size and shifts in enterprises that the southern area did. The northern area was limited in its expansion process by large acreages of tobacco which appeared to tie labor to a small farm size and prevent expansion into other enterprises. The northern area was also limited in the quantity of land available in the Appalachian Area for expansion into high return row crops.

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CHAPTER I

INTRODUCTION.

The variation in farm income within a particular area and between given areas is a well known and much publicized fact. Farm incomes, rather than moving toward equality over time, have pulled increasingly further apart. Historically some areas on the American scene, notably the Southeastern states have lagged behind the national average in per farm income gains.

Southeastern agriculture is generally characterized as being low in productivity and yielding a low per farm return when compared with other areas of the United States. The states of the Southeast are not homogeneous in terms of income changes. Some states have had very significant increases in their average net income per farm while others have had only small increases. Tennessee has shown a pronounced lag in its rate of income increase when compared to other Southeastern states in recent years. Tennessee had only a 24 percent increase in its average net farm income over the 1954-1964 period while Mississippi had a 150 percent increase during the same period. The source of such a large variation in income is not easily determined. Increases in net income per farm can be due to a wide variety of reasons.

No previous research has been directed at Tennessee's income position relative to other states within the region. This investigation has been directed toward an understanding of changes in net income per farm in eight Southeastern states over the recent past. If some of the

causes can be better understood, it may point the way toward a program which will allow Tennessee's farmers to achieve a more favorable level of income.

I. THE PROBLEM UNDER STUDY

The relative position of Tennessee's farmers when compared to other Southeastern states, in terms of productivity and profitability, has diminished in recent years. The changes that have taken place in average net farm income and Tennessee's lag in its rate of increase is shown in Table I and Figure 1.

The time period of 1954 through 1964 was chosen primarily because of the availability of data in the 1954 and 1964 Census of Agriculture and also because this time period portrays the most evident variation in rates of income change between states. The measure of income was the realized net income per farm. The high income state in 1954 was North Carolina which had a net income of \$2,225 per farm. This was 83 percent larger than the lowest income state, South Carolina, which was \$1,211 per farm. In 1964, the high income state was Georgia at \$3,685 per farm which was 104 percent larger than the low income state, Tennessee, at \$1,801 per farm. Thus, the variation between high and low income state increased 21 percent over the 11 years from 1954 to 1964. As can be noted from Table I, however, the two states that served as the largest source of variation in income in 1954 were not the same as those in 1964.

Shifts in State Income Positions

A very evident shift has occurred in the ranking of the states on

TABLE I

RELATIVE NET INCOME PER FARM POSITION OF STATES IN 1954 AND
1964 AND THE RANKED PERCENTAGE INCREASE IN
NET INCOME PER FARM^a

	Per farm income 1954	Rank	Per farm income 1964	Rank	Income change 54-65	Percent change	Rank
Virginia	\$1707	3	\$2293	7	\$ 586	34	7
North Carolina	2225	1	3293	2	1086	48	6
South Carolina	1211	8	2820	5	1609	132	3
Georgia	1475	4	3685	1	2210	149	2
Kentucky	1820	2	2910	4	1090	60	5
Tennessee	1452	5	1801	8	349	24	8
Alabama	1332	6	2692	6	1360	102	4
Mississippi	1307	7	3279	3	1972	150	1

^aEconomic Research Service, Farm Income State Estimates 1949-1965, United States Department of Agriculture, FIS 203 Supplement (Washington, D. C.: Government Printing Office, August 1966), pp. 10-11.

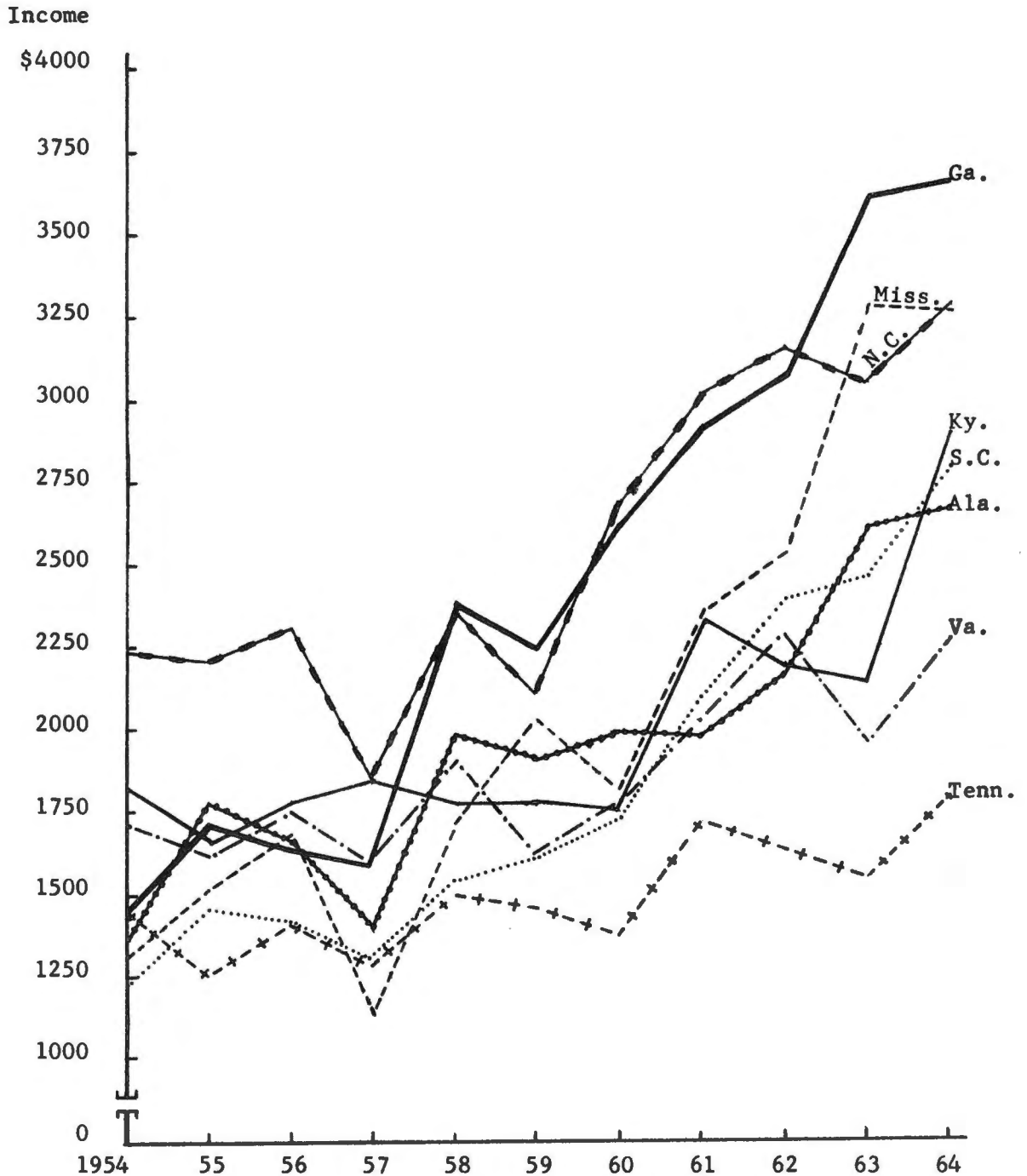


Figure 1. Realized net income per farm from 1954 to 1964 for the eight states of the study. (From Economic Research Service, Farm Income State Estimates 1949-1965, United States Department of Agriculture, FIS 203 Supplement, Washington, D. C.: Government Printing Office, August, 1966, pp. 10-11).

and Alabama, 9.6 percent. Virginia, North Carolina, Kentucky and Tennessee were states having slower than average increases in income. Tennessee was responsible for 29.9 percent of the lag in income increases below the average rate for the region. Virginia produced 28.8 percent of the lag; North Carolina, 26.8 percent; and Kentucky, 14.2 percent. If Tennessee had increased at the average rate of the entire region, its 1964 net farm income would have been \$2,641 instead of \$1,801.

The Direction of the Study

The primary consideration of this study was not the relative position of the states in 1954 or the original differences in income which may be due to differences in soil fertility or other factors. Such factors if present in 1954 would likely continue, under normal circumstances, to exert an influence on income throughout the 1954-64 period. This study is concerned with the changing characteristics that took place during this time period that may have influenced the variation in the rate of income change. Original geographic differences will be considered only if it appears that such differences have influenced the changes that have taken place in the mixture of enterprises produced.

The effect of price on income was not considered in this study. The rates of increase in net income per farm between states appear to have varied beyond what price fluctuations within a region would produce. Although prices may have had some influence on the rates of increase it was not the objective of this study to determine the extent of that influence.

II. IMPORTANCE OF THE STUDY

The problem of low income or lagging income in agriculture is of paramount importance to many people. First of all, it is important to the farmers themselves. This is their livelihood and they are the individuals most acutely affected by the variation in the returns to production. Another sector that is directly affected is the business sector serving agriculture. As farms grow in size and net returns, the farmers require more purchased inputs. Thus, a profitable farm sector means an increased demand in the business sector. Community social institutions are also directly influenced. Schools, churches, hospitals, libraries, and county governmental units are stimulated by a prosperous agricultural community.²

III. PURPOSE AND JUSTIFICATION OF THE STUDY

The primary purpose of this investigation was to determine the cause or causes of the lag in the rate of increase in net income per farm in Tennessee. This information can be used to direct the development of future research and educational programs in Tennessee agriculture. To eliminate poverty within agriculture, research talent must be directed to the core or source of the problems that suppress income. If factors associated with low income can be identified, then this is an important step in the process toward eliminating or improving causes of low income.

²Ethel Gertrude Vatter, "The Composition and Distribution of Iowa Farm Incomes by County, 1948-57," (unpublished Doctoral dissertation, The State University of Iowa, 1962), pp. 2-4.

CHAPTER II

THE AREA OF THE STUDY

The area of this investigation, in addition to Tennessee, consisted of six of the states that border Tennessee plus South Carolina. These eight states form a major part of what is classified geographically as the Southeastern portion of the United States. Arkansas, Missouri, West Virginia, Louisiana and Florida were not included in the study because their agriculture is not typical of the states being analyzed.

This region can best be described as

consisting of three valley sections which come together at the Southern tip of the Appalachians, forming what we may call a trihedral angle. One valley section slopes at right angles to the Appalachian chain from its apex to the Atlantic. Another slopes from this apex to the Mississippi River across the state of Tennessee. The third section from the apex continues parallel with the Appalachian chain across Georgia and Alabama until it reaches the Gulf Coast near the Mississippi's mouth.¹

I. THE SOILS OF THE REGION

The region composed of the eight states can be divided into four major or primary land areas. They are the Atlantic Coastal Plains, the Piedmont, the Upland and the Cotton Belt. The land areas are displayed in Figure 2.

¹Rupert B. Vance, Human Geography of the South (Chapel Hill: The University of North Carolina Press, 1935), p. 31

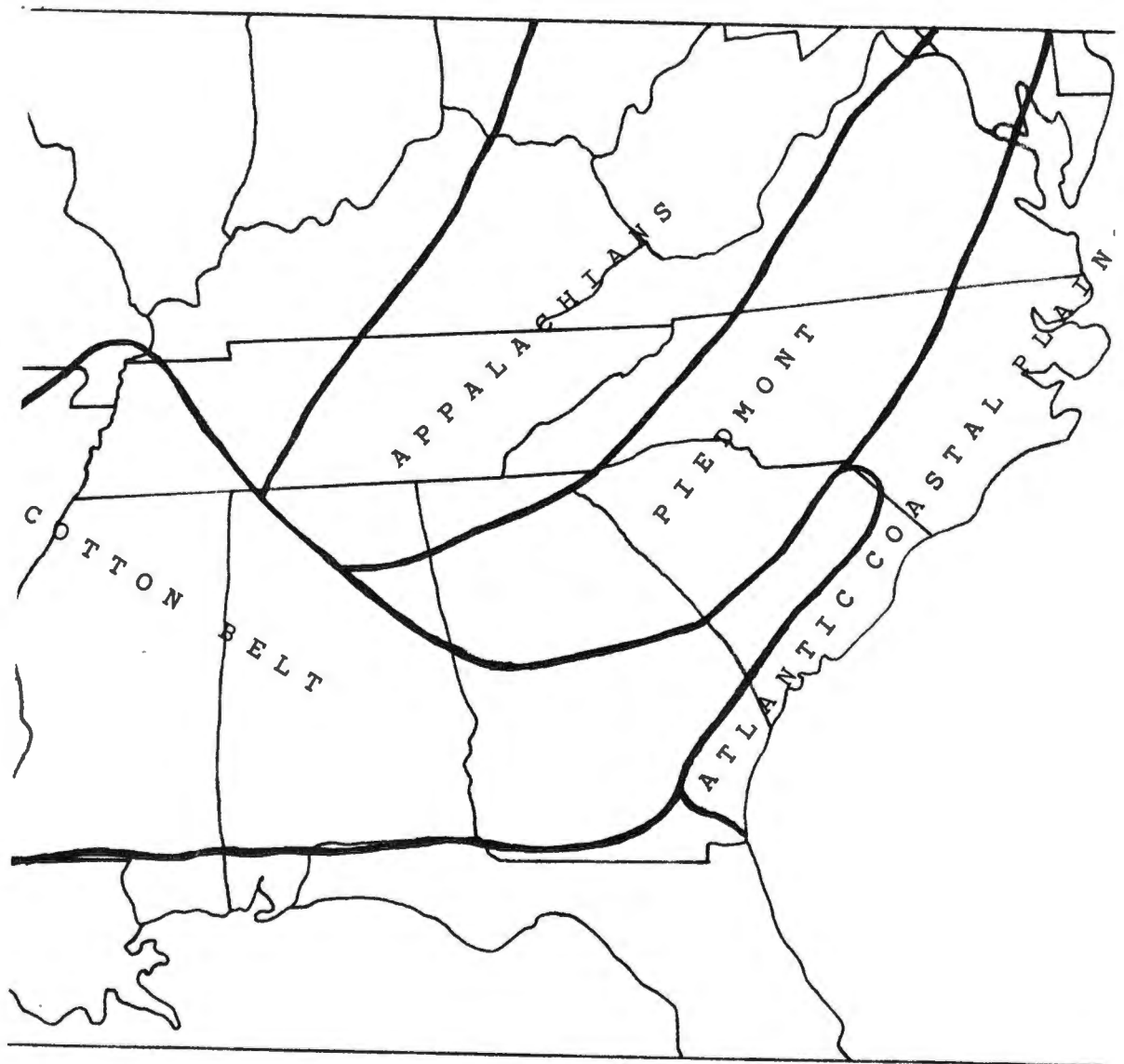


Figure 2. Map of the major soil regions of the South East.

The Atlantic Coastal Plains

The Atlantic Coastal Plains area has a parent material of marine sand and silt. It is generally easily worked, drains readily, leaches rapidly, warms up rapidly, aerates well, yet has very little soluble mineral for the plants. Heavy and frequent fertilization is necessary to secure economic returns.²

Agriculture within this area has the advantage of a mild winter and early spring, thereby enabling farmers to market their produce earlier than areas farther north or farther away from the coast.³ Major crops of this area include tobacco, vegetables, peanuts, soybeans and some cotton.

The Piedmont

The Piedmont Area has a parent soil material that is heavy being composed largely of clay derived from the chemical weathering of the fieldspar of granite and meta-igneous rocks. Piedmont soils even though the parent material has undergone much change in their evolution are stiff and hard to work, aerate poorly and are cold. Leaching is much less active than the Coastal Plains Area.⁴ The soils are mostly loams of red clay over clay subsoils. Tobacco is the major cash crop in the central section of the Piedmont and cotton is the major cash crop of the southern section of the area. Both crops have exhausted the soil and thousands of acres of worn out land in the Southern Piedmont have returned to scrub pine.⁵ The Piedmont has been an area of rapid growth in

²A. E. Parkins, The South Its Economic-Geographic Development (New York: John Wiley and Sons, Inc., 1938), p. 58.

³Theo L. Hills and George S. Tomkins, A Regional Geography of North America (Toronto: W. J. Gage Limited, 1962), p. 341.

⁴Parkins, op. cit., p. 58.

⁵Hills and Tomkins, op. cit., p. 436.

poultry production over the past two decades.

The Cotton Belt

Soils of the Cotton Belt are normally sandy loams underlain by sandy clays. These soils gradually change into silt loam of loessial origin in the western area of the study region that is formed by the eastern half of the Mississippi River Valley.⁶ This is the region that more than any other typifies the traditional personality of the South. Historically, cotton has been the major income producer for this area. In recent years the areas agriculture has become much more diversified as farmers moved toward enterprises such as soybeans and poultry.

The Uplands or Appalachian Area

Soils within the Uplands Area vary widely depending on their location. The Appalachians may be subdivided into three areas known as the Blue Ridge and Great Smoky Ranges, the Ridge and Valley area and, on the west side, a large plateau area. Most of the rugged land in the Blue Ridge and Smokies area is poor in quality and heavily forested. The agriculture is centered in small valleys and consists of small farms subject to severe erosion.⁷ Tobacco, corn, hay, beef, and dairy are the principal farm products of the Ridge and Valley area. Further west in the rolling plateau country is the famous bluegrass region where livestock farming predominates with special emphasis on purebred animals.⁸

⁶Vance, op. cit., p. 90.

⁷Hills and Tomkins, op. cit., p. 437.

⁸Ibid., p. 439.

Tennessee

Tennessee does not differ radically from the study region from a natural resource and climatic standpoint, however, it possesses a greater range of geographic characteristics than the other states. The far western portion of the state is quite similar to the Delta or cotton growing section of Mississippi and Alabama. Middle Tennessee is considered an excellent livestock producing area and resembles much of the bluegrass section of Kentucky. The mountainous portion of East Tennessee is similar to the entire Appalachian Area. Thus, Tennessee is quite varied geographically and encompasses a wide range of the geographic characteristics of the study region. Table III contains climatic and geographic information for the eight states.

TABLE III

GEOGRAPHIC AND CLIMATIC CONDITIONS FOR THE EIGHT STATES^a

	Total land area (square miles)	Annual temperature (degrees)	Annual precipitation (inches)	Mean elevation (feet)	Growing season (days)
Virginia	40,315	56	42.6	950	150-240
North Carolina	52,712	59	49.7	700	150-290
South Carolina	31,055	60	47.7	350	190-290
Georgia	58,876	65	50.2	600	190-290
Kentucky	40,395	58	45.2	750	170-210
Tennessee	42,244	60	49.9	900	150-320
Alabama	51,609	64	52.0	500	198-298
Mississippi	47,716	64	52.9	300	190-270

^aCollier's Encyclopedia (1964), Vol. 23, p. 150; Vol. 17, p. 612; Vol. 21, p. 294; Vol. 14, p. 30; Vol. 22, p. 148; Vol. 1, p. 418; Vol. 16, p. 361.

CHAPTER III

THE RELATIONSHIP BETWEEN GIVEN FACTORS AND FARM INCOME

The problem of low income in agriculture is influenced by a vast array of factors and not all of them can be assembled into one study. Certain factors were selected that could have influenced the variation. To meet the needs of this study, it was necessary to make assumptions which more narrowly define the problem. In selecting the factors that determined income variation, attention was focussed on those which varied over the 1954-64 period.

Dynamic Factors

Changing factors were presented as dynamic differences in studies conducted by a research team at Vanderbilt University.

There are many theories that have been advanced in the explanation of income disparity in agriculture and its ever widening trend. It may be well to point out at the outset that these theories will be evaluated from the standpoint of their plausibility in explaining not the short run differences, but the persistent increasing differences in farm income over time. The more popular explanations may be grouped broadly as follows: 1) those which rest on some original difference between communities, 2) those which rest on some dynamic difference, 3) those which rest on the ground that communities have not been uniformly affected by the varying pattern of secular drifts in commodity prices. Original differences in the natural capabilities of the human agent and in the utility functions between communities are undoubtedly capable of giving rise to important differences in community farm income even under conditions of perfect factor markets. However, only within the framework of imperfectly-functioning factor markets are we likely to find increasing income differences over time.¹

¹Tang, op. cit., p. 2.

Thus, in the Vanderbilt study, it was hypothesized and concluded that original differences in a given farm community are not responsible for continuous and increasing income differences over time.

Thus, dynamic or changing factors appear to hold the key to rates of change in income of the type under investigation here. This study attempted to relate these rates of change in income to various other changes. The measure of income change used here was the percent increase in net income per farm over an 11 year period. Therefore, in moving from one level to another some causative change has definitely taken place. This point was reinforced in a Vanderbilt bulletin by Nicholls concerning income variation in the 1900-1950 period. "Clearly one must look for dynamic rather than original differences in community attributes to explain recent development."²

I. RANK CORRELATION OF FACTORS TO INCOME

The factors that were considered as sources of income variation in this study were broadly grouped into two categories: (1) the shifts in certain measures of comparison by states of farm characteristics such as farm size in acres, gross sales, and cost of production and (2) shifts in major enterprises. Enterprise as used in this study will refer to one of the eight major agriculture products of the study area which include cotton, corn, soybeans, tobacco, beef, hogs, dairy, and poultry.

²William H. Nicholls, "The Effects of Industrial Development on Tennessee Valley Agriculture, 1900-1950," The Journal of Farm Economics, XXXVIII (December, 1956), p. 1637.

Rank Correlation

Spearman's rank correlation was used as a method of measuring the relationship between income change and changes in the factors under consideration. Rank correlation was not used in this study as a statistical technique in the sense that a sample was chosen from which to determine a characteristic of the population. The changes analyzed are measures of the entire population as defined in the study. Thus, the correlation is simply a measure of the relationship between certain parameters of the population. The correlation coefficient was derived by the following formulae:

$$1 - \frac{6 \sum (d)^2}{N (N^2 - 1)}$$

d = difference in the ranks

N = 8, the 8 states of the study region

The percent change in net income per farm from 1954 to 1964 for the eight states served as one ranking and the percentage change in enterprises on other factors served as the other ranking. The correlation coefficient determines if the states having large increases in a particular factor are the same states having large increases in income. The higher the coefficient the greater the relationship between the income movement and the factor movement.

II. RANK CORRELATION OF FARM CHARACTERISTICS TO INCOME CHANGE

Gross Receipts

The category that includes the measures of comparison for farms was considered first. Table IV and its rank correlation coefficient displays an almost perfect correlation (.98) between the ranking of

TABLE IV

REALIZED GROSS INCOME PER FARM IN 1954 AND 1964 AND THE PERCENT
INCREASE IN REALIZED GROSS INCOME PER FARM^a

	1954 gross income per farm	1964 gross income per farm	Increase from 1954-1964	Percent increase	Ranked percent increase	Ranked increase in net income	Difference
Virginia	4423	7049	2626	59	7	7	0
North Carolina	4216	7298	3082	73	6	6	0
South Carolina	3120	7076	3956	126	4	3	1
Georgia	4385	10912	6527	148	2	2	0
Kentucky	3534	6173	2639	74	5	5	0
Tennessee	2981	4719	1738	58	8	8	0
Alabama	3058	7117	4059	132	3	4	1
Mississippi	2989	7768	4779	159	1	1	0

Rank correlation = .98

^aEconomic Research Service, Farm Income State Estimates 1949-1965, United States Department of Agriculture FIS 203 Supplement (Washington, D. C.: Government Printing Office, August, 1966), pp. 8-9.

states on the basis of percent increase in realized net and gross receipts. Those states having the largest increases in gross income per farm were the states that had the largest increases in realized net income per farm.

Economic Class of Farm

The shifts of farm numbers within the Economic Classes of the Census of Agriculture offer insight into the effect of gross income on net income. The examination of these shifts is limited by certain changes in definition of different types of farms from 1954 to 1964. These definition changes are given in Tables V, VI and VII. The changes in definition allow only three groupings of classes of farms to be used in comparing shifts in number of farms within classes from 1954 to 1964. These groupings are: farms above \$10,000 in gross receipts, farms from \$2,500 to \$9,999 in gross receipts and farms below \$2,500 in gross receipts.

Tables V, VI, and VII portray the shifts in farm numbers that occurred within these three groupings and the rank correlation of the shift to increases in net income. The increase in the percent of farms grossing \$10,000 or more had a rank correlation of $+.48$ to increases in net income. The increase in the percent of farms having gross receipts from \$2,500 to \$9,999 had a rank correlation of $-.16$ to increases in net income. The range of gross income from \$2,500 to \$9,999 included farms that could have caused either an increase or a decrease in average net income depending on the direction of shift within the range. Farms moving out of the \$2,500 to \$9,999 grouping into the \$10,000 or more

TABLE V

CHANGES IN THE PERCENT OF FARMS WITH GROSS SALES OF \$10,000 OR MORE BETWEEN 1954^a AND 1964^{b,c}

	Percent of farms over 10,000 gross 1954	Percent of farms over 10,000 gross 1964	Increase in percentage 1954-1964	Ranked increase in percentage 1954-1964	Ranked increase in net income	Difference
Virginia	4.7	12.8	8.1	5.5	7	1.5
North Carolina	2.6	20.5	17.9	2	6	4.0
South Carolina	2.4	12.9	10.5	3.5	3	.5
Georgia	4.9	24.5	19.6	1	2	1.0
Kentucky	2.8	9.7	6.9	7	5	2.0
Tennessee	1.7	8.0	6.3	8	8	0
Alabama	2.5	13.0	10.5	3.5	4	.5
Mississippi	2.2	10.3	8.1	5.5	1	4.5

Rank correlation = +.48

^aConsisting of Economic Class I which included farms having gross receipts of \$25,000 or more and Economic Class II which included farms having gross receipts of \$10,000 to \$24,999.

^bConsisting of Economic Class I which included farms having gross receipts of \$40,000 or more, Economic Class II which included farms having gross receipts of \$20,000 to \$39,999 and Economic Class III which included farms having gross receipts of \$10,000 to \$19,999.

^cComputed from United States Bureau of the Census, United States Census of Agriculture 1954, Vol. II (Washington, D. C.: Government Printing Office, 1956), pp. 1165-1166; United States Bureau of the Census, United States Census of Agriculture 1964, Vol. II (Washington, D. C.: Government Printing Office, 1966), p. 635.

TABLE VII

CHANGES IN THE PERCENT OF FARMS WITH GROSS SALES OF \$2,500 OR LESS BETWEEN 1954^a AND 1964^{b,c}

	Percent of farms having gross receipts less than \$2,500 in 1954	Percent of farms having gross receipts less than \$2,500 in 1964	Decrease in percentage 1954-1964	Ranked increase in percentage 1954-1964	Ranked increase in net income	Difference
Virginia	77.5	59.3	-18.2	4	7	3
North Carolina	63.9	43.9	-20.0	1	6	5
South Carolina	75.6	58.2	-17.3	5	3	2
Georgia	70.1	50.5	-19.6	2	2	0
Kentucky	72.7	55.8	-16.9	6	5	1
Tennessee	80.9	64.2	-16.7	7	8	1
Alabama	84.4	65.7	-18.7	3	4	1
Mississippi	79.9	66.9	-13.0	8	1	7

Rank correlation = -.13

^aConsisting of Economic Class V which included farms having gross receipts from \$2,499 to \$1,200, Economic Class VI which included farms having gross receipts of \$250 to \$1,199, part time farms which had gross receipts from \$250 to \$1,199 and the farm operator worked off the farm 100 days or more and non-farm income was greater than the value of all farm products sold, and residential farms which had gross receipts of \$250 or less.

^bConsisting of Economic Class VI which included farms with gross receipts of \$50 to \$2,499, part time farms which had gross receipts of \$50 to \$2,499 and the operator was under 65 years of age and worked off the farm 100 days or more, and part-retirement farms which had gross receipts of \$50 to \$2,499 and the operator was 65 years old or over.

^cComputed from United States Bureau of the Census, United States Census of Agriculture 1954, Vol. II (Washington, D. C.: Government Printing Office, 1956), pp. 1165-1166; United States Bureau of the Census, United States Census of Agriculture 1964, Vol. II (Washington, D. C.: Government Printing Office, 1966), p. 635.

group should have increased average net income. Average net income would also have been increased by farms moving out of the \$2,500 or less range into the \$2,500 to \$9,999 group or simply by moving to a higher level within the given groups. Therefore, the movement of farm numbers within the \$2,500 to \$9,999 range offers no clear pattern in their relationships to changes in net income.

The decrease in the percent of farms having gross receipts of \$2,500 or less had a rank correlation of $-.13$ to increases in net income. Thus, the states having the largest decreases in percent of these small farms do not appear to be the states having the largest increases in net income per farm. However, much of this negative correlation is due to the influence of Mississippi which had the smallest decrease in its percent of farms having gross receipts of \$2,500 or less and the largest increase in net income per farm. In Mississippi the distribution of farm numbers was such that a high rate of increase in net income per farm was achieved even though a large percent of farms remained in the group having gross receipts of \$2,500 or less. This was due primarily to a relatively high rate of increase in numbers of farms in Economic Class I, which included farms having gross receipts of \$40,000 or more. This distribution of farm numbers for Mississippi is shown in Table VIII. Table VIII also shows the rapid decline in Mississippi of farms in Economic Class V. Although the percent of farms having gross receipts of \$2,500 or less remained high, there was a substantial reduction in the 62,168 farms of Economic Class V. See Tables VIII and IX.

If Mississippi is removed from the rank correlation of decreases in the percent of farms having gross receipts of \$2,500 or less to

TABLE VIII (Continued)

Class	1954		1964		1954		1964	
	number	percent	number	percent	number	percent	number	percent
VI								
Part time	35,196	19.9	20,231	21.9	43,250	20.0	25,732	23.6
Residential 1954	29,919	16.9	26,929	29.1	27,729	12.8	29,104	26.7
Part retired 1964	51,877	29.2	13,659	14.8	39,608	18.3	18,343	16.7
Totals	176,949		92,530		215,887		109,141	

^aUnited States Bureau of the Census, United States Census of Agriculture 1954, Vol. II (Washington, D. C.: Government Printing Office, 1956), pp. 1165-1166; United States Bureau of the Census, United States Census of Agriculture 1964, Vol. II (Washington, D. C.: Government Printing Office, 1966), p. 635.

^bTotals do not equal the sum of the classes due to a small number of abnormal farms included in the total.

increases in net income per farm, the rank correlation becomes +.40. Thus, with the exception of Mississippi, those states having the largest decreases in the percent of farms in the small farm group tended to be the states having the largest increases in net income per farm.

Off Farm Work

Table X shows that the increases in off farm work of 100 days or more had a positive rank correlation to increases in net income per farm of +.61. Mississippi was the state having the largest increase in the percent of farmers working off the farm 100 days or more and also the state having the largest increase in net income per farm. Those farmers working off the farm were not limited to the part time classification in which the farmer worked off the farm 100 days or more and had gross receipts of farm products of \$50 to \$2,499. If the farmer working off the farm part time had gross receipts from the farm of \$2,499 or more, he may have contributed to increases in net income per farm. In such a case he was not classified as a part time farmer. The low gross income per farm of those farmers classified as part time farmers was apparently offset by movement into Economic Class I in the case of Mississippi. Mississippi had a rapidly increasing net income per farm even though it maintained a relatively large percent of its farms in the part time classification.

Number of Farms and Size of Farms

The relationship between the decrease in number of farms and income increases is shown in Table XI. The rank correlation of .76 is indicative of the effect that the decrease in farm numbers has had on

TABLE X

PERCENT OF FARMERS WORKING OFF THE FARM 100 DAYS OR MORE IN 1954 AND 1964

	Percent working off the farm 1954	Percent working off the farm 1964	Increase in percentage	Ranked increase in percentage	Ranked increase in net income	Difference
Virginia	36 ^a	34 ^b	2	8	7	1
North Carolina	25	28	3	7	6	1
South Carolina	30	36	6	5.5	3	2.5
Georgia	30	37	7	3.5	2	1.5
Kentucky	22	28	6	5.5	5	.5
Tennessee	28	35	7	3.5	8	4.5
Alabama	30	39	9	2	4	2
Mississippi	21	34	13	1	1	0

Rank correlation = +.61

^aComputed from United States Bureau of the Census, United States Census of Agriculture 1954, Vol. II (Washington, D. C.: Government Printing Office, 1956), p. 165.

^bComputed from United States Bureau of the Census, United States Census of Agriculture 1964, Vol. I (Washington, D. C.: Government Printing Office, 1966), p. 40.

TABLE XI

CHANGES IN THE NUMBER OF FARMS BETWEEN 1954 AND 1964

	Number of farms 1954 (thousands) ^a	Number of farms 1964 (thousands) ^b	Decrease in number of farms (thousands)	Percent decrease	Ranked percent decrease	Ranked increase in net income	Difference
Virginia	136	80	- 56	41.1	6	7	1
North Carolina	267	148	-119	44.5	5	6	1
South Carolina	124	56	- 68	54.8	1	3	2
Georgia	165	83	- 82	49.6	2	2	0
Kentucky	193	133	- 60	31.0	8	5	3
Tennessee	203	133	- 70	34.4	7	8	1
Alabama	175	92	- 84	47.7	4	4	0
Mississippi	215	109	-106	49.3	3	1	2

Rank correlation = +.76

^aUnited States Bureau of the Census, United States Census of Agriculture 1954, Vol. II (Washington, D. C.: Government Printing Office, 1956), p. 30.

^bUnited States Bureau of the Census, United States Census of Agriculture 1964, Vol. II (Washington: D. C.: Government Printing Office, 1966), p. 244.

size of farms and production per farm. The decrease in the number of farms has resulted in consolidation into larger units. These larger units have greater opportunity in specialization, mechanization, and the resulting increase in returns per farm. The correlation between increases in farm size and increases in income is $+0.71$ and is portrayed in Table XII.

III. RANK CORRELATION OF ENTERPRISE CHANGES TO INCOME CHANGE

One of the hypotheses to be investigated was the effect of different combinations of enterprises on income. If product mix affects income and if a given enterprise is profitable, then states having large shifts to or increases in this enterprise should have large increases in income.

The association between income change and enterprise changes was tested in Tables XIII, XIV, XV, XVI and XVII by using rank correlation. The percent changes in net income per farm from 1954 to 1964 for the eight states serves as one rank and the weighted percentage change in a given enterprise serves as the other rank. The enterprise changes were weighted to give some measure of the magnitude of shifts taking place. A 100 percent increase in the average acreage of soybeans per farm will have more effect on income if it is from 5 to 10 acres than if it is from 1 to 2 acres. The shifts were weighted by multiplying the percent change in an enterprise by the percent that the given commodity occupied of total gross receipts in 1954. The percent change in an enterprise was the increase in acreage or animal units from 1954 (Col. 1) to 1964

TABLE XII

CHANGES IN THE AVERAGE SIZE OF FARMS BETWEEN 1954 AND 1964

	Acres per farm 1954 ^a	Acres per farm 1964 ^b	Increase in acres per farm	Percent increase	Rank	Ranked net increase	Difference
Virginia	107	149	42	40	5	7	2
North Carolina	68	97	29	42	4	6	2
South Carolina	89	144	55	61	2	3	1
Georgia	145	214	69	47	3	2	1
Kentucky	93	122	29	30	8	5	3
Tennessee	86	144	28	31	7	8	1
Alabama	117	164	47	39	6	4	2
Mississippi	95	163	68	69	1	1	0

Rank correlation = .71

^aUnited States Bureau of the Census, United States Census of Agriculture 1954, Vol. II (Washington, D. C.: Government Printing Office, 1956), p. 379.

^bUnited States Bureau of the Census, United States Census of Agriculture 1964, Vol. II (Washington, D. C.: Government Printing Office, 1966), p. 250.

TABLE XIV

ACRES OF SOYBEANS^a IN 1954 AND 1964, THE PERCENT INCREASE
IN ACREAGE AND THE WEIGHTED INCREASE

	Soybean acreage 1954 in thousands ^b	Soybean acreage 1954 in thousands ^c	Increase from 1954- 1964	Percent increase	Percent soybeans occupied of 1954 total receipts	Weighted increase	Rank of weighted increase	Rank of increase in net income	Difference
Virginia	205	382	177	86	1.4	124	6	7	1
North Carolina	289	638	349	120	1.5	180	4	6	2
South Carolina	150	746	596	397	1.0	397	2	3	1
Georgia	33	120	87	263	.5	131	5	2	3
Kentucky	130	260	130	100	1.0	100	7	5	2
Tennessee	214	586	372	173	1.8	311	3	8	5
Alabama	95	161	66	69	.6	41	8	4	4
Mississippi	519	1291	772	148	3.2	473	1	1	0

Rank correlation = +.29

^aAcres harvested for beans.^bUnited States Department of Agriculture, Agricultural Statistics 1956 (Washington, D. C.: Government Printing Office, 1957), p. 126.^cUnited States Department of Agriculture, Agricultural Statistics 1966 (Washington, D. C.: Government Printing Office, 1966), p. 135.

TABLE XV

NUMBER OF BEEF COWS IN 1954 AND 1964, THE PERCENT INCREASE
IN NUMBER AND THE WEIGHTED INCREASE

	Beef cows 1954 in thousands ^a	Beef cows 1964 in thousands ^b	Increase from 1954- 1964	Percent increase	Percent beef cows occupied of 1954 total receipts	Weighted increase	Rank of weighted increase	Rank of increase in net income	Difference
Virginia	323	425	102	31	13	403	5	7	2
North Carolina	143	249	106	134	2	268	8	6	2
South Carolina	100	199	99	100	4	400	6	3	3
Georgia	355	606	251	70	6	420	3	2	1
Kentucky	351	788	437	124	13	1612	1	5	4
Tennessee	316	700	384	121	12	1452	2	8	6
Alabama	575	752	177	30	11	330	7	4	3
Mississippi	580	923	343	59	7	413	4	1	3

Rank correlation = -.11

^aUnited States Department of Agriculture, Agricultural Statistics 1955 (Washington, D. C.: Government Printing Office, 1956), p. 305.

^bUnited States Department of Agriculture, Agricultural Statistics 1965 (Washington, D. C.: Government Printing Office, 1965), p. 309.

TABLE XVI

NUMBER OF DAIRY COWS IN 1954 AND 1964, THE PERCENT DECREASE
IN NUMBER AND THE WEIGHTED DECREASE

	Dairy cows 1954 in thousands ^a	Dairy cows 1964 in thousands ^b	Decrease from 1954- 1964	Percent decrease	Percent dairy occupied of 1954 total receipts	Weighted decrease	Rank of weighted decrease	Rank of increase in net income	Difference
Virginia	494	348	146	29	14.0	406	2	7	5
North Carolina	399	272	127	31	4.7	146	8	6	2
South Carolina	176	103	73	41	6.0	246	7	3	4
Georgia	395	212	183	46	7.0	322	3	2	1
Kentucky	708	522	186	26	10.0	260	6	5	1
Tennessee	736	505	231	31	14.0	434	1	8	7
Alabama	472	234	238	50	6.0	300	5	4	1
Mississippi	624	322	302	48	6.5	312	4	1	3

Rank correlation = -.26

^aUnited States Department of Agriculture, Agricultural Statistics 1955 (Washington, D. C.: Government Printing Office, 1956), p. 365.

^bUnited States Department of Agriculture, Agricultural Statistics 1965 (Washington, D. C.: Government Printing Office, 1965), p. 371.

TABLE XVII

NUMBER OF HOGS IN 1954 AND 1964, THE PERCENT INCREASE
IN NUMBER AND THE WEIGHTED INCREASE

	Hogs 1954 in thousands ^a	Hogs 1964 in thousands ^b	Increase from 1954- 1964	Percent increase	Percent hogs occupied of 1954 total receipts	Weighted increase	Rank of weighted increase	Rank of increase in net income	Difference
Virginia	445	640	+195	43	5.0	215	4	7	3
North Carolina	982	1669	+687	69	3.6	248	3	6	3
South Carolina	525	465	- 60	11	4.0	- 44	8	3	5
Georgia	1593	1767	+174	10	7.0	70	6	2	4
Kentucky	987	1906	+919	93	8.0	744	1	5	4
Tennessee	897	1539	+642	69	8.4	579	2	8	6
Alabama	1093	1054	- 39	3	6.0	- 18	7	4	3
Mississippi	324	516	+192	59	1.7	100	5	1	4

Rank correlation = -.62

^aUnited States Department of Agriculture, Agricultural Statistics 1955 (Washington, D. C.: Government Printing Office, 1956), p. 323.

^bUnited States Department of Agriculture, Agricultural Statistics 1965 (Washington, D. C.: Government Printing Office, 1965), p. 325.

TABLE XXII

ACRES OF SOYBEANS PER FARM IN 1954 AND 1964, THE PERCENT INCREASE
IN ACREAGE PER FARM AND THE WEIGHTED INCREASE

	Acres of soybeans per farm 1954	Acres of soybeans per farm 1964	Increase from 1954-1964	Percent increase	Percent soybeans occupied of 1954 total receipts	Weighted increase	Rank of weighted increase	Rank of increase in net income	Difference
Virginia	1.50	4.77	3.27	218	1.4	305	6	7	1
North Carolina	1.07	4.31	3.24	302	1.5	453	4	6	2
South Carolina	1.20	13.32	12.12	1010	1.0	1010	2	3	1
Georgia	.20	1.44	1.24	620	.5	310	5	2	3
Kentucky	.67	1.95	1.28	191	1.0	191	7	5	2
Tennessee	1.05	4.40	3.35	319	1.8	574	3	8	5
Alabama	.53	1.75	1.22	230	.6	138	8	4	4
Mississippi	2.41	11.84	9.43	391	3.2	1251	1	1	0

Rank correlation = +.29

TABLE XXIII

ACRES OF COTTON PER FARM IN 1954 AND 1964, THE PERCENT INCREASE
IN ACREAGE PER FARM AND THE WEIGHTED INCREASE

	Acres of cotton per farm 1954	Acres of cotton per farm 1964	Increase from 1954-1964	Percent increase	Percent cotton occupied of 1954 total receipts	Weighted increase	Rank of weighted increase	Rank of increase in net income	Difference
Virginia	.11	.16	.05	45	.5	22	7	7	0
North Carolina	2.04	2.57	.53	25	10.0	250	6	6	0
South Carolina	6.69	9.60	2.91	43	37.0	1591	2	3	1
Georgia	6.21	7.61	1.40	22	26.0	571	4	2	2
Kentucky	.04	.04	0	0	--	0	8	5	3
Tennessee	3.19	3.77	.58	18	29.0	522	5	8	3
Alabama	6.64	9.03	2.39	35	45.0	1372	3	4	1
Mississippi	9.11	13.39	4.28	46	67.0	3082	1	1	0

Rank correlation = .72

TABLE XXIX

SUMMATION OF THE WEIGHTED INCREASES IN THE EIGHT ENTERPRISES

	Weighted increase in the eight enterprises ^a	Ranked weighted increase	Ranked increase in net income	Difference
Virginia	3886	8	7	1
North Carolina	6017	5	6	1
South Carolina	4970	6	3	3
Georgia	11358	2	2	0
Kentucky	4537	7	5	2
Tennessee	7223	4	8	4
Alabama	12774	1	4	3
Mississippi	9390	3	1	2

Rank correlation = .48

^aComputed by summing the weighted increases in the eight enterprises from Tables XVIII through XXIV.

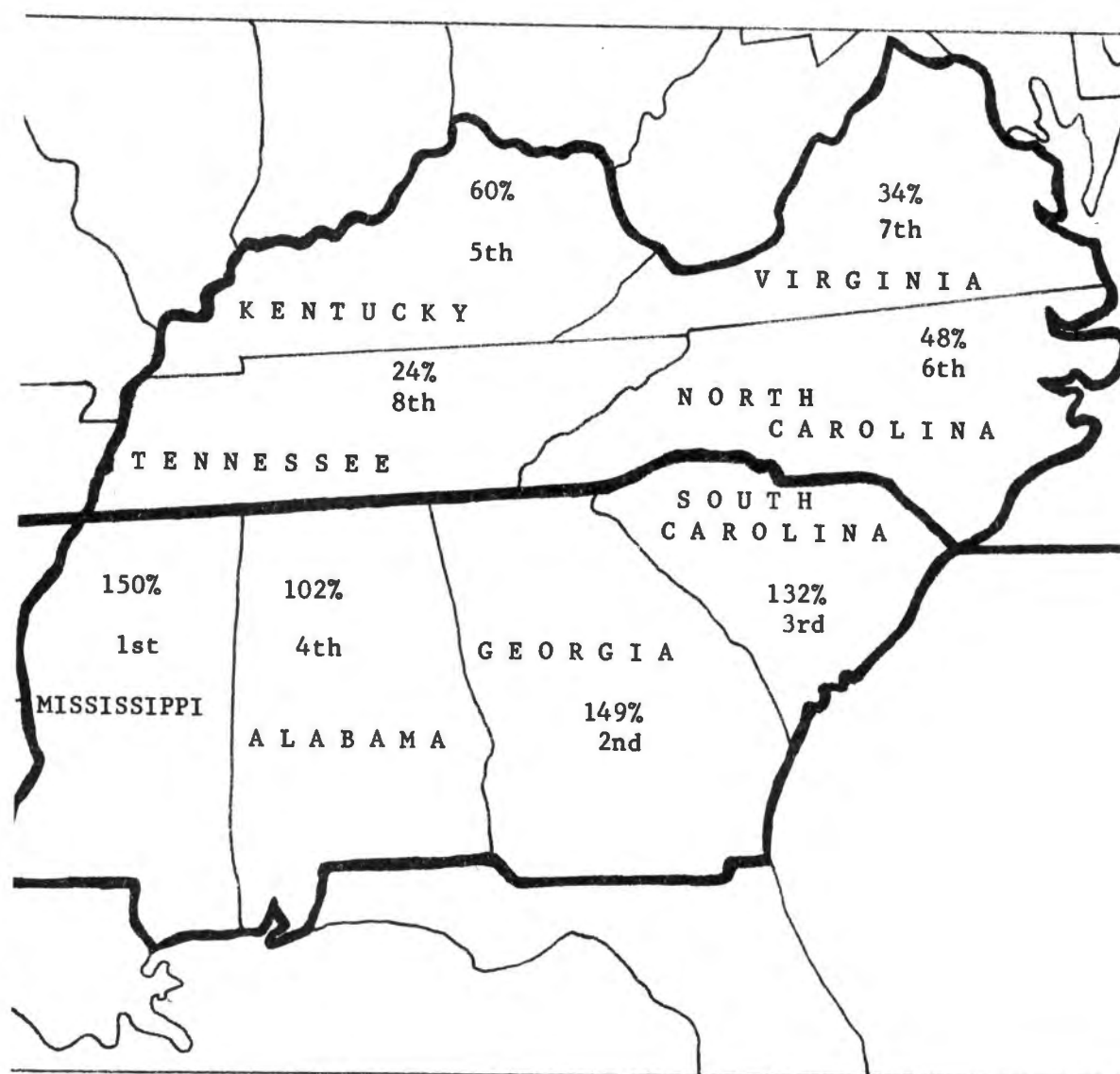


Figure 3. The study area divided into a four state northern area and a four state southern area and the percent increase in net farm income and its rank for each state.

North Carolina, Kentucky, Virginia and Tennessee, in that order, were the four leading states in total tobacco acreage in 1964. These were the four states having the smallest increases in net income per farm; thus, tobacco production does not appear to be correlated with increasing income. This statement is further substantiated by a negative correlation of -0.69 between income increases and total tobacco acreage. The large tobacco acreage has apparently tied farmers and their labor to that enterprise and has not allowed them to expand into other enterprises. These four states had the smallest increases in enterprise production per farm as well as the smallest increases in gross income. They also had the smallest increases in average farm size, with the exception of North Carolina which was fourth. Thus, farms in the tobacco states remained small and did not increase in acreage or shift into other enterprises as fast as farms in other states.

The Southern States

The four southernmost states, Georgia, Mississippi, Alabama, and South Carolina, tend to be characterized as the cotton belt area. These four states had the largest increases in income of the eight states in the study area as well as the largest total acreage of cotton. The rank correlation between total cotton acreage and increases in income for the eight states was $+0.72$. Thus, the large cotton acreage appears to have exerted a positive influence on income.

The states having large acreages of cotton were also the states having the largest increases in yield of cotton per acre during the 1954-1964 period. The rank correlation between cotton yield increases

per acre and total acreage of cotton was +.91. Therefore, increasing income could have resulted from the large acreage per farm or from the increase in the yield per acre.

The four southern states had the largest increases in the index of soybeans and poultry as shown in Table XXVI. Soybeans and poultry were the leading sources of enterprise increases so the cotton states received the benefit of the largest of these increases. These states also tended to have the largest increases in farm size. The cotton states, therefore, have received the benefit of rapid expansion in size and rapid shifts in enterprise structure favorable for income gains.

This increase in farm size and enterprises appears to be partially due to a rapid increase in mechanization in cotton farming. This trend, much of which took place during the 1954-1964 period, greatly reduced the labor requirements of cotton and encouraged the more enterprising farmers to increase the size of their operations. This could be done by increasing farm size or by increasing the production of other enterprises or by both. This hypothesis is substantiated by the fact that Mississippi, with a cotton acreage that far outstrips any other state, is the leading state in increases in farm size, in gross receipts, and is second in increases in the index of all eight enterprises per farm.

Another factor that was a benefit to the four southernmost states of the study area was their suitability to row crops; thus, it was natural for farmers to expand their operation more toward row crops. Much of the northern portion of the study area, particularly the Appalachian area, is less suited for row crops. Therefore, the northern

states were limited in their expansion into high return crops.

V. INCREASES IN PRODUCTION PER MAN HOUR

Certain enterprises appear to be more adapted to mechanization and specialization than do others. This results in increased production per man hour, and in most cases, increased returns to the farmer. These changes in farm production and efficiency are reported by enterprise and by region by U.S.D.A.³ and can be used as a measure of the rate of technological improvement. The study region of this investigation forms a part of three farm production regions delineated by U.S.D.A. The three regions, Appalachian, Southeast and Delta states, encompass four bordering states which are not included in this study. The changes in production per man hour appear to be more related to enterprise than to region so the inclusion of these extra states should not affect the accuracy of the index too adversely.

The Measure of Increase in Production per Man Hour

The U.S.D.A. report uses the years 1957 to 1959 as a base equal to 100 in each region. The rates of increase in production per man hour, from 1954 to 1964, over the three regions by enterprise are as follows: feed grains (corn, oats, barley and sorghum grain), 260 percent; poultry, 220 percent; oil crops (soybeans and peanuts), 153 percent; cotton, 138 percent; milk cows, 79 percent; tobacco, 42 percent; meat animals

³Economic Research Service, Changes in Farm Production and Efficiency, Supplement IV, United States Department of Agriculture, Statistical Bulletin No. 233 (Washington, D. C.: Government Printing Office, Revised August, 1967), pp. 5-6.

(cattle, sheep and hogs), 15 percent. The feed grains and poultry are particularly well adapted to increases in production per unit of time input and are followed by oil crops and cotton. Milk cows, meat animals and tobacco have experienced limited increases in production per man hour.

The Enterprise Shifts

The enterprises, poultry, soybeans and cotton, were the enterprises that had relatively high correlations to income increases. The increase in production per man hour resulted in the individual farmer being able to increase his output by expanding the size of his operation. Thus, the states giving more emphasis to these enterprises were able to gain more in production and income. The southernmost states tended to have the largest increases in cotton, poultry and soybeans; thus, effectively increasing their production per man hour and per farm. The northernmost states tended to have the largest acreage of tobacco, and, in the cases of Kentucky and Tennessee, have large increases in meat animals. These were the enterprises having only small increases in production per man hour from 1954 to 1964. Tobacco is not adapted to labor saving technology as well as other crops and continued to require large amounts of labor per unit of output throughout the 1954-1964 period. If part of this labor could have been released, it might have encouraged the production of other enterprises and the expansion of farm size.

VI. THE EFFECTS OF CHANGES IN COST ON NET INCOME

Thus far this investigation has pursued the factors that increased

gross returns per farm. The changes that have taken place in cost must also be considered to determine expected levels of net income. Table XXX gives the percent cost of gross in 1954 and 1964, and the increase in that percentage over the period. The correlation between increases in percent cost of gross and increases in net income is $-.79$ and is shown in Table XXX. Thus, the states having the smallest increases in percent cost over the 11 year period were also the states having the largest increases in income. The reasons behind the varying rates in cost increases are difficult to identify. The variation could be due to different rates of technological development, to management, to price, to enterprise shifts or to many other factors.

Certain enterprises do have lower cost as a percent of gross receipts. The Farm Planning Manual published by The University of Tennessee Extension Service gives the following estimated cost percentages as average for Tennessee: soybeans, 34 percent; corn, 42 percent; tobacco, 44 percent; broilers, 56 percent; cotton, 59 percent; dairy, 68 percent; beef, 71 percent; and hogs, 77 percent. It would seem feasible that the states having large shifts into the high cost enterprises such as dairy, beef and hogs would have the largest increases in cost as a percent of total receipts. This appears true for Tennessee which had a large increase in beef and hogs and the largest increase in cost. The product mix varies such between states that there are few shifts to only the high cost or low cost enterprises. Therefore, resource shifts offer only limited insights into cost increases. Tennessee did have the second largest increase in the three high cost enterprises and also the third smallest increase in low cost enterprises so this may have resulted

TABLE XXX

PERCENT COST OF PRODUCTION WAS OF GROSS FARM INCOME IN 1954 AND 1964

	Gross Income 1954 ^a	Cost, 1954 ^b	Percent cost of gross income in 1954	Gross Income 1964 ^a	Cost, 1964 ^b	Percent cost of gross income in 1964	Increase in percent cost 1954-1964	Rank of increase in percent cost	Rank of increases in net income	Difference
Virginia	3944	2237	57	7049	4756	68	11	2.5	7	4.5
North Carolina	3997	1772	45	7298	4005	55	10	4	6	2
South Carolina	3001	1790	60	7076	4256	61	1	8	3	5
Georgia	4057	2582	64	10912	7227	67	3	7	2	5
Kentucky	3287	1467	45	6173	3263	53	8	5	5	0
Tennessee	2773	1321	48	4719	2918	62	14	1	8	7
Alabama	2745	1413	52	7117	4425	63	11	2.5	4	1.5
Mississippi	2786	1479	54	7768	4489	58	4	6	1	5

Rank correlation = .79

^aEconomic Research Service, Farm Income State Estimates 1949-1965, United States Department of Agriculture, FIS 203 Supplement (Washington, D. C.: Government Printing Office, August, 1966), pp. 8-9.

^bComputed from Economic Research Service, Farm Income State Estimates 1949-1965, United States Department of Agriculture, FIS 203 Supplement (Washington, D. C.: Government Printing Office, August, 1966), pp. 10-11.

in overall cost increases.

VII. TENNESSEE'S RELATIVE POSITION AS COMPARED TO MISSISSIPPI

Additional insight into Tennessee's slow rate of income growth was gained by examining Tennessee which had the lowest income gains when compared with Mississippi which experienced the highest rate of gain.

Tennessee's Rank in Farm Characteristics

Tennessee's rank of increases in gross income was eighth; in increases in cost as a percent of gross income, first; in increases in the index of all enterprises, fourth; in increases in the average number of acres per farm, seventh; in decreases in farm numbers, seventh; and in increases in the percent of farms with gross sales of \$10,000 or more, eighth. Thus, Tennessee has been in a relatively unfavorable position for income increases in almost all of these areas.

Tennessee's Rank in Enterprise Shifts

Table XXXI shows Tennessee's rank in enterprise changes, the correlation of each enterprise to net income change, and the percent increase from 1954 to 1964 in production per man hour for each enterprise. From Table XXXI it is readily apparent that Tennessee had its three highest ranked increases in the three enterprises--tobacco, hogs and beef. These three enterprises had the smallest increases in production per man hour and had negative rank correlations to income increases. The other five enterprises had larger increases in production per man hour and had positive correlations to income increases with the exception

TABLE XXXI

TENNESSEE'S RANKED INCREASE IN ENTERPRISES AND
ENTERPRISE CHARACTERISTICS

	Rank of Tennessee's increase among the eight states	Percent increase in production per man hour 1954-1964	Rank correlation of Enterprise to increases in net income ^a
Soybeans	3	153	+.29
Corn	6	260	+.12
Poultry	5	220	+.53
Cotton	5	138	+.72
Dairy	5	79	-.59
Tobacco	1	42	-.09
Hogs	2		-.54
Beef	2	15	-.43

^aTaken from Tables XVIII through XXV.

of dairy. In these five enterprises Tennessee had one third place ranking increase, three rankings in fifth position and one in sixth.

Mississippi's Rank in Farm Characteristics

Mississippi, in contrast to Tennessee, had the largest increases in net farm income. It also had the highest percent increase in gross, the third lowest percent increase in cost, the third highest percent decrease in farm numbers, and the highest percent increase in farm size.

Mississippi's Rank in Enterprise Shifts

From Table XXXII, it is evident that, in general, Mississippi had its lowest ranked increases in the enterprises that were negatively correlated to income increases and had small increases in production per man hour. Moreover, with the exception of corn, Mississippi had its largest increases in the enterprises highly correlated to income increases and having the largest increases in production per man hour.

VIII. SHIFT ANALYSIS AS A MEASURE OF ENTERPRISE MOVEMENT

Shift analysis can be used to determine rates of increase in enterprise structure. The net shifts in agriculture mix measure the actual growth of each enterprise in a state against its average growth rate for all states. The measure of enterprise increase was the average number of animal units or acres per farm in 1954 and again in 1964. Table XXXIII and XXXIV measure the extent of net shifts above and below average regional shifts for each enterprise. The net enterprise shifts were calculated in the same manner as the net income shifts in Chapter I.

TABLE XXXII

MISSISSIPPI'S RANKED INCREASE IN ENTERPRISES AND
ENTERPRISE CHARACTERISTICS

	Rank of Mississippi's increase among the eight states	Percent increase in production per man hour 1954-1964	Rank correlation of enterprise to increases in net income
Soybeans	1	153	+.29
Corn	6	260	+.12
Poultry	3	220	+.53
Cotton	1	138	+.72
Dairy	8	79	-.59
Tobacco	7.5	42	-.09
Hogs	8	15	-.54
Beef	5		-.43

TABLE XXXIII

NET SHIFTS OF ENTERPRISES FOR VIRGINIA, NORTH CAROLINA,
SOUTH CAROLINA AND GEORGIA

Enterprises	Net Shifts	Enterprises	Net Shifts
Virginia		North Carolina	
Poultry	-1.69	Poultry	+0.35
Beef	-1.00	Beef	+0.30
Dairy	+0.32	Dairy	+0.24
Hogs	+0.22	Hogs	+2.54
Soybeans	-2.83	Soybeans	-1.11
Cotton	--	Cotton	-0.20
Corn	+1.53	Corn	+1.51
Tobacco	.00	Tobacco	-0.10
South Carolina		Georgia	
Poultry	-1.40	Poultry	+0.15
Beef	-0.50	Beef	+0.30
Dairy	+0.28	Dairy	-0.07
Hogs	-1.76	Hogs	+2.17
Soybeans	+7.24	Soybeans	+0.43
Cotton	+0.50	Cotton	-0.70
Corn	-0.41	Corn	+6.53
Tobacco	+0.20	Tobacco	.00

If all net shifts in a state are considered, they reflect the overall change of the state in its enterprise structure. The tables also show in which states a particular enterprise grew most rapidly. Georgia was the state responsible for the greatest proportion of above average income. This appears to be due in part to its greater than average increase in five enterprises. Its rapid increase in farm size and rapid expansion of enterprises per farm resulted in high returns to the farmer. Tennessee was the state responsible for the greatest proportion of below average income. This can be explained in part by Tennessee's negative differential shifts in both soybeans and poultry. Virginia and Kentucky also had negative shifts in both of these enterprises.

Comparison to Other Analysis

The net differential shifts tend to follow a similar pattern to the weighted percent changes of Section III of this chapter. Overall increases in resources per farm again appear to be the most important factor in influencing net income. Some states had greater than average increases in some of its enterprises and less than average increases in others. In these states the ones having the greatest share of increasing income were the same states having greater than average shifts toward the enterprises that had large increases in returns per man hour and were correlated to net income increases. There were some exceptions but this trend was evident as was shown in Section III.

There were some differences between the importance that a weighted percent change from Section III placed on enterprise change and the importance that the net differential shifts placed on the change. This

was due to the fact that the net differential shifts were not weighted according to the importance of that enterprise in the state's agriculture. The net shifts do not include the greater effect on income of increasing a large base of an enterprise by a given percent as compared to the effect of increasing a small base by that same percentage. In this sense it is not as effective a measure of factors that influence net income as weighted percent changes.

The Use of Shift Analysis

Shift analysis normally includes a proportional effect which measures the difference between total net shifts and differential shifts. In the literature this proportional effect is referred to as the regional share effect. This part of shift analysis is possible only if the data used in total shifts and differential shifts are measurements of the same character. In this study income change was used to measure total shifts and average acreage and animal units per farm were used to measure differential shifts. Data were not available on the net income that each enterprise contributed to income; therefore, the proportional effect could not be determined.

"Shift analysis is basically a descriptive tool, it does not identify the causes of change within and among economic regions. It does, however, put a spotlight on the underlying mechanics of change."⁴

⁴Blowers, op. cit., p. 4.

CHAPTER IV

MULTIPLE REGRESSION USED TO MEASURE INCOME

In the preceding sections rank correlation and shift analysis have been used as tools to measure the relationship of various factors to changes in net income. The viewing of trends in such a manner did not isolate the effect of one variable's change on income. In Chapter IV stepwise regression was used as a technique to determine the partial effect of a given variable on net income as portrayed by the b values in the equation, and to measure the effect of an enterprise on income variability by the use of coefficients of determination.

I. THE DATA AND HOW IT WAS UTILIZED

The nine variables under consideration were the eight enterprises of Chapter III and average acres of land per farm. The data were again considered over the 1954-1964 period for comparative purposes with previous analysis. The enterprises were entered in the analysis in the form of the average number of units per farm. The source of enterprise data was Agriculture Statistics. The average acres of land per farm was obtained from the U.S.D.A. publication Number of Farms and Land in Farms. The data yielded an observation on the variables in each year and in each state. This produced 88 degrees of freedom and since only nine variables were under consideration, this was adequate for the analysis. The dependent variable was realized net income.

The Use of Time Series and Cross-Sectional Data

It was realized that special problems are involved in the use of time series and cross-sectional data. In this case, it was necessary to combine the time series and cross-sectional data to obtain sufficient observations for analysis. The use of time series data along with cross-sectional does help eliminate one source of bias. The cross-sectional data contains trends that can distort the estimated coefficients in the particular cross section. For example, if Georgia has plentiful rain during a particular year or if Tennessee had a drought, the low or high economic returns would produce distorted coefficients for the crop acreages. Time series adds additional strength to the analysis by smoothing out weather variations over time.

Assumptions of the Analysis

Several assumptions were necessary in using the regression analysis due to the nature of the data available. The purpose of the analysis was to determine the effect of product mix and farm size on net income. Multiple regression provided the relationship between changes in net income and changes in enterprise structure. Due to the limited amount of data available over the period under study, it was combined on a cross-sectional time series basis. From the combined data a regression equation was developed for the entire study region over the 1954-64 time period. Several basic assumptions were necessary for such analysis to be valid. The effects of price and yield variation over the region and over time were assumed constant and an average b value was determined for each enterprise. Once the contribution of an enterprise was

determined then those states having highest increases in the enterprises contributing most to income increases should have been the states having large increases in income. Averaging the profitability of an enterprise throughout the region may appear to have constrained the analysis to uncertain limits. However, regression was being used in this case to determine the effects of different mixtures of products on income for the region, not to measure differences in income producing ability of enterprises in different states.

II. THE STEPWISE REGRESSION PROGRAM

The program selected for the regression analysis was the stepwise regression model. The regression enters each independent variable in order of its effect on the variability of the dependent variable. A sequence of multiple linear regression equations is computed in a stepwise manner, adding one variable to the regression equation at each step. The variable added was the one which had contributed the greatest amount of the variation in income or made the greatest reduction in the error sum of squares.¹

The regression was an attempt to derive a function that would express the value added to income per unit increase in enterprise over the 1954-64 period. Thus, each b value is a partial regression coefficient in that it measures the effect of one unit increase of an

¹The University of Tennessee Computing Center, "EMD02 Stepwise Regression," (Knoxville, Tennessee: The University of Tennessee, September 1, 1965), p. 1.

enterprise while holding all other enterprises constant at a given level.

The Variables Considered

The variables used in the analysis were as follows:

Y = realized net income per farm

X₁ = poultry--average number of units of broilers and laying hens per farm (1,000 birds per unit)

X₂ = tobacco--average number of acres per farm

X₃ = soybeans--average number of acres per farm

X₄ = dairy--average number of milk cows per farm

X₅ = beef--average number of beef cows per farm

X₆ = cotton--average number of acres per farm

X₇ = hogs--average number of market hogs per farm

X₈ = size of farm in acres

X₉ = corn--average number of acres per farm

Only those variables whose b values were significant at the 95 percent level were considered in the analysis. The F test was utilized to measure whether or not the b values were significantly different from 0. A b value significant at the 95 percent level justifies 95 percent confidence that the difference from 0 did not occur by chance alone.

The regression program showed corn acreage and average acres of land per farm as having b values not significantly different from 0. In the case of corn this could be due to the effect on income of not growing corn and receiving a subsidy payment. Reductions in corn acreage would have about the same effect on income as would increases. Land was

highly correlated to all other variables except tobacco so its positive influence may have been displayed through the b coefficients of other variables.

The Regression Equation

The regression analysis yielded the following equation:

$$Y = 73.08 + 340.11X_1 + 654.41X_2 + 92.19X_3 + 120.52X_4 + 71.06X_5 + 34.72X_6 + 23.29X_7$$

The b value, standard error and F value were as follows for each enterprise:

	b value	standard error	F value
X_1 = poultry	304.11	49.20	47.79
X_2 = tobacco	654.41	67.20	94.84
X_3 = soybeans	92.91	14.30	41.59
X_4 = dairy	120.52	25.73	21.93
X_5 = beef	71.06	22.52	9.68
X_6 = cotton	34.72	13.84	6.29
X_7 = hogs	23.29	10.72	4.72
R^2 = .83			

Standard error of the estimate = 202.30

Coefficient of Determination

R^2 is the coefficient of determination and indicates the proportion of the variability in income that is associated with the independent variables.

In a case where the observed relation explains all the variation in the dependent variable, the estimated values will be

identical with the actual value. The standard deviation of y^1 will, therefore, be exactly as large as the standard deviation of Y and the ratio of SY^1/SY will be equal to 1.0.²

The R^2 for the regression equation that includes the seven significant variables was .83. Thus, 83 percent of the variability in net income is related to the variability of the seven enterprises. The first enterprise entered in the equation or the enterprise responsible for the greatest amount of variation in income was poultry. Poultry was responsible for an increase in R^2 of .385. Tobacco entered the equation in the second step and was responsible for an increase in R^2 of .194. The third variable entered was soybeans and it was responsible for an increase in R^2 of .209. These three enterprises were responsible for a major portion of the variability in income. Large increases in poultry and soybeans over the 11 year span apparently contributed very significantly to increases in net income. Tobacco also was highly related to income variation which appears contrary to evidence previously presented. However, previous analysis showed tobacco to be negatively correlated, not to net income, but to increasing net income per farm. The time series regression analysis measures the average effect of tobacco on net income over the period. In 1954, states having large tobacco acreage were the same states having large net incomes. The correlation between net income and total tobacco acreage was +.76 in 1954 but had dropped to +.09 by 1964. Thus, it appears that the positive association between tobacco acreage and state average net income per farm declined over this

²Mordecai Ezekiel and Karl A. Fox, Methods of Correlation and Regression Analysis (New York: John Wiley and Sons, Inc., 1959), p. 128.

period. The remaining four enterprises did not contribute greatly to the increase in R^2 .

The b Coefficients

The b coefficients of the regression equation measure the association between changes in net income and a one unit change in a given variable. The b values cannot be interpreted as accurate estimates of marginal returns of each enterprise. Rather, they are measures of the gross relationship between changes in average net income per farm and average unit changes in the various enterprises per farm.

Sources of Error and Methods of Improving the Analysis

The stepwise regression program was used primarily as a check against the findings of the rank correlation analysis. The coefficients of determination were another means of measuring the relationship between variability in net income and variability in enterprise movement. Multicollinearity did not appear to have been an evident source of bias in the data but could have had a limited effect. The use of dummy variables to separate the effects of different states by yielding separate intercepts was attempted but tended to produce results less reasonable than when dummy variables were omitted. The degrees of freedom were insufficient to allow a separate equation to be run for each state. Dummy variables can be used to permit changes in both intercept and slope coefficients. Future research in this area might consider the possibility of both slope and intercept changes to increase the accuracy of the multiple regression. The inclusion of more variables would

increase the usefulness of the study. However, 83 percent of the variability in income was explained by the variability in the enterprises so the R^2 was considered sufficiently high.

III. THE RESULTS OF THE REGRESSION ANALYSIS

The results of the stepwise regression analysis, in general, corroborates the findings of the previous analysis. Those states which had the greatest shifts to enterprises which have shown the most rapid gains in output per man hour, particularly poultry, cotton and soybeans, have had the most rapid gains in net income per farm. In addition to the effects which shifts in product mix has had on changes in net income per farm, there has been the effect of differential rates of change in farm size. As was pointed out in earlier analysis, in general, those states which have made faster shifts to the higher output per man hour enterprises have also made the most rapid gains in farm size. Thus, it appears that the combination of these two forces have been effective in bringing about the differential rates of growth in average net income per farm in the eight states.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

Tennessee has shown a pronounced lag in its rate of increase in net farm income over the past number of years when compared to other Southeastern states. This lag is particularly evident during the 1954-1964 period. During this time Tennessee increased its realized net per farm income by only 24 percent while other states in the region achieved rates of increase up to 150 percent.

The study was directed toward the testing of three primary hypotheses in an attempt to determine some of the causes of this lag.

The first hypothesis tested was the relationship between changes in net income and trends in farm size in terms of gross sales and acreage. The measure of relationship between increases in gross income and increases in net income was determined by rank correlation and found to be +.98. States having the largest increases in the index of total production of all eight enterprises had a rank correlation of +.48 to the states having the largest increases in net income.

Shift analysis provided further evidence of the relationship between net and gross. Those states having larger than average increases in almost all of the eight enterprises tended to be the same states having large increases in income.

The trend in farm size distribution in terms of land area per

farm was found to be related to changes in net income. The rank correlation between the decrease in number of farms and the increase in income was $+0.76$ and the rank correlation between the increase in average farm size and the increase in income was $+0.71$.

The relationship between the trend in farm cost as a percent of gross and changes in net income served as the second hypothesis under investigation. The correlation between increases in the percentage of gross taken up by cost and income increases was -0.79 .

The third hypothesis tested was the shift in the combination of crop and livestock products and the relationship between these shifts and income change. The rank correlation coefficients between various enterprise increases and income increases were as follows: hogs, -0.12 ; dairy, -0.59 ; poultry, $+0.53$; beef, -0.43 ; corn, $+0.12$; soybeans, $+0.29$; tobacco, -0.09 ; and cotton, $+0.77$. Soybeans and poultry were the two commodities having the highest percent increases in number of units per farm and thus were responsible for a large part of farm enterprise expansion.

Shifts in product mix and farm size were determined by comparing the northern and southern states in the study area. The northern states had the slowest rates of income increase, the largest total acreage of tobacco and, in general, the smallest increases in farm size. There was a -0.46 correlation between tobacco and acres per farm in the regression analysis. The southern states had the largest increases in income as well as the largest total acreage of cotton and the largest increases in the combined index of poultry and soybeans. Moreover, these three enterprises along with feed grains were the four leading enterprises in

increases in production per man hour in the 1954-1964 period. Increases in these enterprises aided in increasing returns per man and per farm. The southernmost states also had a geographic advantage over the northern Appalachian area in the expansion into the high return row crops.

Shift analysis was used as a descriptive technique to measure the rates of change in income and in enterprise structure. Those states that had greater than average increases in the enterprises that had large increases in production per man hour were the same states having large increases in income. These were also the states having large increases in those enterprises highly correlated to income increases.

In looking at Tennessee as an individual state, the data revealed that the three enterprises in which it had its three highest ranking increases were tobacco, hogs and beef. These three enterprises were negatively correlated to income increases and possessed the smallest increases in production per man hour of the eight major enterprises. The four enterprises that Tennessee had low ranking increases in were corn, cotton, dairy and poultry. These four enterprises, with the exception of dairy, had large increases in production per man hour and were positively associated with income increases.

Stepwise regression analysis produced the following equation from cross-sectional time series data for the study region:

$$Y = 73.08 + 340.11X_1 + 654.41X_2 + 92.19X_3 + 120.52X_4 + 71.06X_5 \\ + 34.72X_6 + 23.29X_7$$

The R^2 for the equation was .83 and the standard error of the estimate was \$202.30. Poultry was the variable responsible for the

greatest reduction in the error sum of squares and was also the variable exhibiting the highest correlation to income. Tobacco and soybeans were the other two variables responsible for large reductions in the error sum of squares.

II. CONCLUSIONS

The cause of Tennessee's lag in its rate of increase in net income per farm is due to many factors. From the observations of resource and enterprise movements presented in this study, the following causes appear to have influenced Tennessee's slow rate of net income increase:

1. Most important is the fact that Tennessee did not increase its gross returns per farm. This is evidenced by its slowest rate of increase in gross receipts per farm of any state and is influenced by its slow increase in farm size. It is also influenced by Tennessee's slow decrease in number of farms and particularly farms grossing less than \$2,500.
2. This slow rate of growth has been coupled with the largest increase, of any state, in the percent that cost takes of gross receipts.
3. Enterprise shifts in Tennessee have moved generally toward small increases in those enterprises that were experiencing rapidly increasing returns per man hour and rapid increases in enterprises that experienced the smallest increases in returns per man hour.
4. Tennessee lies in the northern portion of the study area,

which did not experience the expansion in farm size and shift in enterprises that the southern area did. The four northern states possessed the smallest increases in income and the largest total acreage of tobacco, thus, indicating that tobacco, which has not experienced the labor saving technological advancement of other crops, may act as an inhibitor to expansion of farm size and farm enterprise. This influence, along with the lack of suitable land for the expansion of row crops in the Appalachian area may have tended to limit shifts in this direction. The southern area, geographically suited to row crops, experienced a quite rapid increase in the measures used to indicate farm growth. The rapid technological improvements in cotton, poultry, and soybeans tended to reduce labor requirements and stimulate the growth process through the expansion of farm size and farm enterprises.

5. The enterprise shifts in Tennessee have been away from those enterprises which were correlated to income increases and toward those enterprises that were not correlated to income increases.

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