To the Graduate Council:

I am submitting herewith a thesis written by Robert Harrison Neal entitled "The Economic Importance of Agricultural Production in Selected Rural Persistent Poverty Counties in Tennessee." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

William M. Park, Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Vice Provost
and Dean of The Graduate School

The Economic Importance of Agricultural Production in Selected Rural Persistent Poverty Counties in Tennessee

A Thesis

Presented for the

Master of Science Degree

The University of Tennessee, Knoxville

Robert Harrison Neal

August 1990

AG-VET-MED.
THESIS
90
.N325

ACKNOWLEDGEMENTS

The author wishes to express sincere appreciation to Dr. William Park for his guidance and constructive criticism throughout this study. Special thanks must be extended to Dr. Burton English for providing access to and instruction in the use of the IMPLAN I/O model. Additionally, appreciation is expressed to Dr. Charles Cleland for his constructive criticism and editorial review.

Gary Cole and Robert Alexander provided invaluable assistance with IMPLAN and other computer applications necessary to this study. Special thanks goes to Dr. Robert Goodman for his painfully honest editorial review of the early drafts of this study.

Finally, this manuscript is dedicated to my wife who provided the support and inspiration that made it all worthwhile.

ABSTRACT

It has been suggested that the agricultural sector has little potential as an instrument for rural economic development in Tennessee. However, many persistent poverty counties in Tennessee have relatively large agricultural sectors. Therefore, agriculture may have a greater impact on the economies of rural persistent poverty counties than on the economies of other rural counties. This study estimated the indirect and induced income and employment effects generated by production of agricultural commodities in selected rural persistent poverty counties in Tennessee.

These rural persistent poverty counties were grouped into relatively self-contained economic regions based on similarity of enterprise mix, spatial proximaty, and transportational routes. Type I and Type III income and employment multipliers were estimated for each of these regions using the IMPLAN input/output model. Indirect and induced income and employment effects were derived from these multipliers.

The Type I income multipliers ranged from a low of 1.47 in TPPR 6 to a high of 1.77 in TPPR 4 while Type III income multipliers ranged from 2.12 in TPPR 1 to 2.83 in TPPR 4. The Type I employment multipliers ranged from a low of 1.25 in TPPR 6 to a high of 1.46 in TPPR 1 while Type III

employment multiplier ranged from 1.61 in TPPR 6 to 1.80 in TPPR's 1 and 2.

The results generated by this study indicate that rural persistent poverty counties which are proximate to major metropolitan areas do not generate as much indirect or induced income or employment from agricultural production as rural persistent poverty counties which have no neighboring major metropolitan areas. Contrary to hypotheses of the study, average farm size and amount of cash receipts were not found to be correlated with the Type I or Type III income and employment multipliers or the indirect or induced income or employment effects.

The income and employment multipliers generated by this study represent the additions to income and employment that would accrue _if_ demand for agricultural commodities produced in the study area were increased by one dollar. Additional information concerning the ability of persistent poverty counties to respond to increased agricultural demand is needed before economic development decisions can be made. Furthermore, the size of the multipliers generated by agricultural production relative to multipliers in other industrial sectors must be evaluated. Finally, the effects of governmental agricultural programs must be appraised when agricultural production is considered as an economic development option.

TABLE OF CONTENTS

CHAPTER		PAGE
1.	Introduction	1
	Objectives	5
2.	Input/Output Methodology	8
	Limitations of the IMPLAN Model	10
	Indicators of Economic Importance	13
3.	Designation of the Study Area	18
	West Tennessee Counties	23
	East Tennessee Counties	28
4.	Results of the Input/Output Analysis	37
	The Income Multipliers	38
	The Employment Multipliers	41
	Comparison with Previously Estimated Income and Employment Multipliers	44
5.	Interpretation of Results	47
	Income and Employment Effects and the Influence of Farm Size	50
	Income and Employment Effects and the Influence of Average Annual Cash Receipts Per Farm	52
	Income and Employment Effects and the Influence of Enterprise Mix	54
	The Induced Income and Employment Effects	62

CHAPTER	PAGE
6. Conclusions	65
Summary	65
Policy Implications	69
Impacts of Governmental Agricultural Programs and Policies	72
Further Research	74
Bibliography	77
Appendixes	80
Appendix 1	81
Appendix 2	118
Vita	121

LIST OF TABLES

TABLE		PAGE
1.	Weighted Income Multipliers for Agricultural Production by Region.	39
2.	Indirect and Induced Income Effects from Agricultural Production by Regions.	40
3.	Weighted Employment Multipliers for Agricultural Production by Regions.	42
4.	Indirect and Induced Employment Effects from Agricultural Production by Regions.	43
5.	The Number of Industrial Sectors Identified by the IMPLAN Model in Each of the Regions.	49
6.	Average Acres Per Farm and Indirect and Induced Income Effects by Region.	51
7.	Average Acres Per Farm and Indirect and Induced Employment Effects by Region.	53
8.	Average Cash Receipts Per Farm and Indirect and Induced Income Effects by Region.	55
9.	Average Cash Receipts Per Farm and Indirect and Induced Employment Effects by Region.	56
10.	Percent of Cash Receipts from Crop and Livestock Enterprises and Indirect and Induced Income Effects by Region.	58
11.	Percent of Cash Receipts from Crop and Livestock Enterprises and Indirect and Induced Employment Effects by Region.	60
12.	Total Income Earned from Agricultural Production by Region, 1986.	66
13.	Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 1.	81
14.	Weighted Type I Income Multiplier for TPPR 1.	82
15.	Weighted Type III Income Multiplier for TPPR 1.	83

TABLE PAGE

16. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 1. 84

17. Weighted Type I Employment Multiplier for TPPR 1. 85

18. Weighted Type III Employment Multiplier for TPPR 1. 86

19. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 2. 87

20. Weighted Type I Income Multiplier for TPPR 2. 88

21. Weighted Type III Income Multiplier for TPPR 2. 89

22. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 2. 90

23. Weighted Type I Employment Multipliers for TPPR 2. 91

24. Weighted Type III Employment Multiplier for TPPR 2. 92

25. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 3. 93

26. Weighted Type I Income Multiplier for TPPR 3. 94

27. Weighted Type III Income Multiplier for TPPR 3. 95

28. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 3. 96

29. Weighted Type I Employment Multiplier for TPPR 3. 97

30. Weighted Type III Employment Multipliers for TPPR 3. 98

31. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 4. 99

TABLE		PAGE
32.	Weighted Type I Income Multiplier for TPPR 4.	100
33.	Weighted Type III Income Multiplier for TPPR 4.	101
34.	Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 4.	102
35.	Weighted Type I Employment Multiplier for TPPR 4.	103
36.	Weighted Type III Employment Multiplier for TPPR 4.	104
37.	Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 5.	105
38.	Weighted Type I Income Multiplier for TPPR 5.	106
39.	Weighted Type III Income Multiplier for TPPR 5.	107
40.	Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 5.	108
41.	Weighted Type I Employment Multiplier for TPPR 5.	109
42.	Weighted Type III Employment Multiplier for TPPR 5.	110
43.	Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 6.	111
44.	Weighted Type I Income Multiplier for TPPR 6.	112
45.	Weighted Type III Income Multiplier for TPPR 6.	113
46.	Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 6.	114
47.	Weighted Type I Employment Multiplier for TPPR 6.	115
48.	Weighted Type III Employment Multiplier for TPPR 6.	116

LIST OF FIGURES

FIGURE		PAGE
1.	Nonmetropolitan Persistent Poverty Counties in Tennessee.	2
2.	Percentage of Income Earned by Farming in Persistent Poverty Counties in Tennessee.	5
3.	Geographic Distribution of Rural Persistent Poverty Counties in Tennessee.	19
4.	Three Isolated Rural Persistent Poverty Counties (Monroe, Cocke, and Johnson) in East Tennessee.	20
5.	Grundy County, the forth isolated Rural Persistent Poverty County in Tennessee.	21
6.	West Tennessee Rural Persistent Poverty Counties.	23
7.	Average Acres Planted in Selected Rural Persistent Poverty Counties in Tennessee, 1983 - 1988.	25
8.	Average Livestock Numbers for Western Rural Persistent Poverty Counties in Tennessee, 1986 - 1988.	26
9.	Selected East Tennessee Rural Persistent Poverty Counties.	29
10.	Cash Receipts for Selected Livestock Enterprises in Selected Eastern Rural Persistent Poverty Counties, 1987.	31
11.	Cash Receipts for Selected Crop Enterprises in Selected Eastern Rural Persistent Poverty Counties, 1987.	34
12.	Selected Rural Persistent Poverty Counties in Tennessee by Regions.	36
13.	Percent of Cash Receipts Generated by Crop and Livestock Enterprises in Six Tennessee Persistent Poverty Regions (TPPR's).	57

CHAPTER 1

Introduction

Deavers and Long stated in Economic Prospects for Tennessee's Future, "Agriculture continues to have a significant economic and social role in non-metro Tennessee, but is by no means the economic engine driving the State's rural economy." (Deavers and Long p. 32) The manufacturing and service sectors of the Tennessee economy are each responsible for greater employment and more income than the agricultural sector. However, agricultural production may be more important in the economies of the poorest rural counties of Tennessee than is implied by Deavers and Long.

In Procedures for Developing a Policy Oriented Classification of Nonmetropolitan Counties, Ross and Green classified 27 rural counties in Tennessee as being characterized by persistent poverty (Ross and Green). These counties, listed in Figure 1, were so classified because each reported per capita incomes in the bottom quintile of all rural counties in the United States in four time periods (1950, 1959, 1969, and 1979). The Ross and Green nonmetropolitan classification has been widely cited in United States Department of Agriculture publications and other related literature.

Bledsoe	Grainger	Lewis
Campbell	Grundy	Monroe
Chester	Hancock	Morgan
Claiborne	Hardeman	Overton
Clay	Hardin	Perry
Cocke	Haywood	Pickett
Cumberland	Jackson	Scott
Fayette	Johnson	Van Buren
Fentress	Lauderdale	Wayne

Figure 1. Nonmetropolitan Persistent Poverty Counties in Tennessee.

Historically, these persistent poverty counties have experienced low per capita incomes, low rates of economic growth, and high rates of unemployment (Center for Business and Economic Research (CBER), 1969 - 1988). These indicators of economic well-being (income, employment, and growth) are all heavily influenced by the underlying economic structure of the area under investigation.

According to Cocheba, Gilmer, and Mack, service sector employment growth in the Tennessee Valley was almost nonexistent from 1959 to 1979 (Cocheba, Gilmer, and Mack). The service sector growth that was observed in predominantly rural counties occurred overwhelmingly in low paying,

consumer services (restaurant, hotel/motel, recreation, etc.) rather than higher paying, producer services (accounting and financial services, data processing, etc.). Miller and Bluestone argued: "Location theory suggests that consumer services, such as retail stores, restaurants, and auto repair shops, will be distributed in relation to population, whereas 'advanced' producer services, such as data processing and other business services which can market over large areas, will tend to locate in metropolitan areas." (Miller and Bluestone p. 29) In addition, according to Cocheba, Gilmer, and Mack, a major reason for low service sector employment in the, predominantly rural, Tennessee Valley region is the relatively low income in the region. Due to their low population densities and low incomes, rural counties have not captured any significant portion of the economic benefits from the service sector expansion that has reportedly occurred in Tennessee over the past ten years.

Deavers and Long reported that, "Nearly 80 percent of Tennessee's nonmetro employment was in the 51 counties dependent on manufacturing for 25 percent or more of labor and proprietor income in 1979, and almost 85 percent of Tennessee's rural manufacturing employment was in these counties." (Deavers and Long p. 34) However, Ross and Green observed that in Tennessee no manufacturing dependent rural counties were also persistent poverty counties (Ross and Green). This would indicate that much of the manufacturing

employment in rural counties was outside rural persistent poverty counties. Only about 15 percent of the manufacturing employment in rural counties in Tennessee takes place in rural persistent poverty counties. Because of this low percentage in manufacturing employment, expansion in the Tennessee manufacturing sector since 1981 has had less impact on these rural persistent poverty counties than on the rest of the rural counties in Tennessee.

Rural persistent poverty counties in Tennessee have a greater percentage of their economies tied to agriculture than the State as a whole. Rural persistent poverty counties are even more agriculturally dependent than the average rural county in Tennessee. As shown in Figure 2, in the 1981-86 period, income from farming represented 4.1 percent of all income earned in the State, but 6.4 percent of all income earned in rural persistent poverty counties. In eight rural persistent poverty counties in Tennessee, more than 10 percent of all income was earned from farming during this period. This evidence indicates that even though agriculture may not be "the economic engine driving the State's rural economy," it still has significant impacts on the economies of many rural persistent poverty counties.

Bledsoe	4.2	Grainger	19.0	Lewis	2.5
Campbell	1.8	Grundy	18.0	Monroe	5.6
Chester	3.1	Hancock	33.1	Morgan	7.2
Claiborne	11.1	Hardeman	3.1	Overton	9.2
Clay	10.9	Hardin	5.3	Perry	11.4
Cocke	4.5	Haywood	5.0	Pickett	8.1
Cumberland	3.3	Jackson	15.2	Scott	1.5
Fayette	9.1	Johnson	9.7	Van Buren	15.4
Fentress	4.2	Lauderdale	2.8	Wayne	6.6

Average for all Persistent Poverty Counties	6.4
Average for all Counties in the State	4.1

Source: Local Area Personal Income 1981-86
U.S. Department of Commerce.

Figure 2. Percentage of Income Earned by Farming in Persistent Poverty Counties in Tennessee.

Objectives

Deavers and Long reported in Economic Prospects for Tennessee's Future, "It is important not to confuse a strategy for the development of the state's agricultural sector with a plan for rural economic development."(Deavers and Long p. 30) In light of this view concerning agricultural links to rural economic development, what impacts does agricultural production have on the economies of rural counties, particularly rural persistent poverty

counties? The specific objectives of this study are therefore:

a) to construct regions that are composed of persistent poverty counties, sufficiently similar in production and trade patterns, such that they are definable as relatively self-contained, functional economic units,
b) estimate the value of production for agricultural commodities in these persistent poverty county regions, and
c) estimate the income and employment multipliers for each agricultural industry in each region and the weighted income and employment multipliers for all agricultural production in each region.

Input/output (I/O) analysis was chosen as the tool to be used in this investigation of the impacts of agricultural production within the economies of rural persistent poverty counties in Tennessee. Regional input/output (I/O) analysis is frequently used to measure the contributions of an industry or industrial sector to a local economy. In this study the impacts on income and employment attributable to the agricultural sector in a given study region will be estimated. However, regionalization of the counties, selection of a measurement tool, and development of a

weighting mechanism are all tasks which must be completed prior to an empirical estimation of income and employment effects. The IMPLAN input/output model and the selected weighting mechanism are discussed in detail in Chapter 2. Regionalization of the counties is detailed in Chapter 3. Empirical results and their interpretation are discussed in subsequent chapters.

CHAPTER 2

Input/Output Methodology

This study attempts to quantify the direct, indirect and induced impacts of the agricultural sector on selected rural persistent poverty counties in Tennessee using input/output analysis. This technique examines the ways in which the economic sectors are linked with each other and to final demand (household consumption, government purchases, private capital formation, and exports). Input/output analysis is also used to estimate the direct, indirect, and induced contributions of industries and sectors to the overall economy in the region.

Input/output analysis is based on the principle that industries purchase inputs from other industries and sell output to other industries, households, and government. Thus, any economic activity in one sector has impacts in several other sectors within any given region. For example, when farmers purchase inputs (chemicals, machinery, services), income and employment in other sectors is created and can be indirectly attributed to the agricultural production sector.

Input/output (I/O) models can be constructed in three ways. They can be based on primary data from surveys of local or regional economies; they can be built using

secondary data from previously published studies; or, they can be constructed using some combination of these two data sources. Many regional economists feel that primary data (survey models) are significantly more accurate than secondary data (non-survey) models. However, if the study area is large (three or more counties), the cost of collecting the necessary data for a primary data model can be prohibitive. Klindt and Smith conducted a primary data, I/O study in 1974 which examined a three county area in Tennessee (Claiborne, Overton, and Pickett Counties). They recognized that, "Because of data requirements, input-output analysis has a relatively high cost."(Klindt and Smith p. 8) Secondary data source I/O models are less costly to use, but are believed to produce results that are less accurate than those generated by primary data models. According to Lofting,"... professional opinion varies from the firm opinion that an exhaustive field survey is necessary to obtain meaningful results, to that being cautiously optimistic that national variables applied to a region may yield sufficiently valid results to be of considerable use in planning policies." (Lofting p. 306) However, because of the non-stochastic nature of I/O models in general, it is not presently possible to determine whether primary data models or secondary data models generate more accurate results (Radtke, Detering, and Brokken).

This study uses the Micro-IMPLAN input/output model developed by the U. S. Forestry Service. IMPLAN is composed of Bureau of Economic Analysis (BEA) national-level technical coefficients for 1982, detailing the economic links between industries and regional estimates of total gross output, final demand, final payments, and employment. By using U. S. Department of Commerce County Business Patterns Data, IMPLAN adapts this national-level data to fit the economic make-up and estimated inter-sectorial relationships at the county level. The results generated by this input/output model make it possible to quantify the additions to income and employment attributable to agricultural production in rural persistent poverty counties in Tennessee.

Limitations of the IMPLAN Model

The IMPLAN I/O model, like all other static I/O models, contains a number of restrictive assumptions that may limit the conclusions drawn from generated figures. To reduce the transaction table to a manageable size, individual firms are aggregated into industries based on similarity of production process and output. Furthermore, each industry is assumed to produce a single homogeneous product using a constant, linear production function. A constant, linear production function removes complications from the model that arise

from economies of scale and input substitution that occur in reality. Assuming a linear production function exists for every industry is an obvious departure from reality and creates an opportunity for the model to generate results that are not likely to occur in the real world. Static I/O models also assume that trade relationships and relative prices remain unchanged. Lastly, resources are assumed to be unlimited. These assumptions appear to be naive, however, they are instrumental in making the model empirically implementable. Furthermore, "...for many purposes they predict reasonably well." (Richardson p. 9)

Some assumptions are specific to the IMPLAN model, but not to static I/O models in general. IMPLAN assumes that additional labor requirements in the study region are satisfied by in-migration of households and that each member of the household will consume at the average rate of consumption, as defined by a previously designated consumption vector. This assumption forms the basis for the use of Type III, rather than Type II, multipliers (Olson).

Type II multipliers estimate induced effects by assuming a linear relationship exists between income and consumption. Population is assumed stable, therefore an increase in output will result in an increase in income and a proportional increase in household consumption.

Type III multipliers estimate induced effects based on changes in employment and population. Direct and indirect

effects are first converted to changes in employment based on each industry's employment-to-output ratio. Population change is estimated by use of the region's population to employment ratio. Population change is then multiplied by the region's average per-capita consumption rate to estimate the region's additional consumption due to the initial change in final demand. This procedure is subjected to an iterative process, capturing successive rounds of induced effects, until population change is less than 10 people (Olson). Miernyk states that Type III multipliers are typically five to fifteen percent smaller than Type II multipliers (Richardson).

There are several further considerations that must be addressed. First, the IMPLAN model is a secondary data model, composed of national level data that has been adjusted to the region's economic make-up. If actual regional level technical coefficients are significantly different from national level technical coefficients, the model will generate inaccurate results. In this study the assumption has been made that regional level technical coefficients are sufficiently similar to the national level technical coefficients to eliminate any significant error. The second issue that must be addressed deals with economic changes over time. The IMPLAN model was constructed using 1982 data. If technological changes since 1982 have been sufficiently great, the model may no longer be generating

accurate results. Although some technological improvements have obviously been made since 1982, the assumption has been made in this model that the national and regional technical coefficients in 1987 are sufficiently similar to the 1982 coefficients to avoid significant inaccuracies. Finally, IMPLAN assumes that inputs of production for each industry are obtained from within the region until stocks are exhausted. However, due to differences of quality, price, and many other factors, industries often purchase inputs outside the local economy even when these inputs are available locally. Therefore, to the extent that industries in the study region are obtaining locally available inputs from suppliers outside the study region, income and employment multipliers may be overstated.

Indicators of Economic Importance

The IMPLAN input/output model is used to estimate the importance of agriculture in each region in terms of income and employment. These indicators, income and employment, were chosen because, in the final analysis, they are the most fundamental indicators of economic importance to the workers and residents of the study area. Static input/output (I/O) analysis calculates direct, indirect, and induced effects by industry for a given study area. Direct effects are the result of additional production necessary to

satisfy increased final demand. Static (I/O) analysis in general and IMPLAN specifically are demand driven. Indirect effects result from increased production and sales of inputs needed in primary production. Induced effects are due to additional consumption made possible by increased income. This increase in income is generated by additional primary production (the direct effect) and additional production and sales of production inputs (the indirect effect).

The impacts on income and employment that result from an increase in final demand are measured in terms of multiplier effects. A unit increase in final demand results in a total increase in income and employment equal to its multiplier. According to Richardson, "The output multiplier (Type I) for industry (i) simply measures the sum of direct and indirect requirements from all sectors needed to deliver one additional dollar of output of (i) to final demand." (Richardson p. 32) The Type I output multiplier is derived by summing the direct and indirect effects and then dividing by the direct effect.

$$\frac{D_i + I_i}{D_i}$$

Where D_i is the direct effect in industry i and

I_i is the indirect effect in industry i.

The Type I income multiplier,"... is expressed as the ratio of the direct plus the indirect income change to the direct income change resulting from a unit increase in final demand for any given sector." (Richardson p. 32) In addition, Richardson states, "The employment multiplier (Type I) analogous to the Type I income is the ratio of this direct plus indirect employment change to the direct employment change." (Richardson p. 35)

The Type III multiplier, derived by Miernyk, represents the ratio of the sum of direct, indirect, and induced changes to the direct change which is due to a unit change in final demand:

$$\frac{D_i+I_i+In_i}{D_i}$$

Where D_i is the direct effect in industry i,

I_i is the indirect effect in industry i, and

In_i is the induced effect in industry i.

The Type III income multiplier represents "... the ratio of the direct, indirect, and induced income change to the direct income change due to a unit increase (change) in final demand." (Richardson p. 33) The Type III employment multiplier represents the ratio of the direct, indirect, and induced employment change to the direct employment change

and provides a measure of the total number of jobs created per additional job created directly (Olson).

The IMPLAN I/O model generates Type I and Type III income and employment multipliers for each industry in the study area (region). The multipliers generated by IMPLAN are simple (unweighted) estimates for each industry and provide information specific and applicable only to that industry in that region. However, the focus of this study is on the aggregate importance of all agricultural production in a given region, therefore, the agricultural production industries in each region will be aggregated into a single category. To avoid, as much as is possible, aggregation errors which are caused by aggregating industries within the IMPLAN model, income and employment multipliers will be generated in an unaggregated state and then aggregated on a spreadsheet. Before aggregation, the multipliers for each industry in the region are weighted based on the value of their cash receipts for 1987. The weights for each industry are derived by dividing the value of cash receipt for that industry (i) by the sum of the cash receipts for all agricultural industries in the region:

$$\frac{W_i}{\Sigma W}$$

Where W_i is the value of the cash receipts in industry i and

ΣW is the value of all agricultural cash receipts.

The Type I income and employment multipliers for agriculture in each region are expressed as the sum of the weighted multipliers for each industry (i) in that region:

$$\sum_{i=1}^{n}\left[\left(\frac{D_i+I_i}{D_i}\right)\frac{W_i}{\Sigma W}\right]$$

And, the Type III income and employment multipliers for agriculture in each region are expressed as the sum of the weighted multipliers for each industry (i) in that region:

$$\sum_{i=1}^{n}\left[\left(\frac{D_i+I_i+In_i}{D_i}\right)\frac{W_i}{\Sigma W}\right]$$

In each case, income and employment, the direct effect equals 1, indicating 1 dollar of income earned or 1 job created directly. The indirect effect is derived by subtracting the direct effect (1) from the Type I multiplier. And, the induced effect is derived by subtracting the Type I multiplier (which is the direct effect plus the indirect effect) from the Type III multiplier (which is the sum of the direct, indirect, and induced effects).

The merits and limitations of input/output analysis have been discussed and a weighting scheme has been developed. However, regionalization of the counties into reasonably self-contained economic units must also be accomplished before empirical results are estimated. This procedure is discussed in Chapter 3.

CHAPTER 3

Designation of the Study Area

Designation of the study area (regions and sub-regions) is very important. If the model is to paint an accurate picture of the economic structure of the study area, regions and sub-regions must be constructed such that they include all important economic and geographic actors. Richardson says that it is fundamentally important to include within any given regional or sub-regional boundary homogeneous areas of production, supply, and consumption (Richardson). However, designation of the study area (the region or sub-region) must be done with the objectives of the study in mind. The objectives of this study are the estimation of economic impacts accruing to rural persistent poverty counties due to the demand for and production of agricultural commodities. Therefore, the regions and sub-regions should be constructed with agricultural production and input supply boundaries in mind.

The geographic distribution of rural persistent poverty counties in Tennessee is shown in Figure 3. Nine of these counties are in West Tennessee, 3 are in extreme East Tennessee, and the remaining 15 are clustered in an area encompassing both Upper East Tennessee and the rim of the Cumberland Plateau. Four rural persistent poverty counties

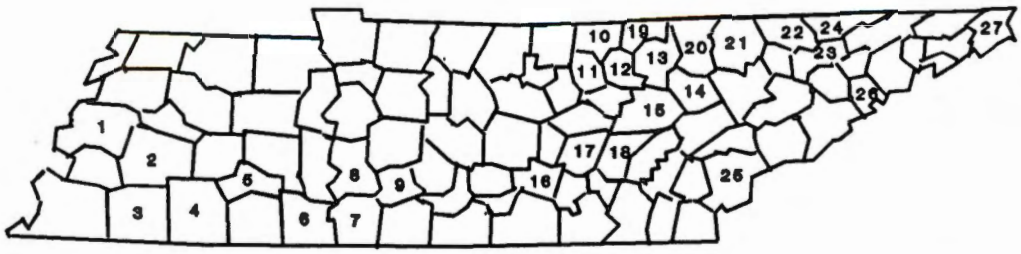

Figure 3. Geographic Distribution of Rural Persistent Poverty Counties in Tennessee.

in Tennessee (Grundy, Morgan, Cocke, and Johnson) are somewhat isolated from all other counties so designated. Morgan, Cocke, and Johnson Counties, shown in Figure 4, neither border nor have any significant economic ties with any other persistent poverty counties in Tennessee. Due to their isolation, they can not be incorporated into definable regions including other persistent poverty counties. Each of these counties must therefore be examined as regions unto themselves. However, to do so would violate rational economic guidelines for delineation of study areas in input/output analysis.

Grundy County, located on the southeastern rim of the Cumberland Plateau, is the fourth isolated rural persistent

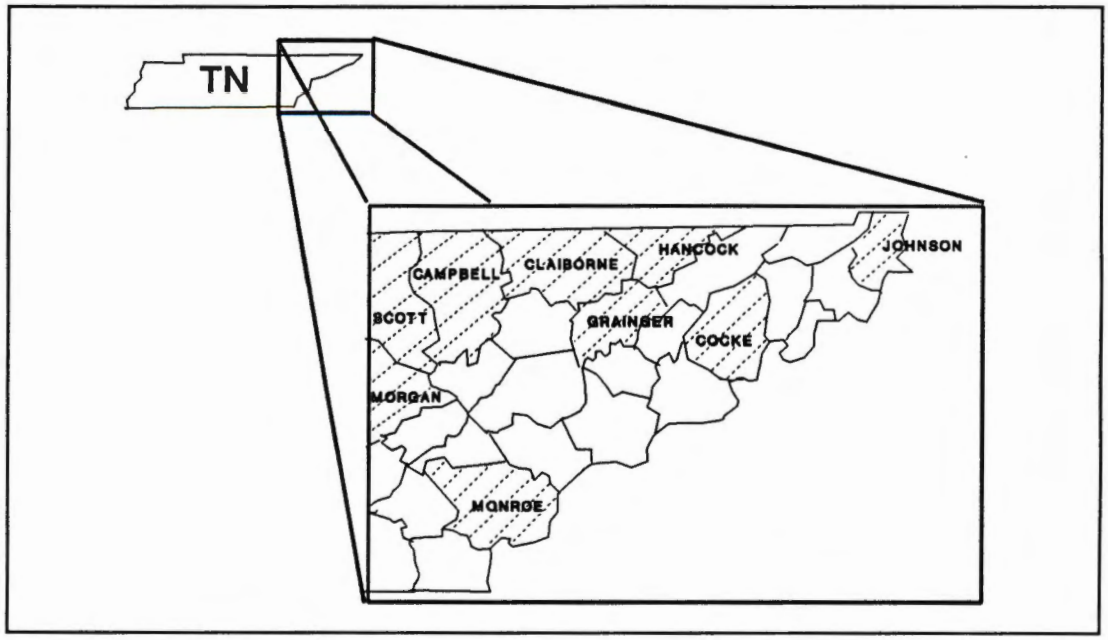

Figure 4. Three Isolated Rural Persistent Poverty Counties (Monroe, Cocke, and Johnson) in East Tennessee.

poverty county in this study. Although casual observation indicates that Grundy County, shown in Figure 5, is in close proximity to Van Buren and Bledsoe Counties, (two other rural persistent poverty counties) Grundy County has neither direct transportational access nor significant economic ties to either of these of counties.

Richardson states that input/output study areas, "...should not cut across local economic structure." (Richardson p. 87) The boundaries of the study area should avoid including only a fraction of a major industrial sector's local economic activity. For example, in designating a study area, care should be taken to avoid constructing boundaries that include only half of a crop growing or livestock producing region. Monroe, Cocke,

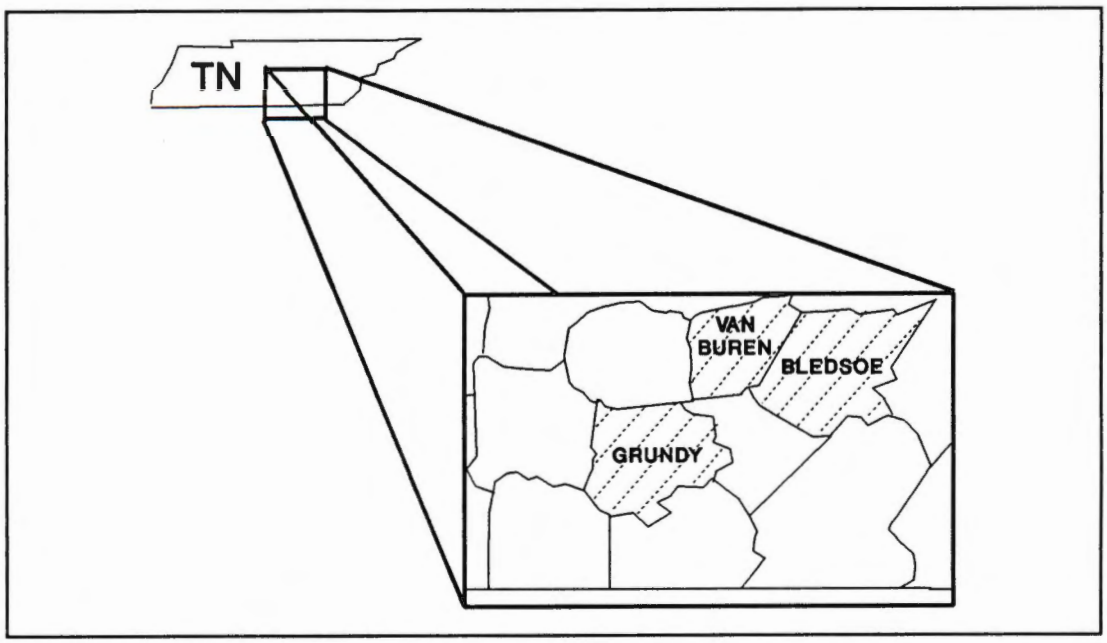

Figure 5. Grundy County, the forth isolated Rural Persistent Poverty County in Tennessee.

Johnson, and Grundy Counties, all isolated rural persistent poverty counties in Tennessee, do not qualify as reasonably self contained economic units. Each of these counties is only a portion of a larger crop or livestock producing region and must therefore be incorporated with other economically similar surrounding counties if any meaningful results are to be produced. These counties (Monroe, Cocke, Johnson, and Grundy) are thus not included in this investigation of the economic impacts on rural persistent poverty counties in Tennessee.

As is evident from the geographic distribution of the remaining rural persistent poverty counties, an obvious east/west division exists. Because there are vast differences (in soil productivity, crop and livestock

enterprises, access to markets and transportation networks) between West Tennessee counties and East Tennessee counties, this division makes regionalization of the counties somewhat easier. West Tennessee land is generally flat, with relatively fertile soils, while much of the land in eastern rural persistent poverty counties is steeply sloped and only marginally productive (Mundy and Gray). Soybeans and cotton are important crops in West Tennessee persistent poverty counties and the production of hogs is the dominant livestock enterprise. In East Tennessee persistent poverty counties, soybeans cover far fewer acres, cotton is nonexistent, and, although hog and dairy operations are common, the dominant livestock enterprise is beef cattle production. Intuitively, western and eastern counties will be regionalized using different criteria. Similarity of economic enterprises is a necessary condition for the grouping of counties into regions, however, it is not a sufficient condition. These economically similar counties must also be connected by a network of roads, railroads, and/or waterways. Without transportational access to input suppliers and markets in surrounding counties, no economic interaction will take place. Therefore, regionalization of counties must be based on both similarity of economic enterprises and the presence of adequate transportational access.

West Tennessee Counties

As can be seen in Figure 6, the nine West Tennessee persistent poverty counties stretch from the Mississippi River east, lying mainly along the southern boarder of

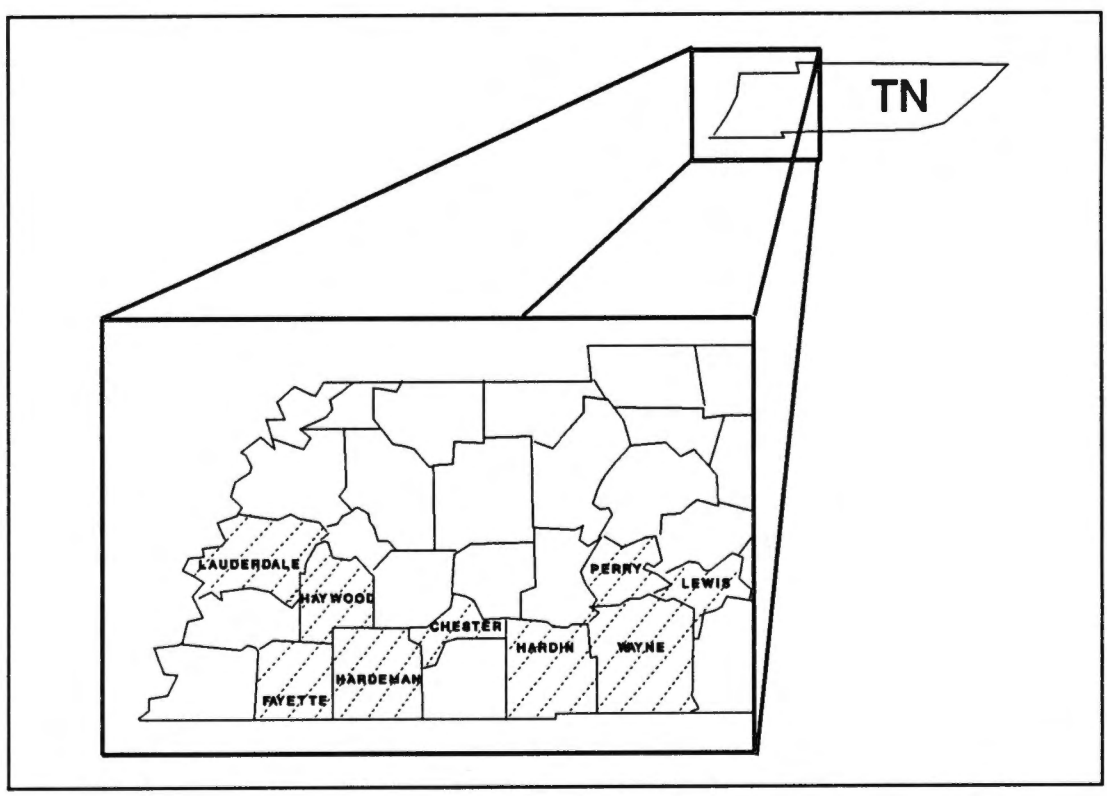

Figure 6. West Tennessee Rural
Persistent Poverty Counties.

Tennessee. Although these counties are agriculturally quite diverse, they can be divided into two regions based on their mix of agricultural enterprises, levels of production and transportational interconnection. Lauderdale and Haywood counties reported agricultural cash receipts of $30.8 million and $39.1 million, respectively, for 1986 (CBER).

In each of these two counties, greater than 90 percent of their cash receipts came from the marketing of crops (principally soybeans and cotton). Fayette County reported agricultural cash receipts for 1986 totalling $74.3 million (CBER). Approximately 65 percent of Fayette County's cash receipts were generated by the production and sale of livestock (principally hogs). Fayette County is also the 8th largest producer of soybeans and the 3rd largest producer of cotton in Tennessee (Tennessee Agricultural Statistics, 1988). Hardeman County reported agricultural cash receipts of $16.3 million for 1986 (CBER). Crop production (most notably soybeans and cotton) generated about 64 percent of these cash receipts and livestock production (beef cattle and hogs) was responsible for approximately 36 percent.

These counties (Lauderdale, Haywood, Fayette, and Hardeman) are major agricultural producers in the sub-set of western rural persistent poverty counties and, based on agricultural cash receipts, are significantly different from all other western rural persistent poverty counties, except Hardin County. As shown in Figure 7, these counties have significantly more acres in soybeans and cotton, two major West Tennessee crops, than do other western rural persistent poverty counties. They are adjacent to each other and are also connected by several highways (Interstate 40 and State Highways 19, 57, 64, and 76). Based on these

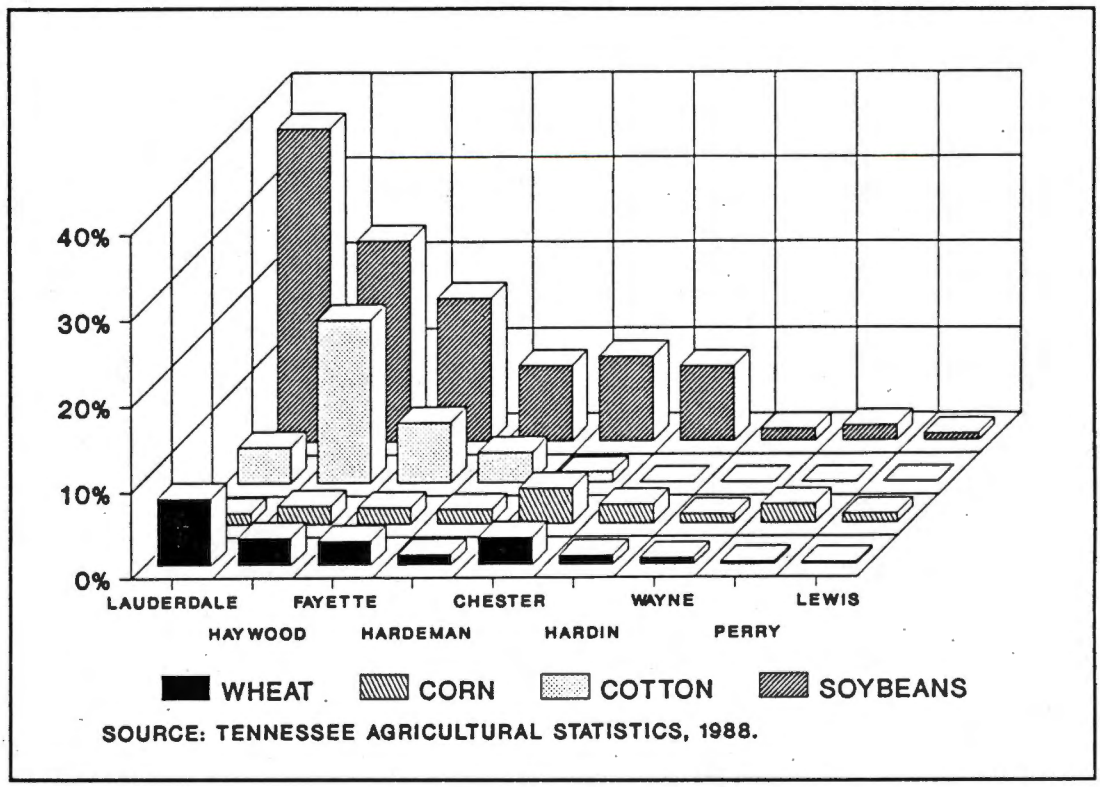

Figure 7. Average Acres Planted in Selected Rural Persistent Poverty Counties in Tennessee, 1983 - 1988.

considerations, Lauderdale, Haywood, Fayette, and Hardeman Counties are grouped into a single region designated Tennessee Persistent Poverty Region 1 (TPPR 1).

Hardin County reported agricultural cash receipts totaling $16.3 million for 1986; 71 percent from the marketing of livestock (primarily hogs and beef cattle) and the remaining 29 percent from the marketing of crops (mostly soybeans) (CBER). As shown in Figure 8, Hardin County is the second largest producer of hogs among western rural persistent poverty counties. Wayne County producers generated agricultural cash receipts totaling $7.4 million

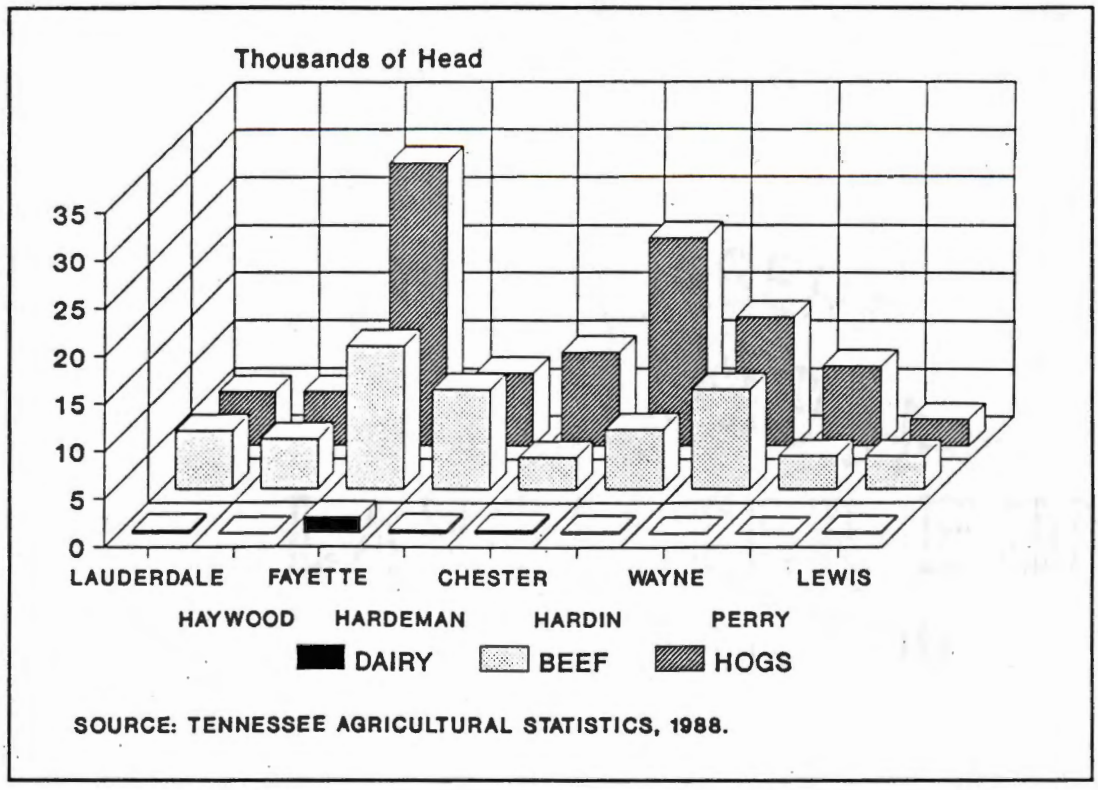

Figure 8. Average Livestock Numbers for Western Rural Persistent Poverty Counties in Tennessee, 1986 - 1988.

for 1986; approximately 85 percent from the sale of livestock (hogs and beef cattle) and about 15 percent from crop sales (soybeans and corn). For 1986, Perry and Lewis Counties reported agricultural cash receipts of $5.4 million and $1.6 million, respectively. Approximately 72 percent of these receipts were earned from the sale of livestock (hogs and beef cattle) in both counties. These counties (Hardin, Wayne, Perry, and Lewis) have similar mixes of agricultural enterprises, are adjacent to one another, and are linked by state highways 64, 13, 412, and the Natchez Trace Parkway. Based on these factors, these counties (Hardin, Wayne,

Perry, and Lewis) are incorporated into a region designated Tennessee Persistent Poverty Region 2 (TPPR 2).

Chester County, the one remaining western rural persistent poverty county, can not be placed in either of the previously identified western regions. As was shown in Figures 7 and 8, Chester County is agriculturally quite similar to the counties in TPPR 2 (Hardin, Wayne, Perry, and Lewis). Furthermore, Chester County reported agricultural cash receipts for 1986 totalling $7.7 million; 63 percent from livestock and 37 percent from crops. This level of cash receipts and relative mix of enterprises is comparable to any of the TPPR 2 counties. However, Chester County has very poor transportational access to TPPR 2 counties. In fact, the Tennessee River separates Chester County from all rural persistent poverty counties in TPPR 2. This severely reduced transportational access dramatically reduces opportunities for economic interaction. Only 2 percent of the workers in Chester County who commuted outside the county to work commuted to any of the TPPR 2 counties. Furthermore, only 7 percent of the workers in Hardin County (the only TPPR 2 county which reported workers commuting either to or from Chester County in 1980) that commuted to work outside the county did so to Chester County (Polk).

Chester County can not be included in TPPR 1 because it is, based on magnitude of production and relative enterprise mix, significantly different from the counties in this

region. Nonetheless, it can not be included in TPPR 2 because it has very little economic interaction with the counties in this region. Chester County is not a self contained economic unit and, therefore not eligible to be treated as a region in and of itself. Therefore, to eliminate any inconsistency or error that may arise from including it in either TPPR 1 or TPPR 2, Chester County is eliminated from consideration in this study.

East Tennessee Counties

East Tennessee rural persistent poverty counties, shown in Figure 9, are located in upper East and Middle Tennessee and along the rim of the Cumberland Plateau. These counties are extremely diverse. Differences in topography, agricultural enterprise mix, magnitude of production, and transportational access abound. Unlike western rural persistent poverty counties, eastern rural persistent poverty counties can not be easily subdivided into relatively self contained regions. Many eastern rural persistent poverty counties are not highly agricultural. Unlike some western rural persistent poverty counties, which have as much as a third of their land tied up in the production of a single crop, no eastern rural persistent poverty counties have even 3 percent of their land in production of any one crop. Most eastern rural persistent

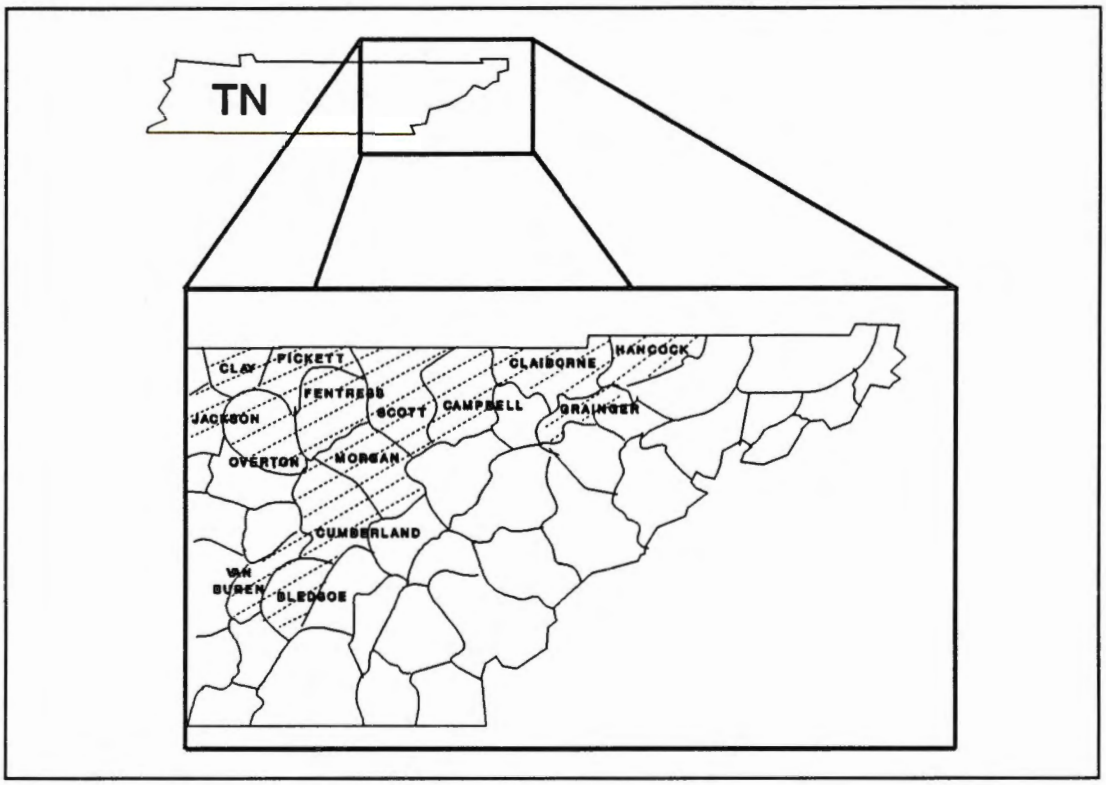

Figure 9. Selected East Tennessee Rural Persistent Poverty Counties.

poverty counties generated the majority of their agricultural cash receipts in 1986 from the production and sale of livestock and dairy products (CBER). Hancock and Morgan Counties, two exceptions to this generalization, reported 1986 agricultural cash receipts that were almost evenly divided between crop and livestock enterprises (49.4 percent from livestock and 50.6 percent from crops in Hancock County and 49.6 percent from livestock and 50.4 percent from crops in Morgan County).(CBER) Clearly, the agricultural situation in East Tennessee is different from that encountered in West Tennessee.

Clay, Jackson, and Pickett Counties reported agricultural cash receipts for 1986 of $5.6 million, $5.2 million, and $3.1 million, respectively. In Clay County, 62 percent of these receipts were generated by livestock enterprises and the remaining 38 percent by crop enterprises; Jackson County reported 55.5 percent from livestock sales and 44.5 percent from crop sales; and Pickett County reported 66 percent from livestock and 34 percent from crops (CBER).

Overton and Fentress Counties reported agricultural cash receipts for 1986 totalling $12.2 million and $12.0 million, respectively. Livestock enterprises generated the majority of cash receipts in both of these counties; 80 percent in Overton County and 77 percent in Fentress County (CBER). As shown in Figure 10, Clay, Overton, and Fentress Counties generated significant cash receipts ($5.8 million for Clay County, $4.4 million for Overton County, and $3.9 million for Fentress County) from the production and sale of beef cattle in 1987. Pickett County generated only $1.6 million from the sale of beef cattle, however, due to Pickett County's much smaller geographic area, this figure is comparable to the beef cattle cash receipts figure for Clay, Overton, and Fentress Counties. Although Jackson County is not as dependent on livestock enterprises as Clay, Overton, Fentress, and Pickett Counties, it must be grouped with these counties for locational and transportational

reasons. These five counties (Clay, Jackson, Overton, Fentress, and Pickett) are adjacent to one another and well connected by state highways 127, 42, 52, 53, and 85. These counties are incorporated into a region designated Tennessee Persistent Poverty Region 3 (TPPR 3).

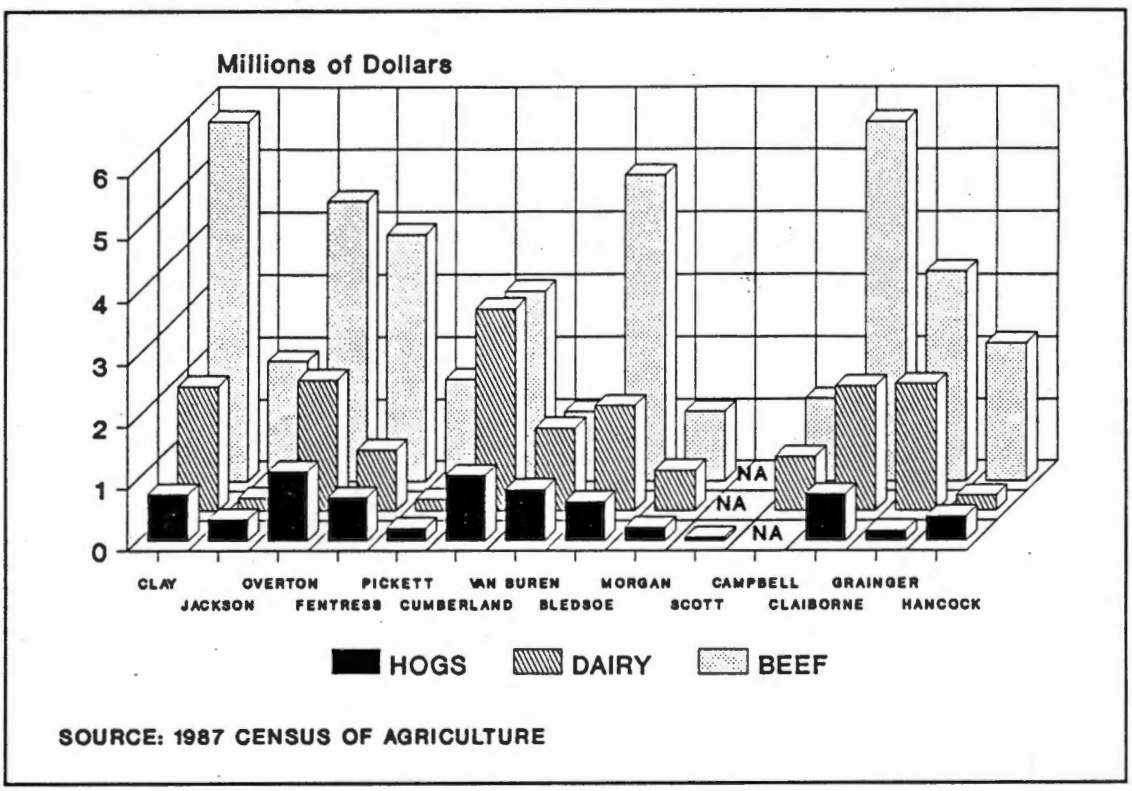

Figure 10. Cash Receipts for Selected Livestock Enterprises in Selected Eastern Rural Persistent Poverty Counties, 1987.

Three rural persistent poverty counties, Cumberland, Bledsoe, and Van Buren, lie to the south of TPPR 3. These three counties are similar to region 3 counties. They are, however, on average more economically dependent on agriculture than region 3 counties and generate agricultural cash receipts from a different mix of agricultural

enterprises (Mundy and Gray). Cumberland County reported agricultural cash receipts for 1986 of $17.2 million; 53 percent from livestock enterprises and 47 percent from crop enterprises. Bledsoe County reported agricultural cash receipts for 1986 totalling $11.3 million; 64 percent from livestock enterprises and 36 percent from crop enterprises. And, Van Buren County, geographically the smallest of the three counties, reported agricultural cash receipts for 1986 of $7.3 million; 83 percent from livestock enterprises and 17 percent from crop enterprises. Cumberland, Bledsoe, and Van Buren Counties, are relatively more dependent on dairying than other surrounding rural persistent poverty counties and, although feed grains are grown in these counties in significant quantities, cash receipts do not reflect this production because much of this grain is fed to livestock on the same farms where it is produced (1987 Census of Agriculture). Furthermore, Cumberland, Bledsoe, and Van Buren Counties are adjacent to one another and adequately connected by state highways 30, 101, and 127. Therefore, these counties are incorporated into one region designated Tennessee Persistent Poverty Region 4 (TPPR 4).

Scott County, to the east of TPPR 3, can be excluded from inclusion in region 3 due to the physical barrier which separates it from Pickett County and the other counties in this region. The Big South Fork National River and Recreation Area, a wilderness area with no improved roads

through it, effectively blocks transportational access and economic interaction between Pickett County and Scott County. Scott County, although geographically quite large, generated agricultural cash receipts for 1986 totalling only $5.1 million. Livestock enterprises, primarily the sale of dairy products, produced a commanding 94 percent of the agricultural cash receipts generated in Scott County in 1986. Crop production accounted for only 6 percent ($324 thousand) of these 1986 agricultural cash receipts. Morgan County reported 1986 agricultural cash receipts of $5.8 million. Approximately 50 percent of these receipts were produced by livestock enterprises and 50 percent by crop enterprises. Campbell County reported agricultural cash receipts totalling $2.9 million; 67 percent from livestock enterprises and 33 percent from crop enterprises. Although these counties display considerable diversity in enterprise mix, they are all relatively small agricultural producers even among the sub-set of eastern rural persistent poverty counties. As shown in Figure 11, cash receipts from tobacco production are much lower in Scott, Morgan, and Campbell Counties than for surrounding rural persistent poverty counties. Furthermore, Scott, Morgan, and Campbell Counties are adjacent to one another and relatively well connected by state highways 27, 63, and Interstate 75. These counties are, therefore, grouped into a region designated Tennessee Persistent Poverty Region 5 (TPPR 5).

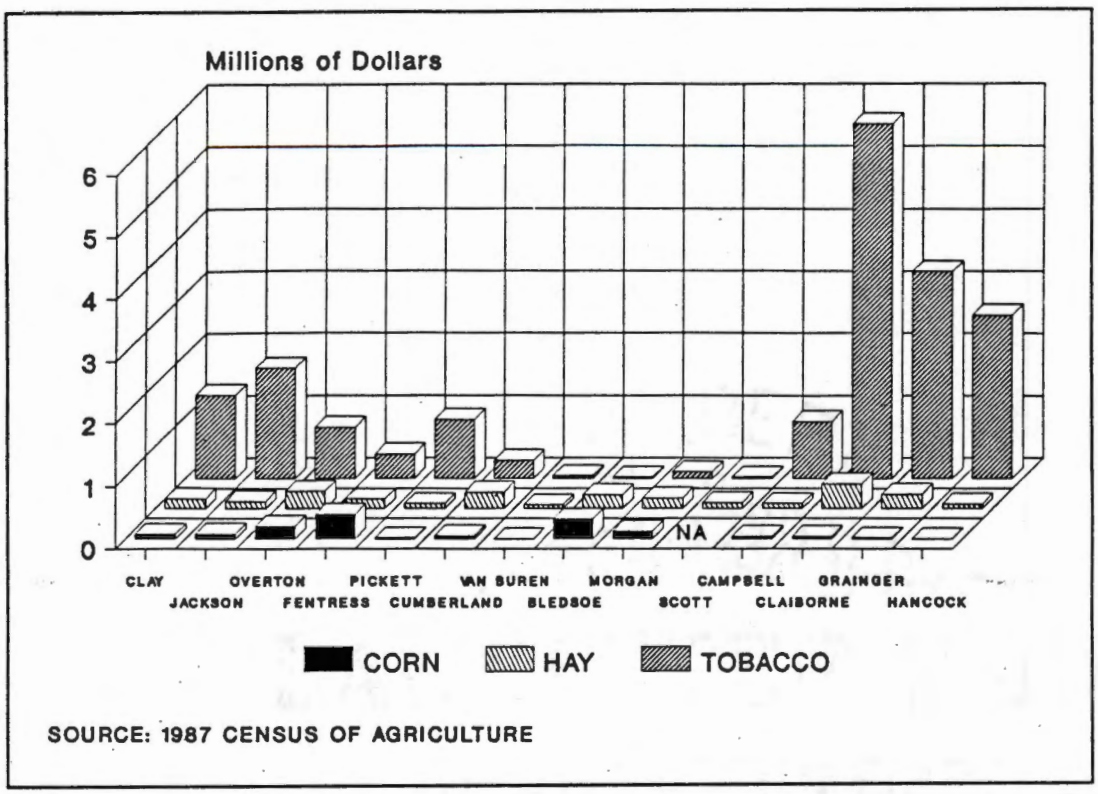

Figure 11. Cash Receipts for Selected Crop Enterprises in Selected Rural Persistent Poverty Counties in East Tennessee, 1987.

The three remaining rural persistent poverty counties under investigation are Claiborne, Grainger, and Hancock Counties. Agriculturally, these counties are highly dependent on beef and dairy operations and tobacco production. Claiborne County reported agricultural cash receipts for 1986 of $17.5 million; 61 percent from livestock enterprises and 39 percent from crop enterprises. Grainger County reported agricultural cash receipts totalling $11.4 million; 58 percent from livestock enterprises and 42 percent from crop enterprises. Hancock County, geographically the smallest of the three, reported

1986 agricultural cash receipts of $5.3 million; 49 percent from livestock and 51 percent from crops (CBER). In these three counties (Claiborne, Grainger, and Hancock), beef, dairy, hog, and tobacco production account for 80 percent or more of the agricultural cash receipts. As was shown in Figures 10 and 11, cash receipts generated from these enterprises are significantly greater in Claiborne, Grainger, and Hancock Counties than for any surrounding rural persistent poverty counties. For this reason, as well as close spatial proximity and adequate transportational interconnection, these counties are grouped into a single region designated Tennessee Persistent Poverty Region 6 (TPPR 6).

To summarize the regionalization of counties, eight western rural persistent poverty counties are divided into two regions and fourteen eastern rural persistent poverty counties are divided into four regions based primarily on transportational access and relative mix of crop and livestock enterprises. The counties, grouped by region, are shown in Figure 12.

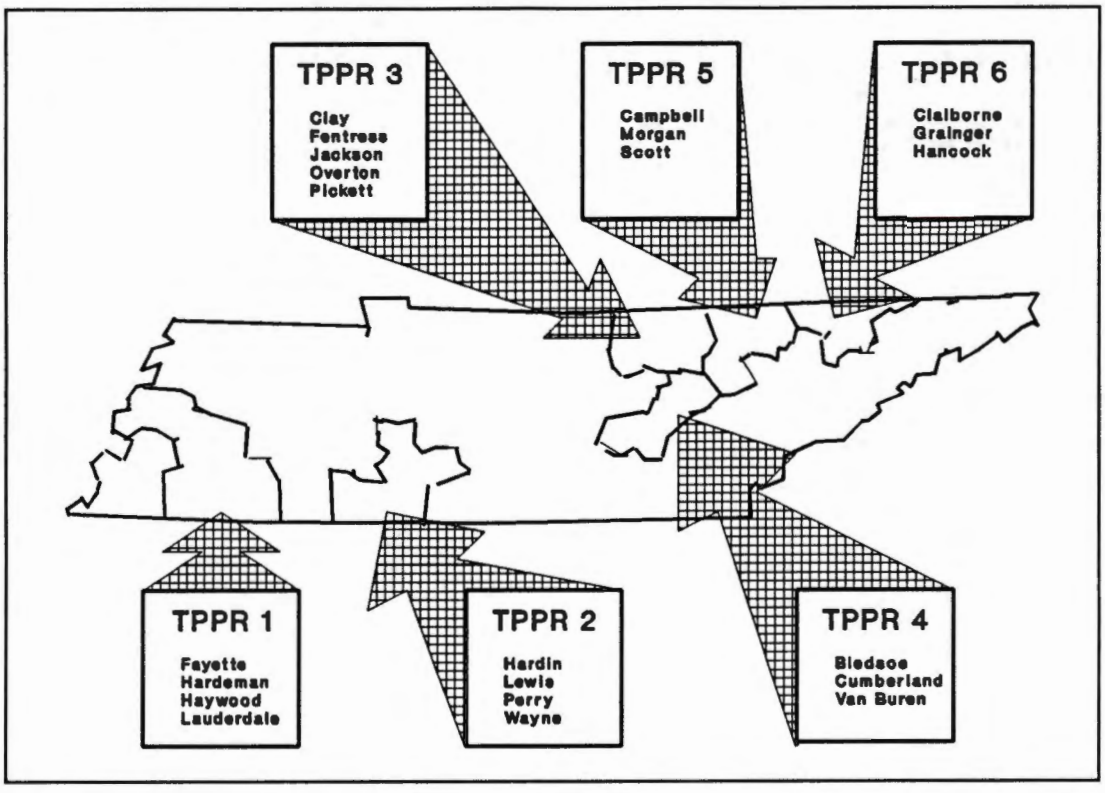

Figure 12. Selected Rural Persistent Poverty Counties in Tennessee by Regions.

CHAPTER 4

Results of the Input/Output Analysis

In this study input/output (I/O) analyses are conducted for six regions composed of rural persistent poverty counties in Tennessee. These regions have been designated Tennessee Persistent Poverty Regions (TPPR's) 1 through 6. The purpose of this study was to estimate the economic importance of agricultural production in each of these regions. As was detailed in Chapter 2, (I/O) analysis provides estimates of this importance in the form of income and employment multipliers.

The IMPLAN I/O model generates unweighted Type I and Type III income and employment multipliers for each agricultural industry in each region. These unweighted multipliers, detailed in the appendix one, are then weighted by the relative value of their production before they are summed. The sum of the weighted multipliers (income and/or employment) for each industry in a given region is the weighted multiplier for all agricultural production in that region. These weighted Type I and Type III income and employment multipliers are shown in Appendix one.

The Income Multipliers

The Type I income multipliers, shown in Table 1, range from a low of 1.47 in TPPR 6 to a high of 1.77 in TPPR 4 and the Type III income multipliers range from 2.12 in TPPR 1 to 2.83 in TPPR 4. The significance of these figures can be illustrated with reference to TPPR 1. The Type I income multiplier for agriculture in TPPR 1 is 1.58 and the Type III income multiplier is 2.12. This indicates that for each dollar of employee compensation (income) generated directly by the production and sale of (demand for) agricultural commodities in this region, 0.58 dollars of indirect employee compensation (income) and 0.54 dollars of induced employee compensation is generated. Indirect employee compensation is derived by subtracting the original dollar of demand from the Type I income multiplier (1.58 minus 1 equals 0.58). Induced employee compensation is derived by subtracting the Type I income multiplier, which contains both direct and indirect income effects, from the Type III income multiplier, which contains direct, indirect, and induced income effects (2.12 minus 1.58 equals 0.54). The indirect and induced employee compensation (income) generated by demand for, and production of, one dollar's worth of agricultural commodities produced in each of the regions is shown in Table 2.

Table 1. Weighted Income Multipliers for Agricultural Production by Region.

Region	Multipliers	
	Type I[a]	Type III[b]
TPPR 1	1.58	2.12
TPPR 2	1.70	2.50
TPPR 3	1.66	2.44
TPPR 4	1.77	2.83
TPPR 5	1.65	2.61
TPPR 6	1.47	2.18

[a] The Type I income multiplier represents the direct and indirect employee compensation (income) divided by the direct employee compensation (which is generated by one dollar of final demand for agricultural commodities produced in the region).

[b] The Type III income multiplier represents the sum of the direct, indirect, and induced employee compensation (income) divided by the direct employee compensation.

Table 2. Indirect and Induced Income Effects from Agricultural Production by Regions.

Region	Income Effects	
	Indirect[a]	Induced[b]
TPPR 1	0.58	0.54
TPPR 2	0.70	0.80
TPPR 3	0.66	0.78
TPPR 4	0.77	1.06
TPPR 5	0.65	0.96
TPPR 6	0.47	0.71

[a] The indirect income effect represents the amount of income generated indirectly in the agricultural input producing and supplying sectors per dollar of income produced directly in the agricultural sector.

[b] The induced income effect represents the amount of income generated by the demand for (production and supply of) consumer goods and services created by income earned directly and indirectly due to the production of one dollar's worth of agricultural commodities.

The Employment Multipliers

The Type I employment multipliers, shown in Table 3, range from a low of 1.25 in TPPR 6 to a high of 1.46 in TPPR 1 and the Type III employment multipliers range from 1.61 in TPPR 6 to 1.80 in TPPR's 1 and 2. The significance of these employment figures can be illustrated with reference to TPPR 1. The Type I employment multiplier in TPPR 1 is 1.46 and the Type III employment multiplier is 1.80. This indicates that for each job created directly by the production and sale of (demand for) agricultural commodities in this region, 0.46 jobs are created indirectly and 0.34 jobs are created by the induced effect. The indirect employment effect is derived by subtracting the direct employment created by demand for agricultural commodities produced within the region (one job) from the Type I income multiplier (1.46 minus 1 equals 0.46). The induced employment effect is derived by subtracting the Type I employment multiplier, which contains both direct and indirect employment effects, from the Type III employment multiplier, which contains direct, indirect, and induced employment effects (1.80 minus 1.46 equals 0.34). The indirect and induced employment created by the addition of one job due to demand for, and production of, agricultural commodities produced in each of the regions is shown in Table 4.

Table 3. Weighted Employment Multipliers for Agricultural Production by Regions.

Region	Multipliers	
	Type I[a]	Type III[b]
TPPR 1	1.46	1.80
TPPR 2	1.41	1.80
TPPR 3	1.30	1.65
TPPR 4	1.36	1.79
TPPR 5	1.26	1.68
TPPR 6	1.25	1.61

[a] The Type I employment multiplier represents the direct and indirect employment change divided by the direct employment change (which is generated by one dollar's worth of demand for agricultural commodities produced in the region).

[b] The Type III employment multiplier represents the sum of the direct, indirect, and induced employment change divided by the direct employment change which is generated by one dollar's worth of demand for agricultural commodities produced in the region.

Table 4. Indirect and Induced Employment Effects from Agricultural Production by Regions.

Region	Employment Effects	
	Indirect	Induced
Region 1	0.46	0.34
Region 2	0.41	0.39
Region 3	0.30	0.35
Region 4	0.36	0.43
Region 5	0.26	0.42
Region 6	0.25	0.36

[a] The indirect employment effect represents the number of jobs created indirectly in the agricultural input producing and supplying sectors per job created directly in the agricultural sector.

[b] The induced employment effect represents the number of jobs created by the purchase of consumer goods and services, per job created directly in the agricultural sector.

Comparison with Previously Estimated Income and Employment Multipliers

The income and employment multipliers detailed in this chapter have been generated using the IMPLAN I/O model. This model is a static input/output model and, therefore, yields only a snapshot (a picture of a single point in time) of the economic impacts associated with agricultural production in each of the regions. Bearing this in mind, it is advantageous to compare these IMPLAN generated income and employment multipliers with income and employment multipliers estimated in previous studies. This comparison does not verify or validate the IMPLAN generated multipliers, however, it does offer an opportunity to identify glaring inconsistencies between results of different studies which may be an indication of errors in the IMPLAN model or this I/O study.

Comparison of results with other I/O studies indicates that the income and employment multipliers generated by the IMPLAN model are not out of line with those from previously conducted I/O studies. Farler and Tyner, in a 1972 statewide I/O study of the Florida economy, estimated that the Type I income multiplier for individual agricultural sectors ranged between 1.32 and 2.47. Being a statewide model, their multipliers are prone to be larger than multipliers for a smaller regional area, however, they are

similar to the range of Type I income multipliers estimated by the IMPLAN model (1.47 to 1.77). Employment multipliers were not reported in the Farler and Tyner study.

Curtis and Waldrop, in a 1970 I/O study of a sub-state region of the Mississippi economy, estimated Type I and Type II multipliers (Note: this is a Type II rather than a Type III multiplier and, as stated earlier, yields a value which is likely to be 5 to 15 percent larger than the Type III multiplier) for agriculture for income and Type I multipliers for employment. The Curtis and Waldrop model was very similar to the IMPLAN model. Both used locally adjusted national-level coefficients and estimated income and employment multipliers for sub-state regions. Curtis and Waldrop reported Type I income multipliers for individual agricultural sectors in their sub-state region of Mississippi that ranged from 1.34 to 1.43. The Curtis and Waldrop study produced Type I multipliers which are slightly smaller than the IMPLAN produced Type I income multipliers (1.47 to 1.77). They are, however, quite close. Curtis and Waldrop reported Type II income multipliers which ranged from 1.90 to 2.02. These estimates compare favorably with the IMPLAN generated Type III income multipliers (2.12 to 2.83). Curtis and Waldrop also reported Type I multipliers for employment. They estimated that the Type I employment multiplier for agriculture in their sub-state Mississippi study area ranged from 1.15 to 1.27. These figures are

quite close to the Type I employment multipliers estimated by the IMPLAN model which range from 1.25 to 1.46.

Klindt and Smith, in a 1974 (I/O) study of a three county area in Tennessee (Claiborne, Overton, and Pickett counties), reported a Type I income multiplier for agriculture of 1.78 and a Type I employment multiplier for agriculture of 1.22. These multiplier estimates are very much in line with the Type I multipliers reported in both the Farler and Tyner study and the Curtis and Waldrop study. They are, also, quite similar to the Type I multipliers generated by the IMPLAN model. The Type I income and employment multipliers for TPPR 5, which contains both Overton and Pickett counties, are 1.65 and 1.26 respectively.

The Type I and Type III income and employment multipliers for agriculture generated by the IMPLAN model are similar to multipliers reported in previous I/O studies. No glaring inconsistencies emerged in this comparison. These figures are, however, quite sterile until some economic significance is attached to them. The conclusions which can be drawn from these income and employment multipliers are discussed in Chapter 5.

CHAPTER 5

Interpretation of Results

Extreme care must be taken when interpreting the results of an I/O analysis. Conclusions must be drawn cautiously and conservatively. As stated in Chapter 2, there are limitations of I/O analysis and IMPLAN specifically, which require the researcher to be humble.

In Economic Interrelationships in a Rural Tennessee Economy, Klindt and Smith state, "...when the economy under study is small, unique sectoral interrelationships due to the economic dominance of one or two firms or special circumstances may occur."(Klindt and Smith, p. 8) Due to these unique characteristics, generalizing results to other regions or other studies must be limited. The economies in the six designated regions are quite small and, therefore, caution must be exercised when comparing results between the regions. Moreover, the magnitude and diversity of the economies under study must be considered when interregional comparisons are made. Radtke, Detering, and Brokken note that, "The impact coefficients tend to be smaller in models (regions) where the number of sectors identified in the IMPLAN data base are fewer, i.e., when the economy is less diverse." (Radtke, Detering, and Brokken, p. 387) If, within a given region, there are few suppliers of inputs for

a given industrial sector, the region will capture little additional income or employment when economic activity increases in that given industrial sector. Purchases of inputs must be made outside the region and, therefore, this additional income and employment is captured by input suppliers in another region. In this study, the Type I income and employment multipliers represent the income and employment that accrues primarily to suppliers of agricultural inputs. The Type III income and employment multipliers represent the income and employment generated by purchases of goods and services (housing, food, transportation, recreation, entertainment, etc.) made possible by the increased economic activity in the agricultural production and agricultural input supplying sectors. When significant differences in industrial sector size or diversity among regions exists, it becomes difficult to make valid, defendable comparisons between regions. As shown in Table 5, the number of industrial sectors in the study regions range from 113 in TPPR 6 to 171 in TPPR 1.

At a minimum, it can be said that the indirect and induced income effects, shown in Table 2 on page 40, are estimates of the income that is captured in each region due to an increase in demand for (and production of) agricultural commodities sufficient to generate one dollar of income in the agricultural sector. It can also be said without reservation that the indirect and induced employment

Table 5. The Number of Industrial Sectors Identified by the IMPLAN Model in Each of the Regions.

Region	Number of Sectors
TPPR 1	171
TPPR 2	141
TPPR 3	135
TPPR 4	139
TPPR 5	138
TPPR 6	113

effects, shown in Table 4 on page 42, are estimates of the employment captured in each region due to an increase in demand for (and production of) agricultural commodities sufficient to create 1 job in the agricultural sector. Other observations can be made; however, they must be made cautiously and conservatively.

Income and Employment Effects and the Influence of Farm Size

Farm size, in and of itself, does not influence income or employment multipliers. Farm size may, however, be an indicator of other economic factors which do influence these multipliers. When farms and farming operations are small, many inputs may be purchased locally. It is not usually economically advantageous for small scale agricultural producers to shop in distant markets for a better price on most of their input needs. Conversely, managers of large farming operations may purchase many of their agricultural inputs in large quantities from large suppliers outside their region. Therefore, small Type I income and employment multipliers should not be unexpected in regions with relatively large farms, and regions with small farms may have relatively large Type I income and employment multipliers. IMPLAN generated income effects, shown in Table 6, do not show this to be the case, however, for the

Table 6. Average Acres Per Farm and Indirect and Induced Income Effects by Region.

Region	Average Acres Per Farm*	Income Effects Indirect	Income Effects Induced
TPPR 1	373	0.58	0.54
TPPR 2	206	0.70	0.80
TPPR 3	137	0.66	0.78
TPPR 4	161	0.77	1.06
TPPR 5	112	0.65	0.96
TPPR 6	93	0.47	0.71

* Source: 1987 Census of Agriculture

regions in this study. TPPR 1, with an average farm size of 373 acres, has an indirect income effect of 0.58, which is low relative to TPPR's 2 through 5. However, TPPR 6 has an average farm size of 93 acres, but an indirect income effect of only 0.47. The relationship between average farm size and IMPLAN generated indirect employment effects is more consistent, but converse to that which was hypothesized. As shown in Table 7, as average farm size decreases, the indirect employment effect decreases. This indicates that larger farms may be purchasing more inputs locally than was previously hypothesized. However, as was shown in Table 6, this increased employment does not generate much additional income, which may indicate that employment produced in agricultural input supplying industries in regions with large farms is in predominantly low income jobs.

Income and Employment Effects and the Influence of Average Annual Cash Receipts Per Farm

Indirect and induced income and employment effects which are generated by the direct production of agricultural commodities accrue due to increased economic activity in the study area. Farm size is not necessarily a good measure of economic activity and, therefore, average agricultural cash receipts per farm may provide a better explanation of the

Table 7. Average Acres Per Farm and Indirect and Induced Employment Effects by Region.

Region	Average Acres Per Farm*	Employment Effects Indirect	Employment Effects Induced
TPPR 1	373	0.46	0.34
TPPR 2	206	0.41	0.39
TPPR 3	137	0.30	0.35
TPPR 4	161	0.36	0.43
TPPR 5	112	0.26	0.42
TPPR 6	93	0.25	0.36

* Source: 1987 Census of Agriculture.
receipts per farm may provide a better explanation of the

tendency for income and employment effects to be greater in some regions than in other regions. Once again, the hypothesis is that larger farms (farms with greater average annual cash receipts) may purchase a greater percentage of their input needs outside their region than smaller farms. Consequently, regions with greater average annual agricultural cash receipts per farm should capture less indirect and induced income and employment than regions with moderate average annual agricultural cash receipts per farm. Once again, IMPLAN generated income estimates, shown in Table 8, do not show this to be the case. While, TPPR 1, with by far the highest average annual agricultural cash receipts per farm, has a lower indirect income effect than TPPR's 2 through 5, TPPR 6 has an even lower indirect income effect. The relationship between average cash receipts per farm and IMPLAN generated indirect employment effects, shown in Table 9, are also inconsistent with the previously mentioned hypothesis.

Income and Employment Effects and the Influence of Enterprise Mix

As has been demonstrated, farm acreage and cash receipts do not explain much of the variation in indirect income or employment effects in the six regions under investigation. Enterprise mix, measured by percent of cash

Table 8. Average Cash Receipts Per Farm and Indirect and Induced Income Effects by Region.

Region	Average Cash Receipts Per Farm*	Income Effects Indirect	Income Effects Induced
TPPR 1	$15,379	0.58	0.54
TPPR 2	$ 2,532	0.70	0.80
TPPR 3	$ 2,344	0.66	0.78
TPPR 4	$ 3,752	0.77	1.06
TPPR 5	$ 1,479	0.65	0.96
TPPR 6	$ 3,101	0.47	0.71

* Source: 1987 Census of Agriculture.

Table 9. Average Cash Receipts Per Farm and Indirect and Induced Employment Effects by Region.

Region	Average Cash Receipts Per Farm*	Employment Effects Indirect	Employment Effects Induced
TPPR 1	$15,379	0.46	0.34
TPPR 2	$ 2,532	0.41	0.39
TPPR 3	$ 2,344	0.30	0.35
TPPR 4	$ 3,752	0.36	0.43
TPPR 5	$ 1,479	0.26	0.42
TPPR 6	$ 3,101	0.25	0.36

* Source: 1987 Census of Agriculture.

receipts earned from either crop or livestock enterprises, may be a far more important factor in determining the magnitude of the indirect income and employment effects in each region. The percentage of cash receipts generated by crop and livestock enterprises in TPPR's 1 through 6 are detailed in Figure 13.

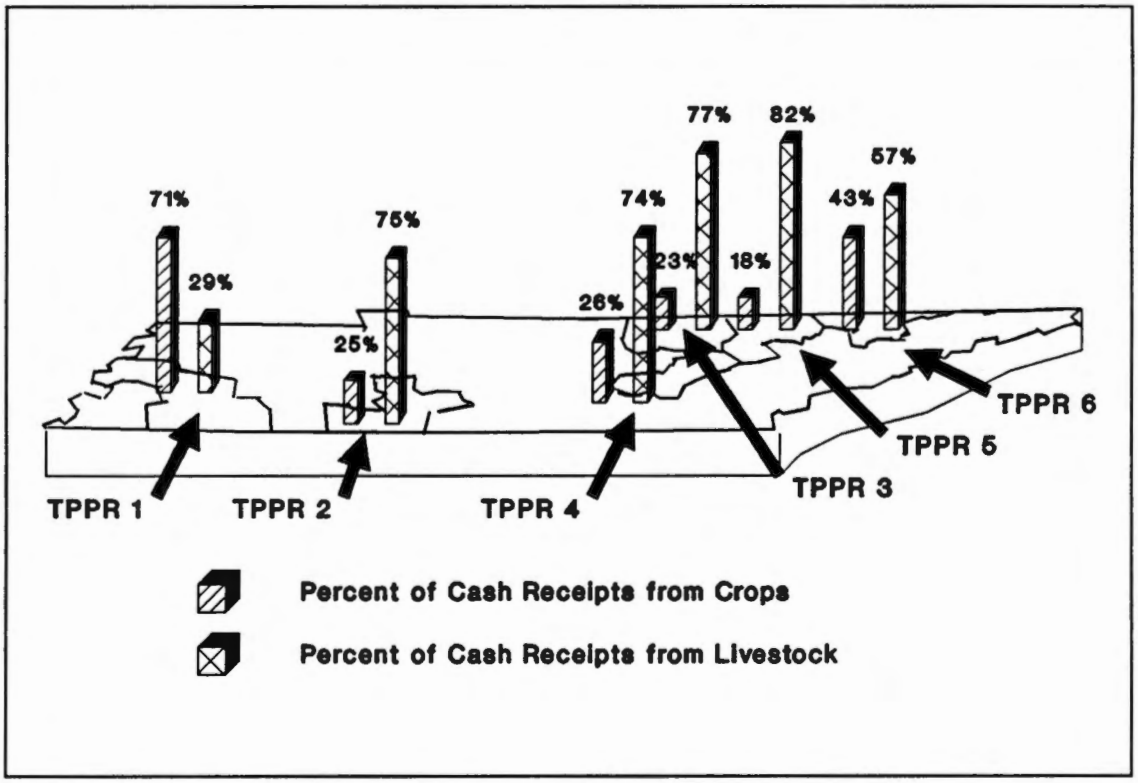

Figure 13. Percent of Cash Receipts Generated by Crop and Livestock Enterprises in Six Tennessee Persistent Poverty Regions (TPPR's).

As shown in Table 10, 71 percent of the agricultural cash receipts for TPPR 1 for 1987 were generated by crop enterprises (predominately cotton and soybeans) and 29 percent by livestock enterprises (mostly hogs and beef cattle). In TRRP 6, for 1987, 43 percent of the

Table 10. Percent of Cash Receipts from Crop and Livestock Enterprises and Indirect and Induced Income Effects by Region.

Region	Enterprises		Income Effects	
	Crops	Livestock*	Indirect	Induced
TPPR 1	71%	29%	0.58	0.54
TPPR 2	25%	75%	0.70	0.80
TPPR 3	23%	77%	0.66	0.78
TPPR 4	26%	74%	0.77	1.06
TPPR 5	18%	82%	0.65	0.96
TPPR 6	43%	57%	0.47	0.71

* Source: 1987 Census of Agriculture.

agricultural cash receipts were produced by crop enterprises (approximately 79 percent of this from the production of tobacco) and 57 percent by livestock enterprises (mostly from beef cattle production). Of the six regions in this study, TPPR's 1 and 6 have the highest percentage of their agricultural cash receipts generated by crop enterprises and the lowest indirect income effects. In TPPR's 2, 3, 4, and 5, no more than 26 percent of the 1987 agricultural cash receipts were generated by crop enterprises. As is evident in Table 10, each of these regions have indirect income effects which are greater than in either Region 1 or 6.

The relationship between the indirect employment effect and the enterprise mix (percentage of cash receipts generated by either crop or livestock enterprises for 1987) for the six regions under investigation, shown in Table 11, paints a different and somewhat inconclusive picture. TPPR 1, with 71 percent of cash receipts accruing to crop enterprises, has an indirect employment effect of 0.46 (the highest of all the regions). TPPR 6 reported 43 percent of their cash receipts for 1987 (second only to TPPR 1) were generated by crop enterprises, however, this region has an indirect employment effect of only 0.25 (lowest of all regions).

Broad categorization may be obscuring the real reason that TPPR 1 and TPPR 6 do not jointly satisfy the enterprise mix hypothesis. The most important agricultural enterprises

Table 11. Percent of Cash Receipts from Crop and Livestock Enterprises and Indirect and Induced Employment Effects by Region.

Region	Enterprises		Employment Effects	
	Crops	Livestock*	Indirect	Induced
TPPR 1	71%	29%	0.46	0.34
TPPR 2	25%	75%	0.41	0.39
TPPR 3	23%	77%	0.30	0.35
TPPR 4	26%	74%	0.36	0.43
TPPR 5	18%	82%	0.26	0.42
TPPR 6	43%	57%	0.25	0.36

* Source: 1987 Census of Agriculture.

in TPPR 1 are soybeans and cotton. In TPPR 1 for 1987, these two enterprises accounted for over 61 percent of all agricultural cash receipts. Soybean and cotton production may be producing more indirect employment than other enterprises, but, as was shown in Table 10, this indirect employment is not generating much additional income. Therefore, the indirect employment generated by agricultural production in TPPR 1 is in low wage jobs. In TPPR 6, where tobacco accounted for 38 percent and beef cattle accounted for 37 percent of all farm production, both the indirect income and employment effects are low. This indicates that the agricultural industries in this region (principally beef cattle and tobacco production) do not generate much indirect employment or income within the region.

In TPPR's 2, 3, 4, and 5, for 1987, livestock enterprises generated the majority of the agricultural cash receipts. As was shown in Tables 10 an 11, livestock enterprises were responsible for between 74 and 82 percent of all agricultural cash receipts in these regions. These enterprises do not generate much indirect employment relative to the dominant agricultural enterprises in TPPR's 1 and 6, however they do generate a proportionally larger income effect. This indicates that the agricultural industries in these regions generate few jobs indirectly, but these jobs provide higher wages than the jobs created indirectly in TPPR's 1 and 6.

The Induced Income and Employment Effects

Induced income and employment effects are not influenced by the same factors which influence indirect income and employment effects. As was detailed in Chapter 2, the induced effect is a measure of the income or employment which is generated in the region by the purchase of goods and services (clothing, food, transportation, health care, recreation and entertainment, etc.) made possible by the increased economic activity in the agricultural producing and input supplying sectors due to an increase in demand for agricultural commodities. Due to the nature of the purchases that generate this induced effect, factors such as farm size, average annual cash receipts, and enterprise mix do not have much, if any, impact. It is important to remember that the induced effect is a measure of the income and or employment which is generated <u>within</u> the region. Therefore, the number and diversity of industrial sectors in the region and adjacent to the region are the most important factors influencing the size of the induced income and employment effects.

Hypothetically, the greater a region's number and diversity of industrial sectors within its boundaries relative to the number and/or diversity of industrial sectors in surrounding regions, the greater the portion

captured of the induced income and employment generated by demand for commodities produced within its boundaries. Consumers can only make purchases where there are businesses providing the goods and services they wish to purchase. If these goods and services are not available locally, they must make their purchases outside the region.

As was shown in Table 5 on page 48, TPPR 1 has the greatest number of industrial sectors with 171, TPPR 6 has the fewest industrial sectors with 113, and the remaining TPPR'S have between 135 and 141 sectors. TPPR 1 has the lowest induced income and employment effects of all the regions; 0.54 and 0.34 respectively. This is likely due to the proximity of Shelby County, which has an economy so large and diverse (over 500 industrial sectors) that it completely overshadows the 171 sectors in this region and probably captures most of the TPPR 1 consumer purchases that generate induced income and employment effects. TPPR 6 has the second lowest income effect (0.71) and the third lowest employment effect (0.36). Once again, this is probably due to the proximity of larger, more diverse economies. The Tri-Cities (Bristol, Kingsport, and Johnson City) and Knox County, two major metropolitan areas, while not adjacent to TPPR 6, are close enough and large enough to capture many of the consumer purchases from this region. TPPR's 2, 3, 4, and 5 have large induced income and employment effects, relative to the income and employment effects present in

TPPR's 1 and 6. The induced income effects for these regions range from 0.79 to 1.06 while the induced employment effects range from 0.35 to 0.43. These regions are not near any major metropolitan areas or any regions with greater numbers of firms in individual industrial sectors or with substantially greater diversity of industrial sectors. Many, if not most, consumer purchases made by residents of these regions are made within the region where they live. Therefore, a significant amount of induced income and employment is created in these regions (TPPR's 2, 3, 4, and 5) by direct demand for and production of agricultural commodities, particularly in TPPR's 4 and 5.

CHAPTER 6

Conclusions

Summary

The purpose of this study was to estimate the economic impacts associated with production of agricultural commodities in selected rural persistent poverty counties in Tennessee. Selected rural persistent poverty counties were grouped into six regions based on similarity of agricultural enterprises, spatial proximity, and transportational interconnection. Input/output analysis was conducted on the six regions of persistent poverty counties and income and employment multipliers for agricultural production were estimated.

The direct income effects associated with agricultural production are easily measured and can be found in the Decennial Census, the Census of Agriculture, and various other data sets. Income earned from the production of agricultural commodities is shown in Table 12. Agricultural employment data is, however, unavailable.

Indirect and induced impacts are also generated by production of agricultural commodities. These impacts are measured by multipliers. These multipliers are shown in Tables 1 and 3 on pages 38 and 41, respectively. These

Table 12. Total Income Earned from Agricultural Production by Region, 1986.

Region	Total Income Earned*
	(Thousands of Dollars)
TPPR 1	$ 25,946
TPPR 2	$ 16,418
TPPR 3	$ 11,971
TPPR 4	$ 10,965
TPPR 5	$ 6,860
TPPR 6	$ 17,632

* Source: Local Area Personal Income, 1981-1986.

indirect and induced income and employment multipliers and the indirect and induced income and employment effects used to derive them demonstrate that differences exist between regions in their ability to capture indirect and induced income and employment effects.

As was detailed in Chapter 4, agricultural production in TPPR's 1 (Lauderdale, Haywood, Fayette, and Hardeman Counties) and 6 (Claiborne, Grainger, and Hancock Counties) generates less indirect or induced income or employment than is generated in the other TPPR's in the State. In TPPR 1, agricultural production generates 0.58 dollars of indirect income and 0.54 dollars of induced income for every dollar of direct income produced and for every job created directly

by agricultural production, 0.46 jobs are created indirectly and 0.34 jobs are created by the induced effect. In TPPR 6, agricultural production generates 0.47 dollars of indirect income and 0.71 dollars of induced income for every dollar of direct income produced and for every job created directly by agricultural production, 0.25 jobs are created indirectly and 0.36 jobs are created by the induced effect. Even though agricultural production may produce a significant amount of direct income and employment in TPPR's 1 and 6, $25.9 million and $17.6 million respectively for 1986, it produces so little indirect or induced income or employment that it has little potential as a vehicle for economic development in these regions.

In TPPR's 2 (Hardin, Lewis, Wayne, and Perry Counties) and 3 (Clay, Jackson, Overton, Pickett, and Fentress Counties) agricultural production generates more indirect and induced income and employment than in TPPR's 1 and 6, but less than in TPPR's 4 and 5. In TPPR 2, agricultural production generates 0.70 dollars of indirect income and 0.80 dollars of induced income for every dollar of direct income produced and for every job created directly by agricultural production, 0.41 jobs are created indirectly and 0.39 jobs are created by the induced effect. In TPPR 3, agricultural production generates 0.66 dollars of indirect income and 0.78 dollars of induced income for every dollar of direct income produced and for every job created directly

by agricultural production, 0.30 jobs are created indirectly and 0.35 jobs are created by the induced effect. From these indirect and induced income and employment figures, it becomes apparent that agricultural production may have more potential as a vehicle for economic development in TPPR's 2 and 3 than in TPPR's 1 and 6 even though income earned from agricultural production in TPPR's 2 and 3 for 1986 was lower than in TPPR's 1 and 6. As shown in Table 13, income earned from agricultural production for 1986 in TPPR's 2 and 3 was $16.4 million and $11.9 million respectively.

In TPPR's 4 (Bledsoe, Cumberland, and Van Buren Counties) and 5 (Campbell, Morgan, and Scott Counties) a greater amount of indirect and induced income and employment is generated by the direct production of agricultural commodities than in any of the other regions in the State. In TPPR 4, agricultural production generates 0.77 dollars of indirect income and 1.06 dollars of induced income for every dollar of direct income produced and for every job created directly by agricultural production, 0.36 jobs are created indirectly and 0.43 jobs are created by the induced effect. In TPPR 5, agricultural production generates 0.65 dollars of indirect income and 0.96 dollars of induced income for every dollar of direct income produced and for every job created directly by agricultural production, 0.26 jobs are created indirectly and 0.42 jobs are created by the induced effect. Although the indirect employment effects in TPPR's 4 and 5

are relatively low, the indirect income effects are average to high relative to the other regions and the induced income and employment effects are significantly higher than in all other regions. Even though total income earned from agricultural production for 1986 in TPPR's 4 and 5 was only $10.9 million and $6.8 million respectively, agricultural production has pronounced potential as a vehicle for economic development in TPPR's 4 and 5. The agricultural enterprises that are most prominent in TPPR's 4 and 5 have greater ability to generate indirect and induced income and employment than the most prominent enterprises in the other regions (TPPR's 1 through 3 and TPPR 6). Therefore, per dollar of demand for agricultural commodities, more income and employment (direct, indirect, and induced) can be generated in these regions (TPPR's 4 and 5) than in any of the other TPPR's in the State.

Policy Implications

The income and employment multipliers generated by this study represent the additions to income and employment that would accrue <u>if</u> demand for agricultural commodities produced in the study areas were increased by one dollar. Due to the realities of comparative advantage and disadvantage, some counties in the State are less able to generate the

additional production needed to satisfy this hypothetical increase in demand than are other counties. The income and employment multipliers for TPPR's 4 and 5 indicate that an additional dollar's worth of demand for agricultural commodities presently produced in these regions would create greater indirect and induced income and employment than would be created in other regions. However, if the most important resources necessary for additional production (suitable land for example) are not available, it is unrealistic to believe that increased demand will have any effect on the level of production, income, or employment. Additional research is needed to determine the ability of selected persistent poverty counties to respond to increased demand for commodities produced within their borders. Those counties which have the ability to respond to increased demand may benefit from increased indirect and induced income and employment. However, those counties without the resources needed to respond can not benefit from increased demand regardless of the size of their income and employment multipliers.

Comparative advantage or disadvantage will also play a part in determining whether it is economically more advantageous to use limited economic development resources to encourage development in the agricultural sector or in some other industrial sector. If it is easier to stimulate greater economic activity in the manufacturing sector than

in the agricultural sector, or if the manufacturing sector has greater income and employment multipliers than the agricultural sector, it may be advantageous to spend limited economic development resources to encourage greater activity in the manufacturing sector. Thus, additional research is needed to estimate the income and employment multipliers for other industrial sectors and the feasibility of stimulating increased economic activity in all sectors before a comparison of economic development potentials can be made between the agricultural sector and these other industrial sectors in persistent poverty counties.

Policy makers and economic development administrators must be cognizant of, not only the potential for development, but also the means by which this development can be generated. Demand must be increased for commodities produced in the study area before the effects of indirect or induced income and employment can be felt. This is generally accomplished by the formulation or fine tuning of a marketing strategy. This strategy may involve encouraging consumers to purchase commodities which are produced locally rather than those imported from outside the region (for example, buying Tennessee produce rather than imported produce). Another marketing approach would be to provide more outlets for producers to sell their commodities. This technique has been adopted in East Tennessee by locating a farmer's market in the community of White Pine. Economic

development administrators may also mount marketing campaigns to encourage consumers in other regions, states, or nations to purchase commodities produced in their (the administrator's) region. These marketing strategies can be instituted at the regional or state level, however, the single greatest influence on agricultural demand results from federal government agricultural policy.

Impacts of Governmental Agricultural Programs and Policies

Governmental agricultural programs and policies impact farm based economies all across the United States. Although these programs and policies have a greater effect in more agriculturally dependant States, (Iowa, Nebraska, Kansas, etc.) Tennessee farmers are recipients of substantial economic benefits from government payments. In 1988, government payments to Tennessee farmers totalled $140 million (Tennessee Agricultural Statistics Service, Aug. 31, 1989). These payments came from a variety of different programs with vastly different objectives. Some of these programs stimulate increased production, while others encourage decreased production.

Price support programs, such as Commodity Credit Corporation (CCC) loans, encourage producers to increase production. By making it financially more attractive to

produce a given commodity, the U.S. Government is artificially increasing demand. When agricultural production is increased, production and supply of agricultural inputs must also increase. Therefore, government price support programs have a positive impact on indirect income and employment effects in rural communities because a portion of these government payments are used to purchase production inputs. A portion of these government payments are also spent on consumer purchases, therefore, induced income and employment is also positively impacted.

Supply control programs, such as acreage reductions or set-asides, encourage decreases in production. When farm acreage decreases, production is decreased and the need for inputs also decreases. This has a negative impact on indirect income and employment effects in these same rural communities. Induced income and employment are also effected negatively, but to a lesser degree.

Environmental programs also have an effect on agricultural production. The Conservation Reserve Program (CRP) and the Agricultural Conservation Program (ACP) both encourage decreases in agricultural production. In each of these programs, participants are required to reduce acreage in production which causes a corresponding decrease in input needs. Therefore, these environmental programs (CRP and ACP) have a negative impact on indirect income and employment in rural communities where they are applied.

In a 1989 I/O study of Terry County, Texas, Bowker and Richardson found that changes in government farm programs impact many sectors of a rural economy. Changes in price support, income support, or environmental programs will be felt in industrial sectors as diverse as agricultural lending and non-durable manufacturing. Bowker and Richardson state, "Declining crop production, value of production, and net returns would be accompanied by declines in output from sectors providing inputs to agriculture and by sectors closely related to the household sector." (Bowker and Richardson p. 44) It is apparent that government programs and policies impact, not just agriculture, but many industrial sectors in rural economies. The effect that these programs have on income and employment multipliers are dependent upon whether they encourage increases or decreases in agricultural production.

Further Research

As this study was being conducted, the need for further research became apparent. The three most obvious to the researcher are as follows:

a) Identification of the ability of persistent rural poverty counties to respond to increases in demand for agricultural commodities,

b) Estimation of the income and employment multipliers for other industrial sectors in these rural counties so that comparisons could be made between the agricultural sector and other industrial sectors, and

c) Collection and analysis of cash receipts, income, and employment data for forestry in Tennessee, so that income and employment multipliers for this sector can be estimated. Forestry data is particularly difficult to obtain and when available its accuracy and reliability are in doubt. This problem is covered in greater depth in Appendix 2.

The information provided by research conducted on these topics would make the income and employment multipliers estimated in this study more useful and help policy makers and administrators make more rational and informed decisions. Regardless of the strategy chosen, policy makers must consider more than just income and employment multipliers when making economic development decisions. They must judge development alternatives based on availability of resources, availability of markets, and comparative advantage, as well.

Deavers and Long stated in Economic Prospects for Tennessee's Future that agricultural development policies

should not be confused with rural economic development policies. This is true for many parts of rural Tennessee, even for some rural persistent poverty areas. However, considering the indirect and induced income and employment effects that are generated by direct agricultural production in some counties, it may be ill advised to dismiss the agricultural sector from consideration as a vehicle for economic development in selected rural counties.

BIBLIOGRAPHY

BIBLIOGRAPHY

Bowker, J. M. and James W. Richardson. "Impacts of Alternative Farm Policies on Rural Communities." Southern Journal of Agricultural Economics., Dec. 1989, pp. 35-46.

Brown, David L., J. Norman Reid, Herman Bluestone, David A. McGranahan, and Sara M. Mazie, editors. Rural Economic Development in the 1980's: Prospects for the Future. Rural Development Research Report No. 69. U.S. Dept. of Agr., Econ. Res. Serv., 1988.

Center for Business and Economic Research, The University of Tennessee, Knoxville. Tennessee Statistical Abstract 1981-1988. Knoxville, Tennessee.

Cocheba, Donald J., Robert W. Gilmer, and Richard S. Mack. "Causes and Consequences of Slow Growth in the Tennessee Valley's Service Sector." Growth and Change. January 1986, pp. 51-65.

Curtis, Wayne C. and John E. Waldrop. Construction of an Input-Output Model for a Sub-StateRegion Through the Use of National Coefficients and Secondary Data Scources, Mississippi Agricultural Experiment Station, Technical Bulletin 61, Mississippi State University. March 1971.

Deavers, Kenneth L. and Richard W. Long. "Trends In Tennessee's Nonmetro Economy", Economic Prospects For Tennessee's Future, June 1989. Tennessee State Planning Office, Nashville, Tennessee.

Farler, Carl and Fred H. Tyner. An Interindustry Analysis of the Florida Economy, Florida Agricultural Experiment Station Bulletin 758, October 1973.

Green, Bernal L. Federal Outlays by Type of Nonmetro County Rural Development Research Report No. 65. U.S. Dept. of Agr., Econ. Res. Serv., 1987.

Klindt, Thomas H., and George F. Smith. Economic Interrelationships in a Rural Tennessee Economy. University of Tennessee, Agricultural Experiment Station Bulletin No. 556, April 1976.

Lofting, E. M. "The Leontief Input-Output System and Its Application to Analysis and Projection for Water Resource Planning." IBM Scientific Computing Symposium, Water and Division EID, Resource Management, Form #320-1933, 1968, p. 306.

Miernyk, W. H., The Elememts of Input-Output Analysis, Random House, New York, New York, 1965.

Miller, James P. and Herman Bluestone. "Prospects for Service Sector Employment Growth in Non-metropolitan America." The Review of Regional Studies. Winter 1988, pp. 28-41.

Mundy, Darrell S. and Morgan D. Gray. Types of Farming in Tennessee, Bulletin 646, The University of Tennessee Agricultural Experiment Station, Knoxvillle, August 1986.

Olson, J. Editor. Micro IMPLAN, Micro Computer-Based System for Regional Economic Analysis of States, Regions, and Communities. Dept. of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota. 1989.

Polk, Glenda. Chester County Profile, March 1985, Tennessee Department of Economic Development, Division of Community Development, Nashville, Tennessee, p. 7.

Richardson, Harry W., Input-Output and Regional Economics, John Wiley and Sons (Halsted Press), New York, New York, 1972.

Ross, Peggy J., and Bernal L. Green. Procedures for Developing a Policy Oriented Classification of Nonmetropolitan Counties. Staff Report No. AGES850308. U.S. Dept. of Agr., Econ. Res. Serv., 1985.

Smith, George F. Tennessee's Agriculture. The University of Tennessee, Agricultural Extension Service, Publication No. 1084.

Tennessee Agricultural Statistics Service. Tennessee Farm Facts. Tennessee Department of Agriculture, Nashville, Tennessee, Vol. 88, No. 8, August 31, 1989.

U. S. Department of Commerce, Bureau of Economic Analysis. Local Area Personal Income, Vol 4, Southeast Region, 1981-86. Washington: U.S. Government Printing Office, July 1988.

APPENDIXES

Appendix 1

Table 13. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 1.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	0.0607	0.0332	0.0456	1.5465	2.2980
Poultry	0.0560	0.0472	0.0401	1.8430	2.5591
Cattle	0.0599	0.0523	0.0361	1.8731	2.4754
Sheep	0.0599	0.0475	0.0400	1.7938	2.4621
Hogs	0.0599	0.0542	0.0384	1.9046	2.5461
Other Meat Products	0.0599	0.0984	0.0625	2.6437	3.6869
Misc. Livestock	0.0905	0.0260	0.0571	1.2876	1.9187
Cotton	0.1317	0.0492	0.0334	1.3738	1.6273
Grains	0.0432	0.0369	0.0543	1.8545	3.1137
Hay	0.0336	0.0362	0.0323	2.0756	3.0340
Fruits	0.2140	0.0464	0.1303	1.2168	1.8254
Vegetables	0.1340	0.0300	0.0776	1.2239	1.8033
Sugar Crops	0.1036	0.0343	0.0821	1.3307	2.1227
Misc. Crops	0.0636	0.0303	0.0440	1.4766	2.1680
Soybeans	0.0386	0.0241	0.0295	1.6260	2.3903
Forest Products	0.0953	0.0288	0.0620	1.3019	1.9529
Greenhouse and Nursery	0.3525	0.0482	0.2167	1.1367	1.7516

Table 14. Weighted Type I Income Multiplier for TPPR 1.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.5465	0.020601	0.031859
Poultry	1.8430	0.099182	0.182792
Cattle	1.8731	0.090974	0.170403
Sheep	1.7938	0.000042	0.000076
Hogs	1.9046	0.073729	0.140425
Misc. Livestock	1.2876	0.001019	0.001312
Cotton	1.3738	0.442222	0.607524
Grains	1.8545	0.064771	0.120117
Hay	2.0756	0.008441	0.017521
Fruits	1.2168	0.000092	0.000112
Vegetables	1.2239	0.022506	0.027545
Misc. Crops	1.4766	0.000750	0.001108
Soybeans	1.6260	0.168343	0.273727
Forest Products	1.3019	0.001331	0.001733
Greenhouse and Nursery	1.1367	0.005991	0.006810
Weighted Sum for all Type I Income Multipliers for Agricultural Industries in TPPR 1.			**1.583199**

Table 15. Weighted Type III Income Multiplier for TPPR 1.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	2.2980	0.020601	0.047341
Poultry	2.5591	0.099182	0.253816
Cattle	2.4754	0.090974	0.225197
Sheep	2.4621	0.000042	0.000104
Hogs	2.5461	0.073729	0.187723
Misc. Livestock	1.9187	0.001019	0.001955
Cotton	1.6273	0.442222	0.719628
Grains	3.1137	0.064771	0.201677
Hay	3.0340	0.008441	0.025611
Fruits	1.8254	0.000092	0.000168
Vegetables	1.8033	0.022506	0.040585
Misc. Crops	2.1680	0.000750	0.001627
Soybeans	2.3903	0.168343	0.402392
Forest Products	1.9529	0.001331	0.002600
Greenhouse and Nursery	1.7516	0.005991	0.010494
Weighted Sum of all Type III Income Multipliers for Agricultural Industries in TPPR 1.			**2.121115**

Table 16. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 1.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	14.4021	3.2281	4.1345	1.2241	1.5112
Poultry	10.6467	4.8459	3.6332	1.4552	1.7964
Cattle	9.5934	4.3474	3.2693	1.4532	1.7940
Sheep	11.6491	3.8187	3.6274	1.3278	1.6392
Hogs	9.6917	5.1566	3.4821	1.5321	1.8914
Misc. Livestock	19.3416	2.7422	5.1789	1.1418	1.4095
Cotton	8.2317	4.6763	3.0271	1.5681	1.9358
Grains	17.8174	3.1890	4.9263	1.1790	1.4555
Hay	9.7295	2.7373	2.9236	1.2813	1.5818
Fruits	45.3768	4.9741	11.8079	1.1096	1.3698
Vegetables	26.909	3.1033	7.0383	1.1153	1.3769
Misc. Crops	14.6183	2.3736	3.9848	1.1624	1.4350
Soybeans	8.5471	2.8483	2.6724	1.3332	1.6459
Forest Products	20.6175	3.3568	5.6223	1.1628	1.4355
Greenhouse and Nursery	77.2591	6.5181	19.6469	1.0844	1.3387

Table 17. Weighted Type I Employment Multiplier for TPPR 1.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.2241	0.020601	0.025217
Poultry	1.4552	0.099182	0.144329
Cattle	1.4532	0.090974	0.132203
Sheep	1.3278	0.000042	0.000056
Hogs	1.5321	0.073729	0.112961
Misc. Livestock	1.1418	0.001019	0.001163
Cotton	1.5681	0.442222	0.693448
Grains	1.1790	0.064771	0.076365
Hay	1.2813	0.008441	0.010816
Fruits	1.1096	0.000092	0.000102
Vegetables	1.1153	0.022506	0.025101
Misc. Crops	1.1624	0.000750	0.000872
Soybeans	1.3332	0.168343	0.224436
Forest Products	1.1628	0.001331	0.001548
Greenhouse and Nursery	1.0844	0.005991	0.006496
Weighted Sum for all Type I Employment Multipliers for Agricultural Industries in TPPR 1.			**1.455232**

Table 18. Weighted Type III Employment Multiplier for TPPR 1.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	1.5112	0.020601	0.031132
Poultry	1.7964	0.099182	0.178170
Cattle	1.7940	0.090974	0.163207
Sheep	1.6392	0.000042	0.000069
Hogs	1.8914	0.073729	0.139452
Misc. Livestock	1.4095	0.001019	0.001436
Cotton	1.9358	0.442222	0.856053
Grains	1.4555	0.064771	0.094274
Hay	1.5818	0.008441	0.013352
Fruits	1.3698	0.000092	0.000126
Vegetables	1.3769	0.022506	0.030988
Misc. Crops	1.4350	0.000750	0.001077
Soybeans	1.6459	0.168343	0.277077
Forest Products	1.4355	0.001331	0.001911
Greenhouse and Nursery	1.3387	0.005991	0.008020
Weighted Sum of all Type III Employment Multipliers for Agricultural Industries in TPPR 1.			**1.796491**

Table 19. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 2.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	0.0607	0.0259	0.0518	1.4262	2.2791
Poultry	0.0560	0.0355	0.0451	1.6346	2.4406
Cattle	0.0599	0.0453	0.0433	1.7562	2.4794
Sheep	0.0599	0.0462	0.0475	1.7723	2.5651
Hogs	0.0599	0.0427	0.0423	1.7137	2.4200
Misc. Livestock	0.0905	0.0283	0.0698	1.3122	2.0828
Cotton	0.1317	0.0446	0.0395	1.3389	1.6383
Grains	0.0401	0.0307	0.0545	1.7655	3.1251
Hay	0.0336	0.0305	0.0369	1.9052	3.0004
Tobacco	0.1028	0.0214	0.0704	1.2078	1.8932
Fruits	0.2140	0.0416	0.1509	1.1945	1.8998
Vegetables	0.1340	0.0235	0.0879	1.1753	1.8316
Misc. Crops	0.0636	0.0344	0.0511	1.5404	2.3442
Soybeans	0.0386	0.0217	0.0342	1.5616	2.4478
Forest Products	0.0953	0.0193	0.0679	1.2022	1.9145
Greenhouse and Nursery	0.3525	0.0241	0.2403	1.0683	1.7501

Table 20. Weighted Type I Income Multiplier for TPPR 2.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.4262	0	0
Poultry	1.6346	0.000873	0.001427
Cattle	1.7562	0.350572	0.615675
Sheep	1.7723	0	0
Hogs	1.7137	0.373143	0.639456
Misc. Livestock	1.3122	0.026800	0.035168
Cotton	1.3389	0.010067	0.013479
Grains	1.7655	0.099388	0.175470
Hay	1.9052	0.017055	0.032493
Tobacco	1.2078	0.005102	0.006163
Fruits	1.1945	0.002252	0.002690
Vegetables	1.1753	0.002850	0.003349
Misc. Crops	1.5404	0	0
Soybeans	1.5616	0.107939	0.168557
Forest Products	1.2022	0.003953	0.004752
Greenhouse and Nursery	1.0683	0	0
Weighted Sum for all Type I Income Multipliers for Agricultural Industries in TPPR 2.			**1.698685**

Table 21. Weighted Type III Income Multiplier for TPPR 2.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	2.2791	0	0
Poultry	2.4406	0.000873	0.002131
Cattle	2.4794	0.350572	0.869209
Sheep	2.5651	0	0
Hogs	2.4200	0.373143	0.903008
Misc. Livestock	2.0828	0.026800	0.055820
Cotton	1.6383	0.010067	0.016493
Grains	3.1251	0.099388	0.310599
Hay	3.0004	0.017055	0.051172
Tobacco	1.8932	0.005102	0.009660
Fruits	1.8998	0.002252	0.004279
Vegetables	1.8316	0.002850	0.005220
Misc. Crops	2.3442	0	0
Soybeans	2.4478	0.107939	0.264213
Forest Products	1.9145	0.003953	0.007568
Greenhouse and Nursery	1.7501	0	0
Weighted Sum for all Type III Income Multipliers for Agricultural Industries in TPPR 2.			**2.499377**

Table 22. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 2.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	14.4072	2.7125	4.7934	1.1883	1.5210
Poultry	10.6932	4.2262	4.1774	1.3952	1.7859
Cattle	9.6030	4.7202	4.0104	1.4915	1.9092
Sheep	11.1583	4.5425	4.3962	1.4071	1.8011
Hogs	9.6919	4.2972	3.9169	1.4434	1.8475
Misc. Livestock	19.3432	3.7292	6.4602	1.1928	1.5268
Cotton	8.2306	4.8179	3.6535	1.5854	2.0293
Grains	15.2454	2.7968	5.0517	1.1834	1.5148
Hay	9.7303	2.4587	3.4129	1.2527	1.6034
Tobacco	21.2945	2.0000	6.5224	1.0939	1.4002
Fruits	45.3770	4.5393	13.9763	1.1000	1.4080
Vegetables	26.8890	2.1997	8.1447	1.0818	1.3847
Misc. Crops	14.8397	2.0639	4.7329	1.1391	1.4580
Soybeans	8.5470	2.7587	3.1656	1.3228	1.6931
Forest Products	20.5663	1.8794	6.2847	1.0914	1.3970
Greenhouse and Nursery	77.2445	2.2388	22.2550	1.0290	1.3171

Table 23. Weighted Type I Employment Multipliers for TPPR 2.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.1883	0	0
Poultry	1.3952	0.000873	0.001218
Cattle	1.4915	0.350572	0.522878
Sheep	1.4071	0	0
Hogs	1.4434	0.373143	0.538595
Misc. Livestock	1.1928	0.026800	0.031968
Cotton	1.5854	0.010067	0.015961
Grains	1.1834	0.099388	0.117616
Hay	1.2527	0.017055	0.021364
Tobacco	1.0939	0.005102	0.005581
Fruits	1.1000	0.002252	0.002477
Vegetables	1.0818	0.002850	0.003083
Misc. Crops	1.1391	0	0
Soybeans	1.3228	0.107939	0.142781
Forest Products	1.0914	0.003953	0.004314
Greenhouse and Nursery	1.0290	0	0
Weighted Sum for all Type I Employment Multipliers for Agricultural Industries in TPPR 2.			**1.407843**

Table 24. Weighted Type III Employment Multiplier for TPPR 2.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	1.5210	0	0
Poultry	1.7859	0.000873	0.001559
Cattle	1.9092	0.350572	0.669312
Sheep	1.8011	0	0
Hogs	1.8475	0.373143	0.689383
Misc. Livestock	1.5268	0.026800	0.040919
Cotton	2.0293	0.010067	0.020430
Grains	1.5148	0.099388	0.150553
Hay	1.6034	0.017055	0.027346
Tobacco	1.4002	0.005102	0.007144
Fruits	1.4080	0.002252	0.003171
Vegetables	1.3847	0.002850	0.003946
Misc. Crops	1.4580	0	0
Soybeans	1.6931	0.107939	0.182751
Forest Products	1.3970	0.003953	0.005523
Greenhouse and Nursery	1.3171	0	0
Weighted Sum of all Type III Employment Multipliers for Agricultural Industries in TPPR 2.			**1.802043**

Table 25. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 3.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	0.0607	0.0345	0.0559	1.5690	2.4901
Poultry	0.0560	0.0320	0.0440	1.5714	2.3575
Cattle	0.0599	0.0502	0.0432	1.8388	2.5604
Sheep	0.0599	0.0596	0.0525	1.9962	2.8736
Hogs	0.0599	0.0518	0.0457	1.8655	2.6287
Misc. Livestock	0.0905	0.0307	0.0739	1.3396	2.1565
Grains	0.0400	0.0365	0.0576	1.9108	3.3489
Hay	0.0336	0.0358	0.0392	2.0649	3.2310
Tobacco	0.1028	0.0284	0.0744	1.2767	2.0007
Fruits	0.2140	0.0325	0.1535	1.1519	1.8693
Vegetables	0.1340	0.0267	0.0932	1.1995	1.8953
Misc. Crops	0.0636	0.0340	0.0544	1.5350	2.3901
Soybeans	0.0386	0.0211	0.0336	1.5464	2.4182
Forest Products	0.0953	0.0197	0.0710	1.2072	1.9526
Greenhouse and Nursery	0.3525	0.0243	0.2531	1.0690	1.7869

Table 26. Weighted Type I Income Multiplier for TPPR 3.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.5690	0.101368	0.159047
Poultry	1.5714	0.214372	0.336864
Cattle	1.8388	0.372782	0.685473
Sheep	1.9962	0.000485	0.000969
Hogs	1.8655	0.078179	0.145843
Misc. Livestock	1.3396	0.005453	0.007305
Grains	1.9108	0.021677	0.041421
Hay	2.0649	0.021839	0.045096
Tobacco	1.2767	0.142132	0.181460
Fruits	1.1519	0.000890	0.001026
Vegetables	1.1995	0.024620	0.029531
Misc. Crops	1.5350	0.002375	0.003646
Soybeans	1.5464	0.009961	0.015404
Forest Products	1.2072	0.002645	0.003193
Greenhouse and Nursery	1.0690	0.001214	0.001298
Weighted Sum for all Type I Income Multipliers for Agricultural Industries in TPPR 3.			**1.657583**

Table 27. Weighted Type III Income Multiplier for TPPR 3.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	2.4901	0.101368	0.252418
Poultry	2.3575	0.214372	0.505383
Cattle	2.5604	0.372782	0.954473
Sheep	2.8736	0.000485	0.001396
Hogs	2.6287	0.078179	0.205510
Misc. Livestock	2.1565	0.005453	0.011759
Grains	3.3489	0.021677	0.072595
Hay	3.2310	0.021839	0.070563
Tobacco	2.0007	0.142132	0.284363
Fruits	1.8693	0.000890	0.001665
Vegetables	1.8953	0.024620	0.046662
Misc. Crops	2.3901	0.002375	0.005677
Soybeans	2.4182	0.009961	0.024088
Forest Products	1.9526	0.002645	0.005165
Greenhouse and Nursery	1.7869	0.001214	0.002170
Weighted Sum for all Type III Income Multipliers for Agricultural Industries in TPPR 3.			**2.443894**

Table 28. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 3.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	14.4019	3.0869	4.6486	1.2143	1.5371
Poultry	10.6464	3.1182	3.6587	1.2929	1.6365
Cattle	9.5925	3.9250	3.5930	1.4092	1.7837
Sheep	11.1296	5.3076	4.3691	1.4769	1.8695
Hogs	9.6920	4.6060	3.8005	1.4752	1.8674
Misc. Livestock	19.3429	3.7928	6.1496	1.1961	1.5140
Grains	15.1594	2.8473	4.7863	1.1878	1.5036
Hay	9.7298	2.5466	3.2631	1.2617	1.5971
Tobacco	21.2961	1.9810	6.1872	1.0930	1.3836
Fruits	45.3709	2.6581	12.7664	1.0586	1.3400
Vegetables	26.9097	2.2588	7.7531	1.0839	1.3721
Misc. Crops	14.6132	2.3972	4.5214	1.1640	1.4735
Soybeans	8.5481	1.9727	2.7965	1.2308	1.5579
Forest Products	20.7306	1.4875	5.9057	1.0718	1.3566
Greenhouse and Nursery	77.2611	1.9125	21.0447	1.0248	1.2971

Table 29. Weighted Type I Employment Multiplier for TPPR 3.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.2143	0.101368	0.123091
Poultry	1.2929	0.214372	0.277162
Cattle	1.4092	0.372782	0.525325
Sheep	1.4769	0.000485	0.000717
Hogs	1.4752	0.078179	0.115330
Misc. Livestock	1.1961	0.005453	0.006522
Grains	1.1878	0.021677	0.025748
Hay	1.2617	0.021839	0.027554
Tobacco	1.0930	0.142132	0.155350
Fruits	1.0586	0.000890	0.000943
Vegetables	1.0839	0.024620	0.026685
Misc. Crops	1.1640	0.002375	0.002765
Soybeans	1.2308	0.009961	0.012260
Forest Products	1.0718	0.002645	0.002835
Greenhouse and Nursery	1.0248	0.001214	0.001244
Weighted Sum for all Type I Employment Multipliers for Agricultural Industries in TPPR 3.			**1.303539**

Table 30. Weighted Type III Employment Multipliers for TPPR 3.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	1.5371	0.101368	0.155813
Poultry	1.6365	0.214372	0.350820
Cattle	1.7837	0.372782	0.664933
Sheep	1.8695	0.000485	0.000908
Hogs	1.8674	0.078179	0.145992
Misc. Livestock	1.5140	0.005453	0.008256
Grains	1.5036	0.021677	0.032594
Hay	1.5971	0.021839	0.034879
Tobacco	1.3836	0.142132	0.196653
Fruits	1.3400	0.000890	0.001193
Vegetables	1.3721	0.024620	0.033781
Misc. Crops	1.4735	0.002375	0.003500
Soybeans	1.5579	0.009961	0.015518
Forest Products	1.3566	0.002645	0.003588
Greenhouse and Nursery	1.2971	0.001214	0.001575
Weighted Sum of all Type III Employment Multipliers for Agricultural Industries in TPPR 3.			**1.650011**

Table 31. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 4.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	0.0607	0.0407	0.0716	1.6711	2.8509
Poultry	0.0560	0.0494	0.0641	1.8836	3.0297
Cattle	0.0599	0.0591	0.0584	1.9874	2.9621
Sheep	0.0599	0.0655	0.0678	2.0936	3.2260
Hogs	0.0599	0.0585	0.0595	1.9777	2.9707
Misc. Livestock	0.0905	0.0273	0.0892	1.3013	2.2871
Grains	0.0409	0.0452	0.0783	2.1050	4.0190
Hay	0.0336	0.0445	0.0523	2.3236	3.8777
Tobacco	0.1028	0.0345	0.0957	1.3355	2.2673
Fruits	0.2140	0.0502	0.2057	1.2344	2.1957
Vegetables	0.1340	0.0367	0.1232	1.2741	2.1935
Misc. Crops	0.0636	0.0364	0.0710	1.5722	2.6886
Soybeans	0.0386	0.0261	0.0444	1.6779	2.8297
Forest Products	0.0953	0.0344	0.0994	1.3615	2.4049
Greenhouse and Nursery	0.3525	0.0537	0.3405	1.1523	2.1183

Table 32. Weighted Type I Income Multiplier for TPPR 4.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.6711	0.258327	0.431690
Poultry	1.8836	0.000081	0.000154
Cattle	1.9874	0.372248	0.739805
Sheep	2.0936	0.000736	0.001542
Hogs	1.9777	0.103813	0.205312
Misc. Livestock	1.3013	0.003478	0.004526
Grains	2.1050	0.021401	0.045049
Hay	2.3236	0.022628	0.052580
Tobacco	1.3355	0.014812	0.019782
Fruits	1.2344	0.000081	0.000101
Vegetables	1.2741	0.139741	0.178044
Misc. Crops	1.5722	0	0
Soybeans	1.6779	0.026597	0.044628
Forest Products	1.3615	0.017063	0.023232
Greenhouse and Nursery	1.1523	0.018986	0.021878
Weighted Sum for all Type I Income Multipliers for Agricultural Industries in TPPR 4.			**1.768328**

Table 33. Weighted Type III Income Multiplier for TPPR 4.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	2.8509	0.258327	0.736465
Poultry	3.0297	0.000081	0.000247
Cattle	2.9621	0.372248	1.102636
Sheep	3.2260	0.000736	0.002376
Hogs	2.9707	0.103813	0.308399
Misc. Livestock	2.2871	0.003478	0.007954
Grains	4.0190	0.021401	0.086011
Hay	3.8777	0.022628	0.087747
Tobacco	2.2673	0.014812	0.033585
Fruits	2.1957	0.000081	0.000179
Vegetables	2.1935	0.139741	0.306522
Misc. Crops	2.6886	0	0
Soybeans	2.8297	0.026597	0.075264
Forest Products	2.4049	0.017063	0.041036
Greenhouse and Nursery	2.1183	0.018986	0.040219
Weighted Sum for all Type III Income Multipliers for Agricultural Industries in TPPR 4.			**2.828646**

Table 34. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 4.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	14.4020	3.4255	5.6751	1.2378	1.6319
Poultry	10.6465	5.3240	5.0839	1.5001	1.9776
Cattle	9.5965	4.9354	4.6260	1.5143	1.9963
Sheep	11.1782	5.7040	5.3742	1.5103	1.9911
Hogs	9.6920	5.1128	4.7129	1.5275	2.0138
Misc. Livestock	19.3531	2.8642	7.0725	1.1480	1.5134
Grains	15.9226	3.5783	6.2078	1.2247	1.6146
Hay	9.7304	3.2903	4.1449	1.3381	1.7641
Tobacco	21.2974	2.5399	7.5882	1.1193	1.4756
Fruits	45.3841	5.8344	16.3046	1.1286	1.4878
Vegetables	26.9093	3.7658	9.7649	1.1399	1.5028
Misc. Crops	14.6308	3.0422	5.6259	1.2079	1.5925
Soybeans	8.5458	2.5155	3.5212	1.2944	1.7064
Forest Products	20.6198	4.1297	7.8786	1.2003	1.5824
Greenhouse and Nursery	77.2593	7.5236	26.9892	1.0974	1.4467

Table 35. Weighted Type I Employment Multiplier for TPPR 4.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.2378	0.258327	0.319757
Poultry	1.5001	0.000081	0.000122
Cattle	1.5143	0.372248	0.563695
Sheep	1.5103	0.000736	0.001112
Hogs	1.5275	0.103813	0.158575
Misc. Livestock	1.1480	0.003478	0.003992
Grains	1.2247	0.021401	0.026209
Hay	1.3381	0.022628	0.030279
Tobacco	1.1193	0.014812	0.016580
Fruits	1.1286	0.000081	0.000092
Vegetables	1.1399	0.139741	0.159291
Misc. Crops	1.2079	0	0
Soybeans	1.2944	0.026597	0.034428
Forest Products	1.2003	0.017063	0.020481
Greenhouse and Nursery	1.0974	0.018986	0.020836
Weighted Sum for all Type I Employment Multipliers for Agricultural Industries in TPPR 4.			**1.355455**

Table 36. Weighted Type III Employment Multiplier for TPPR 4.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	1.6319	0.258327	0.421564
Poultry	1.9776	0.000081	0.000161
Cattle	1.9963	0.372248	0.743118
Sheep	1.9911	0.000736	0.001466
Hogs	2.0138	0.103813	0.209060
Misc. Livestock	1.5134	0.003478	0.005263
Grains	1.6146	0.021401	0.034554
Hay	1.7641	0.022628	0.039919
Tobacco	1.4756	0.014812	0.021858
Fruits	1.4878	0.000081	0.000121
Vegetables	1.5028	0.139741	0.210003
Misc. Crops	1.5925	0	0
Soybeans	1.7064	0.026597	0.045386
Forest Products	1.5824	0.017063	0.027001
Greenhouse and Nursery	1.4467	0.018986	0.027468
Weighted Sum of all Type III Employment Multipliers for Agricultural Industries in TPPR 4.			**1.786948**

Table 37. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 5.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	0.0607	0.0347	0.0651	1.5724	2.6458
Poultry	0.0560	0.0330	0.0510	1.5900	2.5006
Cattle	0.0599	0.0528	0.0509	1.8810	2.7307
Sheep	0.0599	0.0480	0.0552	1.8010	2.7234
Hogs	0.0599	0.0514	0.0521	1.8580	2.7284
Misc. Livestock	0.0905	0.0318	0.0864	1.3518	2.3064
Grains	0.0417	0.0410	0.0746	1.9838	3.7733
Hay	0.0336	0.0420	0.0482	2.2486	3.6820
Tobacco	0.1028	0.0279	0.0890	1.2711	2.1373
Fruits	0.2140	0.0326	0.1832	1.1522	2.0081
Vegetables	0.1340	0.0303	0.1120	1.2260	2.0621
Misc. Crops	0.0636	0.0594	0.0695	1.9348	3.0283
Soybeans	0.0386	0.0165	0.0372	1.4279	2.3916
Forest Products	0.0953	0.0209	0.0854	1.2193	2.1162
Greenhouse and Nursery	0.3525	0.0318	0.3052	1.0903	1.9561

Table 38. Weighted Type I Income Multiplier for TPPR 5.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.5724	0.234381	0.368541
Poultry	1.5900	0.355277	0.564891
Cattle	1.8810	0.237914	0.447517
Sheep	1.8010	0	0
Hogs	1.8580	0.019215	0.035703
Misc. Livestock	1.3518	0.004825	0.006523
Grains	1.9838	0.014735	0.029231
Hay	2.2486	0.030676	0.068979
Tobacco	1.2711	0.090392	0.114897
Fruits	1.1522	0.000947	0.001092
Vegetables	1.2260	0.001809	0.002218
Misc. Crops	1.9348	0.001895	0.003667
Soybeans	1.4279	0.007410	0.010581
Forest Products	1.2193	0.000517	0.000630
Greenhouse and Nursery	1.0903	0	0
Weighted Sum for all Type I Income Multipliers for Agricultural Industries in TPPR 5.			**1.654475**

Table 39. Weighted Type III Income Multiplier for TPPR 5.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	2.6458	0.234381	0.620127
Poultry	2.5006	0.355277	0.888407
Cattle	2.7307	0.237914	0.649673
Sheep	2.7234	0	0
Hogs	2.7284	0.019215	0.052428
Misc. Livestock	2.3064	0.004825	0.011129
Grains	3.7733	0.014735	0.055599
Hay	3.6820	0.030676	0.112950
Tobacco	2.1373	0.090392	0.193194
Fruits	2.0081	0.000947	0.001903
Vegetables	2.0621	0.001809	0.003731
Misc. Crops	3.0283	0.001895	0.005740
Soybeans	2.3916	0.007410	0.017723
Forest Products	2.1162	0.000517	0.001094
Greenhouse and Nursery	1.9561	0	0
Weighted Sum for all Type III Income Multipliers for Agricultural Industries in TPPR 5.			**2.613705**

Table 40. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 5.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	14.4021	2.7465	5.6167	1.1907	1.5807
Poultry	10.6466	2.7674	4.3935	1.2599	1.6726
Cattle	9.5937	3.7999	4.3868	1.3961	1.8533
Sheep	11.2812	3.2569	4.7617	1.2887	1.7108
Hogs	9.6936	4.0263	4.4937	1.4154	1.8789
Misc. Livestock	19.3441	3.4031	7.4505	1.1759	1.5611
Grains	16.5624	3.0669	6.4293	1.1852	1.5734
Hay	9.7308	2.9651	4.1583	1.3047	1.7321
Tobacco	21.2958	2.1343	7.6742	1.1002	1.4606
Fruits	45.3716	2.8423	15.7917	1.0626	1.4107
Vegetables	26.9088	2.5810	9.6589	1.0959	1.4549
Misc. Crops	14.6144	3.6854	5.9938	1.2522	1.6623
Soybeans	8.5570	1.2270	3.2046	1.1434	1.5179
Forest Products	20.6054	1.8848	7.3663	1.0915	1.4490
Greenhouse and Nursery	77.2463	3.0911	26.3132	1.0400	1.3807

Table 41. Weighted Type I Employment Multiplier for TPPR 5.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.1907	0.234381	0.279078
Poultry	1.2599	0.355277	0.447614
Cattle	1.3961	0.237914	0.332152
Sheep	1.2887	0	0
Hogs	1.4154	0.019215	0.027198
Misc. Livestock	1.1759	0.004825	0.005674
Grains	1.1852	0.014735	0.017463
Hay	1.3047	0.030676	0.040023
Tobacco	1.1002	0.090392	0.099449
Fruits	1.0626	0.000947	0.001007
Vegetables	1.0959	0.001809	0.001983
Misc. Crops	1.2522	0.001895	0.002373
Soybeans	1.1434	0.007410	0.008473
Forest Products	1.0915	0.000517	0.000564
Greenhouse and Nursery	1.0400	0	0
Weighted Sum for all Type I Employment Multipliers for Agricultural Industries in TPPR 5.			**1.263056**

Table 42. Weighted Type III Employment Multiplier for TPPR 5.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	1.5807	0.234381	0.370487
Poultry	1.6726	0.355277	0.594237
Cattle	1.8533	0.237914	0.440927
Sheep	1.7108	0	0
Hogs	1.8789	0.019215	0.036104
Misc. Livestock	1.5611	0.004825	0.007533
Grains	1.5734	0.014735	0.023184
Hay	1.7321	0.030676	0.053134
Tobacco	1.4606	0.090392	0.132026
Fruits	1.4107	0.000947	0.001337
Vegetables	1.4549	0.001809	0.002632
Misc. Crops	1.6623	0.001895	0.003151
Soybeans	1.5179	0.007410	0.011248
Forest Products	1.4490	0.000517	0.000749
Greenhouse and Nursery	1.3807	0	0
Weighted Sum of all Type III Employment Multipliers for Agricultural Industries in TPPR 5.			**1.676754**

Table 43. Direct, Indirect, and Induced Income Effects and Unweighted Type I and Type III Income Multipliers for TPPR 6.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	0.0607	0.0313	0.1438	1.5151	2.3688
Poultry	0.0560	0.0321	0.1305	1.5745	2.3320
Cattle	0.0599	0.0432	0.1431	1.7210	2.3900
Sheep	0.0599	0.0481	0.1543	1.8037	2.5764
Hogs	0.0599	0.0439	0.1452	1.7326	2.4249
Misc. Livestock	0.0905	0.0221	0.1780	1.2447	1.9660
Grains	0.0431	0.0296	0.1333	1.6863	3.0904
Hay	0.0336	0.0305	0.1006	1.9050	2.9891
Tobacco	0.1028	0.0180	0.1884	1.1753	1.8332
Fruits	0.2140	0.0358	0.3969	1.1674	1.8547
Vegetables	0.1340	0.0262	0.2482	1.1959	1.8526
Misc. Crops	0.0636	0.0325	0.1470	1.5109	2.3123
Soybeans	0.0386	0.0123	0.0796	1.3186	2.0627
Forest Products	0.0953	0.0222	0.1876	1.2334	1.9688
Greenhouse and Nursery	0.3525	0.0398	0.6382	1.1128	1.8106

Table 44. Weighted Type I Income Multiplier for TPPR 6.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.5151	0.141816	0.214865
Poultry	1.5745	0	0
Cattle	1.7210	0.373363	0.642557
Sheep	1.8037	0	0
Hogs	1.7326	0.043322	0.075060
Misc. Livestock	1.2447	0.012734	0.015850
Grains	1.6863	0.002625	0.004427
Hay	1.9050	0.023696	0.045141
Tobacco	1.1753	0.382158	0.449151
Fruits	1.1674	0.001444	0.001685
Vegetables	1.1959	0.012701	0.015189
Misc. Crops	1.5109	0.002724	0.004115
Soybeans	1.3186	0	0
Forest Products	1.2334	0.001870	0.002307
Greenhouse and Nursery	1.1128	0.001542	0.001716
Weighted Sum for all Type I Income Multipliers for Agricultural Industries in TPPR 6.			**1.472070**

Table 45. Weighted Type III Income Multiplier for TPPR 6.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	2.3688	0.141816	0.335934
Poultry	2.3320	0	0
Cattle	2.3900	0.373363	0.892337
Sheep	2.5764	0	0
Hogs	2.4249	0.043322	0.105053
Misc. Livestock	1.9660	0.012734	0.025035
Grains	3.0904	0.002625	0.008114
Hay	2.9891	0.023696	0.070830
Tobacco	1.8332	0.382158	0.700573
Fruits	1.8547	0.001444	0.002678
Vegetables	1.8526	0.012701	0.023530
Misc. Crops	2.3123	0.002724	0.006298
Soybeans	2.0627	0	0
Forest Products	1.9688	0.001870	0.003683
Greenhouse and Nursery	1.8106	0.001542	0.002792
Weighted Sum for all Type III Income Multipliers for Agricultural Industries in TPPR 6.			**2.176863**

Table 46. Direct, Indirect, and Induced Employment Effects and Unweighted Type I and Type III Employment Multipliers for TPPR 6.

	Income Effects			Multiplier Effects	
	Direct	Indirect	Induced	Type I	Type III
Dairy	14.4017	3.2462	5.0949	1.2254	1.5792
Poultry	10.6393	3.8010	4.1689	1.3573	1.7491
Cattle	9.5924	4.0534	3.9395	1.4226	1.8332
Sheep	10.9950	4.7633	4.5493	1.4332	1.8470
Hogs	9.6910	4.4290	4.0764	1.4570	1.8777
Misc. Livestock	19.3433	2.8988	6.4212	1.1499	1.4818
Grains	17.7922	2.8331	5.9544	1.1592	1.4939
Hay	9.7300	2.6957	3.5872	1.2771	1.6457
Tobacco	21.2962	1.7318	6.6481	1.0813	1.3935
Fruits	45.3887	4.7098	14.4632	1.1038	1.4224
Vegetables	26.9097	3.0635	8.6531	1.1138	1.4354
Misc. Crops	14.6078	2.7467	5.0102	1.1880	1.5310
Soybeans	8.5398	1.2361	2.8222	1.1447	1.4752
Forest Products	20.6123	3.2526	6.8897	1.1578	1.4920
Greenhouse and Nursery	77.2608	6.5168	24.1862	1.0843	1.3974

Table 47. Weighted Type I Employment Multiplier for TPPR 6.

	Unweighted Type I Multiplier	Factor Weights	Weighted Type I Multiplier
Dairy	1.2254	0.141816	0.173781
Poultry	1.3573	0	0
Cattle	1.4226	0.373363	0.531146
Sheep	1.4332	0	0
Hogs	1.4570	0.043322	0.063121
Misc. Livestock	1.1499	0.012734	0.014643
Grains	1.1592	0.002625	0.003043
Hay	1.2771	0.023696	0.030262
Tobacco	1.0813	0.382158	0.413228
Fruits	1.1038	0.001444	0.001593
Vegetables	1.1138	0.012701	0.014146
Misc. Crops	1.1880	0.002724	0.003236
Soybeans	1.1447	0	0
Forest Products	1.1578	0.001870	0.002165
Greenhouse and Nursery	1.0843	0.001542	0.001672
Weighted Sum for all Type I Employment Multipliers for Agricultural Industries in TPPR 6.			**1.252042**

Table 48. Weighted Type III Employment Multiplier for TPPR 6.

	Unweighted Type III Multiplier	Factor Weights	Weighted Type III Multiplier
Dairy	1.5792	0.141816	0.223956
Poultry	1.7491	0	0
Cattle	1.8332	0.373363	0.684449
Sheep	1.8470	0	0
Hogs	1.8777	0.043322	0.081347
Misc. Livestock	1.4818	0.012734	0.018869
Grains	1.4939	0.002625	0.003922
Hay	1.6457	0.023696	0.038996
Tobacco	1.3935	0.382158	0.532538
Fruits	1.4224	0.001444	0.002054
Vegetables	1.4354	0.012701	0.018231
Misc. Crops	1.5310	0.002724	0.004170
Soybeans	1.4752	0	0
Forest Products	1.4920	0.001870	0.002791
Greenhouse and Nursery	1.3974	0.001542	0.002155
Weighted Sum of all Type III Employment Multipliers for Agricultural Industries in TPPR 6.			**1.613482**

Appendix 2

Accuracy and Reliability of Forestry Data

Many data sources were used in this study; Bureau of Economic Analysis (BEA) national-level technical coefficients, 1987 Census of Agriculture acreage and cash receipts data, and Tennessee Statistical Abstract income data, to name but a few. The accuracy and reliability of the data provided by these sources must, for the most part, be assumed. However, there is sufficient doubt concerning the accuracy of the data for one industrial sector (Forestry) to warrant special mention. In Forest Resource Analysis For Morgan County Tennessee And Surrounding Counties, J. Daniel Thomas states that, "Cumberland and Scott Counties rank second and third in the State in total commercial forest land." (Thomas, p. 6) Morgan, Campbell, and Fentress Counties also have significant acreage in commercial forest land. The magnitude of commercial timbering in these rural persistent poverty counties is not consistent with results generated by the IMPLAN model or data provided by the 1987 Census of Agriculture. This inconsistency is probably due to the manner in which receipts from timber are reported. Cash receipts for timber, in many cases, are reported only after some processing has occurred. These cash receipts are for cut lumber rather than timber and, therefore, reported in the manufacturing sector rather than the agricultural sector.

In many counties there are only 1 or 2 commercial forestry firms. This creates a discloser problem which limits the availability of cash receipts data on forestry. It is unfortunate that cash receipts data are not available for forest products in Tennessee because the production of all other agricultural commodities in Tennessee is easily measured using this indicator (cash receipts).

If forest products are more important to the agricultural economies of these counties (Cumberland, Scott, Campbell, Morgan, and Fentress) than is indicated by the IMPLAN results, the income and employment multipliers associated with agricultural production in the regions containing these counties are probably underestimated.

VITA

Robert Harrison Neal was born in Glade Spring, Virginia, on April 13, 1953. He attended Fulton High School in Knoxville, Tennessee and was graduated in June 1971. After serving three years with Tennessee Rural Metro Fire Department and four years with the United States Army, he attended The University of Tennessee in Knoxville. He was graduated in December 1987 with a Bachelor of Science degree in Agricultural Economics and Rural Sociology. He accepted a Graduate Research Assistantship in this same department and began work toward the Master of Science degree in April 1988. He completed the requirements for the Masters degree in Agricultural Economics and Rural Sociology at The University of Tennessee, Knoxville, in August 1990.