Institute of Agriculture

Department of Agricultural Economics

December 2006

Economic Impacts of Agriculture and Forestry in Tennessee, 2003

by

Jamey Menard, Burton C. English, and Kim Jensen

Agricultural Experiment Station
The University of Tennessee
Knoxville

Jamey Menard is a Research Associate. Burton English and Kim Jensen are Professors of Agricultural Economics.

Please visit the Department's web site at http://web.utk.edu/~agecon/.

Additional copies of this report may be obtained from:

Department of Agricultural Economics
The University of Tennessee
2621 Morgan Circle
Knoxville, TN 37996-4518
(865) 974-7231

E11-1215-004-07

Executive Summary

In 2003, the agro-forestry industrial complex contributed $67.0 billion to the Tennessee economy, accounting for 17.3 percent of the economic activity conducted within the state, and employed over 490,000 individuals, or 14.3 percent of the total number of workers. In this study the agro-forestry industrial complex included the primary industries typically associated with agriculture and forest operations such as growing crops, the breeding and feeding of livestock, and the management and logging of trees. Also included in the industrial complex were input supply industries and value-added sub-sectors, which included food and beverage manufacturing, apparel and textiles, and forestry products manufacturing.

Agriculture, a subset of the agro-forestry industrial complex, includes farming and related industries, as well as value-added food and fiber production, processing and manufacturing. Agriculture accounted for 11.4 percent of the state's economy and generated $44.2 billion in output. Agriculture employed about 342,000 Tennesseans, with over 130,000 (both full- and part-time) in agricultural production. In addition,

- Agriculture input supplying industries – agricultural machinery and chemical products – generated nearly $3.6 billion in cash receipts annually.

- Tennessee farmers earned more than 66.1 percent of their cash receipts from cattle and calves, broilers, greenhouse/nursery, soybeans, and cotton.

- Tennessee's equine population, an estimated 210 thousand head of horses, donkeys, and mules, is the second largest in the United States (based on number of head). Tennessee Walkers and Quarter Horses are the top horse breeds in the state.

- The most common types of agri-tourism attractions in the state are on-farm retail markets, on-farm restaurants/eating establishments, on-farm tours, pick-your-own farms, farm festivals and fairs, pumpkin patches, cut-your-own Christmas trees, and on-farm petting zoos.

- Major markets for Tennessee's exports of agricultural and livestock products included China, Mexico, Turkey, Indonesia, and India.

- Tennessee, one of the top hardwood lumber producing states, produced 964.0 million board feet of hardwood lumber and 95.0 million board feet of softwood lumber in 2003.

This analysis was conducted using the Tennessee Agri-Industry model (TNAIM) and the Impact Analysis for Planning (IMPLAN) model and databases. TNAIM, an input-output model for five trading regions within the state, traces transactions conducted within the economy and attempts to quantify the economic interdependencies within each region's economy for a given point in time. Through these interdependencies, one can evaluate the indirect and induced impacts that economic activity in one region might have on the entire state economy.

Table of Contents

List of Tables

List of Figures

Economic Impacts of Agriculture and Forestry in Tennessee

Introduction

Similar to previous reports (English, Jensen, and Menard, 2001; English, Jensen, and Menard, 2003) where the economic importance and impacts of agricultural and forestry industrial complexes on Tennessee's economy were examined using 1997 and 2000 data, this study utilizes an input-output model reflecting the state's 2003 economy to determine direct impacts on related input industries, and impacts through resulting expenditures by households and institutions at both the state and five-region level. The impacts were provided for four major indicators: total industry output, employment, labor income, and value-added.

Input-output model results for previous studies in this series were based on the Standard Industrial Classification (SIC) system as defined by the United States Census Bureau. Results for this study are based on the North American Industrial Classification System (NAICS) (Census NAICS, 2002). The reader is cautioned to not compare industry sector level results from the previous studies using the SIC system with the results from this most recent study using NAICS. For readers who are interested in time series data, this creates a problem since many industries are grouped in different or entirely new categories.

For the purpose of this analysis, agriculture[1] and forestry includes the production and processing of agricultural and forest products and the input suppliers of these products. The objectives of this analysis are to: 1) provide an overview of Tennessee's agriculture and forestry resource base, 2) compare livestock and crop statistics for 2000 and 2003, and 3) evaluate the economic importance and impacts of the agricultural and forestry industrial complex for the state and for specific consumption regions within the state.

[1] In this report, forestry and the production of forest products were incorporated in agriculture and agribusiness, respectively.

This document is structured along the same theme as the objectives. First, an overview of Tennessee's agriculture and forestry is presented. Crop and livestock cash receipts, Tennessee's rank in the United States based on the production of agricultural products, exports for both agricultural and forestry products, plus agricultural and forestry manufacturing statistics are discussed. Next, a review of state level changes in livestock and crops for the years 2000 and 2003 is presented. Changes in livestock inventory, crop acreages, prices, including a brief discussion of rainfall by climate divisions in the state are discussed in the section. Finally, the remaining part of the document evaluates the economic impacts and importance of the agricultural and forestry industrial complex for the state and specific consumption regions within the state via the use of an input-output model. After a data and methodology section discussion, direct and total economic impact results are presented.

Overview of Agriculture and Forestry in Tennessee

In 2003, of Tennessee's 26.4 million acres, 11.6 million acres, or 43.9 percent, were in farms. For 2003, the number of farms totaled 87,000. From 1998 to 2003, the number of farms in the state decreased an average of 0.7 percent annually. The average farm in 2003 was 133 acres in size compared to 441 acres for the United States. Approximately 75.3 percent of the total number of farms had sales in the $1,000-$9,999 range, 20.1 percent in the $10,000-$99,999 range, and 4.6 percent had sales of $100,000 or more (Tennessee Agricultural Statistics Service, 2004).

Tennessee was ranked in the upper half of the nation in all of the major crops except for rice and peanuts (Table 1). Approximately 43.0 percent of the state's crop acreage (roughly 4.7 million acres) was in hay (all types), followed by soybeans (23.7 percent), corn for grain (13.4 percent), cotton (11.2 percent), and wheat (5.7 percent). For crops, soybeans had the largest cash receipts, followed by cotton, corn, tobacco, and vegetables. Tennessee's top crop counties

Table 1. Crops Harvested, Acreage, State Ranking, and Cash Receipts, 2003

Crops	Acreage	State Ranking	Cash Receipts
	(Thousand Acres)		(Thousand $)
Hay (all types)	2,030	--	$41,324
Soybeans	1,120	15	$274,757
Corn for Grain	630	17	$161,075
Cotton, Lint	530	8	$232,507
Winter Wheat	270	20	$40,617
Corn for Silage	50	27	--
Grain Sorghum	40	12	$6,816
Tobacco (all types)	31	3	$90,391
Vegetables*	14	--	$58,578

*Snap beans, squash, and tomatoes
Source: Tennessee Agricultural Statistics Service, 2004

included Robertson County for alfalfa hay, Greene County for all other hay, Macon County for all tobacco, Obion County for corn, Haywood County for cotton, Gibson County for wheat, and Dyer County for soybeans.

In terms of number of head, broilers, chickens, cattle and calves, hogs and pigs, equine, and milk cows were the predominant livestock in the state (Table 2). According to the Tennessee Agricultural Statistics Service for 2003, cash receipts from farm marketing for these livestock products totaled over $1.0 billion. Of that total, cattle and calves contributed 41.9 percent, broilers 30.8 percent, dairy products 15.3 percent, equine 5.5 percent, and hogs and pigs3.4 percent. Tennessee is ranked second in the United States for the number of equine on

Table 2. Livestock Numbers, State Rankings, and Cash Receipts, 2003

Livestock	Inventory	State Ranking	Cash Receipts
	(Number)		(Thousand $)
Broilers	182,300,000	13	$322,320
All Chickens	2,260,000	33	$32,847[1]
Cattle & Calves	2,210,000	14	$438,289[2]
Beef Cows	1,103,000	9	--
Hogs & Pigs	215,000	24	$35,167
Equine	155,000	2	$57,500
Milk Cows	79,000	28	$159,600[3]

[1]Includes eggs and farm chickens; excludes commercial broilers
[2]Includes beef cows
[3]Dairy products
Source: Tennessee Agricultural Statistics Service, 2004

farms, 9th for beef cows, 13th for broilers, 14th cattle and calves, 24th for hogs and pigs, and 28th for milk cows. Tennessee's top livestock counties included Greene County for all cattle and milk cows, Lincoln County for beef cows, Henry County for all hogs, and Rutherford County for all equine.

Tennessee's more significant agricultural commodities in terms of dollar value, along with their corresponding U.S. market share, are shown in Table 3. In descending order they were cattle ranching and farming, poultry and egg production, cotton farming, greenhouse and nursery production, oilseed farming (primarily soybeans), grain farming (barley, corn, oats, sorghum, and wheat), and other crop farming (primarily hay and seed).

Tennessee Agri-Tourism

Agri-tourism is one method to enhance farmers' income and promote rural economic activity within a region. Based on a 2003-2004 study, the most common types of agri-tourism attractions in the state were on-farm retail markets, on-farm restaurants/eating establishments, on-farm tours, pick-your-own farms, farm festivals and fairs, pumpkin patches, cut-your-own Christmas trees, and on-farm petting zoos. Many operators offered more than one attraction and planned to expand their operations in the future. Median expenditures per visitor averaged around $15 at agri-tourism attractions. The majority of the expenditures were spent on admission or user fees and purchasing the venue's product (Jensen et al., 2005).

Table 3. State Value of Agricultural Commodities and U.S. Market Share, 2003

Commodity	Value	U.S. Market Share
	(Million $)	(Percent)
Cattle Ranching & Farming	$597	0.90
Poultry & Egg Production	$384	1.61
Cotton Farming	$360	5.51
Greenhouse & Nursery Production	$318	1.94
Oilseed Farming	$296	1.66
Grain Farming	$210	0.72
All Other Crop Farming*	$149	0.84
Animal Production, except Cattle & Poultry & Eggs**	$130	0.84
Vegetable & Melon Farming	$125	0.74
Tobacco Farming	$90	5.81
Hunting/Trapping	$25	1.10
Fruit Farming	$18	0.14
Fishing	$7	0.20

*Primarily hay and seed farming
**Primarily hogs, sheep & goats, aquaculture, equine, and apiculture
Source: Minnesota IMPLAN Group, Inc., 2003

Tobacco and cotton had the largest U.S. market share at 5.81 percent and 5.51 percent, respectively.

Tennessee's agricultural commodity exports in 2003 totaled $648.6 million. The value of the more predominant commodities exported included cotton and cottonseed products at $133.9 million, soybeans and products at $104.4 million, unmanufactured tobacco at $82.6 million, wheat and products at $81.9 million, feed grains and products at $46.8 million, feeds and fodders at $28.8 million, poultry and products at $30.3 million, and live animals and meat (excluding poultry) at $23.7 million. Exports for the category "Other" totaled $89.6 million, which included minor oilseeds, beverages other than juice, nursery and greenhouse, wine and miscellaneous vegetable products (Tennessee Agricultural Statistics Service, 2004).

In 2003, Tennessee's forest products (paper products, wood products, plus furniture and related products) exported outside the United States, including forestry and logging, totaled $453.3 million. Paper products had the highest export value at $332.4 million, followed by wood products ($73.9 million), furniture and related products ($37.8 million), and forestry and logging ($9.1 million) (U.S. Department of Commerce, 2003b).

Tennessee is one of the top hardwood lumber producing states in the United States. In 2003, approximately 964.0 million board feet of hardwood lumber and 95.0 million board feet of softwood lumber were produced (Tennessee Agricultural Statistics Service, 2004). The majority of the forest cover in the state was hardwoods. White oak, red oak, hickory, yellow poplar, and maple were some of the more predominant hardwood species. For softwoods, loblolly pine, virginia pine, redcedar, and shortleaf pine were major species.

Agriculture and forestry manufacturing industries for the state (Figures 1 through 9) included food, beverage and tobacco products, textile mills, textile product mills, apparel, leather and allied products, wood products, paper, and furniture and related products. In 2003, close to

$28 billion dollars of goods were shipped and over 112,000 Tennesseans were employed with a payroll of over $3.5 billion (Table 4). Food manufacturing shipped the largest value of goods, over $12 billion, followed by paper manufacturing at $4.4 billion, and beverage and tobacco

Table 4. Manufacturing Statistics for Tennessee, 2003

Manufacturing Industry	Employees	Payroll	Establishments	Value of Shipments
	(Number)	(Thousand $)	(Number)	(Thousand $)
Food	38,782	$1,298,940	364	$12,175,459
Beverage & Tobacco Products	3,216	$128,516	68	$3,350,709
Textile Mills	6,177	$199,783	81	$1,442,586
Textile Product Mills	3,464	$100,056	138	$640,324
Apparel	7,505	$174,831	197	$897,489
Leather & Allied Products	1,351	$30,757	37	$132,324
Wood Products	15,690	$428,434	590	$2,475,237
Paper	16,089	$620,747	154	$4,427,647
Furniture & Related Products	19,809	$543,702	450	$2,357,626
Total	112,083	$3,525,766	2,079	$27,899,401

Source: U.S. Census Bureau, Manufacturing, Mining, and Construction Statistics, Annual Survey of Manufacturers, 2003 Geographic Area Statistics; U.S Census Bureau, State and County *Quickfacts*, Tennessee *QuickLinks*, County Business Patterns Economic Profile, 2003.

products at $3.3 billion. As a group, textile mills, including textile product mills and apparel, shipped $2.9 billion. For the forest products group, which included wood product manufacturing, paper manufacturing, and furniture and related products, approximately $9.2 billion of goods were shipped. Tennessee's national market share for value of shipments for food manufacturing was 1.0 percent, beverage and tobacco products at 6.4 percent, textile mills at 2.7 percent, textile product mills at 1.4 percent, apparel manufacturing at 1.8 percent, leather and allied products at 1.2 percent, wood product manufacturing at 1.8 percent, paper manufacturing at 2.3 percent, and furniture and related products at 1.5 percent (U.S. Department of Commerce, 2003b).

In terms of employment, the forest products group (wood product manufacturing, paper manufacturing, and furniture and related products) employed the largest share at over 51,500.

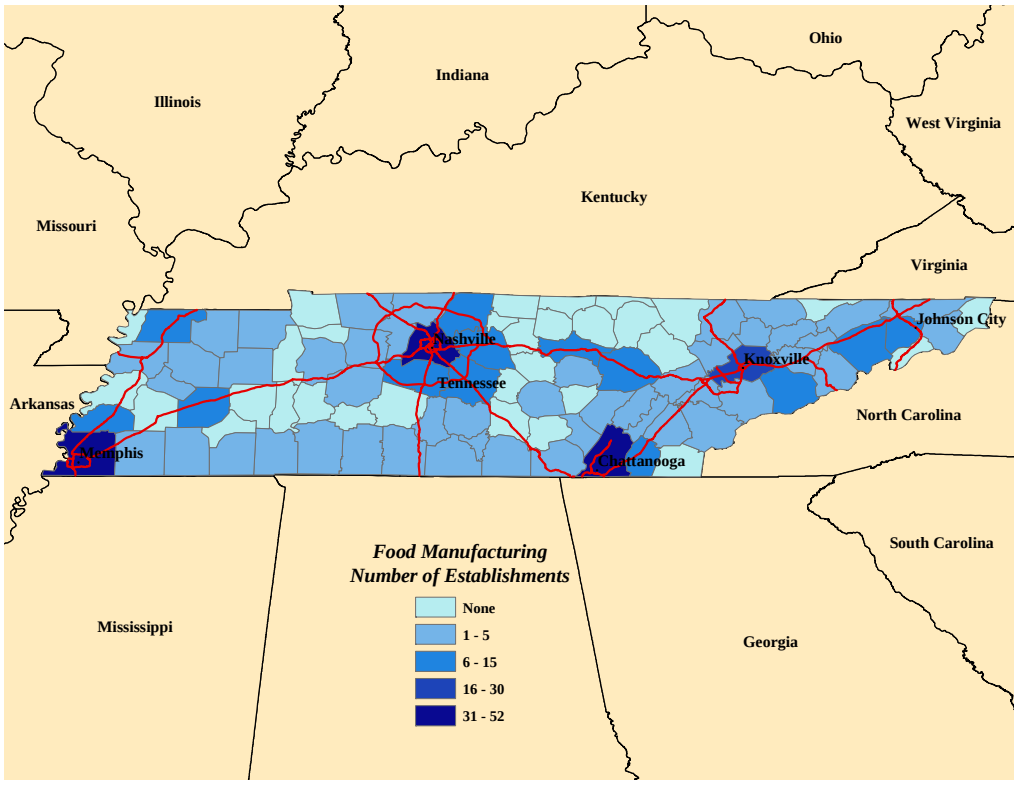


Figure 1. Number of Food Manufacturing Establishments in Tennessee, 2003.

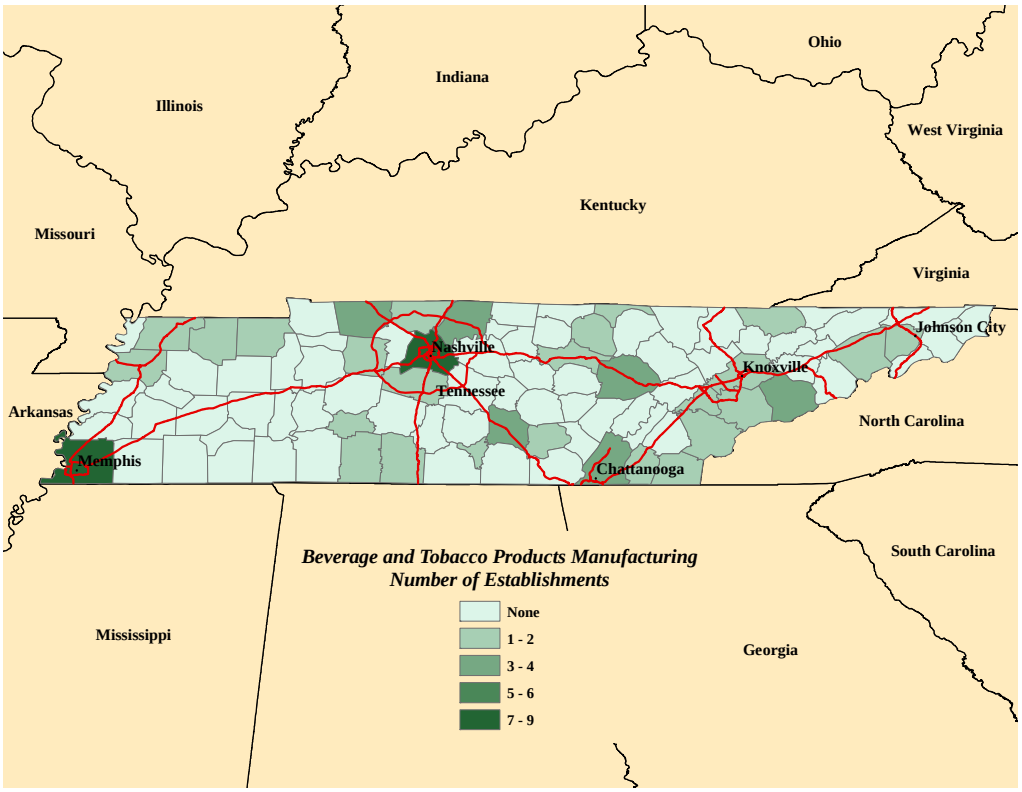


Figure 2. Number of Beverage and Tobacco Products Establishments in Tennessee, 2003.

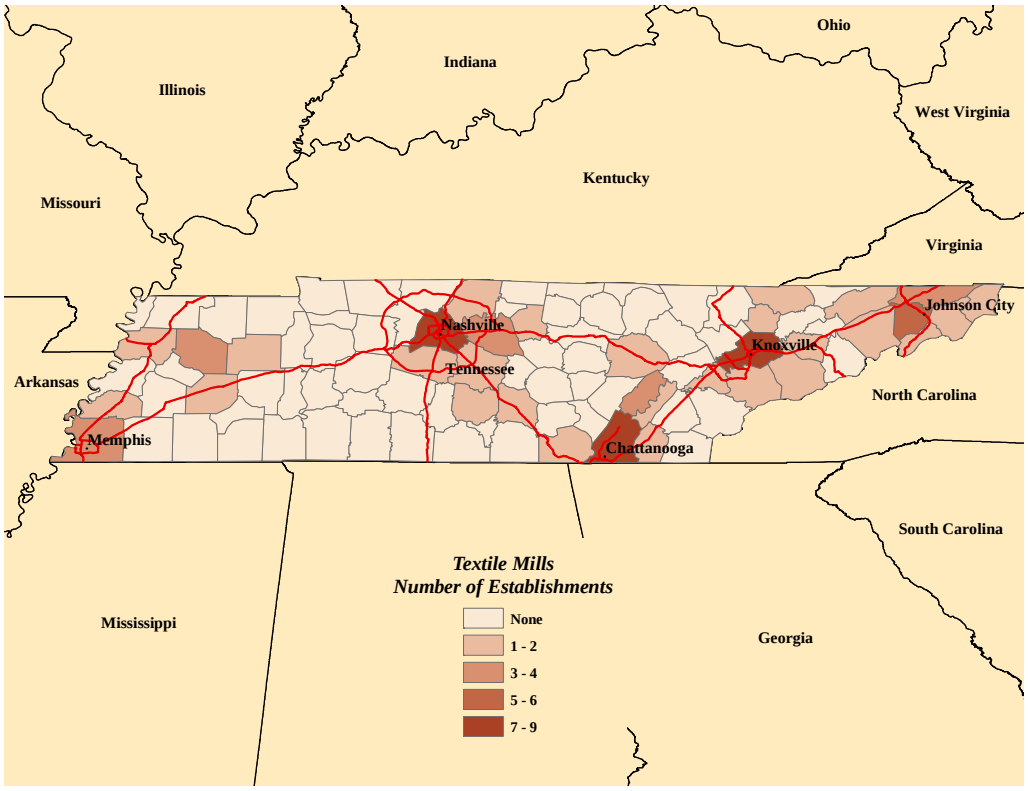


Figure 3. Number of Textile Mill Establishments in Tennessee, 2003.

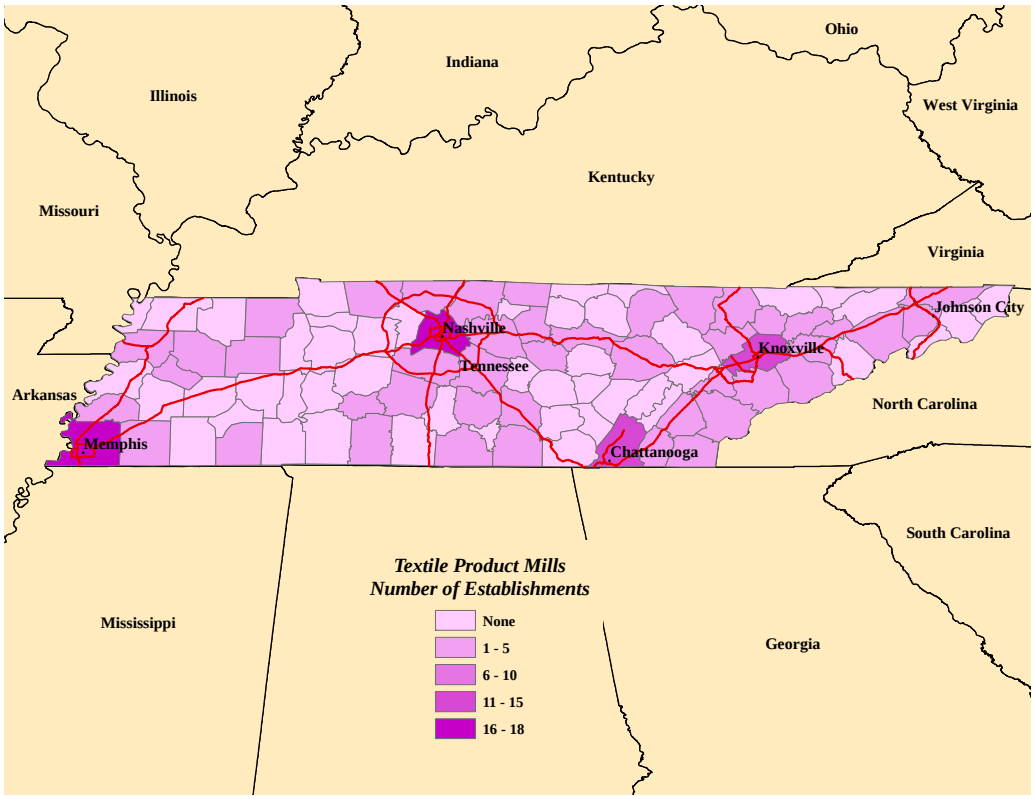


Figure 4. Number of Textile Product Mill Establishments in Tennessee, 2003.

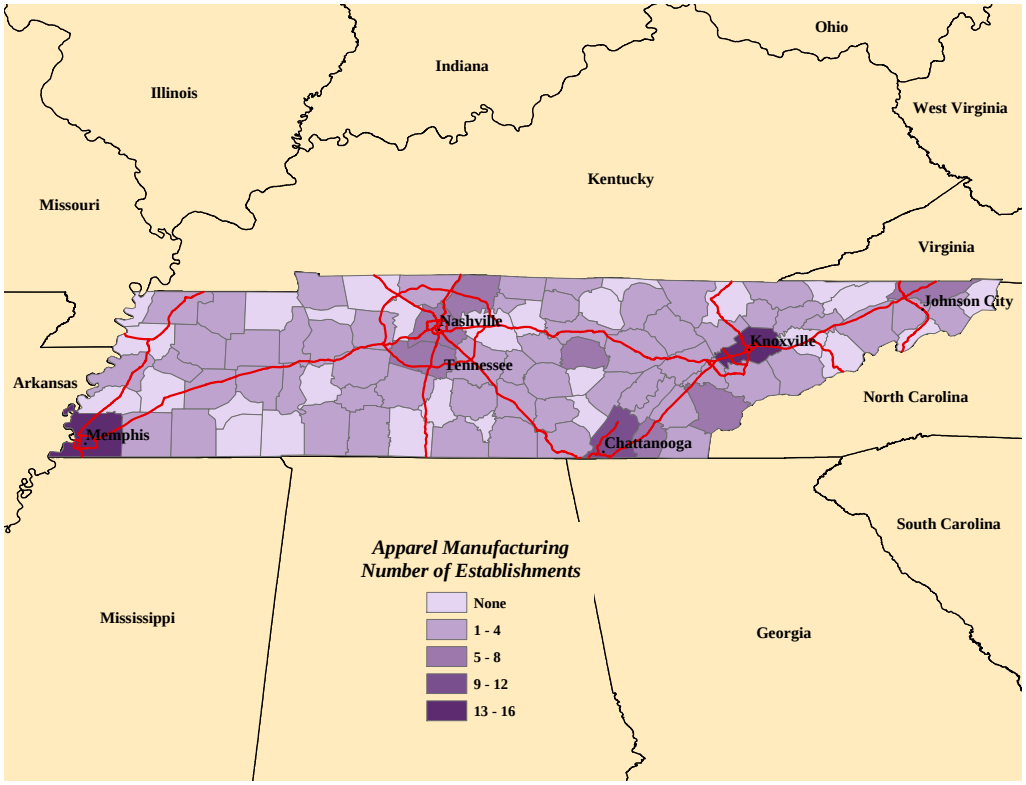


Figure 5. Number of Apparel Manufacturing Establishments in Tennessee, 2003.

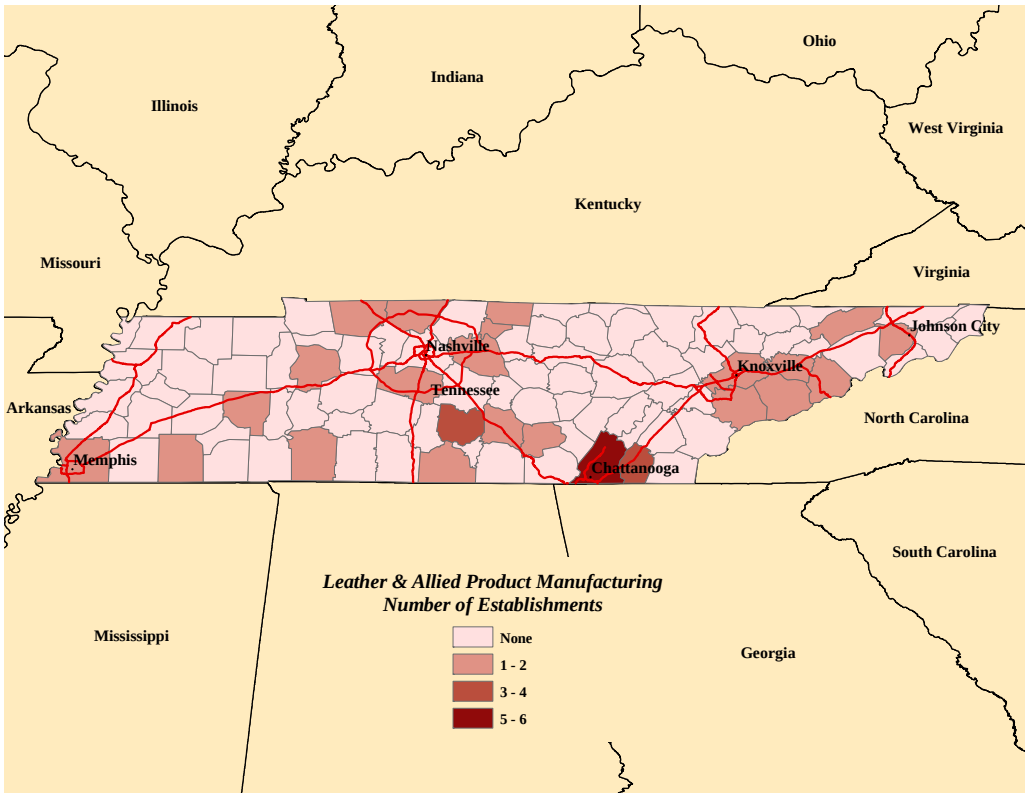


Figure 6. Number of Leather & Allied Product Establishments in Tennessee, 2003.

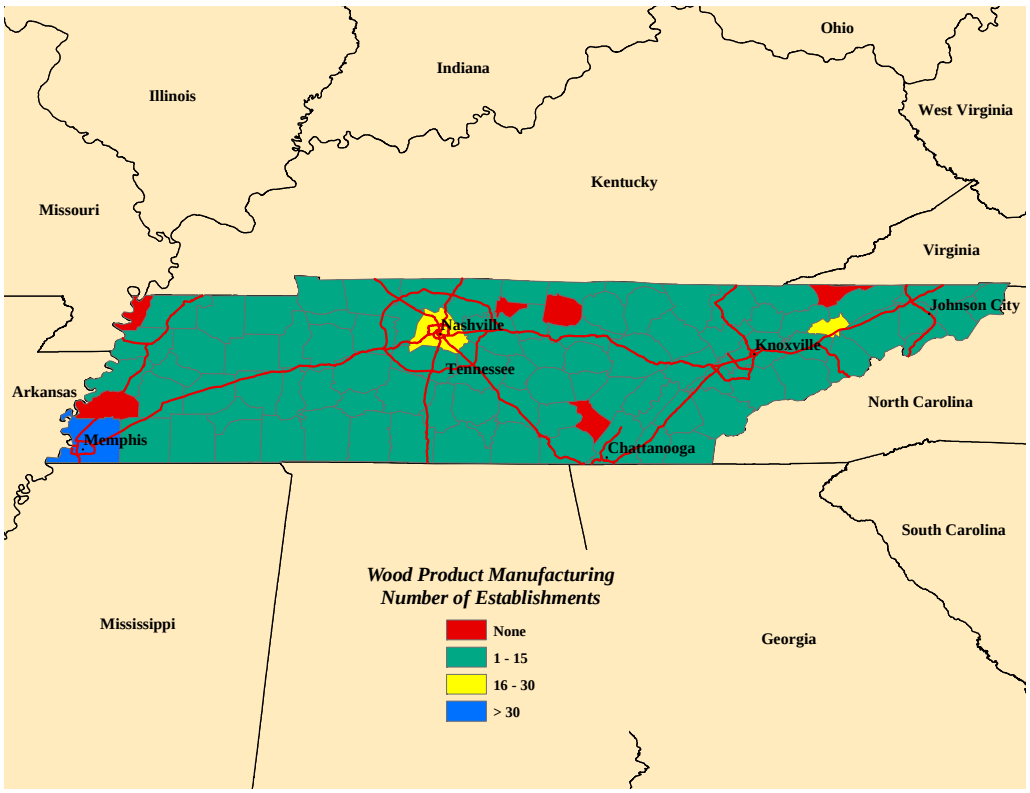


Figure 7. Number of Wood Product Manufacturing Establishments in Tennessee, 2003.

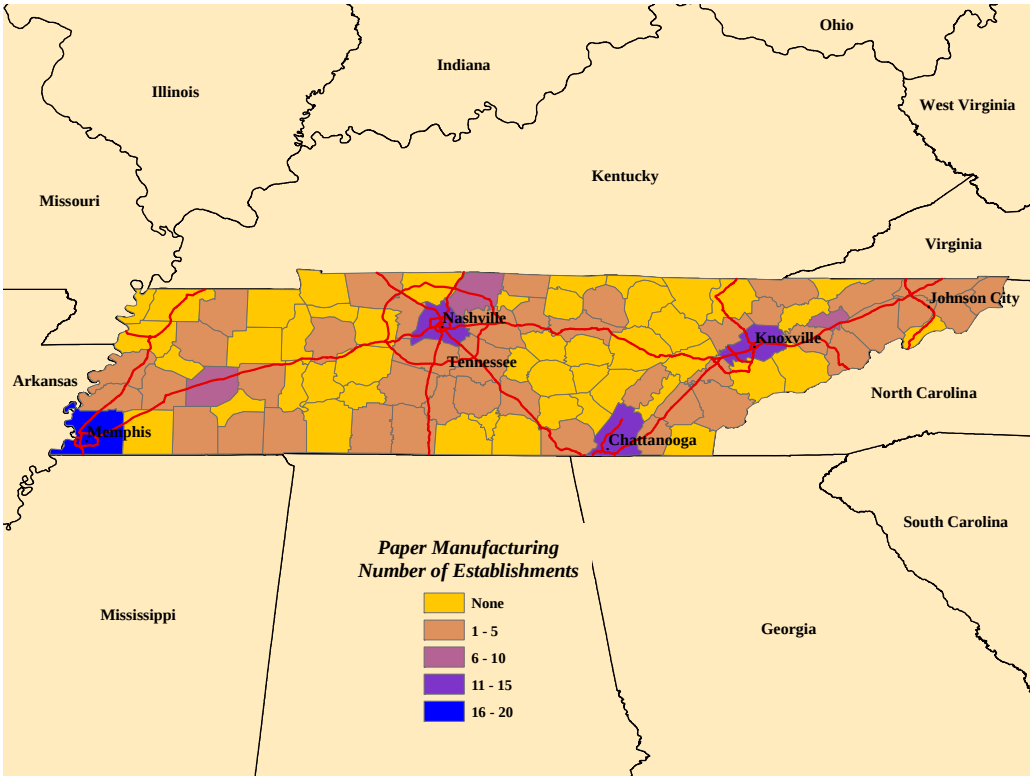


Figure 8. Number of Paper Manufacturing Establishments in Tennessee, 2003.

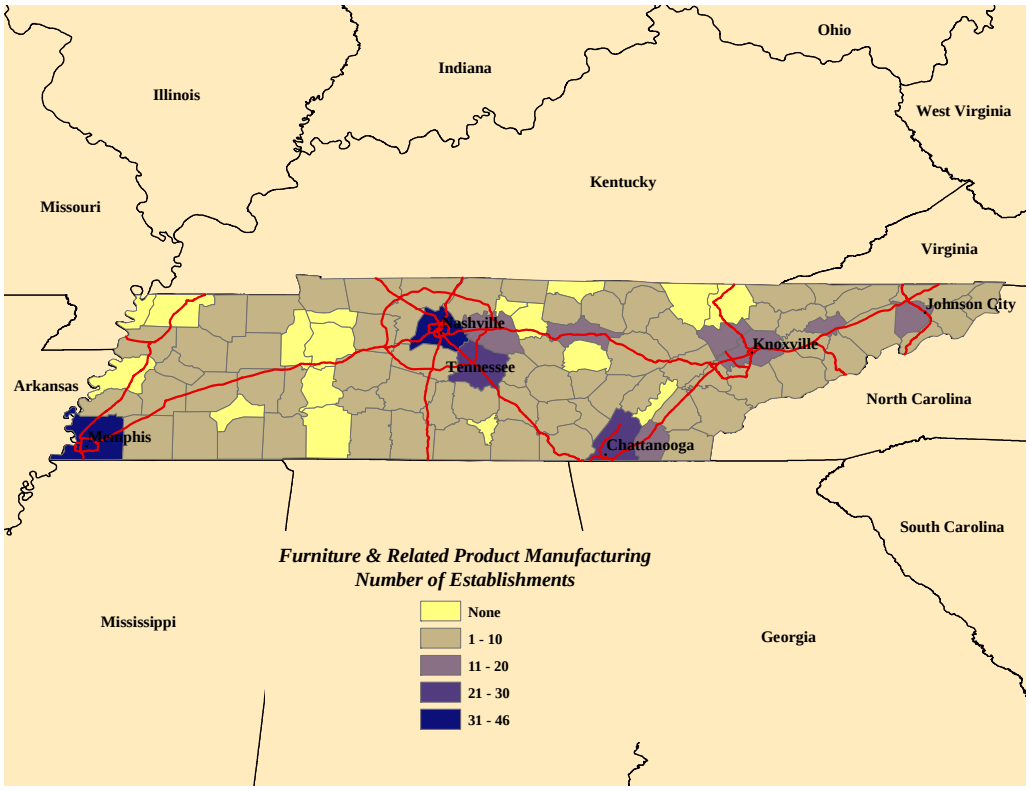


Figure 9. Number of Furniture & Related Products Establishments in Tennessee, 2003.

This was followed by food manufacturing employment at over 38,700 workers and textile mills and related products, including apparel, at close to 17,150 workers.

State Level Changes in Livestock and Crops: 2000 to 2003

Comparing 2000 and 2003 agricultural data for the state revealed an increase in the number of cattle, poultry, broilers, and eggs. Milk cows and hogs production numbers decreased. Prices increased for most livestock products except for cattle and hogs. Most of the traditional row crops grown in the state experienced reduced planted acreage except for grain sorghum. Crop prices were higher for most major crops grown in the state.

Precipitation for the state for the timeframe reviewed can be characterized as extreme. Below average rainfall for years 2000 and 2001 in many areas of the state followed by above

average rainfall for year's 2002 and 2003 (see Figure 10) (U.S. Department of Commerce, 2003a)

Livestock Changes in Inventory and Prices

Compared to 2000 production levels, broilers had the largest increase in numbers (20.5 percent), followed by eggs (4.3 percent), cattle (2.8 percent), and poultry (2.3 percent) (Table 5). The number of milk cows had the largest decrease (17.7 percent) followed by the number of hogs (6.5 percent). Milk production declined 8.4 percent over the timeframe. Livestock prices were higher for all livestock commodities except for cattle and hogs. Hogs had the greatest price decrease (12.2 percent). The greatest price increases were for eggs (6.5 percent), followed by broilers (3.0 percent) and poultry (1.7 percent).

Table 5. Comparison of Tennessee Livestock Numbers and Prices, 2000 and 2003*

Commodity	Inventory		Change	Units	Price		Change	Units
	2000	2003			2000	2003		
			%	1,000	(dollars/unit)		%	
All Cattle & Calves	2,150	2,210	2.8	head	$65.20	$64.20	-1.5	100 pounds
All Chickens	2,210	2,260	2.3	no.	$6.00	$6.10	1.7	head
Broilers	151,300	182,300	20.5	no.	$0.33	$0.34	3.0	pound
Eggs	278,000	290,000	4.3	no.	$1.24	$1.32	6.5	dozen
Milk Cows	96	79	-17.7	head	$1,290	--	--	head
All Hogs	230	215	-6.5	head	$41.00	$36.00	-12.2	100 pounds

Source: Tennessee Agricultural Statistics Service, 2004
*Data in nominal values.

Crop Changes in Acres Planted and Prices

With the exception of grain sorghum, acres of traditional row crops harvested declined from 2000 to 2003 (Table 6). Wheat had the largest decline in acres harvested at close to 51 percent, followed by tobacco (32.6 percent). Grain sorghum harvested acres increased from 25 to 40 thousand acres, a 60 percent increase. Practically all the crop commodities experienced higher prices for the timeframe examined except for peaches. The largest price increase was for soybeans, followed by wheat, grain sorghum, cotton, corn and tomatoes.

Table 6. Comparison of Tennessee Crop Acreages and Prices, 2000 and 2003*

Commodity	Harvested Acres 2000	Harvested Acres 2003	Change	Price 2000	Price 2003	Change	Units
	1,000 acres		%	$/unit		%	
Hay, All	2,035	2,030	-0.2	$51.00	$55.49	8.8	ton
Corn	650	630	-3.1	$1.96	$2.35	19.9	bushel
Soybeans	1,180	1,120	-5.1	$4.69	$7.25	54.6	bushel
Cotton	570	530	-7.0	$0.45	$0.59	31.1	pound
Tobacco	46	31	-32.6	$2.01	$2.10	4.5	pound
Grain Sorghum	25	40	60.0	$1.81	$2.38	31.5	bushel
Wheat	550	270	-50.9	$2.35	$3.17	34.9	bushel
Tomatoes	4.2	3.5	-16.7	$31.00	$37.00	19.4	cwt
Snap Beans	10.5	9.5	-9.5	$26.00	$29.00	11.5	cwt
Apples	1.1	1.1	0.0	$0.24	$0.25	3.5	pound
Peaches	0.6	0.5	-16.7	$0.55	$0.51	-6.4	pound

Source: Tennessee Agricultural Statistics Service, 2004.
*Data in Nominal Values.

Floriculture growers and areas under cover for floriculture crop production increased from 2000 to 2003. However, for that timeframe, the wholesale value of production decreased from $52.4 million to $49.0 million, a decrease of 6.5 percent (Table 7). For operations with sales equal to or greater than $10 thousand, open ground acres totaled 355, an increase of 70.6 percent from 2000's level of 208 acres. Total covered area for growing floriculture crops increased from 4.8 to 7.3 million square feet, an increase of 52.1 percent. For operations with sales equal to or greater than $100 thousand in 2003, bedding and garden plants contributed the greatest amount of the total wholesale value at $26.4 million, followed by potted flowering plants ($10.8 million), herbaceous perennial plants ($5.1 million), and foliage for indoor or patio use ($0.7 million) (Tennessee Agricultural Statistics Service, 2004; National Agricultural Statistics Service, 2002 and 2004).

Table 7. Comparison of Tennessee Floriculture Statistics, 2000 and 2003

Floriculture	2000	2003	Percent
Growers	202	217	7.4
Total Covered Area (1,000 sq. ft.)	6,876	7,336	6.7
Wholesale Value of Production ($ million)	$52.4	$49.0	-6.5

Source: Tennessee Agricultural Statistics Service, 2004.

Corn, cotton, grain sorghum, soybeans, and tobacco had an increase in yields between 2000 and 2003 for the state, while wheat yields decreased. One cause for the change in yields was the weather. Precipitation values from 2000 to 2003 are shown in Figure 10. The values shown were departure from normal precipitation. For example, for climate division four in

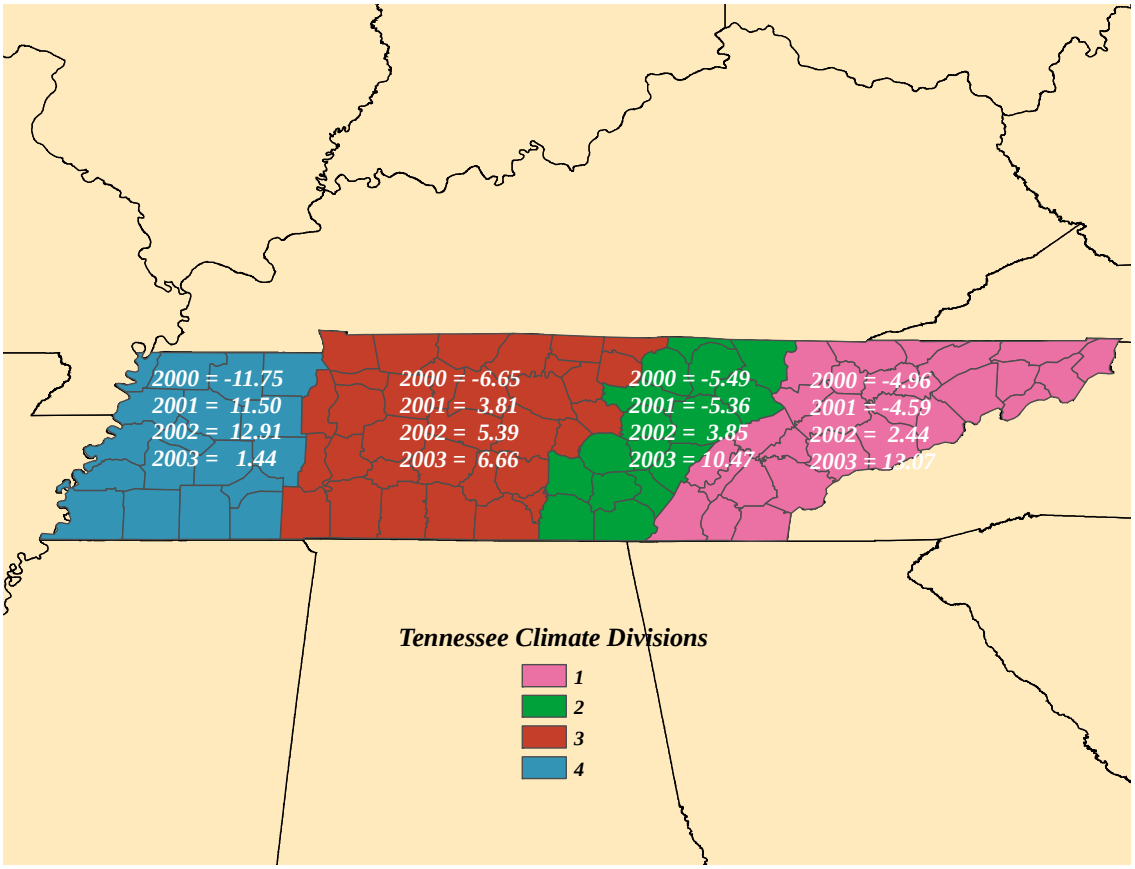


Figure 10. Departure from Normal Precipitation for Tennessee's Climate Divisions.

2003, rainfall was 1.44 inches above normal precipitation values. Likewise, for that same climate division for 2000, rainfall was 11.75 inches below normal. Rainfall for years 2002 and 2003 was above normal for all the climate divisions in the state. On the other hand, rainfall was below normal for all climate divisions for 2000 and for climate divisions one and two for 2001. Rainfall extremes were greater in the western part of the state compared to the middle and eastern parts.

Changes in acres, yields, and prices impacted the total industry output (value of production) contributed to the state's economy from crops. Of the five major crops, soybeans, cotton, and corn had an increase in gross receipts when comparing 2003 with 2000. Tobacco and wheat gross receipts declined from 2000 to 2003 (Tennessee Agricultural Statistics Service, 2002; Tennessee Agricultural Statistics Service, 2004).

Input-Output Analysis: Data and Methods Used

The Tennessee Agri-Industry Model (TN-AIM) was used to model industry and institutional interrelationships in each of five regions within Tennessee and was based on the Impact Analysis for Planning (IMPLAN) model and databases (Olson and Lindall, 1999). The five regions were based on those used by the Bureau of Economic Analysis to represent areas of economic consumption (consumption regions), as displayed in Figure 11 (for county listings, see Appendix A). Regional values were then aggregated to the state level.

IMPLAN employs a regional social accounting system and can be used to generate a set of balanced economic/social accounts and multipliers. The social accounting system is an extension of input-output analysis[2]. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy. Input-output analysis has been expanded beyond market-based transaction accounting to include non-market financial flows by using a social accounting matrix or SAM framework (Pyatt and Round, 1985). The model describes the transfer of money between industries and institutions and contains both market-based transactions and non-market financial flows, such as inter-institutional transfers (see Figure 12). The 'Make' and 'Use' components of the SAM include the commodities made and used by industries. Factors represent the value-added by

[2] Input-output (I-O) analysis, also know as inter-industry analysis, is the name given to an analytical work conducted by Wassily Leontief (1936) in the late 1930's. The fundamental purpose of the I-O framework is to analyze the interdependence of industries in an economy through market-based transactions.

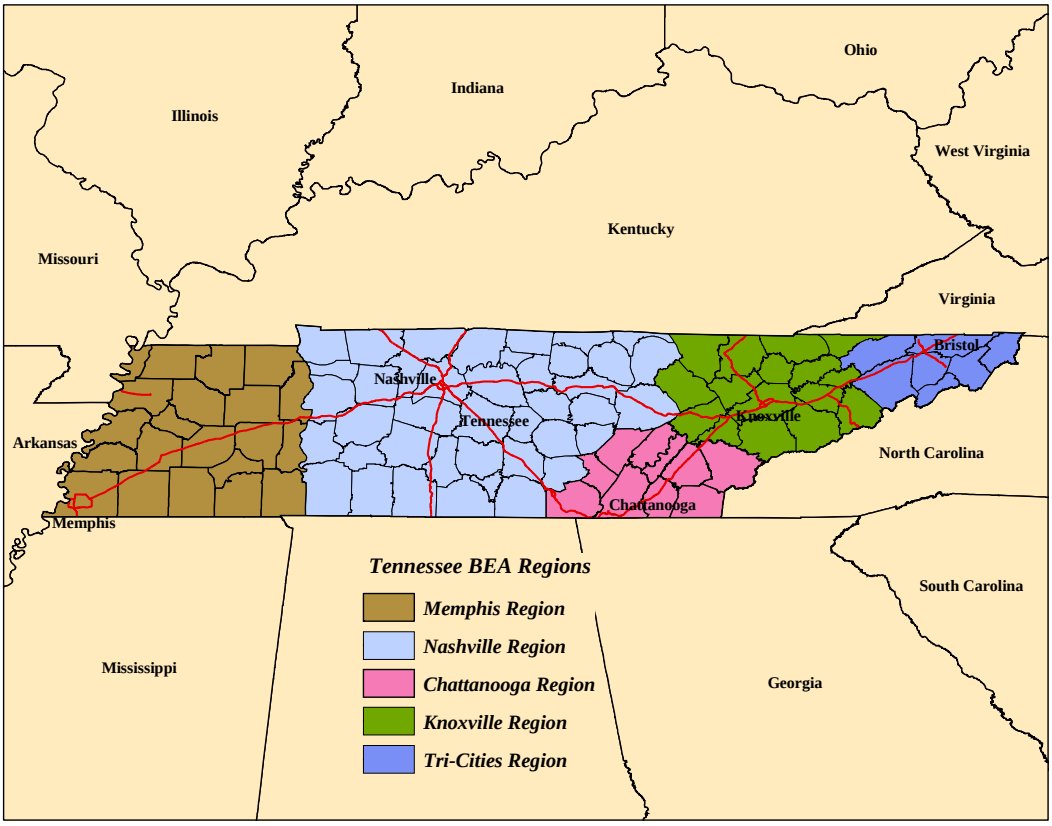


Figure 11. Tennessee Agri-Industry Model Analysis Regions.

industries, including wages and compensation to workers, interest, profits, and indirect business taxes. Capital includes expenditures made by industries and institutions to obtain equipment and construction. The SAM takes into account corporate profits as 'Enterprises'. The SAM also accounts for non-industrial financial flows, including factor exports and imports, institution exports, factor distribution, and inter-institutional transfers. Factor exports include both payments reimbursed from outside the region for exports minus then payments paid for imports. Institutional exports would include situations such as a person from inside the region working outside the region. Factor distributions are payments from the factor sectors to institutions, such as households or governments. Inter-institutional transfers include payments between

	Industry	Commodity	Factors	Institutions	Enterprise	Capital	Trade	Total
Industry		Make					Exports	Total Industry Output
Commodity	Use			Consumption		Consumption		Total Commodity Output
Factors	Value Added						Exports	Total Factor Income
Institutions		Sales	Transfers	Transfers	Transfers		Exports	Total Institutional Income
Enterprises								Total Enterprise Income
Capital						Transfers	Exports	Total Capital Income
Trade	Imports		Factor Trade	Imports		Transfers	Exports	Total Trade Income
Total	Total Industry Outlay	Total Commodity Outlay	Total Factor Outlay	Total Institutional Outlay	Total Enterprise Outlay	Total Capital Outlay	Total Regional Exports	

Figure 12. Social Accounting Matrix Framework

Source: Olson and Lindall, 1999.

institutions, such as federal government grants to state governments, welfare, social security payments, and taxes paid to governments.

The model uses regional purchase coefficients generated by econometric equations that predict local purchases based on a region's characteristics. Output from the model includes descriptive measures of the economy including total industry output, employment, and value-added for over 500 industries in the Tennessee economy. Total industry output is defined as the value of production by industry per year. Employment represents total wage and salary employees, as well as self-employed jobs in a region, for both full-time and part-time workers. Total value added is defined as all income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses. Not only can the model be used to describe a regional economy, but the model also can be used for predictive purposes, by providing estimates of multipliers.

Multipliers measure the response of the economy to a change in demand or production. Multiplier analysis generally focuses on the impacts of exogenous changes on: a) output of the sectors in the economy, b) income earned by households because of new outputs, and c) employment (in physical terms) that is expected to be generated because of the new outputs. The notion of multipliers rests upon the difference between the initial impact of an exogenous change (final demand) and the total impacts of a change. Direct impacts measure the response for a given industry given a change in final demand for that same industry. Indirect impacts represent the response by all local industries that occur as a result of a change in final demand for a specific industry. Induced impacts represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect impacts of the change in final demand for a specific industry. This study uses Type I and Type SAM (Social Accounting Matrix) multipliers. Type I

multipliers are calculated by dividing direct plus indirect impacts by the direct impacts, where the Type SAM multipliers = (direct + indirect + induced impacts)/direct impacts. The Type SAM multipliers take into account the expenditures resulting from increased incomes of households as well as inter-institutional transfers resulting from the economic activity. Therefore, Type SAM multipliers assume that as final demand changes, incomes increase along with inter-institutional transfers. As these people and institutions increase expenditures this leads to increased demands from local industries.

Results

Economic Impacts at the State & In-State Region Levels

Direct economic activity for total industry output (TIO), employment, labor income, and total value-added (TVA) for agriculture and forestry for the state and by analysis regions within the state are presented in Table 8. In 2003, agriculture and forestry related industries contributed a total of $39.3 billion in direct economic activity to the state of Tennessee or 10.1 percent of the state's economy. Employment in agriculture and forestry related industries were over 236 thousand persons or close to 7.0 percent of the workforce. Total value added was over $12 billion with $6.3 billion in labor income. Much of the industry output generated from agriculture and forestry was through secondary or manufactured products. For agriculture, approximately 39.4 percent of the workforce was employed in secondary industries (agriculture input supplying industries plus manufacturing) and the rest (60.6 percent) in primary industries (crop and livestock commodities). For forestry, however, 76.4 percent of the forestry workforce was employed in secondary industries (wood products manufacturing) and 23.6 percent in primary (logging; pulp, paper, and sawmills; and nursery/timber tracts).

The largest value of output from primary agriculture, 39.8 percent, originated in the Nashville Region (Figure 11 on page 16), followed by the Memphis Region at 36.5 percent. For

Table 8. Direct Economic Activity in Agriculture and Forestry

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
All Sectors (Including Non-Agricultural and Non-Forestry):								
State[c]	388,211		3,418,311		131,075		202,825	
Chattanooga	45,303	11.7	372,370	10.9	13,990	10.7	21,742	10.7
Knoxville	60,594	15.6	573,296	16.8	21,037	16.0	32,345	15.9
Memphis	108,311	27.9	966,447	28.3	37,969	29.0	59,145	29.2
Nashville	150,918	38.9	1,284,237	37.6	50,443	38.5	77,867	38.4
Tri-Cities	23,087	5.9	221,961	6.5	7,635	5.8	11,727	5.8
Agriculture & Forestry:								
State[c]	39,328		236,377		6,371		12,205	
Chattanooga	6,366	16.2	31,733	13.4	1,167	18.3	1,955	16.0
Knoxville	4,878	12.4	34,548	14.6	942	14.8	1,551	12.7
Memphis	14,060	35.8	69,182	29.3	2,067	32.4	4,193	34.4
Nashville	11,592	29.5	84,294	35.7	1,783	28.0	3,825	31.3
Tri-Cities	2,435	6.2	16,620	7.0	412	6.5	681	5.6
Primary & Secondary Agriculture								
State[c]	26,269		177,461		3,572		8,086	
Chattanooga	4,003	15.2	22,062	12.4	674	18.9	1,240	15.3
Knoxville	2,769	10.5	21,270	12.0	421	11.8	852	10.5
Memphis	9,883	37.6	53,959	30.4	1,220	34.2	2,846	35.2
Nashville	8,656	33.0	68,678	38.7	1,121	31.4	2,901	35.9
Tri-Cities	960	3.7	11,493	6.5	136	3.8	247	3.1
Primary Agriculture								
State[c]	2,871		107,488		329		1,458	
Chattanooga	244	8.5	5,851	5.4	14	4.3	112	7.7
Knoxville	281	9.8	12,997	12.1	36	10.9	133	9.1
Memphis	1,048	36.5	34,425	32.0	167	50.8	591	40.5
Nashville	1,143	39.8	45,427	42.3	98	29.8	554	38.0
Tri-Cities	158	5.5	8,787	8.2	14	4.3	69	4.7
Secondary Agriculture								
State[c]	23,397		69,974		3,242		6,627	
Chattanooga	3,759	16.1	16,210	23.2	659	25.6	1,128	17.0
Knoxville	2,488	10.6	8,273	11.8	385	11.9	719	10.8
Memphis	8,835	37.8	19,534	27.9	1,052	32.4	2,255	34.0
Nashville	7,514	32.1	23,252	33.2	1,023	31.6	2,346	35.4
Tri-Cities	802	3.4	2,706	3.9	123	3.8	179	2.7
Primary & Secondary Forestry								
State[c]	13,059		58,916		2,799		4,119	
Chattanooga	2,363	18.1	9,671	16.4	493	17.6	715	17.4
Knoxville	2,110	16.2	13,278	22.5	521	18.6	699	17.0
Memphis	4,177	32.0	15,223	25.8	847	30.3	1,347	32.7
Nashville	2,936	22.5	15,616	26.5	662	23.7	924	22.4
Tri-Cities	1,474	11.3	5,127	8.7	276	9.9	434	10.5
Primary Forestry								
State[c]	5,238		13,883		969		1,709	

Table 8. Direct Economic Activity in Agriculture and Forestry (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Chattanooga	1,306	24.9	2,677	19.3	237	24.5	428	25.0
Knoxville	293	5.6	1,019	7.3	49	5.1	89	5.2
Memphis	2,154	41.1	5,248	37.8	422	43.6	732	42.8
Nashville	816	15.6	3,462	24.9	137	14.1	235	13.8
Tri-Cities	669	12.8	1,477	10.6	124	12.8	225	13.2
Secondary Forestry								
State[c]	7,821		45,032		1,831		2,410	
Chattanooga	1,058	13.5	6,994	15.5	257	14.0	286	11.9
Knoxville	1,816	23.2	12,260	27.2	472	25.8	610	25.3
Memphis	2,024	25.9	9,975	22.2	425	23.2	615	25.5
Nashville	2,119	27.1	12,154	27.0	525	28.7	689	28.6
Tri-Cities	805	10.3	3,650	8.1	151	8.2	209	8.7

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interest, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.
[c] State totals may not add due to rounding.

secondary agriculture, however, the largest value of output was from the Memphis Region (37.8 percent) followed by the Nashville Region (32.1 percent). The Knoxville Region contributed roughly the same value of output (9.8 to 10.6 percent) for both primary and secondary agriculture. For both primary and secondary forestry, the Memphis Region had the largest value of total industry output followed by the Nashville Region. The Chattanooga Region followed the Memphis Region in economic activity for primary forestry followed by the Nashville, Tri-Cities, and Knoxville Regions. However, the Nashville Region had more jobs in primary forestry compared to the Chattanooga Region. For secondary forestry, the Knoxville Region had more jobs followed by the Nashville and Memphis Regions. Yet, total industry output was larger for the Nashville Region followed by the Memphis and Knoxville Regions.

Primary Agricultural Products:

The largest output value (20.8 percent) for the state from farm production was from cattle ranching and farming (Table 9), followed by poultry and egg production, cotton farming, greenhouse and nursery production, oilseed farming (primarily soybeans), grain farming, all

other crop farming (primarily hay farming), and animal production, except for cattle and poultry and eggs (primarily hog and pig farming, sheep and goat farming, horses and equine production, and aquaculture). Primary agricultural products also included agriculture and forestry support activities (support activities for crop production [i.e., cotton ginning, soil preparation, planting, and cultivating; crop harvesting; and farm management services]; animal production [i.e., breeding services, pedigree record services, boarding horses, dairy herd improvement activities, livestock spraying, and sheep dipping and shearing], and forestry [i.e., estimating timber, forest

Table 9. State Level: Direct Economic Activity in Farm Production

Rank	Sector	TIO[a]	Emp	Labor Income	TVA[b]
		(Million $)	(Number)	(Million $)	(Million $)
	All Farm Production	2,871	107,488	329	1,458
1	Cattle ranching & farming	597	20,166	21	64
2	Poultry & egg production	384	3,369	20	198
3	Cotton farming	360	8,627	34	219
4	Greenhouse & nursery production	318	11,296	50	286
5	Oilseed farming	296	13,892	1	157
6	Grain farming	210	14,964	3	109
7	Agriculture & forestry support activities	161	8,143	166	129
8	All other crop farming	149	3,339	7	98
9	Animal production, except for cattle and poultry & eggs	130	12,286	10	22
10	Vegetable & melon farming	125	3,064	9	95
11	Tobacco farming	90	6,567	3	65

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.

fire fighting, forest pest control, and consulting on wood attributes and reforestation]). In terms of labor income, cattle ranching and farming had the largest value followed by grain farming, oilseed farming, animal production, except for cattle and poultry and eggs, and greenhouse and nursery production. The largest total value added contributors included greenhouse and nursery production followed by cotton farming, and poultry and egg production.

The direct economic activity from farm production of the top ten sectors for each region within the state is summarized in Table 10. Poultry and egg production, cattle ranching and farming, vegetable and melon farming, and greenhouse and nursery production were primary contributors to total industry output from farm production in the Chattanooga Region. In the Knoxville Region, cattle ranching and farming, greenhouse and nursery production, poultry and egg production, and vegetable and melon farming were important sectors. For the Memphis Region, cotton farming, oilseed, farming, grain farming, and agriculture and forestry support activities had the largest total industry output, while in the Nashville Region the greatest total industry output values were from cattle ranching and farming, poultry and egg production, greenhouse and nursery production, other animal production besides cattle and poultry and eggs, and grain farming. Cattle ranching and farming, greenhouse and nursery production, and poultry and egg production were important contributors to total industry output for the Tri-Cities Region. For all regions except Memphis, cattle ranching and farming employed the largest number of workers. For the Memphis Region, oilseed farming employed the largest numbers, followed by cotton and grain farming.

Table 10. Region Level: Direct Economic Activity in Farm Production (Top Ten Sectors)

Rank	Sector	TIO[a]	Employment	Labor Income	TVA[b]
		(Million $)	(Number)	(Million $)	(Million $)
	Chattanooga:				
1	Poultry & egg production	91	732	5	47
2	Cattle ranching & farming	73	2,062	2	8
3	Vegetable & melon farming	27	536	0[b]	20
4	Greenhouse & nursery production	20	703	2	19
5	All other crop farming	12	219	0[b]	8
6	Animal production, except for cattle and poultry & eggs	7	686	0[b]	1
7	Agriculture & forestry support activities	4	207	5	4
8	Oilseed farming	3	225	0[b]	2
9	Grain farming	2	281	0[b]	1
10	Fruit farming	2	82	0[b]	1

Table 10. Region Level: Direct Economic Activity in Farm Production (Top Ten Sectors) (Cont.)

Rank	Sector	TIO[a]	Employment	Labor Income	TVA[b]
		(Million $)	(Number)	(Million $)	(Million $)
	Knoxville:				
1	Cattle ranching & farming	84	3,490	4	9
2	Greenhouse & nursery production	55	2,583	15	49
3	Poultry & egg production	34	458	2	17
4	Vegetable & melon farming	25	860	2	19
5	All other crop farming	22	620	1	15
6	Animal production, except for cattle and poultry & eggs	17	2,172	2	3
7	Hunting & trapping	16	309	0[c]	1
8	Tobacco farming	11	1,254	0[c]	8
9	Agriculture & forestry support activities	9	489	9	7
10	Fruit farming	3	211	0[c]	2
	Memphis:				
1	Cotton farming	347	7,839	33	212
2	Oilseed farming	233	8,685	1	123
3	Grain farming	146	7,411	2	75
4	Agriculture & forestry support activities	110	5,405	113	88
5	Cattle ranching & farming	62	1,102	2	7
6	Animal production, except for cattle and poultry & eggs	38	1,978	3	6
7	Greenhouse & nursery production	30	768	5	27
8	Vegetable & melon farming	27	279	2	20
9	Poultry & egg production	22	93	2	12
10	All other crop farming	19	232	1	12
	Nashville:				
1	Cattle ranching & farming	312	10,170	9	34
2	Poultry & egg production	216	1,747	10	111
3	Greenhouse & nursery production	196	6,027	26	173
4	All other crop farming	81	1,767	3	53
5	Animal production, except for cattle and poultry & eggs	62	6,593	4	10
6	Grain farming	59	6,730	1	30
7	Oilseed farming	58	4,743	0[c]	31
8	Tobacco farming	58	3,458	2	42
9	Agriculture & forestry support activities	36	1,967	38	29
10	Vegetable & melon farming	35	912	2	26
	Tri-Cities:				
1	Cattle ranching & farming	67	3,342	4	7
2	Greenhouse & nursery production	20	1,215	3	17
3	Poultry & egg production	20	339	1	10

Table 10. Region Level: Direct Economic Activity in Farm Production (Top Ten Sectors) (Cont.)

Rank	Sector	TIO[a]	Employment	Labor Income	TVA[b]
		(Million $)	(Number)	(Million $)	(Million $)
4	All other crop farming	16	502	1	10
5	Tobacco farming	15	1,660	0[c]	11
6	Vegetable & melon farming	11	477	2	9
7	Animal production, except for cattle and poultry & eggs	5	857	1	1
8	Agriculture & forestry support activities	2	75	2	1
9	Grain farming	1	188	0[c]	0
10	Fruit farming	1	92	0[c]	1

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.
[c] Values of 0 are nonzero values that are less than 1.

Secondary Agricultural Products:

Among secondary agricultural products, food manufacturing contributed the largest total industry output, followed by beverage manufacturing, textile mills, tobacco products manufacturing, apparel manufacturing, agricultural machinery, agricultural chemicals, textile product mills, and leather and allied product manufacturing (Table 11). Approximately 56.1 percent of the value of total industry output from processed agricultural products came from food manufacturing. In addition, food manufacturing employed the largest number of workers, had the largest amount of labor income, and contributed the largest amount in total value added. A more detailed presentation of the total industry output from processing by sub-sector is shown in Appendixes B and C.

Primary Forest Products:

The largest output value for primary forest products was from paper and paperboard mills, followed by sawmills; logging; pulp mills; and forest nurseries, forest products, and timber tracts (i.e., growing trees for reforestation; gathering forest products, such as gums, barks,

Table 11. Direct Economic Activity in Secondary Agricultural Products

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Food Manufacturing:								
State[c]	13,127		36,031		1,708		3,292	
Chattanooga	1,965	15.0	7,881	21.9	328	19.2	649	19.7
Knoxville	1,621	12.3	3,892	10.8	215	12.6	429	13.0
Memphis	5,984	45.6	11,721	32.5	680	39.8	1,399	42.5
Nashville	3,330	25.4	12,089	33.6	455	26.6	778	23.6
Tri-Cities	228	1.7	449	1.2	26	1.5	37	1.1
Beverage Manufacturing:								
State[c]	2,824		4,969		351		820	
Chattanooga	581	20.6	1,149	23.1	69	19.7	120	14.6
Knoxville	302	10.7	609	12.3	35	10.0	61	7.4
Memphis	1,173	41.5	1,984	39.9	146	41.6	351	42.8
Nashville	669	23.7	1,044	21.0	87	24.8	265	32.3
Tri-Cities	98	3.5	183	3.7	14	4.0	24	2.9
Textile Mills:								
State[c]	1,534		7,400		305		361	
Chattanooga	657	42.8	3,279	44.3	129	42.3	141	39.1
Knoxville	100	6.5	618	8.4	22	7.2	24	6.6
Memphis	140	9.1	755	10.2	30	9.8	34	9.4
Nashville	379	24.7	1,468	19.8	74	24.3	99	27.4
Tri-Cities	257	16.8	1,282	17.3	50	16.4	63	17.5
Tobacco Products Manufacturing:								
State[c]	1,521		1,046		107		706	
Chattanooga	0	0.0	0	0.0	0	0.0	0	0.0
Knoxville	0	0.0	0	0.0	0	0.0	0	0.0
Memphis	189	12.4	126	12.0	14	13.1	89	12.6
Nashville	1,332	87.6	920	88.0	94	87.9	617	87.4
Tri-Cities	0	0.0	0	0.0	0	0.0	0	0.0
Apparel Manufacturing:								
State[c]	1,472		10,743		353		660	
Chattanooga	398	27.0	3,105	28.9	104	29.5	171	25.9
Knoxville	293	19.9	2,145	20.0	67	19.0	129	19.5
Memphis	272	18.5	2,193	20.4	60	17.0	116	17.6
Nashville	477	32.4	3,107	28.9	114	32.3	229	34.7
Tri-Cities	31	2.1	193	1.8	8	2.3	15	2.3
Agricultural Machinery:								
State[c]	1,245		3,281		145		263	
Chattanooga	45	3.6	169	5.2	6	4.1	9	3.4
Knoxville	18	1.4	62	1.9	3	2.1	5	1.9
Memphis	484	38.9	1,270	38.7	54	37.2	100	38.0
Nashville	531	42.7	1,343	40.9	64	44.1	117	44.5
Tri-Cities	167	13.4	437	13.3	18	12.4	32	12.2
Agricultural Chemicals:								
State[c]	767		780		64		227	

Table 11. Direct Economic Activity in Secondary Agricultural Products (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Chattanooga	9	1.2	9	1.2	1	1.6	3	1.3
Knoxville	36	4.7	34	4.4	3	4.7	12	5.3
Memphis	468	61.0	485	62.2	38	59.4	127	55.9
Nashville	254	33.1	251	32.2	21	32.8	85	37.4
Tri-Cities	0	0.0	0	0.0	0	0.0	0	0.0
Textile Product Mills:								
State[c]	685		3,831		150		196	
Chattanooga	80	11.7	453	11.8	18	12.0	23	11.7
Knoxville	79	11.5	620	16.2	25	16.7	29	14.8
Memphis	112	16.4	874	22.8	27	18.0	34	17.3
Nashville	396	57.8	1,745	45.5	74	49.3	103	52.6
Tri-Cities	18	2.6	139	3.6	6	4.0	7	3.6
Leather & Allied Product Manufacturing:								
State[c]	224		1,894		60		100	
Chattanooga	23	10.3	166	8.8	5	8.3	12	12.0
Knoxville	39	17.4	294	15.5	13	21.7	31	31.0
Memphis	13	5.8	126	6.7	3	5.0	3	3.0
Nashville	145	64.7	1,285	67.8	38	63.3	53	53.0
Tri-Cities	3	1.3	24	1.3	1	1.7	1	1.0

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.
[c] State totals may not add due to rounding.

balsam needles, rhizomes, fibers, and ginseng; and timber tracts for selling timber) (Table 12). The Memphis and Chattanooga Regions had the largest output values for paper and paperboard mills at 39.0 and 36.0, respectively. For employment, paper and paperboard mills had the largest number of individuals with the Memphis and Chattanooga Regions employing the largest numbers. The Nashville Region had the largest output value for sawmills. For logging, the Memphis and Nashville Regions had the largest output values. For pulp mills, 94.6 percent of the economic activity originates from the Memphis Region. For forest nurseries, forest products, and timber tracts, the Tri-Cities Region had the largest output values.

Table 12. Direct Economic Activity in Primary Forest Products

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Paper & Paperboard Mills:								
State[c]	3,351		6,102		630		1,129	
Chattanooga	1,206	36.0	2,228	36.5	220	34.9	397	35.2
Knoxville	129	3.8	277	4.5	18	2.9	32	2.8
Memphis	1,308	39.0	2,277	37.3	263	41.7	470	41.6
Nashville	151	4.5	311	5.1	23	3.7	41	3.6
Tri-Cities	557	16.6	1,009	16.5	106	16.8	189	16.7
Sawmills:								
State[c]	833		3,854		124		190	
Chattanooga	26	3.1	124	3.2	4	3.2	6	3.2
Knoxville	71	8.5	321	8.3	11	8.9	17	8.9
Memphis	202	24.2	956	24.8	28	22.6	43	22.6
Nashville	465	55.8	2,134	55.4	71	57.3	108	56.8
Tri-Cities	69	8.3	318	8.3	11	8.9	16	8.4
Logging:								
State[c]	703		3,280		156		310	
Chattanooga	57	8.1	290	8.8	12	7.7	24	7.7
Knoxville	84	11.9	394	12.0	18	11.5	37	11.9
Memphis	336	47.8	1,458	44.5	77	49.4	152	49.0
Nashville	201	28.6	1,017	31.0	43	27.6	86	27.7
Tri-Cities	26	3.7	123	3.8	6	3.8	11	3.5
Pulp Mills:								
State[c]	316		574		54		65	
Chattanooga	17	5.4	35	6.1	1	1.9	1	1.5
Knoxville	0	0.0	0	0.0	0	0.0	0	0.0
Memphis	299	94.6	539	93.9	52	96.3	63	96.9
Nashville	0	0.0	0	0.0	0	0.0	0	0.0
Tri-Cities	0	0.0	0	0.0	0	0.0	0	0.0
Forest Nurseries/Forest Products/Timber Tracts:								
State[c]	36		74		4		15	
Chattanooga	1	2.8	2	2.7	0[d]	0.0	0[d]	0.0
Knoxville	10	27.8	26	35.1	1	25.0	4	26.7
Memphis	8	22.2	18	24.3	1	25.0	3	20.0
Nashville	0	0.0	0	0.0	0	0.0	0	0.0
Tri-Cities	17	47.2	26	35.1	2	50.0	8	53.3

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.
[c] State totals may not add due to rounding.
[d] Values of 0 are nonzero values that are less than 1.

Secondary Forest Products:

The largest output value for secondary forest products was paper manufacturing, followed by furniture and related product manufacturing; millwork; manufactured home manufacturing; other wood product manufacturing; and veneer, plywood, and engineered wood product manufacturing (Table 13). Furniture and related product manufacturing for this analysis was comprised of household and institutional, office, and other (mattress, blind and shades) furniture categories. The other wood product manufacturing category was comprised of wood preservation, wood containers and pallets, miscellaneous wood products, and kitchen cabinets. The Memphis Region had the largest values for output, employment, labor income, and value added for paper manufacturing. The Knoxville Region had the largest output values for furniture and manufactured home manufacturing, with the latter category being an important industry for the state. Economic activity was the largest for the Memphis and Nashville Regions for millwork and other wood product manufacturing. For the veneer, plywood, and engineered wood product manufacturing category, the Memphis Region had the largest output value, followed by the Knoxville, Nashville, Tri-Cities, and Chattanooga Regions.

Table 13. Direct Economic Activity in Secondary Forest Products

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Paper Manufacturing:								
State[c]	3,420		12,412		675		933	
Chattanooga	374	10.9	1,462	11.8	73	10.8	85	9.1
Knoxville	318	9.3	1,214	9.8	70	10.4	89	9.5
Memphis	1,192	34.9	4,019	32.4	226	33.5	343	36.8
Nashville	934	27.3	3,518	28.3	201	29.8	263	28.2
Tri-Cities	602	17.6	2,200	17.7	104	15.4	151	16.2
Furniture & Related Product Manufacturing:								
State[c]	2,148		16,211		575		685	
Chattanooga	571	26.6	4,547	28.0	154	26.8	162	23.6
Knoxville	844	39.3	6,376	39.3	225	39.1	269	39.3
Memphis	193	9.0	1,438	8.9	47	8.2	60	8.8
Nashville	494	23.0	3,478	21.5	137	23.8	180	26.3
Tri-Cities	46	2.1	372	2.3	10	1.7	13	1.9

Table 13. Direct Economic Activity in Secondary Forest Products (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Millwork:								
State[c]	889		5,847		213		262	
Chattanooga	6	0.7	43	0.7	1	0.5	1	0.4
Knoxville	207	23.3	1,391	23.8	49	23.0	58	22.1
Memphis	306	34.4	1,958	33.5	72	33.8	94	35.9
Nashville	289	32.5	1,919	32.8	71	33.3	86	32.8
Tri-Cities	81	9.1	536	9.2	20	9.4	23	8.8
Manufactured Home Manufacturing:								
State[c]	563		3,965		162		245	
Chattanooga	15	2.7	99	2.5	4	2.5	5	2.0
Knoxville	322	57.2	2,295	57.9	92	56.8	142	58.0
Memphis	79	14.0	585	14.8	22	13.6	34	13.9
Nashville	146	25.9	969	24.4	44	27.2	64	26.1
Tri-Cities	2	0.4	17	0.4	1	0.6	1	0.4
Other Wood Product Manufacturing:								
State[c]	557		5,157		151		197	
Chattanooga	72	12.9	717	13.9	19	12.6	24	12.2
Knoxville	74	13.3	661	12.8	21	13.9	27	13.7
Memphis	140	25.1	1,370	26.6	39	25.8	50	25.4
Nashville	222	39.9	2,039	39.5	63	41.7	83	42.1
Tri-Cities	51	9.2	372	7.2	10	6.6	11	5.6
Veneer, Plywood, & Engineered Wood Product Manufacturing:								
State[c]	246		1,441		53		88	
Chattanooga	20	8.1	128	8.9	5	9.4	8	9.1
Knoxville	54	22.0	322	22.3	15	28.3	25	28.4
Memphis	114	46.3	606	42.1	20	37.7	33	37.5
Nashville	35	14.2	231	16.0	8	15.1	14	15.9
Tri-Cities	23	9.3	153	10.6	6	11.3	9	10.2

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.
[c] State totals may not add due to rounding.

Estimated Total Economic Impacts of Agriculture and Forestry:

The estimated total economic impacts of agriculture and forestry included not only the direct impacts from the industry, but also the impacts the industry had on input supplying industries (indirect impacts) and on expenditures by households and other institutions (induced impacts). The total economic impacts from agriculture and forestry included direct, indirect, and induced impacts. The total industry output, employment, labor income, and value added

Table 14. Estimated Total Economic Impacts from Agriculture and Forestry

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Agriculture & Forestry:								
State	67,056		490,569		15,858		27,765	
Chattanooga	10,028	15.0	68,832	14.0	2,315	14.6	3,924	14.1
Knoxville	8,118	12.1	67,024	13.7	2,081	13.1	3,444	12.4
Memphis	23,655	35.3	154,223	31.4	5,391	34.0	9,600	34.6
Nashville	18,872	28.1	152,959	31.2	4,295	27.1	7,986	28.8
Tri-Cities	3,642	5.4	29,955	6.1	815	5.1	1,345	4.8
Intrastate Trade	2,741	4.1	17,576	3.6	961	6.1	1,466	5.3
Primary & Secondary Agriculture								
State	44,232		341,738		9,685		18,131	
Chattanooga	6,334	14.3	46,509	13.6	1,375	14.2	2,473	13.6
Knoxville	4,493	10.2	38,758	11.3	1,026	10.6	1,860	10.3
Memphis	16,516	37.3	112,548	32.9	3,525	36.4	6,593	36.4
Nashville	13,965	31.6	119,023	34.8	2,940	30.4	5,921	32.7
Tri-Cities	1,405	3.2	16,879	4.9	279	2.9	487	2.7
Intrastate Trade	1,518	3.4	8,020	2.3	540	5.6	797	4.4
Primary Agriculture								
State	4,543		130,291		887		2,438	
Chattanooga	351	7.7	7,391	5.7	44	5.0	169	6.9
Knoxville	449	9.9	15,800	12.1	88	10.0	230	9.4
Memphis	1,638	36.1	41,901	32.2	391	44.1	947	38.8
Nashville	1,757	38.7	54,703	42.0	287	32.3	912	37.4
Tri-Cities	241	5.3	10,574	8.1	36	4.0	113	4.6
Intrastate Trade	108	2.4	-78	-0.1	41	4.6	67	2.8
Secondary Agriculture								
State	39,688		211,447		8,798		15,694	
Chattanooga	5,982	15.1	39,118	18.5	1,331	15.1	2,303	14.7
Knoxville	4,044	10.2	22,957	10.9	937	10.7	1,630	10.4
Memphis	14,878	37.5	70,647	33.4	3,134	35.6	5,646	36.0
Nashville	12,209	30.8	64,321	30.4	2,653	30.2	5,009	31.9
Tri-Cities	1,164	2.9	6,306	3.0	244	2.8	373	2.4
Intrastate Trade	1,411	3.6	8,098	3.8	499	5.7	731	4.7
Primary & Secondary Forestry								
State	22,824		148,831		6,173		9,634	
Chattanooga	3,695	16.2	22,323	15.0	940	15.2	1,451	15.1
Knoxville	3,625	15.9	28,267	19.0	1,055	17.1	1,584	16.4
Memphis	7,139	31.3	41,675	28.0	1,866	30.2	3,007	31.2
Nashville	4,907	21.5	33,936	22.8	1,356	22.0	2,065	21.4
Tri-Cities	2,237	9.8	13,075	8.8	535	8.7	858	8.9
Intrastate Trade	1,221	5.4	9,555	6.4	420	6.8	668	6.9
Primary Forestry								
State	9,082		49,119		2,275		3,830	
Chattanooga	2,059	22.7	9,708	19.8	487	21.4	839	21.9
Knoxville	485	5.3	2,910	5.9	115	5.1	198	5.2

Table 14. Estimated Total Economic Impacts from Agriculture and Forestry (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Memphis	3,728	41.0	19,365	39.4	953	41.9	1,593	41.6
Nashville	1,310	14.4	8,027	16.3	304	13.4	509	13.3
Tri-Cities	1,053	11.6	5,322	10.8	250	11.0	430	11.2
Intrastate Trade	446	4.9	3,787	7.7	165	7.3	261	6.8
Secondary Forestry								
State	13,742		99,712		3,898		5,803	
Chattanooga	1,636	11.9	12,614	12.7	453	11.6	612	10.5
Knoxville	3,140	22.8	25,357	25.4	941	24.1	1,386	23.9
Memphis	3,411	24.8	22,310	22.4	913	23.4	1,414	24.4
Nashville	3,597	26.2	25,909	26.0	1,052	27.0	1,556	26.8
Tri-Cities	1,184	8.6	7,753	7.8	285	7.3	428	7.4
Intrastate Trade	775	5.6	5,769	5.8	255	6.5	407	7.0

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.

resulting from agriculture and forestry, including each of these impacts, are shown in Table 14. Agriculture and forestry contributed an estimated value of over $67.0 billion to Tennessee's $388.2 billion economy annually. An estimated 66.0 percent of the total impacts came from primary and secondary agriculture, while forest operations and forest products contributed about 34.0 percent. Employment from both agriculture and forestry totaled over 490 thousand workers. Of that value, 69.7 percent occurred as a result of primary and secondary agriculture production, with 30.3 percent occurring from primary and secondary forest products production. Intrastate trade represented values purchased or imported from outside the regions but within the state. A more detailed total impact presentation of output, employment, labor income, and value added by sub-sector is shown in Appendix C.

Primary Agriculture Products Total Impacts:

Figures 13 through 17 show the estimated direct, indirect, and induced impacts for cattle ranching and farming; poultry and egg production; cotton farming; greenhouse and nursery

production; oilseed farming; grain farming; all other crop farming; animal production, except for cattle and poultry and eggs; vegetable and melon farming; and tobacco farming agricultural sectors. The top ten indirect and induced sectors based on output value are also listed. Using cattle ranching and farming as an example, indirect impacts (input supplying industries) explained 33.3 percent ($379.1 million) of the total impact on output. The sectors most impacted in descending order included all other crop farming; cattle ranching and farming; real estate; wholesale trade; agriculture and forestry support activities; truck transportation; veterinary services; petroleum refineries; grain farming; and banking. Likewise, induced impacts (expenditures by households and other institutions) explained 14.3 percent ($162.4 million) of the total impact on output. Again in descending order the sectors most impacted included owner-occupied dwellings; state and local education; state and local non-education; wholesale trade; food services and drinking places; real estate; health practitioners; hospitals; banking; and insurance carriers.

Secondary Agriculture Products Total Impacts:

Table 15 shows the estimated total economic impacts from secondary agricultural products. For all categories (output, employment, labor income, and value added), food manufacturing contributed the greatest total economic impact values. The Memphis Region (primarily from grain and oilseed milling, snack foods, and frozen foods), followed by the Nashville Region (primarily from animal slaughtering and processing), had the largest values for each of the categories analyzed for this sector. The Memphis Region also had the largest values for beverage manufacturing (primarily from soft drinks and ice, and breweries) and agricultural chemicals (primarily from pesticide and other agricultural chemicals manufacturing). The Nashville Region had the largest values for tobacco products, apparel manufacturing (primarily from cut and sew apparel), textile product mills (primarily from tire cord and fabric mills, and

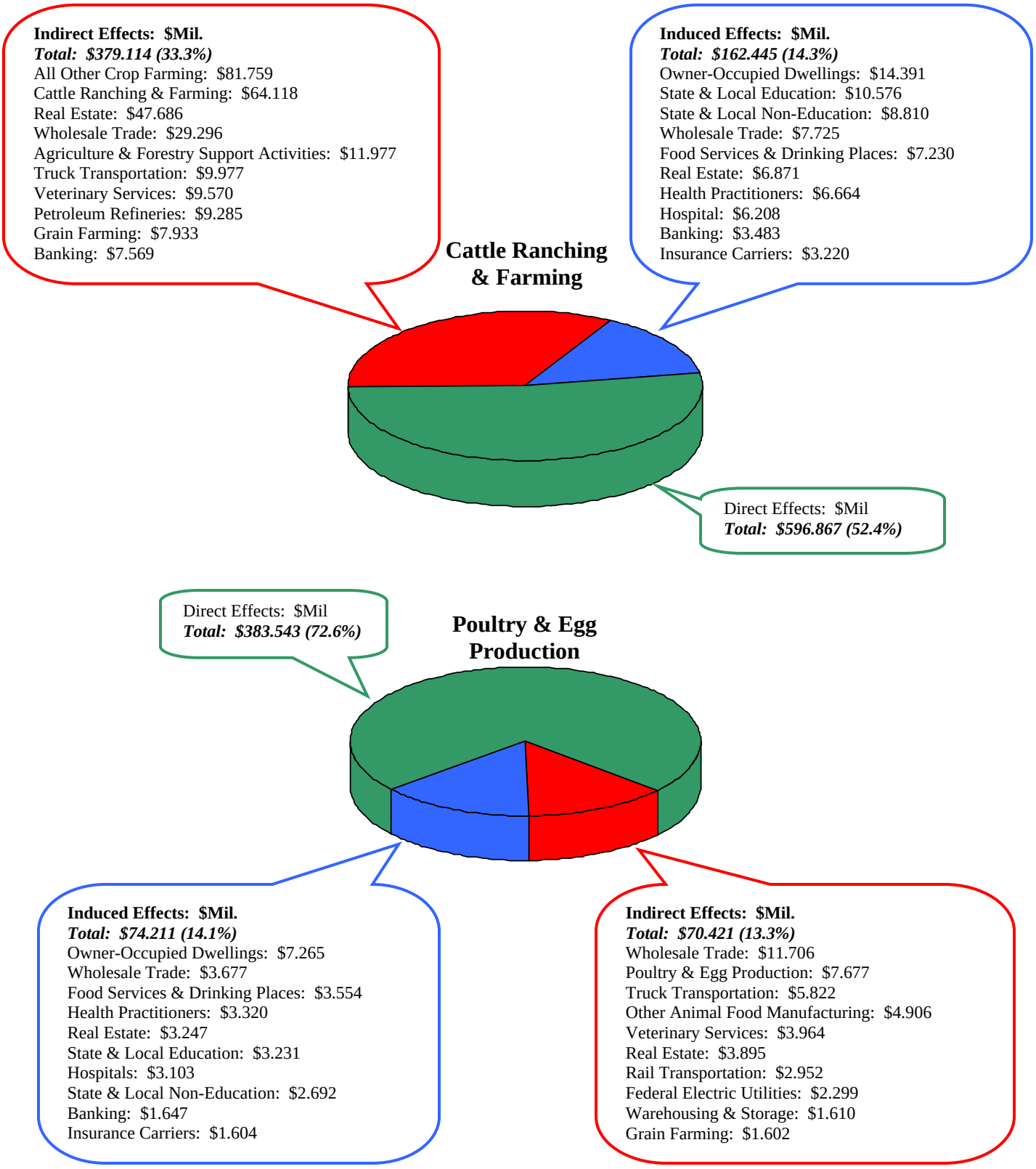
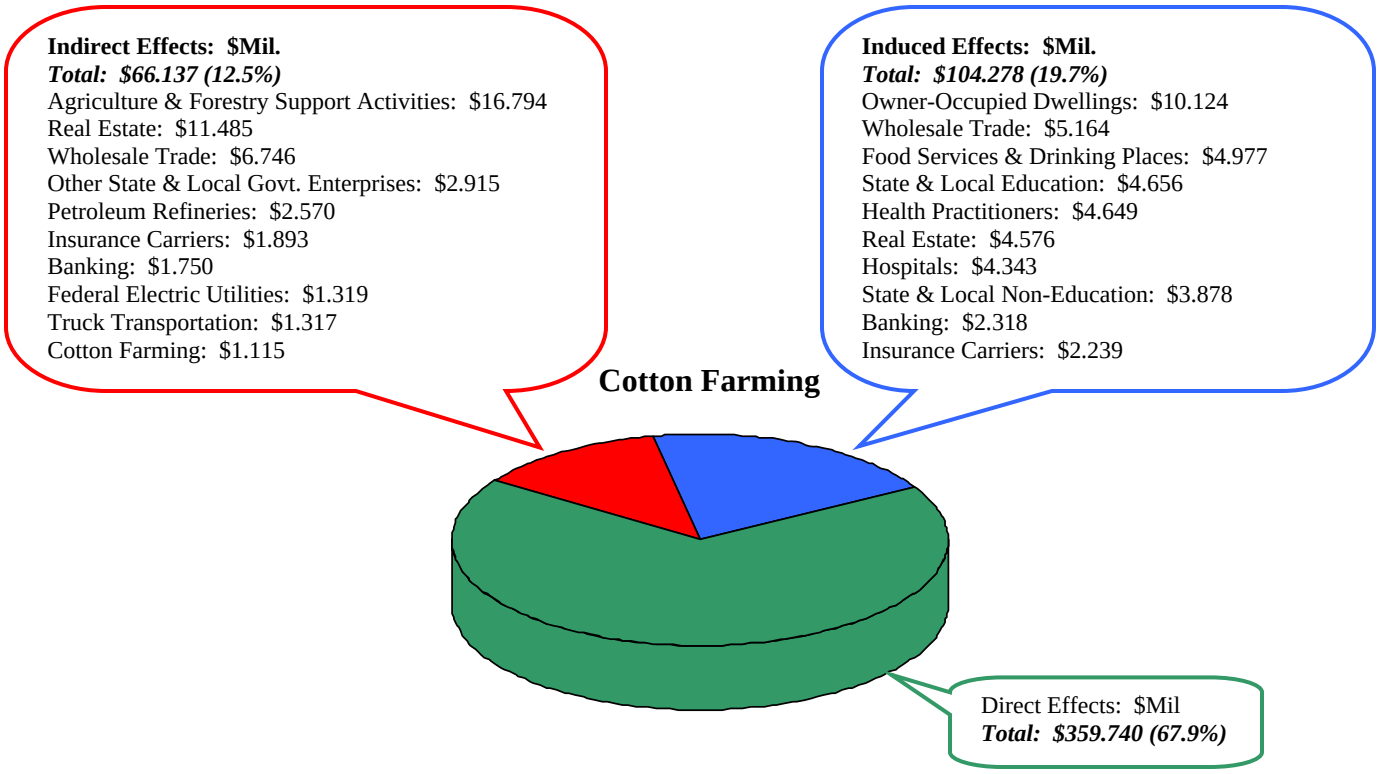


Figure 13. Estimated Direct, Indirect, and Induced Impacts for Cattle Ranching & Farming and Poultry & Egg Production.



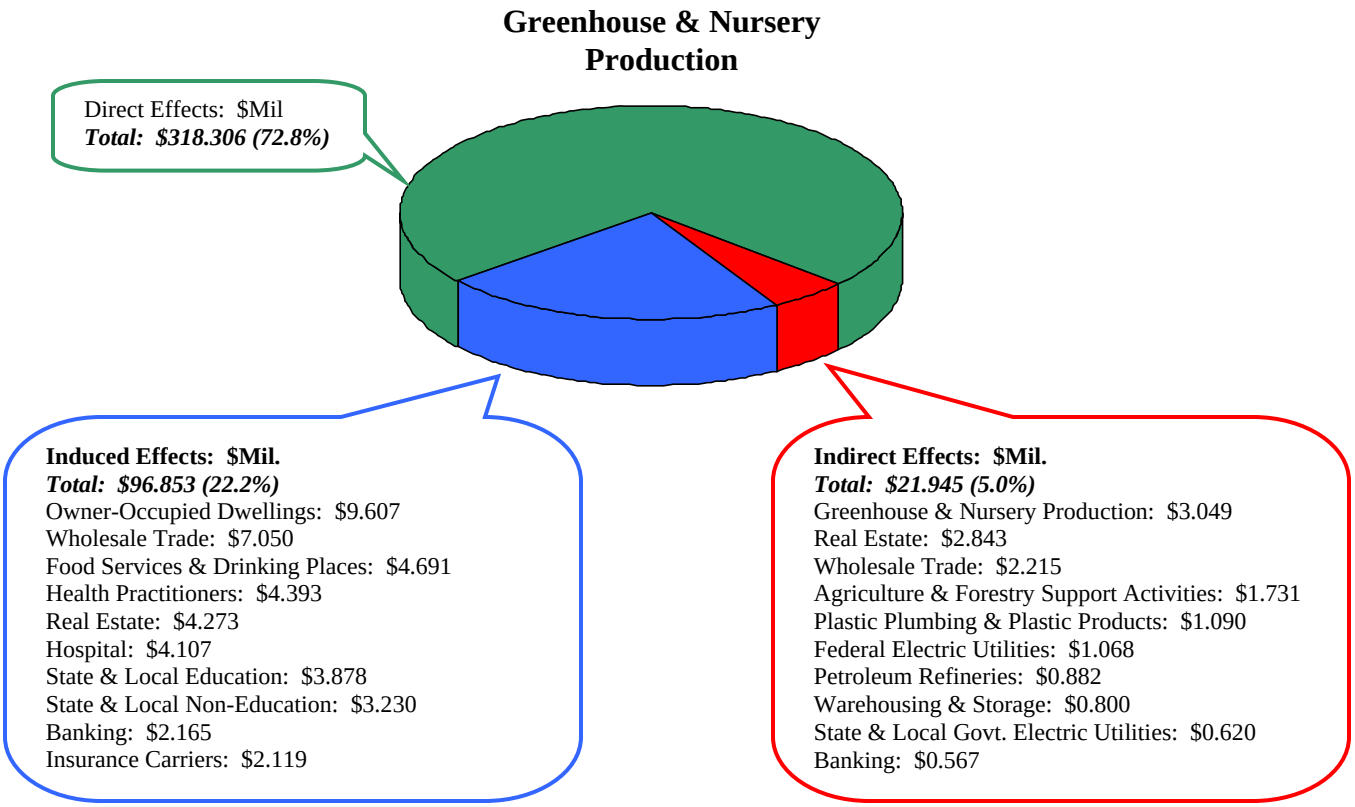


Figure 14. Estimated Direct, Indirect, and Induced Impacts for Cotton Farming and Greenhouse & Nursery Production.

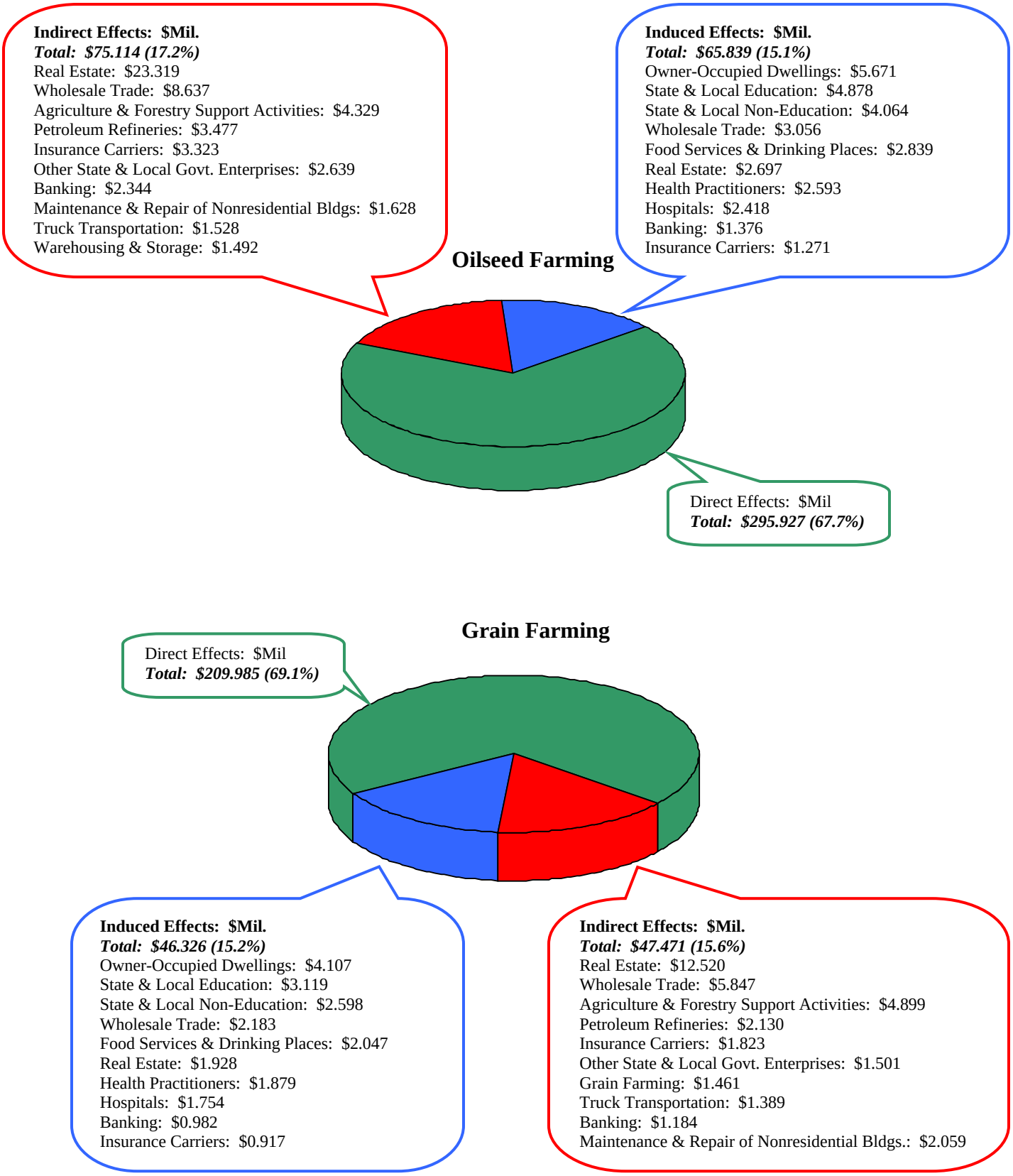
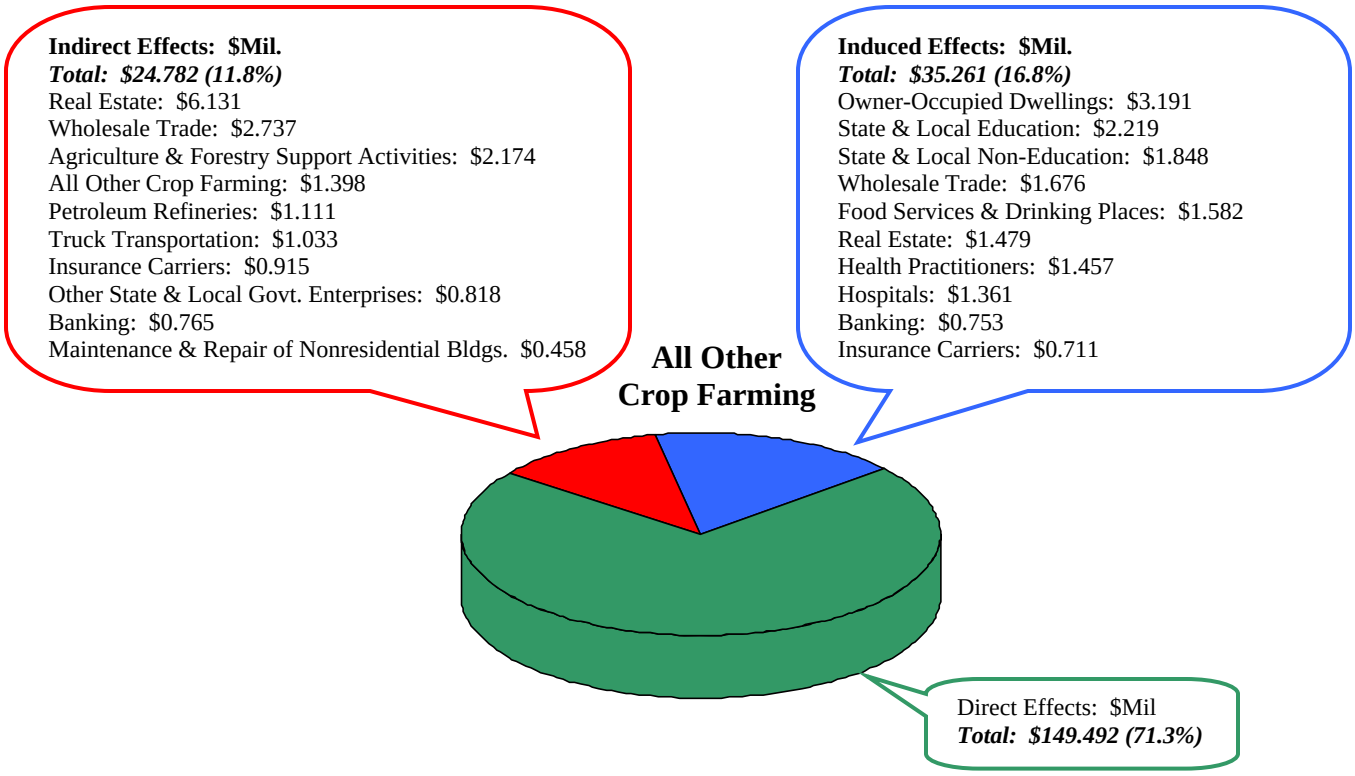


Figure 15. Estimated Direct, Indirect, and Induced Impacts for Oilseed Farming and Grain Farming.



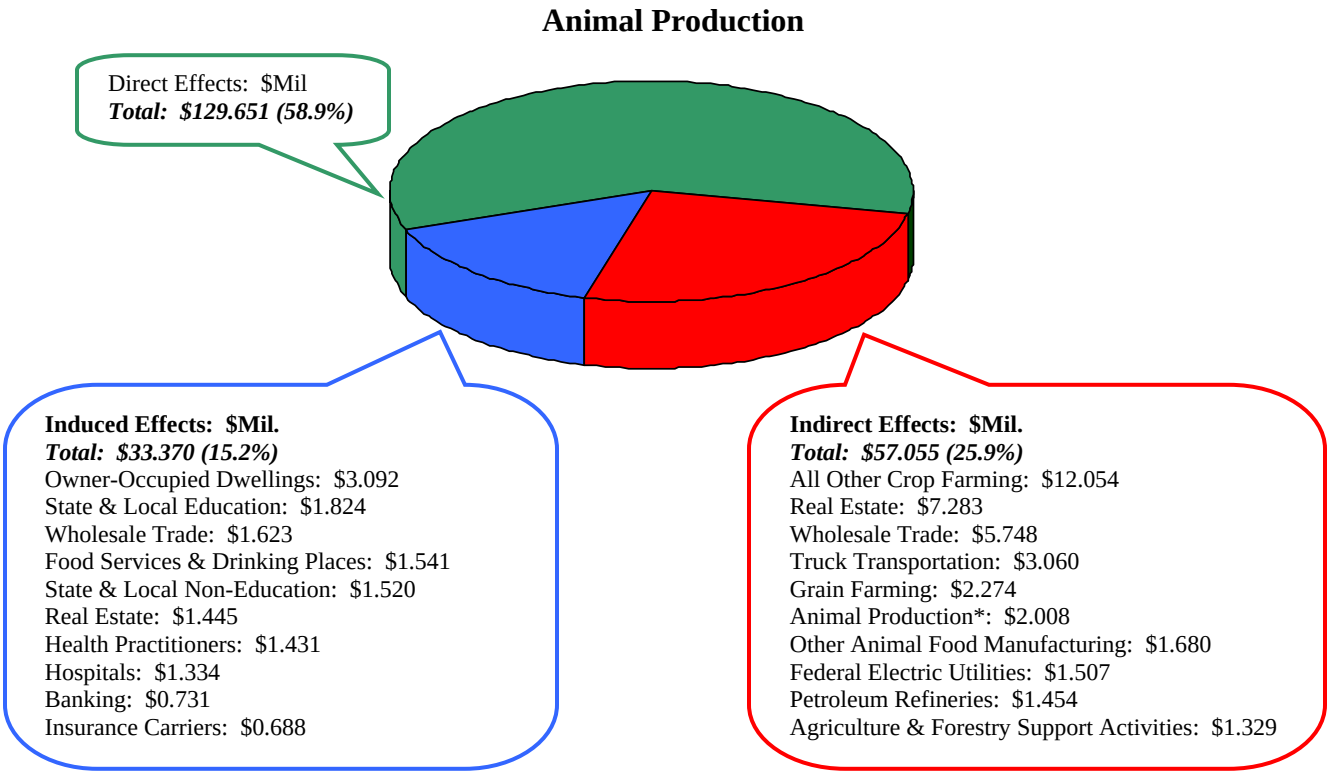


Figure 16. Estimated Direct, Indirect, and Induced Impacts for All Other Crop Farming and Animal Production, except Cattle and Poultry & Eggs.

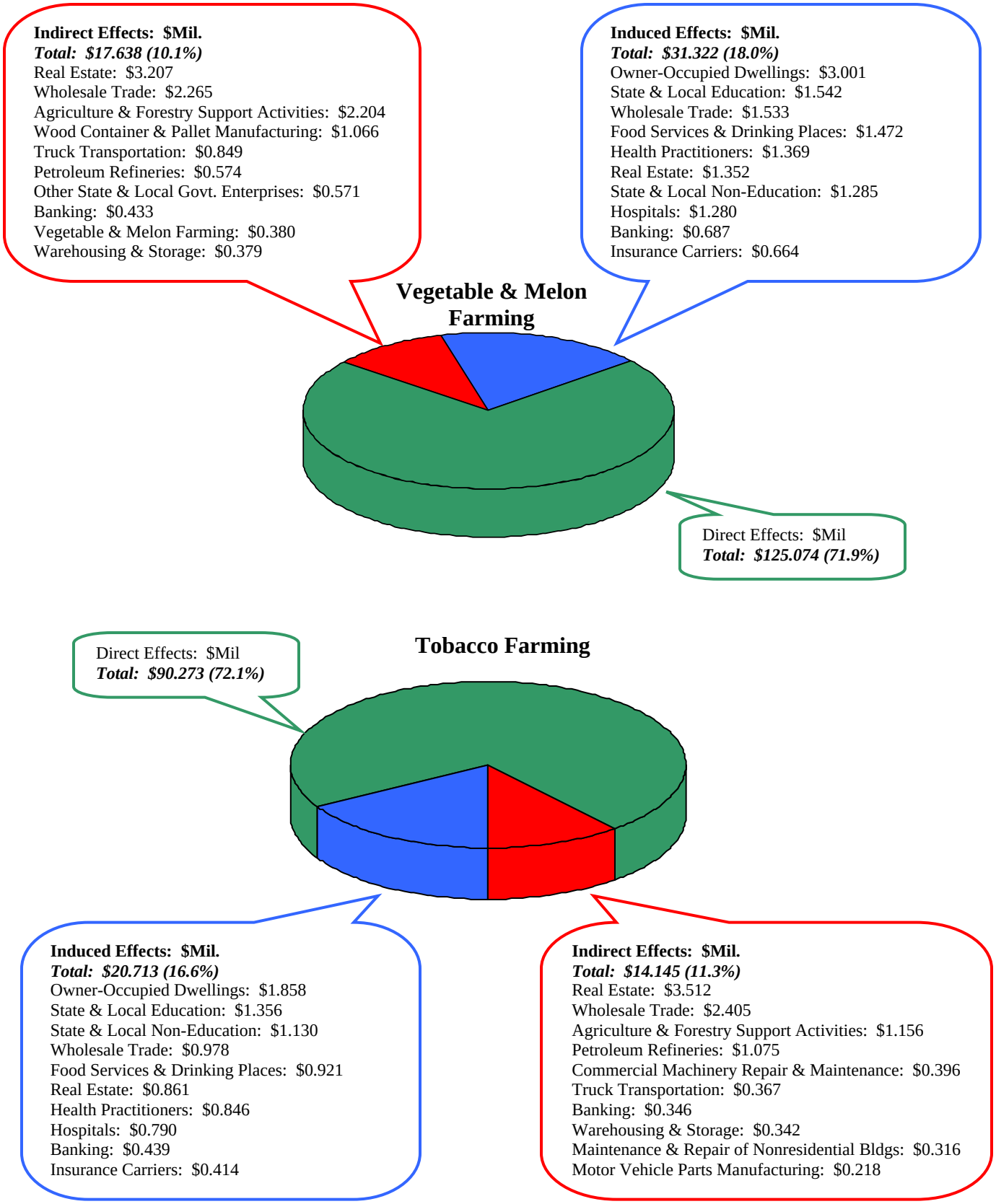


Figure 17. Estimated Direct, Indirect, and Induced Impacts for Vegetable & Melon Farming and Tobacco Farming.

Table 15. Estimated Total Economic Impacts from Secondary Agricultural Products

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Food Manufacturing:								
State	22,127		114,009		4,782		8,305	
Chattanooga	3,161	14.3	21,295	18.7	688	14.4	1,297	15.6
Knoxville	2,687	12.1	13,795	12.1	595	12.4	1,050	12.6
Memphis	10,023	45.3	46,205	40.5	2,088	43.7	3,699	44.5
Nashville	5,307	24.0	28,950	25.4	1,122	23.5	1,855	22.3
Tri-Cities	321	1.5	1,326	1.2	56	1.2	85	1.0
Intrastate Trade	629	2.8	2,438	2.1	233	4.9	318	3.8
Beverage Manufacturing:								
State	4,832		22,524		1,037		1,940	
Chattanooga	962	19.9	3,846	17.1	167	16.1	295	15.2
Knoxville	456	9.4	2,027	9.0	89	8.5	150	7.7
Memphis	1,976	40.9	8,747	38.8	418	40.3	794	40.9
Nashville	1,114	23.1	5,735	25.5	269	25.9	547	28.2
Tri-Cities	134	2.8	563	2.5	26	2.6	45	2.3
Intrastate Trade	190	3.9	1,605	7.1	68	6.6	109	5.6
Tobacco Products:								
State	2,607		9,902		468		1,327	
Chattanooga	0	0.0	0	0.0	0	0.0	0	0.0
Knoxville	0	0.0	0	0.0	0	0.0	0	0.0
Memphis	317	12.2	1,146	11.6	57	12.1	162	12.2
Nashville	2,255	86.5	8,323	84.1	401	85.6	1,148	86.5
Tri-Cities	0	0.0	0	0.0	0	0.0	0	0.0
Intrastate Trade	35	1.4	433	4.4	11	2.3	16	1.2
Textile Mills:								
State	2,502		16,221		644		910	
Chattanooga	986	39.4	6,968	43.0	236	36.6	325	35.7
Knoxville	157	6.3	1,180	7.3	42	6.6	58	6.4
Memphis	232	9.3	1,560	9.6	62	9.6	84	9.2
Nashville	605	24.2	3,471	21.4	152	23.6	227	25.0
Tri-Cities	370	14.8	2,475	15.3	89	13.9	127	13.9
Intrastate Trade	153	6.1	568	3.5	63	9.7	89	9.8
Apparel Manufacturing:								
State	2,476		20,143		705		1,236	
Chattanooga	633	25.6	5,431	27.0	182	25.8	298	24.1
Knoxville	468	18.9	3,896	19.3	130	18.4	233	18.9
Memphis	434	17.5	3,710	18.4	118	16.8	213	17.2
Nashville	758	30.6	5,765	28.6	215	30.5	396	32.1
Tri-Cities	44	1.8	345	1.7	13	1.8	23	1.9
Intrastate Trade	139	5.6	996	4.9	47	6.6	72	5.9
Agricultural Machinery:								
State	2,310		11,910		490		807	
Chattanooga	72	3.1	404	3.4	14	2.9	23	2.9
Knoxville	30	1.3	176	1.5	7	1.4	12	1.4

Table 15. Estimated Total Economic Impacts from Secondary Agricultural Products (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Memphis	894	38.7	4,442	37.3	186	37.9	307	38.0
Nashville	894	38.7	4,452	37.4	190	38.7	316	39.2
Tri-Cities	262	11.4	1,319	11.1	48	9.9	80	9.9
Intrastate Trade	158	6.9	1,117	9.4	44	9.1	70	8.7
Agricultural Chemicals:								
State	1,304		5,389		248		523	
Chattanooga	13	1.0	51	0.9	2	0.9	5	1.0
Knoxville	57	4.4	243	4.5	11	4.5	25	4.8
Memphis	795	61.0	3,092	57.4	146	59.0	301	57.5
Nashville	409	31.4	1,649	30.6	78	31.3	175	33.5
Tri-Cities	0	0.0	0	0.0	0	0.0	0	0.0
Intrastate Trade	29	2.2	354	6.6	10	4.2	17	3.2
Textile Product Mills:								
State	1,129		7,868		303		446	
Chattanooga	119	10.5	833	10.6	31	10.2	44	9.9
Knoxville	130	11.5	1,132	14.4	43	14.1	60	13.4
Memphis	184	16.3	1,529	19.4	53	17.4	76	17.1
Nashville	609	54.0	3,676	46.7	149	49.1	225	50.5
Tri-Cities	28	2.4	238	3.0	9	3.0	12	2.7
Intrastate Trade	59	5.2	459	5.8	18	6.1	29	6.5
Leather & Allied Product Manufacturing:								
State	400		3,481		120		199	
Chattanooga	37	9.2	288	8.3	9	7.8	18	9.1
Knoxville	60	14.9	509	14.6	20	16.7	43	21.6
Memphis	23	5.7	215	6.2	7	5.4	9	4.7
Nashville	258	64.6	2,300	66.1	78	64.6	118	59.3
Tri-Cities	5	1.2	39	1.1	1	1.0	2	1.1
Intrastate Trade	18	4.4	131	3.7	5	4.5	8	4.3

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.

carpet and rug mills), and leather and allied product manufacturing (primarily from footwear). Agricultural machinery values were largest for the Nashville and Memphis Regions (primarily from lawn and garden equipment for both regions). Agricultural machinery is an important industry in the Tri-Cities Region also. Both Nashville and Memphis Regions had similar economic activity for agricultural machinery. The Chattanooga Region had the largest economic activity for textile mills (primarily from fiber, yarn, and thread mills).

Primary Forest Products Total Impacts:

Pulp and paperboard mills contributed the largest values for all the categories analyzed compared to the other four primary forest products sectors combined (Table 16). The Memphis Region dominated all value categories for this sector, with the Chattanooga Region having the largest values next followed by the Tri-Cities Region. The Memphis Region also had the largest

Table 16. Estimated Total Economic Impacts from Primary Forest Products

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Pulp & Paperboard Mills:								
State	5,934		28,820		1,501		2,548	
Chattanooga	1,906	32.1	8,750	30.4	453	30.2	779	30.6
Knoxville	227	3.8	1,161	4.0	51	3.4	86	3.4
Memphis	2,268	38.2	10,418	36.1	583	38.8	993	39.0
Nashville	266	4.5	1,279	4.4	61	4.1	104	4.1
Tri-Cities	893	15.1	4,264	14.8	215	14.4	368	14.4
Intrastate Trade	373	6.3	2,947	10.2	137	9.2	219	8.6
Sawmills:								
State	1,312		8,182		285		452	
Chattanooga	44	3.4	278	3.4	9	3.2	15	3.3
Knoxville	106	8.1	671	8.2	24	8.3	37	8.3
Memphis	312	23.8	1,919	23.5	65	22.8	103	22.8
Nashville	717	54.6	4,384	53.6	155	54.6	247	54.7
Tri-Cities	99	7.6	625	7.6	20	7.2	32	7.1
Intrastate Trade	34	2.6	304	3.7	12	4.1	17	3.8
Logging:								
State	1,187		8,534		328		588	
Chattanooga	78	6.6	530	6.2	20	6.1	37	6.3
Knoxville	138	11.6	950	11.1	37	11.2	68	11.5
Memphis	587	49.4	4,250	49.8	168	51.3	296	50.4
Nashville	327	27.6	2,363	27.7	87	26.6	159	27.0
Tri-Cities	36	3.1	250	2.9	9	2.9	17	3.0
Intrastate Trade	21	1.8	192	2.2	6	1.9	11	1.9
Pulp Mills:								
State	585		2,902		143		209	
Chattanooga	29	5.0	140	4.8	5	3.5	8	3.8
Knoxville	0	0.0	0	0.0	0	0.0	0	0.0
Memphis	546	93.2	2,580	88.9	132	92.6	193	92.3
Nashville	0	0.0	0	0.0	0	0.0	0	0.0
Tri-Cities	0	0.0	0	0.0	0	0.0	0	0.0
Intrastate Trade	11	1.8	182	6.3	6	3.9	8	3.9
Forest Nurseries/Forest Products/Timber Tracts:								
State	63		681		18		33	

Table 16. Estimated Total Economic Impacts from Primary Forest Products (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Chattanooga	1	2.1	9	1.3	0[c]	1.5	1	1.9
Knoxville	15	22.9	127	18.7	3	18.0	7	20.4
Memphis	15	23.7	198	29.1	5	27.5	8	24.0
Nashville	0	0.0	0	0.0	0	0.0	0	0.0
Tri-Cities	24	38.3	183	26.9	5	28.6	13	37.9
Intrastate Trade	8	12.9	163	24.0	4	24.4	5	15.7

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.
[c] Values of 0 are nonzero values that are less than 1.

values for logging and pulp mills. The Nashville Region had the largest output values for sawmills. The Tri-Cities Region had the largest output values for forest nurseries, forest products, and timber tracts.

Secondary Forest Products Total Impacts:

Secondary forest products estimated total impacts are shown in Table 17. Paper manufacturing and furniture and related product manufacturing were the largest contributors for all categories. Although paper manufacturing had the largest value for output, labor income, and value added, the furniture sector had the largest number of employed individuals. The Memphis and Nashville Regions had the largest output value for the paper manufacturing sector (for Memphis, primarily from paperboard containers manufacturing and sanitary paper products; for Nashville, from paperboard containers, all other converted paper products, and coated, laminated paper, and packaging materials). For furniture, the Knoxville (primarily from upholstered household furniture, institutional furniture, and showcases, partitions, shelving, and lockers), Chattanooga (upholstered household furniture), and Nashville (institutional furniture and showcases, partitions, shelving, and lockers) Regions were the leaders. The Knoxville Region also had the largest output values for manufactured home manufacturing. For millwork, both the Memphis and Nashville Regions had the largest values followed by the Knoxville Region. The

Table 17. Estimated Total Economic Impacts from Secondary Forest Products

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Paper Manufacturing:								
State	5,634		32,901		1,460		2,216	
Chattanooga	531	9.4	3,039	9.2	128	8.8	177	8.0
Knoxville	502	8.9	3,085	9.4	138	9.4	201	9.1
Memphis	1,934	34.3	10,606	32.2	488	33.4	772	34.8
Nashville	1,501	26.6	8,797	26.7	406	27.8	599	27.0
Tri-Cities	872	15.5	5,115	15.5	200	13.7	306	13.8
Intrastate Trade	295	5.2	2,258	6.9	101	6.9	161	7.3
Furniture & Related Product Manufacturing:								
State	4,085		33,796		1,235		1,770	
Chattanooga	931	22.8	7,959	23.6	274	22.2	361	20.4
Knoxville	1,526	37.4	13,017	38.5	463	37.5	665	37.5
Memphis	357	8.7	2,877	8.5	103	8.3	152	8.6
Nashville	901	22.1	7,184	21.3	278	22.5	412	23.3
Tri-Cities	74	1.8	663	2.0	20	1.6	29	1.6
Intrastate Trade	296	7.2	2,097	6.2	96	7.8	152	8.6
Millwork:								
State	1,608		12,584		470		683	
Chattanooga	9	0.5	73	0.6	2	0.5	3	0.5
Knoxville	360	22.4	2,912	23.1	104	22.1	149	21.9
Memphis	550	34.2	4,142	32.9	160	34.0	237	34.7
Nashville	500	31.1	3,903	31.0	148	31.5	212	31.0
Tri-Cities	125	7.8	1,017	8.1	35	7.6	49	7.1
Intrastate Trade	65	4.0	538	4.3	21	4.4	81	11.9
Other Wood Product Manufacturing:								
State	1,014		9,494		313		464	
Chattanooga	112	11.0	1,131	11.9	33	10.5	49	10.6
Knoxville	130	12.8	1,233	13.0	41	13.2	61	13.1
Memphis	249	24.5	2,370	25.0	77	24.7	114	24.6
Nashville	391	38.5	3,656	38.5	124	39.6	184	39.6
Tri-Cities	76	7.5	650	6.8	19	6.1	27	5.9
Intrastate Trade	57	5.6	454	4.8	19	5.9	29	6.3
Manufactured Home Manufacturing:								
State	993		7,965		309		487	
Chattanooga	23	2.3	183	2.3	7	2.2	10	2.1
Knoxville	534	53.8	4,427	55.6	166	53.8	265	54.4
Memphis	134	13.5	1,086	13.6	41	13.2	65	13.4
Nashville	247	24.9	1,925	24.2	79	25.6	122	25.1
Tri-Cities	4	0.4	31	0.4	1	0.3	2	0.3
Intrastate Trade	52	5.2	314	3.9	15	4.8	23	4.7
Veneer, Plywood, & Engineered Wood Product Manufacturing:								
State	408		2,972		110		183	
Chattanooga	30	7.3	230	7.7	8	7.2	14	7.7
Knoxville	89	21.7	684	23.0	28	25.1	46	25.1

Table 17. Estimated Total Economic Impacts from Secondary Forest Products (Cont.)

Sector	TIO[a]		Employment		Labor Income		TVA[b]	
	(Million $)	%	(Number)	%	(Million $)	%	(Million $)	%
Memphis	187	45.8	1,229	41.4	44	39.8	73	39.9
Nashville	57	13.9	445	15.0	16	14.8	27	14.8
Tri-Cities	34	8.3	277	9.3	10	8.7	16	8.7
Intrastate Trade	12	3.0	107	3.6	5	4.5	7	3.9

[a] Total Industry Output – annual value of production by industry.
[b] Total Value Added – income to workers paid by employers; self-employed income; interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses.

Nashville (primarily from wood kitchen cabinets and countertops, wood containers and pallets, and all other miscellaneous wood products—NAICS 321999) and Memphis Regions (wood containers and pallets and wood kitchen cabinets and countertops) were the leaders in all categories for other wood product manufacturing. Veneer, plywood, and engineered wood product manufacturing economic activity were the largest in the Memphis Region.

The output and employment multipliers for 2003 for primary agricultural and forestry activities ranged from 1.37 to 2.16 for total industrial output and 1.06 to 5.06 for employment (Table 18). For instance, if pulp mills increased total industry output by $1 million, the state's economy would increase by an estimated $.86 million overall and for each job created in this same industry an estimated 4.06 additional jobs would be added. Soybean farmers (oilseed farming) that produce $1 million of total industry output generated an additional $.25 million indirectly through the purchase of inputs and $.48 million in total economic activity within the state.

Figures 18 through 23 show the estimated direct and total level of economic activity derived from agriculture, forestry, and both agriculture and forestry combined by county for Tennessee. These values were based on total industry output and were compared to the total level of economic activity for each county. Direct agriculture included the growing of crops and the breeding and feeding of livestock, whereas direct forestry included the management and

Table 18. Primary Agriculture and Forestry Output and Employment Multipliers

IMPLAN Sector	TIO[a] Indirect	TIO[a] Indirect & Induced	Employment Indirect	Employment Indirect & Induced
Oilseed farming	1.25	1.48	1.06	1.11
Grain farming	1.23	1.45	1.04	1.08
Vegetable & melon farming	1.14	1.39	1.08	1.20
Tree nut farming	1.21	1.52	1.13	1.24
Fruit farming	1.18	1.48	1.07	1.14
Greenhouse & nursery production	1.07	1.37	1.03	1.12
Tobacco farming	1.16	1.39	1.02	1.06
Cotton farming	1.18	1.47	1.15	1.29
All other crop farming	1.17	1.40	1.09	1.21
Cattle ranching & farming	1.64	1.91	1.34	1.43
Poultry & egg production	1.18	1.38	1.20	1.45
Animal production, except cattle/poultry/eggs	1.44	1.70	1.08	1.11
Fishing	1.40	2.09	1.05	1.16
Hunting & trapping	1.50	1.99	1.96	2.25
Agriculture & forestry support activities	1.09	2.16	1.03	1.26
Logging	1.29	1.69	1.67	2.60
Sawmills	1.30	1.57	1.48	2.12
Pulp mills	1.49	1.86	2.87	5.06
Paper & paperboard mills	1.40	1.77	2.51	4.72

[a] Total Industry Output – annual value of production by industry.

logging of trees. Total agriculture included direct agriculture, plus the input supplying industries and secondary agriculture, which included manufacturing. Likewise for total forestry (direct forestry, plus input supplying industries and secondary forestry). Grundy County in the Nashville Region had the highest level of economic activity for direct agriculture at 13.2 percent (Table 19); for total agriculture, Moore County had the highest level at 79.7 percent. For direct forestry, Van Buren County in the Nashville Region had the highest level of economic activity at 9.2 percent; for total forestry, Hardin County in the Memphis Region had the highest level at 64.3 percent. Likewise, for both agriculture and forestry combined, Grundy (20.6 percent direct) and Moore (79.7 percent total) Counties in the Nashville Region had the largest levels of economic activity.

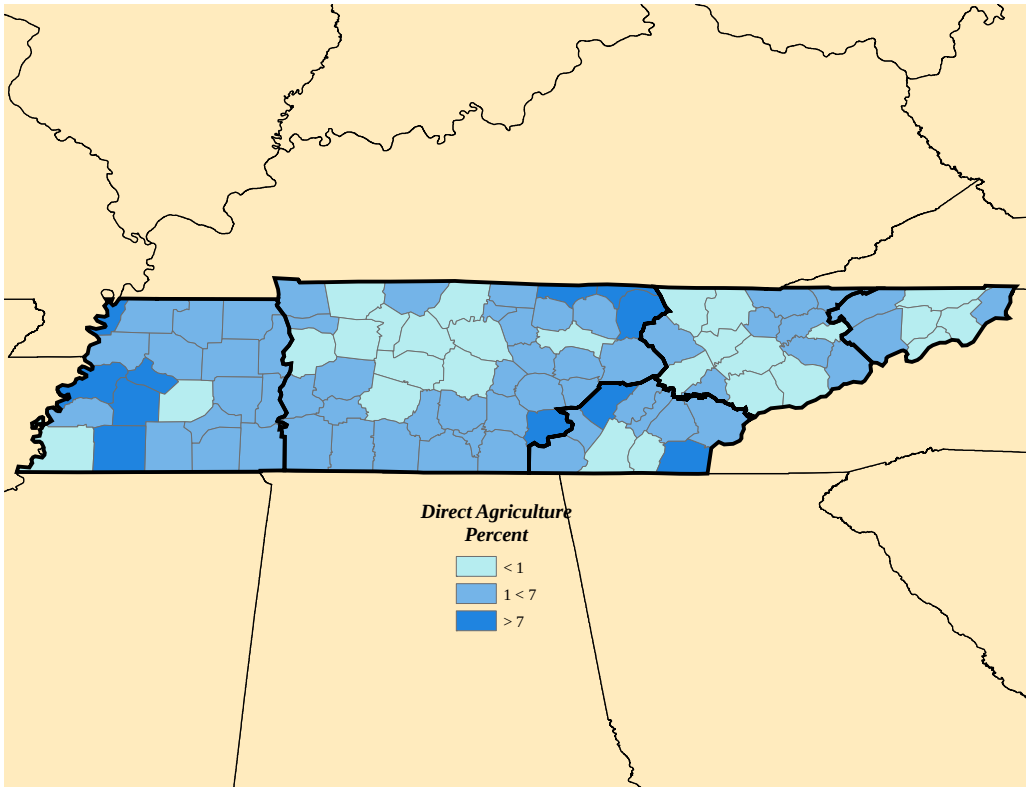


Figure 18. Percent of Economic Activity from Direct Agriculture, 2003.

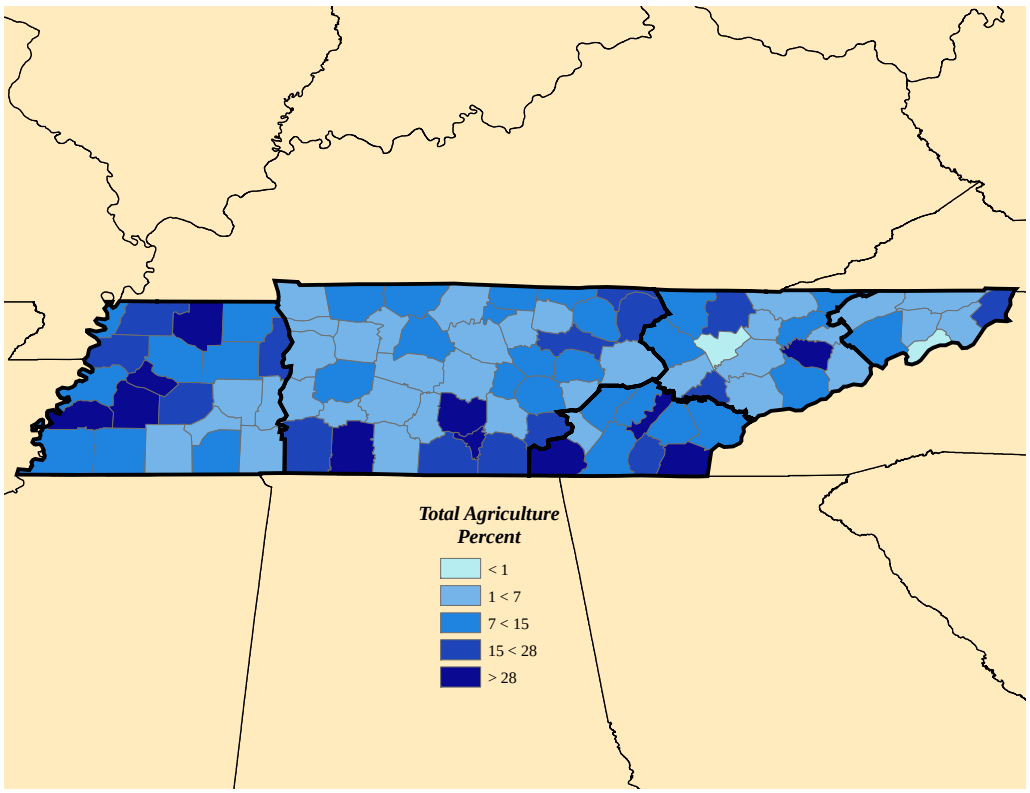


Figure 19. Percent of Economic Activity from Total Agriculture, 2003.

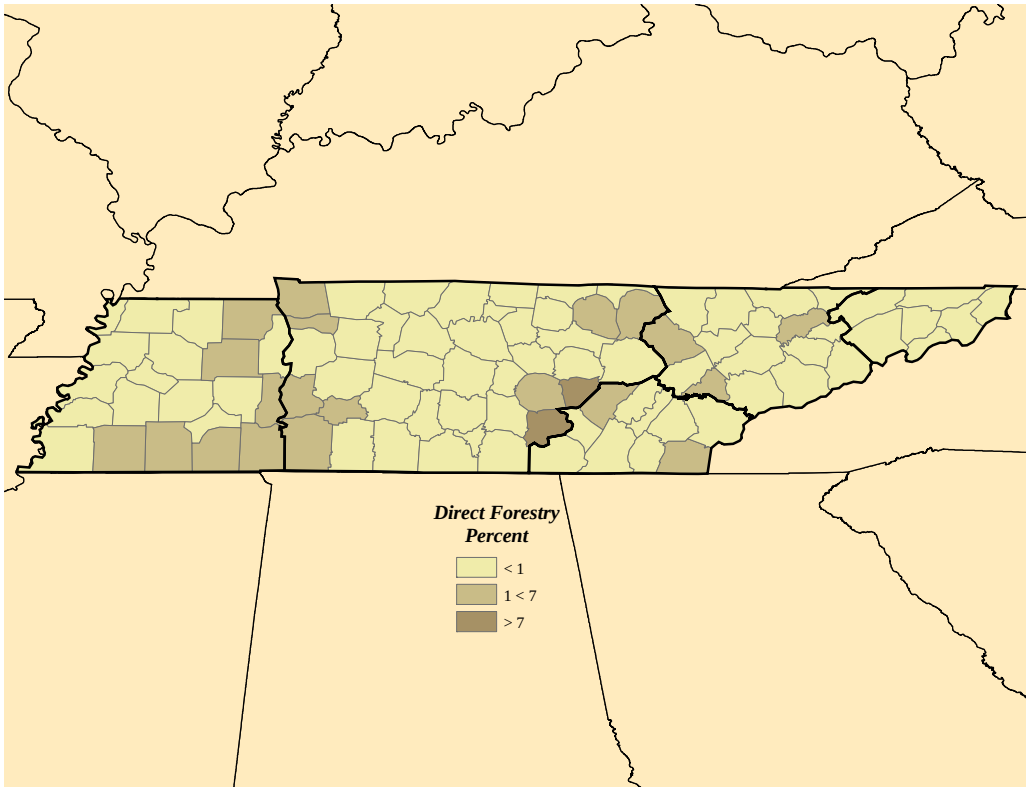


Figure 20. Percent of Economic Activity from Direct Forestry, 2003.

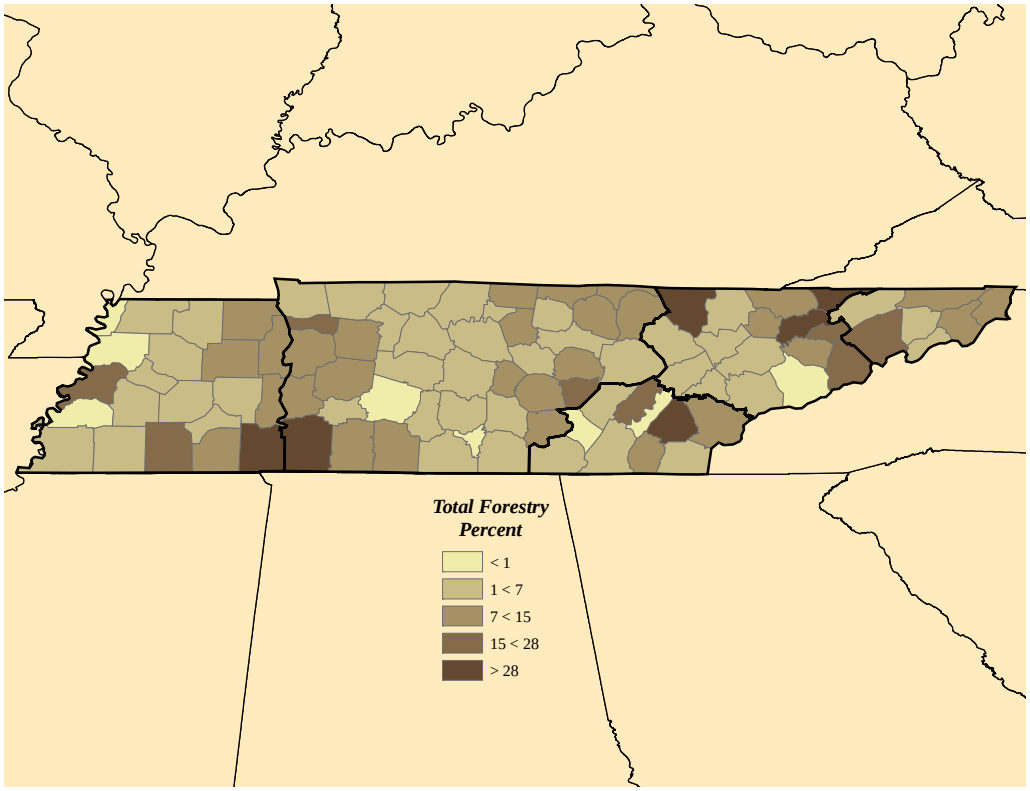


Figure 21. Percent of Economic Activity from Total Forestry, 2003.

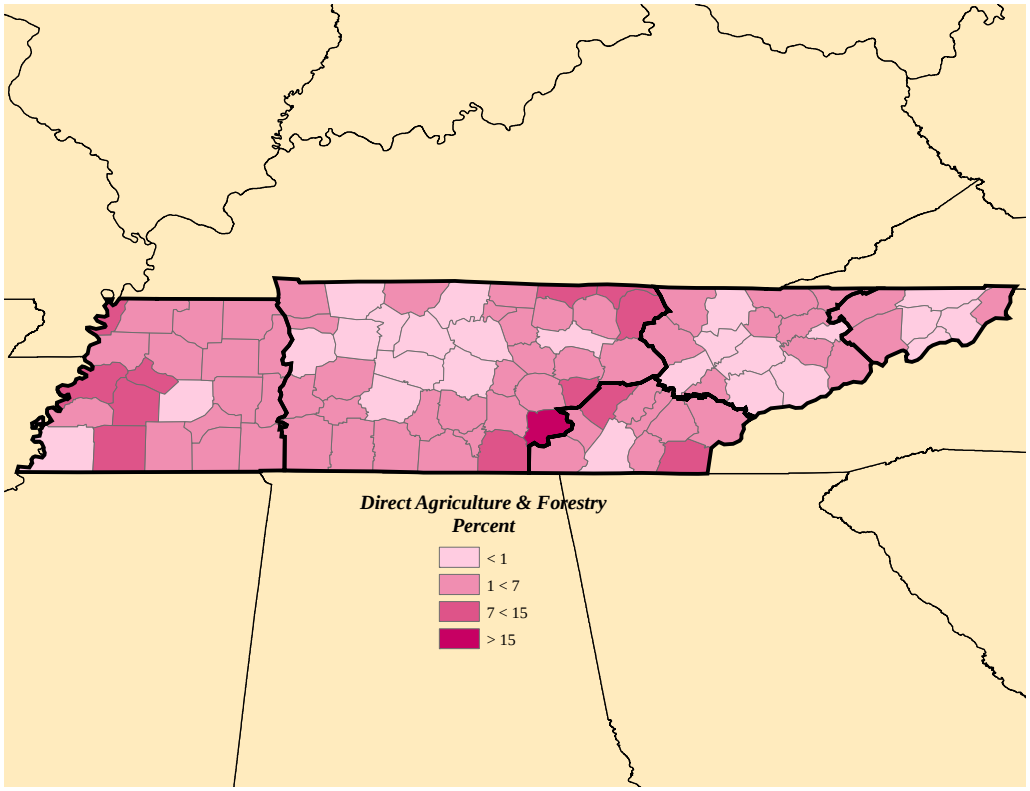


Figure 22. Percent of Economic Activity from Direct Agriculture and Forestry, 2003.

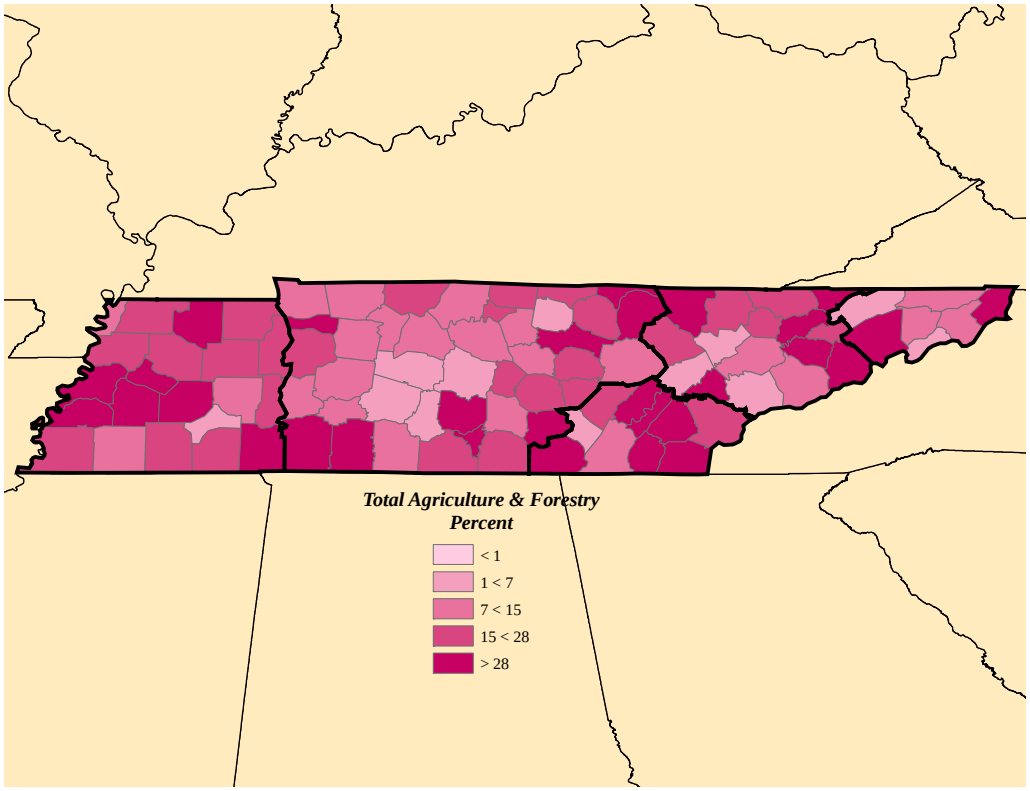


Figure 23. Percent of Economic Activity from Total Agriculture and Forestry, 2003.

Table 19. Counties with the Highest Levels of Economic Activity for Agriculture and Forestry by Analysis Region, 2003

	Region and County									
	Chattanooga	%	Knoxville	%	Memphis	%	Nashville	%	Tri-Cities	%
Agriculture:										
Direct	Bledsoe	10.5	Hancock	6.2	Haywood	11.4	Grundy	13.3	Johnson	3.4
Total	Meigs	46.3	Jefferson	32.1	Crockett	63.8	Moore	79.7	Johnson	27.3
Forestry:										
Direct	Bledsoe	2.8	Loudon	2.2	Hardin	2.8	VanBuren	9.2	Johnson	0.4
Total	McMinn	51.8	Hancock	39.8	Hardin	64.3	Wayne	32.0	Greene	16.2
Combined:										
Direct	Bledsoe	13.4	Hancock	6.2	Haywood	12.2	Grundy	20.6	Johnson	3.8
Total	McMinn	61.6	Grainger	49.3	Hardin	69.2	Moore	79.7	Johnson	39.8

Summary and Conclusion

Input-output modeling is useful for evaluating and analyzing information on the interrelationships in a regional economy and impacts of changes on that economy. The model is a useful planning tool for policy-makers in evaluating potential impacts of their decisions concerning agriculture and forestry industries for the state. For this analysis, a baseline for 2003 was developed using Tennessee Agricultural Statistics Service information, along with the Minnesota IMPLAN Group's input-output model information. The state was divided into five trade regions. Look for these five regions in future analyses as individual sectors are examined and the impacts of additions to the state's agro-forestry industrial complex are evaluated.

Comparing agricultural data for 2000 and 2003 revealed that most of Tennessee's traditional row crops acreage declined but their corresponding crop prices increased for the major crops grown. Livestock numbers increased for traditional livestock commodities, except for milk cows, during that timeframe. Livestock prices increased for most of the livestock products except for cattle and hogs. Precipitation for the state for the timeframe reviewed can be characterized as unpredictable. Below average rainfall for both years 2000 and 2001 was followed by wet conditions for years 2002 and 2003.

Agriculture and forestry were very important to the Tennessee's economy holding a 17.3 percent share in the state's economy. The agro-forestry industrial complex included the primary industries typically associated with agriculture and forest operations such as the growing of crops, the breeding and feeding of livestock, and the management and logging of trees. Also included in the industrial complex were the input supplying industries and value-added subsectors, which included food and beverage manufacturing, apparel and textiles, and forestry products manufacturing. In 2003, the agro-forestry industrial complex contributed $67.0 billion to the Tennessee economy and employed over 490,000 individuals.

Agriculture, a subset of the agro-forestry industrial complex in Tennessee, included farming and related industries, as well as value-added food and fiber production, processing and manufacturing. Agriculture accounted for 11.4 percent of the state's economy and generated $44.2 billion in output. About 342,000 Tennesseans, with over 130,000 in the production sector (both full- and part-time), were employed in agriculture.

Forestry included the management and logging of trees; sawmills (primary forestry products), including pulp and paper mills, plus forestry products manufacturing (secondary forestry products). Forestry accounted for 5.9 percent of the state's economy, employed close to 149,000 Tennesseans, and generated $22.8 billion in output.

From a regional perspective, the agro-forestry industrial complex was more important to the Chattanooga and Memphis regions relative to other regions in the state followed by the Tri-Cities, Knoxville and Nashville regions (Table 20). Although the Memphis Region contributed the largest amount of economic activity, $23.6 billion, this value represented only 22 percent of the total for the region.

When comparing county level total economic activity (across all industries) with county level agricultural economic activity, the counties with the highest percentage levels were Moore

Table 20. Regional Importance of Agriculture to that Region's Economy, 2003

Location	Total Economic Activity	Estimated Agro-Forestry Industrial Complex Contributions to the State's Economy	Proportion
	(Million $)	(Million $)	(Ratio)
State	388,211	67,056	0.17
Chattanooga	45,303	10,028	0.22
Knoxville	60,594	8,118	0.13
Memphis	108,311	23,655	0.22
Nashville	150,918	18,872	0.13
Tri-Cities	23,087	3,642	0.16

Source: Minnesota IMPLAN Group, Inc.

(79.7 percent) in the Nashville Region, Crockett (63.8 percent) in the Memphis Region, Meigs (46.3 percent) in the Chattanooga Region, Jefferson (32.1 percent) in the Knoxville Region, and Johnson (27.3 percent) in the Tri-Cities Region. Likewise, for forestry, Hardin County (64.3 percent) had the highest level of forestry economic activity percentage in the Memphis Region, followed by McMinn County (51.8 percent) in the Chattanooga Region, Hancock County (39.8 percent) in the Knoxville Region, Wayne County (32.0 percent) in the Nashville Region, and Greene County (16.2 percent) in the Tri-Cities Region. Combining both agriculture and forestry economic activity levels and comparing to the total, the counties with the highest percentages were Moore (79.7 percent) in the Nashville Region, Hardin (69.2 percent) in the Memphis Region, McMinn (61.6 percent) in the Chattanooga Region, Grainger (49.3 percent) in the Knoxville Region, and Johnson (39.8 percent) in the Tri-Cities Region.

Literature Cited

Bureau of Economic Analysis, Regional Economic Accounts, BEA Economic Areas Component County List. Available at http://www.bea.gov/bea/regional/docs/econlist.cfm.

English, B., K. Jensen, and J. Menard. 2001. "Economic Impacts of Agriculture and Forestry in Tennessee, 1997", Research Series 04-01. Available at http://web.utk.edu/~aimag/pubimpact.html.

English, B., K. Jensen, and J. Menard. 2003. "Economic Impacts of Agriculture and Forestry in Tennessee, 2000", Research Series 02-03. Available at http://web.utk.edu/~aimag/pubimpact.html.

Jensen, K., G. Dawson, M. Bruch, J. Menard, and B. English. 2005. "Agri-tourism in Tennessee: Current Status and Future Growth, 2003-2004." Available at http://web.utk.edu/~aimag/pubmkt.html.

Leontief, Wassily. (1936). "Quantitative Input and Output Relations in the Economic System of the United States", *Review of Economics and Statistics* 18:105-125.

Minnesota IMPLAN Group, Inc., IMPLAN System (data and software), 1725 Tower Drive West, Suite 140, Stillwater, MN 55082 www.implan.com.

Olson, D. and S. Lindall. (1999). "IMPLAN Professional Software, Analysis, and Data Guide", Minnesota IMPLAN Group, Inc., 1725 Tower Drive West, Suite 140, Stillwater, MN 55082, www.implan.com.

Pyatt, G. and J. Round. (1985). Social Accounting Matrices, A Basis for Planning, The World Bank, Washington, D.C.

Tennessee Agricultural Statistics Service. "Tennessee Agriculture 2004". Department Report & Statistical Summary.

U.S. Census Bureau, North American Industry Classification System (NAICS). 2002. Available at http://www.census.gov/epcd/www/naics.html

U.S. Census Bureau, Manufacturing, Mining, and Construction Statistics, Annual Survey of Manufacturers, 2003 Geographic Area Statistics. Available at http://www.census.gov/mcd/asmhome.html.

U.S. Census Bureau, State and County *QuickFacts*, Tennessee *QuickLinks*, County Business Patterns Economic Profile, 2003. Available at http://quickfacts.census.gov/qfd/states/47000lk.html.

U.S. Department of Agriculture, National Agricultural Statistics Service. 2002. Floriculture Crops. Available at http://usda.mannlib.cornell.edu/reports/nassr/other/zfc-bb/.

U.S. Department of Agriculture, National Agricultural Statistics Service. 2004. Floriculture Crops. Available at http://usda.mannlib.cornell.edu/reports/nassr/other/zfc-bb/.

U.S. Department of Commerce, National Climatic Data Center, NOAA Satellite and Information Service, Climatological Data. Available at http://www5.ncdc.noaa.gov/cgi-bin/script/webcat.pl.

U.S. Department of Commerce, TradeStats Express™-Home, State Export Data, Office of Trade and Industry Information. 2003. Available at http://tse.export.gov/.

Appendix A: County Region Identification Table

Table A.1. County Assignment to TNAIM's Modeling Regions

Memphis	Nashville		Chattanooga	Knoxville	Tri-Cities
Benton	Bedford	Macon	Bledsoe	Anderson	Carter
Carroll	Cannon	Marshall	Bradley	Blount	Greene
Chester	Cheatham	Maury	Hamilton	Campbell	Hawkins
Crockett	Clay	Montgomery	McMinn	Claiborne	Johnson
Decatur	Coffee	Moore	Marion	Cocke	Sullivan
Dyer	Cumberland	Overton	Meigs	Grainger	Unicoi
Fayette	Davidson	Perry	Monroe	Hamblen	Washington
Gibson	DeKalb	Pickett	Polk	Hancock	
Hardeman	Dickson	Putnam	Rhea	Jefferson	
Hardin	Fentress	Robertson	Sequatchie	Knox	
Haywood	Franklin	Rutherford		Loudon	
Henderson	Giles	Smith		Morgan	
Henry	Grundy	Stewart		Roane	
Lake	Hickman	Sumner		Scott	
Lauderdale	Houston	Trousdale		Sevier	
McNairy	Humphreys	Vanburen		Union	
Madison	Jackson	Warren			
Obion	Lawrence	Wayne			
Shelby	Lewis	White			
Tipton	Lincoln	Williamson			
Weakley		Wilson			