

MANAGEMENT

REGIONAL ECONOMIC CONTRIBUTIONS OF THE FOREST-BASED INDUSTRIES IN THE SOUTH

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ABSTRACT

Forest-based industries (including forestry) make substantial direct contributions to the economy of the South, as well as contributing to pleasant living conditions and environmental protection. As of 1992, about 633,000 persons were employed in forest-based industries, comprising 1.5 percent of all southern employment. Total wages amounted to \$15 billion in 1990, or 1.7 percent of all wages paid. Forest-based value added, which is the best measure of total net contributions for all economic sectors, amounted to \$32 billion in 1991. This comprised 1.9 percent of the \$1,666 billion in gross state product for the southern states. The value of shipments from forest industries, which includes the value added contributed by other sectors as well as forestry, amounted to \$70 billion. Multipliers were calculated using IMPLAN for industrial output, employment, value added, regional income, and personal income. They indicate that forest-based industries have substantial indirect and induced effects in the southern economy — up to two or three times the direct impact, depending on the state, sector, and economic measure.

Southern forests provide many benefits for the region, ranging from production of commodities to provision of recreational activities and amenity values. These forests provide direct economic returns to landowners, loggers, and wood processors, as well as help protect the environment. Assessing the economic diversity and dependency of the forest-based sector in each of 13 southern states is the first step toward formulating strategies, goals, and policies to improve regional economic growth and development. Planners and policy makers will be able to use this regional economic information to make better development decisions. Periodic estimates of the economic contributions of southern forests have been made in various states. The most recent integrated South-wide estimates were published in 1996 based mostly on 1984 and 1990 data (6). This paper up-

dates these statistics and discusses their implications.

DATA COLLECTION METHODS AND ASSUMPTIONS

Impacts of forest-based activities on the state-level economy were estimated through various sources. Employment figures were obtained from the IMPLAN (IMpact analysis for PLANning) 1992 database. They include total state employment; and employment in the sectors of lumber and wood products; forestry (non-manufacturing activities); wood furniture, and paper and allied products.

Southern forest-based earnings were obtained from an American Forest and Paper Association (AF&PA) report (3) that reported the U.S. Department of Commerce, Census of Manufactures statistics for 1990. Southern forest-based value of shipments and value added were obtained from the 1991 survey of manufacturers (12).

Regional economic multipliers were estimated using Micro IMPLAN. IMPLAN is an economic impact analysis system based on an input-output (I/O) model developed by the USDA Forest Service (1,2,16,17). Details on I/O theory are provided in (8). I/O provides a framework in which to collect, categorize, and analyze data on the interindustry structure and interdependencies of the community's economy. The structure of a regional economy, the relationships among various actors (industries, institutions such as households, and federal, state, and local governments) performing different activities is described in the regional economic accounts. Within this structure, one actor's expenditures corresponds to other actors' receipts. It is this "backward linked" structure that allows I/O to be used for impact analysis and to develop regional economic multipliers. IMPLAN is derived from a national model. The national model represents the

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TABLE 1. — Southern forest-based employment.^a

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State	Total state employment	Forest-based employment				Total forest based	Total forest-based as % of total state
		Forestry	Paper and allied products	Wood furniture	Lumber and wood products		
----- (no. of employees) -----							(%)
Alabama	2,129,834	849	21,148	5,867	30,969	58,833	2.8
Arkansas	1,274,478	316	14,172	5,370	22,509	42,367	3.3
Florida	7,111,231	1,570	13,464	5,667	19,210	39,911	0.6
Georgia	3,768,056	1,405	31,228	4,714	28,960	66,307	1.8
Kentucky	2,016,886	245	8,904	2,404	16,454	28,007	1.4
Louisiana	2,060,312	402	12,214	455	13,039	26,110	1.3
Mississippi	1,249,574	305	8,970	4,154	28,101	41,530	3.3
North Carolina	4,055,213	591	22,714	46,023	38,893	108,221	2.7
Oklahoma	1,696,144	122	3,911	1,271	3,699	9,003	0.5
South Carolina	1,953,687	992	11,848	3,375	15,296	31,511	1.6
Tennessee	2,873,863	423	21,247	11,762	21,438	54,870	1.9
Texas	9,354,518	974	23,638	7,795	32,558	64,965	0.7
Virginia	3,776,416	1,310	16,647	18,598	25,177	61,732	1.6
South total	43,320,212	9,504	210,105	117,455	296,303	633,367	1.5
U.S. total	139,676,090	33,764	701,800	205,190	852,200	1,587,764	1.1
South % of U.S.	31.0	28.1	29.9	57.2	34.8	39.9	

a Source: IMPLAN Database 1992.

“average” condition for a particular industry. National production functions do not necessarily represent industries comprising a region. Therefore, adjustments for regional differences are made using regional purchase coefficients (RPC), which are estimated using regional production coefficients. An RPC represents the proportion of the total supply of a good or service used to fulfill the demands (intermediate and final) of a region that is supplied to itself. The remainder represents imports. Hence, these adjustments indicate different levels of local production versus imports as captured by RPC.

The main assumptions behind IMPLAN are:

1. The industry production function is linear, homogeneous, and has constant returns to size.
2. Production technology is known and fixed.
3. Changes in relative factor prices will not affect the proportion of a factor used. The only way a given factor or intermediate product will be used is through a change in final demand. Final demand refers to purchases for final use or consumption.
4. Resources (including labor) are unlimited.
5. There is no time dimension – all changes are assumed to be average annual changes. This assumption implies

that there is no new technology, trade relationships are static, and there are no structural changes other than those included by the user.

Supply is never an issue because IMPLAN assumes infinite supplies available at current prices. Therefore, the economic impacts due to a change in the supply of a commodity/service cannot be modeled using the system. One has to assess the effects on an economy of changes in elements that are exogenous to the model of that economy. This limits the magnitude of impact analysis.

EMPLOYMENT

Southern forest-based industries make substantial contributions to the economies of each state. **Table 1** summarizes the contributions of forest-based employment for the lumber and wood products sector, paper and allied products sector, wood furniture sector, and forestry sector. In total, the forest-based industries in the South employ about 633,000 persons, accounting for 1.5 percent of total employment in the region. The lumber and wood products sector employed the most people in forest-based manufacturing, with 296,000 employees. The South's Fourth Forest (15) reported employment for 1982 (556,000 jobs), which increased to 633,000 jobs in 1992 (IMPLAN). This is an increase of 1.38 percent per year for these 10 years.

Among the southern states, North

Carolina is first in terms of total forest-based employment with 108,000 employees. This is 17.08 percent of employees in this industry in the South and 2.7 percent of the state's total employment (13). North Carolina is followed by Georgia and Texas. More than 39 percent of all southern wood furniture employees (46,000) work in North Carolina. Virginia and Tennessee followed North Carolina in employment in the wood furniture sector. North Carolina also employed the most people in the lumber and wood products sector, with 38,000 employees (13.1% of all southern lumber and wood products employment). Georgia employed the most people in the paper and allied products sector, with 31,000 employees, followed by Texas and North Carolina. Arkansas and Mississippi had a higher percentage of employees in forest-based industries (3.3%) than did other states, followed by Alabama (2.8%) and North Carolina (2.7%) in 1992. Total forest-based employment in the South as a percentage of total U.S. forest-based employment was 39.9 percent.

EARNINGS

Table 2 summarizes the earnings for different sectors of the forest-based industry. Forest-based earnings (wages) accounted for about \$15 billion, or 1.7 percent of all earnings in the South. The paper and allied products sector paid the most in total wages, at \$8.2 billion. This

TABLE 2. —Southern forest-based earnings, 1990.^a

State	Total state earnings	Forest-based earnings			Total forest-based	Total forest-based as % of total state
		Forestry	Paper and allied products	Lumber and wood products		
		(million \$)				(%)
Alabama	43,672	22	963	687	1,672	3.8
Arkansas	23,617	17	484	481	982	4.2
Florida	150,022	18	513	545	1,076	0.7
Georgia	85,021	32	1,245	782	2,059	2.4
Kentucky	39,235	0	309	286	595	1.5
Louisiana	43,561	9	527	308	844	1.9
Mississippi	22,622	11	331	618	960	4.2
North Carolina	82,612	8	827	883	1,718	2.1
Oklahoma	33,764	1	129	79	209	0.6
South Carolina	39,208	37	659	365	1,061	2.7
Tennessee	58,349	3	743	490	1,236	2.1
Texas	214,975	14	868	761	1,643	0.8
Virginia	86,737	2	612	646	1,260	1.5
South total	923,395	174	8,210	6,931	15,315	1.7
U.S. total	3,378,897	350	26,024	19,938	46,312	1.4
South % of U.S.	27.3	49.7	31.5	34.8	33.1	

a Source: American Forest & Paper Association (3).

sector had higher wage rates than did the lumber and wood products sector, which had more employees, but lower total earnings.

Among the southern states, Georgia had the highest total forest-based earnings with \$2 billion; 60.5 percent of those earnings was from the paper and allied products sector. North Carolina and Alabama ranked second and third. North Carolina ranked first in earnings from the lumber and wood products sector (\$883 million) followed by Georgia and Texas. Paper and allied products sector earnings were highest in Georgia (\$1 billion) followed by Alabama and Texas. Forestry sector earnings in the South were dominated by South Carolina at \$37 million, followed by Georgia and Alabama. Mississippi and Arkansas had the highest earnings from the forest-based industry as a percentage of total state earnings at 4.2 percent, followed by Alabama and South Carolina. The South's Fourth Forest (15) reported earnings for 1982, which can be compared to the 1990 American Forest and Paper Association data (3). Forest-based industries total wages and salaries in 1982 were \$8.5 billion. Thus, nominal earnings have almost doubled, increasing from \$8.5 billion in 1982 to \$15.3 billion in 1990, excluding the effects of inflation.

VALUE OF SHIPMENTS, VALUE ADDED, AND GROSS STATE PRODUCT

Table 3 summarizes the value added and value of shipments for southern forest-based industries and gross state product (GSP) for the southern states (12,14). Value of shipments covers the received or receivable net selling values, f.o.b. plant (exclusive of freight and taxes), of products shipped. These include both primary and secondary products, as well as all miscellaneous receipts. The measure of value added by a manufacturer is derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments (products manufactured plus receipts for services rendered). The result of this calculation is adjusted by the addition of value added by merchandising operations (the difference between the sales value and the cost of merchandise sold without further manufacture, processing, or assembly) (10,11). Value added only includes the cost of materials within an industry, not including previous costs incurred by another sector. Value added is considered to be the best measure available for comparing the relative economic importance of manufacturing among industries and geographic areas because it avoids double counting (12). Value added is used as the basis for measuring the total GSP for

a state or gross national product (GNP) for the entire United States. GSP is defined as the market value of the goods and services produced by the labor and property located in a state and is measured as the sum of GSP in all industries in a state (14).

The value added by forest-based industries in 1991 was \$31.5 billion (a nominal increase of 59.8% from 1984) or 8 percent of all manufacturing output. Value added by forest-based industries was the highest in Georgia (\$4 billion) followed by Alabama (\$3.6 billion), and North Carolina (\$3.1 billion). Arkansas ranked first in forest-based value added as a percent of total (17.6%) followed by Alabama (17.3%) and Mississippi (15.5%). The total southern GSP in 1991 was \$1,666 billion, so southern forest-based value added comprised 1.9 percent of all state economic activity.

Forest-based industries shipped about \$70.1 billion worth of products in 1991 (a nominal increase of 42.8% from 1984), or 7.8 percent of all manufacturing output in the South. Value of shipments of forest-based industries were the largest in Georgia (\$10 billion) followed by Alabama (\$8 billion) and North Carolina (\$7 billion). The value of shipments of forest-based industries as a percentage of all manufacturing were the highest in Alabama and Arkansas (16.6%) followed by Mississippi (15.5%) and Geor-

gia (12.7%). The forest-based value of shipments and manufacturing value added as a percentage of total manufacturing have declined since 1984. Thus, while forest-based industries did increase rapidly in the South during the 1980s, other industries increased faster. Forest-based industries contributed more than 10 percent of the entire manufacturing value of shipments and/or value added in the states of Alabama, Arkansas, Georgia, Mississippi, and South Carolina.

The forest-based industries' share of total state manufacturing activity (8%) is larger than their share of total employment and earnings (about 1.5%), as reported by the American Forest and Paper Association (3). Of course, forest-based industries comprise a larger share of the manufacturing sector, compared to their share of the whole economy. The manufacturing, or basic, sector of the economy is particularly important because it usually provides large multiplier effects that are felt throughout a region.

METHODS USED TO ESTIMATE ECONOMIC MULTIPLIERS

To estimate the regional economic impacts of the forest-based industries, multipliers were calculated using a micro IMPLAN model for each state in the South for 1992. The South's Fourth Forest (15) reported Type II multipliers for the southern states based on 1982 data. In this paper, Type I and Type III multipliers

were calculated for the 13 southern states instead of Type II. Type III multipliers are typically 5 to 15 percent smaller than Type II multipliers because they minimize the overestimation that occurs with a linear consumption function (16). The makeup of Type I and III multipliers will be explained shortly.

The micro IMPLAN model is based on I/O theory. Sectors were aggregated into lumber and wood products, paper and allied products, and wood furniture, based on the underlying assumption that each sector represents a homogeneous production function. Aggregation results in a production function that is a weighted average for all the industries included in that sector. The Standard Industrial Classification (SIC) codes were used when creating aggregation schemes. SIC codes 24, 25, and 26 were used for aggregating lumber and wood products, furniture, and paper and allied products sectors, respectively. IMPLAN sectors 133-147 (excluding mobile homes) were used for the lumber and wood products sector. IMPLAN sectors 148-157 (excluding non-wood furniture) and IMPLAN sectors 161-173 (excluding newspaper and other newsprint) were used for the wood furniture and paper and allied products sectors, respectively.

IMPLAN's unit of measure for output, value added, and income is millions of dollars and for employment is number of

jobs per million dollars of output. The magnitude and distribution of output, value added, income, and employment resulting from disturbances in exogenous demand is therefore expressed in terms of per unit changes in this measure.

Impacts are measured in terms of direct, indirect, and induced effects. Type I and Type III multipliers are generated for output, employment, total income, personal income, and value added. Direct effects are the immediate effects associated with the change in demand for a particular good or service. For example, an increase in demand for furniture, lumber, or paper would cause the manufacturer to produce more furniture, lumber, or paper. Indirect effects are the secondary effects that are caused when input needs change due to the impact of directly affected industries. For example, the indirect effects would include additional purchases of wood to manufacture furniture, cutting more trees to generate additional lumber, purchasing more pulpwood to manufacture paper, etc. Thus all industries that supply production inputs would increase production. Induced effects are the changes in regional household spending patterns caused by changes in regional employment. For example, an increase in the sale of furniture, paper, or lumber would cause income and employment to in-

TABLE 3. — Southern forest-based manufacturing sector value of shipments, value added, and gross state product (GSP).^a

State	Value of shipments			Manufacturing value added			Gross state product	
	All manufacturing in the South	Forest-based industries	Forest-based industries as % of total	All manufacturing in the South	Forest-based industries	Forest-based industries as % of total	Total Southern GSP	Forest-based industries value added as % of Southern GSP
	----- (million \$) ^b -----			----- (million \$) -----			(million \$)	(%)
Alabama	48,448	8,051	16.6	21,056	3,652	17.3	74,347	4.91
Arkansas	31,084	5,172	16.6	12,825	2,261	17.6	40,748	5.55
Florida	59,275	4,900	8.3	29,054	1,928	6.6	255,162	0.76
Georgia	82,764	10,529	12.7	36,576	4,414	12.1	143,741	3.07
Kentucky	53,500	2,606	4.9	23,713	954	4.0	70,115	1.36
Louisiana	63,381	1,916	3.0	22,125	2,220	10.0	95,606	2.32
Mississippi	31,196	4,833	15.5	12,880	1,993	15.5	41,704	4.78
North Carolina	118,206	7,497	6.3	59,914	3,164	5.3	147,847	2.14
Oklahoma	28,418	1,631	5.7	11,958	761	6.4	57,983	1.31
South Carolina	47,515	5,431	11.4	22,490	2,597	11.5	66,658	3.90
Tennessee	69,549	4,960	7.1	32,499	2,219	6.8	101,335	2.19
Texas	204,001	7,345	3.6	77,569	3,081	4.0	396,327	0.78
Virginia	61,642	5,284	8.6	33,245	2,346	7.1	174,444	1.34
South total	898,979	70,155	7.8	395,904	31,590	8.0	1,666,017	1.90

a Sources: Value of shipments and manufacturing value added: U.S. Department of Commerce, 1991 (12); gross state product: U.S. Department of Commerce, 1991 (14).

b All values are 1991 dollars.

crease, thereby stimulating spending in the economy in general.

The direct, indirect, and induced effects are combined to develop regional economic multipliers. Type I multipliers are the direct effect (produced by a change in final demand) plus the indirect effect, divided by the direct effect:

$$\text{Type I} = \frac{(\text{Direct} + \text{Indirect})}{\text{Direct}} \quad [1]$$

It is assumed that increased demand leads to increased employment and population, with the average income level remaining constant.

Type III multipliers compare direct, indirect, and induced effects to the direct effects generated by a change in final demand:

$$\text{Type III} = \frac{(\text{Direct} + \text{Indirect} + \text{Induced})}{\text{Direct}} \quad [2]$$

Differences among Type I, Type III, direct, indirect, induced, and total multipliers are a matter of economic scope. The difference among the multipliers is analogous for output, personal income, total income, value added, and employment multipliers. Direct effects are often the largest, induced the next largest, and indirect the smallest effect. The smaller magnitude of the indirect effects is a result of a lack of interindustry purchases, and the resulting need to import a large percentage of the supporting goods and services. While I/O models are useful for assessing how economic effects get distributed among a region's industries, one should be cautious using multipliers and cognizant of the various assumptions that these models are based on. The notion of a multiplier rests upon the difference between the initial effect of a change in final demand and the total effects of that change.

OUTPUT

The Type I and Type III output multipliers (Table 4) represent the value of production required from all sectors by a particular sector to deliver \$1 million of output to final demand. Final demand is the ultimate consumption of commodities, including both goods and services. The size of the multiplier does not represent the importance of a given industry for the economy. It provides an estimate of the impact created if that industry's sales to final demand changed. Hence, it is an indicator that can be used to gauge the interdependence of sectors. The

larger the output multiplier, the greater the dependence of the sector on the rest of the regional economy and the more a dollar turns over in an economy. Output multipliers are useful only as an indicator of the degree of structural interdependence between each industry and the rest of the economy. Income and employment multipliers, on the other hand, are

of more interest in most studies. The policy makers tend to use this information to make regional investment decisions. The economic ramifications of introducing new industries to a region or having existing ones close down are routinely evaluated using such information.

Type I output multipliers for the lumber and wood products sector are greater

TABLE 4. — Output multipliers (aggregated) for the Southern United States.^a

State	Sector	Type I	Type III	PCPCE
Alabama	Lumber and wood products	1.5868	2.1168	6
	Furniture	1.4886	2.1666	32
	Paper and allied products	1.4320	1.7086	1
Arkansas	Lumber and wood products	1.6192	2.2176	8
	Furniture	1.3675	1.9644	32
	Paper and allied products	1.3344	1.6324	4
Florida	Lumber and wood products	1.4071	2.1399	3
	Furniture	1.3417	2.2357	14
	Paper and allied products	1.3206	1.6632	1
Georgia	Lumber and wood products	1.6125	2.1659	4
	Furniture	1.5500	2.3471	22
	Paper and allied products	1.3979	1.6889	3
Kentucky	Lumber and wood products	1.5301	2.2455	5
	Furniture	1.3696	2.1207	13
	Paper and allied products	1.2886	1.6107	3
Louisiana	Lumber and wood products	1.6224	2.1413	2
	Furniture	1.4855	2.2141	4
	Paper and allied products	1.4373	1.7601	1
Mississippi	Lumber and wood products	1.6709	2.1938	7
	Furniture	1.4685	2.1063	25
	Paper and allied products	1.3598	1.6384	1
North Carolina	Lumber and wood products	1.5844	2.1550	8
	Furniture	1.5015	2.1622	37
	Paper and allied products	1.3582	1.6324	1
Oklahoma	Lumber and wood products	1.5043	2.2173	5
	Furniture	1.3087	2.0682	2
	Paper and allied products	1.2586	1.5048	3
South Carolina	Lumber and wood products	1.5439	1.9589	5
	Furniture	1.4792	2.0831	30
	Paper and allied products	1.3484	1.5844	2
Tennessee	Lumber and wood products	1.4783	2.2562	7
	Furniture	1.3790	2.0585	33
	Paper and allied products	1.3463	1.6706	3
Texas	Lumber and wood products	1.5454	2.2256	6
	Furniture	1.3981	2.0703	5
	Paper and allied products	1.3769	1.6995	1
Virginia	Lumber and wood products	1.5241	2.0580	5
	Furniture	1.5282	2.2514	39
	Paper and allied products	1.3397	1.6171	1

^a Type I and III output multipliers represent the value of production required to deliver \$1 million of output. Per-capita personal consumption expenditure (PCPCE) represents per person expenditures (\$) toward the purchase of goods and services. Sectors have been aggregated based on the SIC codes. The IMPLAN 1992 database was used to generate the multipliers.

than the other two sectors in all 13 southern states. They range from 1.40 (Florida) to 1.67 (Mississippi). However, in relative terms, the Type I output multipliers for all three sectors are rather close. A Type I output multiplier of 1.40 for Florida would mean, for each \$1 million of output produced by the lumber and wood products sector, \$.40 million of indirect

output is generated in other local industries. In other words, a multiplier of 1.4 means that each dollar ripples through the economy 1.4 times in creating direct and indirect output.

Type III output multipliers for these southern states were substantially higher in the lumber and wood products and furniture sectors compared to the paper

and allied products sector. Type III output multipliers for the paper and allied products sector ranged from 1.50 (Oklahoma) to 1.76 (Louisiana); for the lumber and wood products sector they ranged from 1.95 (South Carolina) to 2.25 (Tennessee); for the furniture sector they ranged from 1.96 (Arkansas) to 2.34 (Georgia). A Type III output multiplier of 2.34 for

TABLE 5. — *Employment multipliers (aggregated) for the Southern United States.^a*

State	Sector	Direct	Indirect	Induced	Total	Type I	Type III
Alabama	Lumber and wood products	9.5666	6.2800	9.5485	25.3951	1.6564	2.6546
	Furniture	14.5480	5.7240	12.2151	32.4871	1.3935	2.2331
	Paper and allied products	4.3835	4.1862	4.9832	13.5530	1.9550	3.0918
Arkansas	Lumber and wood products	10.3393	7.1290	11.3055	28.7737	1.6895	2.7830
	Furniture	12.2452	5.1776	11.2760	28.6988	1.4228	2.3437
	Paper and allied products	5.1359	3.5653	5.6314	14.3326	1.6942	2.7907
Florida	Lumber and wood products	10.7893	4.9990	12.4588	28.2471	1.4633	2.6181
	Furniture	14.5546	4.7066	15.1994	34.4607	1.3234	2.3677
	Paper and allied products	4.0398	3.5093	5.8248	13.3740	1.8687	3.3106
Georgia	Lumber and wood products	8.8250	6.2444	9.0145	24.0839	1.7076	2.7291
	Furniture	15.5125	6.1958	12.9858	34.6941	1.3994	2.2365
	Paper and allied products	4.2116	3.9990	4.7418	12.9524	1.9495	3.0754
Kentucky	Lumber and wood products	12.2153	6.6292	13.1488	31.9933	1.5427	2.6191
	Furniture	14.7780	5.0053	13.8040	33.5873	1.3387	2.2728
	Paper and allied products	5.6642	2.9692	5.9191	14.5524	1.5242	2.5692
Louisiana	Lumber and wood products	8.0281	5.9150	9.0499	22.9929	1.7368	2.8641
	Furniture	13.9003	5.3786	12.7100	31.9889	1.3869	2.3013
	Paper and allied products	4.9179	3.7557	5.6296	14.3032	1.7637	2.9084
Mississippi	Lumber and wood products	9.5847	7.0797	9.4718	26.1361	1.7386	2.7269
	Furniture	14.6311	5.6958	11.5535	31.8804	1.3893	2.1790
	Paper and allied products	5.5649	3.6035	5.0455	14.2139	1.6475	2.5542
North Carolina	Lumber and wood products	10.7794	6.7184	9.8852	27.3830	1.6233	2.5403
	Furniture	14.0902	6.1744	11.4483	31.7129	1.4382	2.2507
	Paper and allied products	4.9052	3.7789	4.7517	13.4358	1.7704	2.7391
Oklahoma	Lumber and wood products	12.0109	6.4964	12.9576	31.4650	1.5409	2.6197
	Furniture	15.1635	4.5494	13.8018	33.5147	1.3000	2.2102
	Paper and allied products	3.7088	3.0896	4.4751	11.2735	1.8330	3.0396
South Carolina	Lumber and wood products	8.6104	5.4639	7.7383	21.8126	1.6346	2.5333
	Furniture	15.1586	5.3223	11.6080	31.7417	1.3511	2.0940
	Paper and allied products	4.8988	3.3541	4.4012	12.6541	1.6847	2.5831
Tennessee	Lumber and wood products	13.9830	6.1873	13.0143	33.1846	1.4425	2.3732
	Furniture	12.5687	5.0511	11.3687	28.9884	1.4019	2.3064
	Paper and allied products	5.1292	3.6211	5.4257	14.1759	1.7060	2.7638
Texas	Lumber and wood products	10.7521	5.8773	10.5082	27.1376	1.5466	2.5239
	Furniture	11.3793	5.0541	10.3844	26.8179	1.4441	2.3567
	Paper and allied products	4.6891	3.5059	4.9831	13.1782	1.7477	2.8104
Virginia	Lumber and wood products	9.8326	5.7518	9.2443	24.8286	1.5850	2.5251
	Furniture	14.8262	6.2843	12.5223	33.6328	1.4239	2.2685
	Paper and allied products	4.922	3.4597	4.8023	13.1841	1.7029	2.6786

^a Employment multipliers estimate the effects on employment (measured in terms of number of jobs) from the production of \$1 million of additional output. Sectors have been aggregated based on the SIC codes. The IMPLAN 1992 database was used to generate the multipliers. The induced and total components are based upon the Type III multipliers.

the furniture sector in Georgia would mean that for each \$1 million of output produced by the furniture industry, \$.55 million of indirect output is generated in other local industries and \$.80 million of induced effect is felt in the regional household spending patterns due to changes in regional employment.

The per-capita personal consumption expenditure (PCPCE) represents per person expenditures toward the purchase of goods and services. PCPCE (Table 4) patterns show the spending of labor income via personal consumption. This is important because labor payments are a significant component of an industry's

total outlay. Therefore, the feedback effects of PCPCE can be significant. PCPCE is the highest for the furniture sector compared to the other two sectors in all the states. Virginia has the highest PCPCE for the furniture sector (\$39), followed by North Carolina (\$37). The PCPCE reflects how much consumers

TABLE 6. — Value added multipliers (aggregated) for the Southern United States.^a

State	Sector	Direct	Indirect	Induced	Total	Type I	Type III
Alabama	Lumber and wood products	0.3229	0.2414	0.3255	0.8898	1.7477	2.7556
	Furniture	0.4104	0.2222	0.4164	1.0489	1.5415	2.5561
	Paper and allied products	0.3878	0.2001	0.1699	0.7578	1.5159	1.9539
Arkansas	Lumber and wood products	0.3588	0.2661	0.3670	0.9920	1.7417	2.7644
	Furniture	0.3935	0.1778	0.3660	0.9373	1.4518	2.3820
	Paper and allied products	0.3678	0.1603	0.1828	0.7110	1.4359	1.9329
Florida	Lumber and wood products	0.3596	0.1946	0.4676	1.0218	1.5412	2.8416
	Furniture	0.4071	0.1892	0.5704	1.1668	1.4649	2.8663
	Paper and allied products	0.3706	0.1637	0.2186	0.7529	1.4417	2.0316
Georgia	Lumber and wood products	0.3555	0.2794	0.3447	0.9796	1.7857	2.7554
	Furniture	0.4254	0.2753	0.4966	1.1974	1.6471	2.8144
	Paper and allied products	0.3714	0.2012	0.1813	0.7540	1.5418	2.0301
Kentucky	Lumber and wood products	0.3580	0.2336	0.4317	1.0233	1.6526	2.8587
	Furniture	0.4571	0.1782	0.4532	1.0886	1.3899	2.3814
	Paper and allied products	0.3636	0.1361	0.1943	0.6941	1.3742	1.9087
Louisiana	Lumber and wood products	0.3365	0.2594	0.3228	0.9187	1.7710	2.7303
	Furniture	0.4240	0.2281	0.4533	1.1054	1.5379	2.6072
	Paper and allied products	0.3837	0.2046	0.2008	0.7891	1.5332	2.0565
Mississippi	Lumber and wood products	0.3190	0.2696	0.3122	0.9008	1.8452	2.8240
	Furniture	0.4045	0.2084	0.3808	0.9937	1.5152	2.4567
	Paper and allied products	0.3800	0.1638	0.1663	0.7101	1.4312	1.8689
North Carolina	Lumber and wood products	0.3571	0.2605	0.3533	0.9709	1.7295	2.7187
	Furniture	0.4438	0.2388	0.4091	1.0917	1.5381	2.4601
	Paper and allied products	0.3467	0.1762	0.1698	0.6927	1.5081	1.9979
Oklahoma	Lumber and wood products	0.3499	0.2350	0.4323	1.0173	1.6717	2.9073
	Furniture	0.4827	0.1603	0.4605	1.1034	1.3321	2.2861
	Paper and allied products	0.3809	0.1308	0.1493	0.6610	1.3434	1.7353
South Carolina	Lumber and wood products	0.3331	0.2275	0.2556	0.8162	1.6831	2.4504
	Furniture	0.4192	0.2153	0.3719	1.0064	1.5137	2.4009
	Paper and allied products	0.3686	0.1647	0.1454	0.6787	1.4469	1.8412
Tennessee	Lumber and wood products	0.3979	0.2322	0.4741	1.1041	1.5836	2.7751
	Furniture	0.4186	0.1982	0.4141	1.0309	1.4734	2.4627
	Paper and allied products	0.3892	0.1717	0.1976	0.7586	1.4412	1.9490
Texas	Lumber and wood products	0.4118	0.2731	0.4212	1.1060	1.6632	2.6861
	Furniture	0.4054	0.2205	0.4162	1.0421	1.5440	2.5706
	Paper and allied products	0.3721	0.1963	0.1997	0.7681	1.5274	2.0641
Virginia	Lumber and wood products	0.3821	0.2469	0.3345	0.9634	1.6461	2.5216
	Furniture	0.4145	0.2636	0.4531	1.1313	1.6360	2.7291
	Paper and allied products	0.3605	0.1725	0.1738	0.7067	1.4784	1.9604

^a Value added multipliers estimate the effects on value added generated from the production of \$1 million of additional output. Sectors have been aggregated based on the SIC codes. The IMPLAN 1992 database was used to generate the multipliers. The induced and total components are based upon the Type III multipliers.

buy from that industry in that state. Since most consumers do not make purchases directly from the paper and allied products sector and lumber sector, the PCPCE for these two sectors are low compared to the furniture sector. Texas (\$5), Louisiana (\$4), and Oklahoma (\$2) also have low PCPCE for the furniture sector. This indicates that consumers buy less from

the relatively smaller furniture sector in these states.

EMPLOYMENT

The employment multipliers (Table 5) estimate the effects on employment (measured in terms of the number of jobs) from the production of \$1 million of additional output for final demand. The Type I and Type III employment

multipliers for the paper and allied products sector were generally larger than the lumber and wood products and furniture sectors. This means that the paper and allied products sector would have a greater impact in terms of employment if that sector's final demand changes.

The Type I employment multipliers for the paper and allied products sector

TABLE 7. — Total income multipliers (aggregated) for the Southern United States.^a

State	Sector	Direct	Indirect	Induced	Total	Type I	Type III
Alabama	Lumber and wood products	0.3057	0.2256	0.2895	0.8208	1.7380	2.6849
	Furniture	0.4013	0.2075	0.3703	0.9791	1.5170	2.4397
	Paper and allied products	0.3731	0.1866	0.1511	0.7108	1.5000	1.9048
Arkansas	Lumber and wood products	0.3423	0.2489	0.3252	0.9164	1.7270	2.6771
	Furniture	0.3882	0.1659	0.3244	0.8785	1.4273	2.2630
	Paper and allied products	0.3585	0.1484	0.1620	0.6689	1.4140	1.8659
Florida	Lumber and wood products	0.3422	0.1774	0.4100	0.9296	1.5184	2.7164
	Furniture	0.4000	0.1729	0.5001	1.0730	1.4322	2.6827
	Paper and allied products	0.3536	0.1479	0.1917	0.6931	1.4181	1.9601
Georgia	Lumber and wood products	0.3246	0.2560	0.3061	0.8867	1.7888	2.7321
	Furniture	0.4190	0.2543	0.4410	1.1143	1.6070	2.6595
	Paper and allied products	0.3549	0.1847	0.1610	0.7006	1.5203	1.9740
Kentucky	Lumber and wood products	0.3206	0.2119	0.3796	0.9122	1.6609	2.8449
	Furniture	0.4533	0.1642	0.3985	1.0161	1.3623	2.2415
	Paper and allied products	0.3557	0.1246	0.1709	0.6512	1.3503	1.8307
Louisiana	Lumber and wood products	0.3202	0.2399	0.2800	0.8401	1.7492	2.6238
	Furniture	0.4198	0.2110	0.3933	1.0241	1.5027	2.4395
	Paper and allied products	0.3702	0.1871	0.1742	0.7315	1.5055	1.9761
Mississippi	Lumber and wood products	0.2985	0.2467	0.2696	0.8149	1.8265	2.7297
	Furniture	0.3982	0.1907	0.3289	0.9178	1.4789	2.3048
	Paper and allied products	0.3556	0.1482	0.1436	0.6474	1.4166	1.8205
North Carolina	Lumber and wood products	0.3437	0.2439	0.3116	0.8991	1.7098	2.6165
	Furniture	0.4365	0.2236	0.3609	1.0209	1.5123	2.3391
	Paper and allied products	0.3334	0.1635	0.1498	0.6467	1.4905	1.9397
Oklahoma	Lumber and wood products	0.3418	0.2178	0.3789	0.9385	1.6371	2.7455
	Furniture	0.4795	0.1484	0.4036	1.0316	1.3096	2.1513
	Paper and allied products	0.3750	0.1189	0.1305	0.6248	1.3170	1.6660
South Carolina	Lumber and wood products	0.3073	0.2091	0.2244	0.7408	1.6806	2.4109
	Furniture	0.4029	0.1981	0.3265	0.9275	1.4917	2.3021
	Paper and allied products	0.3473	0.1510	0.1276	0.6260	1.4349	1.8024
Tennessee	Lumber and wood products	0.3874	0.2169	0.4181	1.0224	1.5598	2.6388
	Furniture	0.4141	0.1848	0.3652	0.9640	1.4463	2.3283
	Paper and allied products	0.3753	0.1591	0.1743	0.7087	1.4240	1.8884
Texas	Lumber and wood products	0.3796	0.2497	0.3696	0.9989	1.6579	2.6315
	Furniture	0.3958	0.2040	0.3652	0.9650	1.5153	2.4381
	Paper and allied products	0.3518	0.1788	0.1753	0.7059	1.5082	2.0064
Virginia	Lumber and wood products	0.3672	0.2313	0.2956	0.8940	1.6298	2.4348
	Furniture	0.4068	0.2479	0.4004	1.0551	1.6095	2.5937
	Paper and allied products	0.3467	0.1598	0.1535	0.6600	1.4609	1.9038

^a Total income multipliers estimate the effects on total income generated from \$1 million of additional production. Sectors have been aggregated based on the SIC codes. The IMPLAN 1992 database was used to generate the multipliers. The induced and total components are based upon the Type III multipliers.

ranged from 1.52 (Kentucky) to 1.95 (Alabama); Type III ranged from 2.55 (Mississippi) to 3.31 (Florida). A Type I employment multiplier of 1.52 for the paper and allied products sector in Kentucky implies that for each job created directly by this sector .52 jobs are created indirectly. The Type I employment multipliers for the lumber and wood products sector in the southern region ranged from

1.44 (Tennessee) to 1.73 (Mississippi); Type III ranged from 2.37 (Tennessee) to 2.86 (Louisiana). The Type I employment multipliers for the furniture sector in this region ranged from 1.30 (Oklahoma) to 1.44 (Texas); Type III ranged from 2.09 (South Carolina) to 2.36 (Florida).

VALUE ADDED

Value added multipliers (**Table 6**) estimate the effects on value added gener-

ated from the production of \$1 million of additional output for final demand. Value added represents the costs added to the intermediate costs of producing goods and services to form the producer price. There are four components of value added: 1) employee compensation, e.g., wages and salaries; 2) proprietary income, including self-employment income; 3) other property-type income,

TABLE 8. — *Personal income multipliers (aggregated) for the Southern United States.*^a

State	Sector	Direct	Indirect	Induced	Total	Type I	Type III
Alabama	Lumber and wood products	0.1865	0.1393	0.1710	0.4967	1.7468	2.6636
	Furniture	0.2871	0.1311	0.2187	0.6370	1.4566	2.2184
	Paper and allied products	0.2252	0.1077	0.0892	0.4222	1.4784	1.8746
Arkansas	Lumber and wood products	0.2207	0.1552	0.1860	0.5619	1.7029	2.5453
	Furniture	0.2759	0.1047	0.1855	0.5661	1.3795	2.0518
	Paper and allied products	0.2064	0.0850	0.0926	0.3840	1.4119	1.8608
Florida	Lumber and wood products	0.2231	0.1200	0.2577	0.6008	1.5379	2.6930
	Furniture	0.2712	0.1144	0.3144	0.7000	1.4219	2.5812
	Paper and allied products	0.1772	0.0952	0.1205	0.3929	1.5373	2.2174
Georgia	Lumber and wood products	0.2014	0.1653	0.1856	0.5523	1.8211	2.7427
	Furniture	0.3027	0.1670	0.2674	0.7370	1.5518	2.4352
	Paper and allied products	0.1891	0.1187	0.0976	0.4054	1.6275	2.1438
Kentucky	Lumber and wood products	0.1744	0.1284	0.2226	0.5254	1.7360	3.0122
	Furniture	0.3212	0.1013	0.2337	0.6562	1.3154	2.0427
	Paper and allied products	0.2136	0.0757	0.1002	0.3895	1.3546	1.8237
Louisiana	Lumber and wood products	0.2025	0.1493	0.1637	0.5155	1.7373	2.5456
	Furniture	0.2802	0.1324	0.2299	0.6425	1.4726	2.2930
	Paper and allied products	0.2338	0.1080	0.1018	0.4436	1.4621	1.8976
Mississippi	Lumber and wood products	0.1716	0.1421	0.1509	0.4646	1.8279	2.7073
	Furniture	0.2863	0.1154	0.1841	0.5858	1.4030	2.0460
	Paper and allied products	0.2333	0.0810	0.0804	0.3947	1.3472	1.6919
North Carolina	Lumber and wood products	0.2089	0.1528	0.1824	0.5441	1.7315	2.6046
	Furniture	0.3240	0.1428	0.2112	0.6780	1.4407	2.0927
	Paper and allied products	0.2020	0.0990	0.0877	0.3887	1.4902	1.9243
Oklahoma	Lumber and wood products	0.2192	0.1354	0.2170	0.5716	1.6176	2.6073
	Furniture	0.3664	0.0896	0.2311	0.6871	1.2445	1.8753
	Paper and allied products	0.1393	0.0707	0.0749	0.2849	1.5072	2.0449
South Carolina	Lumber and wood products	0.1845	0.1265	0.1304	0.4413	1.6854	2.3922
	Furniture	0.2983	0.1244	0.1897	0.6124	1.4170	2.0531
	Paper and allied products	0.2238	0.0891	0.0742	0.3871	1.3983	1.7296
Tennessee	Lumber and wood products	0.2303	0.1381	0.2458	0.6142	1.5994	2.6665
	Furniture	0.2969	0.1202	0.2147	0.6319	1.4049	2.1280
	Paper and allied products	0.2149	0.0979	0.1025	0.4153	1.4558	1.9327
Texas	Lumber and wood products	0.2480	0.1589	0.2173	0.6242	1.6407	2.5173
	Furniture	0.2678	0.1344	0.2148	0.6170	1.5017	2.3037
	Paper and allied products	0.1916	0.1062	0.1031	0.4009	1.5539	2.0918
Virginia	Lumber and wood products	0.2227	0.1471	0.1792	0.5491	1.6606	2.4650
	Furniture	0.3015	0.1595	0.2427	0.7037	1.5292	2.3343
	Paper and allied products	0.2177	0.0989	0.0931	0.4097	1.4545	1.8821

^a Personal income multipliers estimate the effects on employee compensation generated by \$1 million of additional output. Sectors have been aggregated based on the SIC codes. The IMPLAN 1992 database was used to generate the multipliers. The induced and total components are based upon the Type III multipliers.

e.g., interest and corporate profits; and 4) indirect business taxes, e.g., sales and excise tax.

The Type I value added multipliers for the lumber and wood products sector in the southern region ranged from 1.54 (Florida) to 1.84 (Mississippi); Type III ranged from 2.45 (South Carolina) to 2.90 (Oklahoma). Both these multipliers are relatively large for the lumber and wood products sector compared to the paper and allied products and furniture sectors. The Type I value added multipliers for the furniture sector in this region ranged from 1.33 (Oklahoma) to 1.64 (Georgia); Type III ranged from 2.28 (Oklahoma) to 2.86 (Florida). The Type I value added multipliers for the paper and allied products sector ranged from 1.34 (Oklahoma) to 1.54 (Georgia); Type III ranged from 1.73 (Oklahoma) to 2.06 (Texas).

TOTAL INCOME

Total income multipliers (**Table 7**) estimate the effects on total income (a sum of employee compensation, proprietary income, and other property income) generated from \$1 million of additional production for final demand.

The Type I total income multipliers for the lumber and wood products sector in the southern region ranged from 1.51 (Florida) to 1.82 (Mississippi); Type III ranged from 2.41 (South Carolina) to 2.84 (Kentucky). The Type I total income multipliers for the furniture sector in this region ranged from 1.30 (Oklahoma) to 1.60 (Virginia) and Type III ranged from 2.15 (Oklahoma) to 2.68 (Florida). The Type I total income multipliers for the paper and allied products sector ranged from 1.31 (Oklahoma) to 1.52 (Georgia); Type III ranged from 1.66 (Oklahoma) to 2.00 (Texas). The Type I multipliers for all three sectors were close in magnitude, but the Type III multipliers varied more.

PERSONAL INCOME

The personal income multipliers (**Table 8**) estimate the effects on employee compensation generated by \$1 million dollars of additional output for final demand. The Type I personal income multipliers for the lumber and wood products sector in the southern region ranged from 1.53 (Florida) to 1.83 (Mississippi); Type III ranged from 2.39 (South Carolina) to 3.01 (Kentucky). The Type I personal income multipliers for the furniture sector in this region ranged from 1.24 (Oklahoma) to 1.55 (Georgia); Type III ranged

from 1.87 (Oklahoma) to 2.58 (Florida). The Type I personal income multipliers for the paper and allied products sector ranged from 1.34 (Mississippi) to 1.62 (Georgia); Type III ranged from 1.69 (Mississippi) to 2.21 (Florida). The Type I personal income multiplier for the paper and allied products sector in Mississippi of 1.34 and the Type III multiplier of 1.69 would mean that for each \$1 million of direct employee compensation generated by the industry, \$.34 million of indirect employment compensation and \$.35 million of induced employee compensation is generated.

CONCLUSION

North Carolina, Georgia, and Texas, respectively, ranked highest in terms of total forest-based employment in the South. Georgia, North Carolina, and Alabama were highest in terms of total forest-based earnings. Oklahoma had the least forest-based employment (9,000 employees) and also the least earnings (\$209 million). Kentucky and Louisiana had lower forest-based employment and earnings compared to the other southern states. In Texas, the forest-based contribution as a percent of total state employment (0.7%) and total state earnings (0.8%) is small. However, forest-based employment and earnings are significant in relation to other states.

The Georgia, North Carolina, Texas, and Alabama employment multipliers were nearly identical. Louisiana had the largest employment multiplier (Type I and Type III) for the lumber and wood products sector (1.73 and 2.86) implying that if the final demand decreased or increased, this sector would have the greatest impact on the economy.

A larger Type III multiplier and a relatively small Type I multiplier for the same industry can be observed in the tables. This results because the backward linked sectors had small output-to-employment ratios (i.e., required a large number of employees to supply the output). A low multiplier does not always indicate a poor performance of an industry in a state. For example, there are other factors like exports from the state that could result in a lower multiplier. The size of the regional economy also has an effect on multiplier size. A small area means more is purchased outside the area resulting in a smaller multiplier due to the dollars being spent. Multipliers can be used to determine the relative effec-

tiveness of sectors to promote area growth and provide information for identifying economic development opportunities for different states. However, they should be evaluated in conjunction with other relevant information such as the comparative advantage of each state, overall goals, and environmental considerations.

In brief, southern forests make a large contribution to the resource-based production in the South and to economic development (7,9,10). Forest Service projections indicate that the South's contributions to timber supply, and thus economic development, will increase substantially in the next two decades (6). There are, however, many competing uses that will challenge the industry's ability to achieve these projections (4,5).

Overall, the economic measures provide an interesting summary of the state of the southern economy. Depending on the specific measure, forest-based industries comprise about 1.5 to 1.7 percent of the total southern employment and earnings, respectively, but exceed 2 to 3 percent in some states (Alabama, Arkansas, and Mississippi). Forest-based industries comprise 8.0 percent of the total manufacturing value added in the South, and more than 15 percent in Alabama, Arkansas, and Mississippi. In states with strong, diversified economies, such as Georgia, Texas, and North Carolina, forest-based industries may contribute less to the total economy, but still comprise very large and important sectors. Georgia actually has the largest total value added and earnings (based on the largest paper and allied products sector) and North Carolina has the largest total employment (based on its large furniture sector). Multipliers for industrial output, employment, value added, regional income, and personal income indicate that forest-based industries have substantial indirect effects in the southern economy — two or three times the direct impact, depending on the state, sector, and economic measure.

While the economic measures calculated here are substantial, they are still somewhat less than some spectacular numbers cited by advocates of forest-based industries. Several states advertise their forest-based industries as exceeding \$10 billion, but only value of shipments even approach that in Georgia and Alabama, which have the greatest values.

The large economic contributions publicized by states actually consist of multiple contributions of all sectors added together. These type of data are interesting (and large) but not meaningful for comparisons with other sectors that could make equally inflated claims. Value added, which is the basis of GNP or GSP, is the best measure of a sector's total contributions relative to other sectors in a state. Southern forest-based industries' value added comprised 1.9 percent of total southern GSP, with a high of 5.55 percent in Arkansas, 4.91 percent in Alabama, and a low of 0.76 percent in Florida.

Competition requires wiser and more efficient use of forest resources. Increasing timber harvests and enhancing southern economic contributions will require more intensive timber production practices on nonindustrial private forest land as well as industrial lands. Increasing recreational and urban uses of forest lands will require development of new methods to protect forests and enhance nontimber values. Forest health and amenity values also will require development and implementation of improved forest management to ensure sustainable forestry. The southern forest-based industries, including five million private

forest landowners and 199 million acres of timberland, will continue to be a key to economic development in the region.

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