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Forest Dependence and Community Well-Being: A Segmented Market Approach

CHRISTINE OVERDEVEST

USDA Forest Service
Southeastern Forest Experiment Station
Athens, Georgia, USA

GARY P. GREEN

Department of Rural Sociology
University of Wisconsin-Madison
Madison, Wisconsin, USA

Forestry activities, such as timber production and processing, are important economic activities in many rural communities. Yet the research on the relationship between forest dependence and community economic well-being is inconclusive. This article examines the relationship between forest dependence and county per capita income and poverty in rural Georgia. Forest dependence is conceptualized according to Averitt's theory of the dual economy. Core dependence, in other words, dependence on well-capitalized, pulp and paper firms, is expected to affect county-level economic well-being differently than dependence on periphery forest industry or high timberland concentrations. Regression analyses show that core forest industries are positively related to county per capita income, while periphery industries have no significant effect and timberland concentration is negatively related to per capita income and positively related to the poverty rate.

Keywords core, dual economy, periphery, rural development, uneven development

The relationship between economic structure and community well-being has been an important topic in rural sociology for several decades. Walter Goldschmidt's (1947) classic work on Arvin and Dinuba served as an important model for a plethora of studies that have examined the relationship between the structure of agriculture and the quality of life in rural communities (Bowker & Richardson, 1989; Green, 1985; Harris & Gilbert, 1982; Heffeman, 1972; Reif, 1987; Rodefield. 1974; Swanson, 1988). Another recent line of research, based on the dual economy model, has focused on the relationship between industrial structure and community well-being (Bloomquist & Summers, 1982; Lobao, 1990). Although many rural communities are dependent on agriculture and manufacturing indus-

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Address correspondence to Christine Overdevest, USDA Forest Service, Southeastern Forest Experiment Station, 320 Green Street, Athens, GA 30602.

tries, a large number of communities continue to be dependent on natural resources, particularly forestry, fishing, and mining.

A limited number of studies have examined the relationship between forest dependence and well-being in rural communities, particularly in the South, and the results are inconsistent (Drielsma, 1984; Elo & Beale, 1983; Fortmann et al., 1991; Overdevest, 1992). In the following, we'discuss some of the methodological problems in previous studies. We draw from the literature on economic segmentation and uneven development theories to examine the consequences of forest dependency for community well-being. We attempt to show that combining different kinds of forest employment under one measure of forest dependence or excluding timberland from a forest dependence measure obscures important differences in economic returns to host counties.

Previous Studies

Over the past decade, much attention has been paid to the relationship between community stability and sustained timber yields (Beuter & Schallau, 1978; Byron, 1978; Huebner & Holden, 1988; Jackson & Flowers, 1983; MacCleery, 1983; Machlis & Force, 1988; Schallau, 1974, 1983; Waggener, 1977), but few attempts have been made to identify and measure other aspects of well-being in forest-dependent communities. Studies by Drielsma (1984), Elo and Beale (1983), and Fortmann et al. (1991) investigated the relationship between forest dependence and community well-being. They present us, however, with contrasting conclusions.

Drielsma (1984) compiled social and economic profiles of workers in forest and tourism industries and suggests that wood products industries generally provide employment opportunities for males in prime work years, excluding young workers, older workers, and females.' Wood products industries are much more capital intensive and more unionized than tourism industries. Wood products industries employ more blue collar workers and have less inequality within pay rates. He also found high employment insta bility among wood products workers.

Concerning occupational distinctions within forestry, Drielsma (1984) takes an economic segmentation theory approach; that is, he segments the labor force between the core sector, which provides good paying, stable jobs, and the periphery sector, which consists of low-paying jobs with few benefits. He regards logging as a periphery occupation, pulp and paper mill work as core, and sawmilling as between these two extremes. Although he develops an economic segmentation theoretical model; empirically, he compares counties high in forest industry to counties low in forest industry, drawing no strict empirical distinction between core and periphery dependence. Drielsma found that high levels of forest industry are related to higher income, reduced migration, less poverty, and better education in forest-dependent counties. Forested counties without forest industry have unstable populations, economic instability, lower incomes, and higher poverty rates. Drielsma used no controls for non-forest industry variables, such as levels of nonforestry manufacturing and agriculture.

Fortmann et al. (1991) assessed whether timberland ownership, particularly concentration of public versus private ownership, affects local well-being. They defined forest-dependent counties as counties with 3% or greater wages in forest-related industries or with 50% or greater timberland. They sampled 31 northern California counties, operationalizing well-being as county poverty rate, median family income, income inequality, level of health (county on-the-job injury rate), and social pathology (county crime rate). As independent variables, they operationalized the economic importance of the forest sector as total timber production income per capita and number of mills. The amount of public land was measured as percent of timberland under public jurisdiction. Concentration of private timberland was operationalized as percent of timber production zone acres owned by the largest owner. The economic importance of tourism was measured as percentage of total wages. Fortmann et al. (1991) found that the level of forest industry is not significantly related to well-being. They reported that forestdependent county well-being varies negatively with concentrations of public and private timberland. Although forest industry in these two studies does not bonsistently predict high levels of well-being, the absence of forest industry consistently predicts low well-being.

Elo and Beale (1983) compared the social and economic profiles of counties dependent on forestry, agriculture, and mining. They defined forest dependency as 20% of total employment in forest industry, which ties dependency directly to industry employment without consideration of amount of forested lands.2 Elo and Beale (1983) concluded that forest-dependent counties generally have higher well-being (higher school graduation rates, higher median household income, lower poverty) compared with other natural resource-dependent counties. Elo and Beale omitted a measure for timberland in their dependency measure. This excluded counties with high timberland but no forest industry from their sample. Both Drielsma and Fortmann et al.'s studies show that high timberland counties characteristically have low well-being. Therefore, Elo and Beale may have found forest-dependent counties to have higher well-being than other resource-dependent counties because they did not use a measure of timberland in their dependence measure.

Economic Segmentation Theory

To more carefully theorize the nature of forest dependency, we draw on two relevant bodies of literature--economic segmentation and uneven development theories. According to the dual economy or economic segmentation theory, there are two sectors in the economy: the core and the periphery (Averitt, 1968). Core firms are large-scale bureaucratic firms that often enjoy oligopolistic or oligopsonistic status within their industries and dominate their product markets; periphery firms do not dominate their product markets. Core firms pass on benefits, including higher pay, stable employment, and fringe benefits such as insurance, vacations, and retirement to their employees, whereas periphery firms' employees do not receive such benefits (Bluestone, 1970; Doeringer & Piore, 1971; Gordon, 1972; O'Connor, 1973). Economic segmentation theory has often been used to predict individual earnings or other individual benefits of employment (Hodson, 1978; Tomaskovic-Devey. 1987). Bloomquist and Summers (1982) and Lobao (1990), however, use economic segmentation theory to investigate ***community*** economic returns. Bloomquist and Summers found that growth in core employment predicts higher community economic well-being at the county level. Lobao (1990) found that nonfarm core and nonfarm periphery characteristics, as well as farm size and structure, are strong predictors of well-being in rural agriculture-dependent counties. Both Lobao and Bloomquist and Summers used standard industrial code (SIC) as a basis for allocating core and periphery industry at the county level.

Core firms, however, are not always stable institutions (Bluestone & Harrison, 1982; Rural Sociological Society Task Force on Persistent Rural Poverty, 1993). The final stages of the profit cycle lead to market decline, profit squeezes, plant closing, and relocation of capital (Rural Sociological Society Task Force on Persistent Rural Poverty, 1993). Brunelle (1990) notes that during the 1980-1982 recession, large-scale forest companies relocated from the Pacific Northwest to the South because of unionization, high wage structure, and higher stumpage prices in the Pacific Northwest. In 1980, average annual wage and salary earnings in the forest products industry were 30% less than those in the Pacific Northwest (Schallau & Maki, 1986). Thus, in addition to providing stable and secure incomes and greater possibilities for community well-being, the trade-off in concentrated ownership is the potential devastation that can occur if core capital relocates.

In economic segmentation theory, forestry is generally considered part of the periphery sector, as are most extractive industries (Bloomquist & Summers, 1982; Hodson, 1978; Lobao, 1990). Yet some jobs in the forest industry sector provide well-paid, secure employment opportunities, which are characteristic of the core. Therefore, in this article we use economic segmentation theory to investigate different kinds of forest-dependent communities in terms of returns based on specialization within forestry, including timberland, core, and periphery forest industry.

Theories of Incremental Growth Versus Unequal Exchange

Another complementary approach to understanding forest dependence is to consider explanations of extractive economic growth. There are two competing theories about economic growth in communities that pursue extraction-based rural development. The theory of incremental growth argues that communities located in forested areas experience incremental growth from the reinvestment of profits of extraction and taxable income for public services (Hirschman, 1958; North, 1955; North & Thomas, 1973; Samuelson & Scott, 1975). Exporting timber products enables remote, resource-rich communities to capture otherwise unavailable local employment and income. Sites of extraction act rationally in exploiting the comparative advantage offered by their resource endowment.

Other scholars reject the notion that forested areas develop into self-sustaining, diverse, and healthy economies (Bunker, 1989; Marchak, 1983). They argue that industrial development does not occur at the site of extraction. It occurs largely in nonremote areas or in foreign cities with an established infrastructure and an abundance of low-wage workers (Humphrey, 1990; Marchak, 1983). According to this view, people who live in forested areas do not share in an equitable distribution of *benefits* from forest production.

Bunker (1989). in his important work on extractive economies, argued that the theories of incremental growth and comparative advantage justify spatially unbalanced growth and err by neglecting the practical differences between the nature of extraction and industry. Commercially viable resource production is spatially limited to areas remote from the built environment (e.g., rural areas) and is dependent on soil fertility, climate, and topography (Bunker, 1989). However, capital investments in processing timber into lumber, plywood, paper, cardboard, and furniture are tied to the logic of capital. Capital's search for efficiency leads it not to the hinterland but to areas where transportation and labor pools already exist to support industrial production. The greatest return from industrial investments comes from investing in locations with well-established links to economic sectors. Geographic space, then, is crucial in differentiating the development potential of extraction and industrial production. The fixity of extraction leads to its isolation from other industrial processes. Extraction tends to dominate the social and political organization of the entire community (Humphrey, 1990; Marchak, 1983). Marchak (1983) also argued that rural forest-dependent communities do not fare well; they stay specialized as producers of raw materials and do not diversify. The idea that specialization benefits both trading partners operates under the assumption that no power differential exists between sites of extraction and production regarding pricing. Marchak contends that extractive areas are price takers in the forest production process.

In an empirical study, Marchak (1983) looked at the softwood forest that dominates the coastline and remote interior of British Columbia. She found that considering the level of timber production the area has changed little from its origins as a primary raw material exporter. Although the level of forest production has remained fairly constant, growth of the primary linkages to forest industry-primary metal, metal fabricating, chemicals, printing and publishing, foods, nonmetallic mineral, and electric products—declined. Only growth of transportation equipment, nonelectric machinery, and petroleum products improved. She notes that pulp, mill machinery firms, chemical plants, and computer equipment businesses, all high-value technologically advanced equipment, and supplies for the pulping sector, are missing from the British Columbian landscape.

Whether theories of incremental growth or unequal exchange best characterize the development trajectories of forest-dependent communities has not been satisfied through empirical studies (Humphrey, 1990). Humphrey (1990) suggests future work may show that either view is accurate for certain kinds of forest dependence.

Both the economic segmentation/dual economy and uneven development approaches focus on the differential impact of various sectors of the forest industry on community well-being. Forestry is conceptualized as consisting of various sectors that are embedded in significantly different market positions and based on entirely different social relationships. For economic segmentation theorists, the important distinction is between capital-intensive (core) firms and small, labor-intensive (periphery) firms. For uneven development theorists, the major distinction is between extractive economies and those based on processing and production. Capital tends to favor those sites where industrialization has occurred. What we can glean from this literature is a theoretical basis for modeling the impacts of forest dependence on rural communities.

What are the implications for rural Georgia counties of attracting forest products industries? What negative effects occur when they are highly concentrated, and what, if anything, might we do to mitigate those effects? In a cross-sectional study, we analyze core, periphery, and timberland forest dependence among nonmetropolitan counties in Georgia to assess the relationships between dependence and per capita income and poverty.

Research Questions and Hypotheses

Taking an economic segmentation approach to forest dependence, informed by theories of uneven development, generates needed sensitivity to the complexities of forest dependence. Forest dependence provides a case in which the theoretical distinctions between core and periphery overlap significantly with the theoretical distinctions between sites of extraction and processing. Geographically, dependence on timberland is more fixed than dependence on core industry; it is unlikely that the forest industry will choose to invest in areas of high timberland.

Consistent with the economic segmentation model of forest dependence, we hypothesize that core forest industry is positively associated with and periphery industry negatively associated with economic well-being in rural Georgia counties. These hypotheses will be tested by a regression analysis. We also consider the independent effects of timberland concentration on community well-being. The improbability of incremental growth in extraction-based communities suggests the hypothesis that areas with high levels of timberland will have low levels of well-being (Bunker, 1989; Marchak, 1983). This hypothesis is consistent with the findings of Fortmann et al. (1991) and Drielsma (1984) and will also be tested by a regression analysis.

The Model

Table 1 summarizes the income characteristics of forest industries in Georgia by standard industrial code (SIC). Number of employees, average industry pay, and average number of employees per firm are reported. The average wage for employees in pulp, paper, and paperboard mills is $41,752, and the average wage for all other forest industry employees is $21,672. The average number of employees per firm in pulp and paper mills is 414; the average number in all other firms is 36. The pay for work, the size; and the concentrated ownerships of the pulp, paper, and paperboard sectors compared with other forest industries suggests pulp, paper, and paperboard are the core forest industries (Drielsma, 1982; Humphrey, 1990; Overdevest, 1992). The total number of employees in core sectors is 14,547, and the total number of employees in periphery forestry employment is 49,803.

Our theoretical model is specified as:

$$\text{Well-being} = f(\text{CORE, PERIPHERY, TIMBERLAND/AG, MAN, RACE})$$

where we use county-level per capita personal income (PERCAP) and county poverty rate (POVERTY) as indicators of economic well-being; we use a binary variable to indicate the presence or absence of pulp or paper mills (PAPER) and percent of county employment in paperboard mills (PAPERBOARD) in a county as our measure of core forest dependence. We define periphery forest dependence as the percent county employment in the following forest sectors: logging (LOGGERS); sawmill (SAWMILLS); plywood and veneer mills (PLYWOOD); wood container (WOODBOXES); miscellaneous mills, i.e., mills involved in the production of particleboard, flakeboard, hardboard, strandboard, and waferboard (PARTICLE); paperboard boxes (PAPERBOXES); converted paper (BROWN PAPER); and furniture mill employment (FURNITURE).[3] We use percent of county land in government-, industry-, and farmer-owned timberlands (GOVERNMENT, INDUSTRY, FARMER) as measures of timberland dependence. Controls for other sources of variation in the dependent variables include agriculture employment, manufacturing employment, and racial composition (AGRICULTURE, MANUFACTURE, RACE). Previous studies show agricultural and industrial structure to be relevant to county-level economic well-being (Bloomquist & Summers, 1982; Lobao, 1990; Tomaskovic-Devey, 1987) and that individual characteristics such as race are important for the allocation of poverty (Hodge & Laslett, 1980). We noted that previous work in forest dependence lacked controls for non-forest-related sources of variation. Because we include in our analysis rural counties with and without forestry in Georgia, it is important to control for variations due to other kinds of economic structures. We use ordinary least-squares regression (Neter et al., 1985; SAS Institute, 1985). Sources and complete definitions of the variables are reported in Table 2.

Study Population and Data

The population is all nonmetropolitan Georgia counties. There are 121 nonmetropolitan counties in Georgia, most of which include only a few incorporated areas. For most purposes, the county is an appropriate political, economic, and social unit to analyze community issues (Lobao, 1990). This is especially the case for rural Georgia, where there are a large number of small counties.

We operationalized each forest industry dependence, except pulp and paper mills, by the percent of the total county employment in that sector, obtained from County Business Patterns (Bureau of the Census, 1989). We combined pulp and paper mills and defined them as a binary variable (PAPER). Since there are only eight nomnetropolitan pulp and paper mills in Georgia, we argue there is no substantial loss in variability in using a binary variable.

Table 1
Georgia State employment, average annual pay, and average employees per firm in forestry by standard industrial code (SIC)

SIC	Description	Employees	Average pay	Employees per firm
Core forestry				
2611	Pulp mills	2,844	$42,783	406
2621	Paper mills	6,769	$37,571	484
2631	Paperboard mills	4,934	$44.902	352
Periphery forestry				
08	Forestry cruising and estimating timber, fire prevention, forest management, forest nurseries	1,491	$22,608	9
2411	Logging	4,926	$19,425	6
242	Sawmills and planing mills, hardwood dimension and flooring mills, special product sawmills	8,752	$20,474	47
243	Millwork, veneer, plywood and structural wood members	4,150	$21,026	8
244	Wood container mills, wood pallet mills	1,701	$15,502	19
249	Woodpreserving, reconstituted wood products, hardboard, particleboard, fiberboard, waferboard, strandboard	3,417	$24,369	33
25	Furniture manufacture	6,061	$18,304	22
265	Paperboard containers	8,698	$28,732	79
267	Converted paper products	10,607	$24,610	105

Source: Georgia Department of Labor Statistics (1991).

The dependent variables in this analysis, county-level per capita personal income and poverty rate, are used as indicators of economic well-being. Although measures of per capita income and poverty rate fail to capture the full multidimensional@ of well-being, they pro vide comparative statistics sufficient to test the hypothesis that different kinds of forest de pendencies affect counties differently. Per capita income is considered a good indicator of relative economic development and has been used to measure relative well-being in several studies (Lobao, 1990; Stevens & Jabara, 1988). The poverty rate variable adds another dimension of well-being to the analysis; it considers the effects on the most disadvantaged residents rather than the average level of well-being. This research does not provide a definitive model of well-being; the model lacks the economic dimension of equity and noneconomic aspects of quality of life, such as level of community services, environmental quality, weather, and kin relations (Stevens & Jabara, 1988). We choose a county-level effect over an individual earnings effect because the county-level effect is an important consideration for counties

Table 2
Measurement and sources for variables used in regression analyses

Variable	Variable measure	Standard industrial code (SIC)	Source
Core forestry			
PAPER	Binary variable taking the value of 1 for counties with a pulp or paper mill	—	Butts (1990)
PAPERBOARD	% of county employment in paperboard	SIC 263	1989 County Business Patterns
Periphery forestry			
LOGGERS	% of county employment in logging	SIC 2411	1989 County Business Patterns
SAWMILLS	% of county employment in sawmills	SIC 242	1989 County Business Patterns
PLYWOOD	% of county employment in plywood	SIC 243	1989 County Business Patterns
WOODBOXES	% of county employment in wood pallets. wood box production	SIC 244	1989 County Business Patterns
PARTICLE	% of county employment in reconstituted products	SIC 249	1989 County Business Patterns
FURNITURE	% of county employment in furniture	SIC 25	1989 County Business Patterns
PAPERBOXES	% of county employment in paperboard boxes	SIC 265	1989 County Business Patterns
BROWN PAPER	% of county employment in packaging paper	SIC 267	1989 County Business Patterns
FORESTERS	% of county employment in forestry, i.e., foresters	SIC 08	1989 County Business Patterns
Timberland ownership			
INDUSTRY	% of county timberland held by forest industry		1989 Southeastern Forest Experiment Station, Asheville. NC
FARMER	% of county timberland held by farmers		1989 Southeastern Forest Experiment Station. Asheville. NC
GOVERNMENT	% of county timberland held by government		1989 Southeastern Forest Experiment Station, Asheville, NC
Control variables			
AGRICULTURE	% of county employment in agriculture	SIC 900	1989 County Business Patterns
MANUFACTURE	% of county employment in manufacturing	SIC 20[a]	1989 County Business Patterns
RACE	% of county population black		1989 Census of Population and Housing[b]
Dependent variables			
PERCAP	County per capita personal income		1989 Bureau of Economic Analysis
POVERTY	Percent of all persons living under the poverty line		1990 Census of Population and Housing

[a]Omitting all values for forest-related manufacturing industries.
[b]100 x Black population/total population.

Source: Buruu of the Census (1989); Bureau of the Census (1990). Butts (1990); U.S. Department of Commerce (1989).

courting or losing these types of industries. The per capita income of rural counties in Georgia ranges from a low of $8,875 in Clay County to a high of $16,875 in Whitfield County. The poverty rate in rural Georgia counties ranges from a low of 10% to a high of 35%.

Table 3 provides descriptive statistics for the independent and dependent variables in the analysis. Forest industry and timberland variables all have minimum scores of zero. In other words, included in this analysis are some rural counties in Georgia without any commercial forest land or forest-related industry. As such, the full range of variation in forest dependence in rural Georgia is analyzed.'

A correlation analysis (see Table 4) reveals that the forestry employment variable

Table 3
Descriptive statistics: Minimum and maximum values, means, and standard deviations

Variable	Minimum	Maximum	Mean	Std. dev.
Core forestry				
PAPER	0	1 .00000	0.06611	0.2495 17
PAPERBOARD	0	38.67574	0.74553	4.52602
Periphery forestry				
SAWMILLS	0	38.86010	2.20839	4.61388
LOGGERS	0	30.70175	2.19046	3.76516
PLYWOOD	0	27.6923 1	0.88554	3.13242
WOODBOXES	0	4.84434	0.29024	0.89914
PARTICLE	0	12.82051	0.59452	1.97258
FURNITURE	0	25.21452	1.11455	3.19062
PAPERBOXES	0	2.85109	0.09 144	0.38859
BROWN PAPER	0	17.41294	0.37599	1.88350
FORESTERS	0	14.76793	0.45685	1.93457
Timberland dependence				
INDUSTRY	0	79.05401	16.24927	14.62973
GOVERNMENT	0	57.72453	4.96338	10.11076
FARMER	0	34.58897	14.58990	8.67159
Control variables				
AGRICULTURE	0	16.62447	1.25964	2.62558
MANUFACTURE	0	78.30264	36.51778	15.81841
RACE	0	79.44544	29.55993	17.36227
Dependent variables				
PERCAP	8875	16876	12367	1606
POVERTY	10.35	34.78	20.87	6.29

(FORESTERS) is strongly correlated with agricultural employment at 0.73.[5] We decided to omit the forestry employment variable (FORESTERS) and keep the agriculture variable in the model because previous research has shown that agriculture structure is closely related to low well-being (Lobao, 1990). The next highest correlations are between the pulp and paper mill dummy variable and paperboard mills at 0.44; between government-owned timberland and percent of African-American population, also 0.44; and between percent of agricultural employment and industry-owned timberland, 0.43. Although these three correlations are moderately strong, we kept them in the analysis.[6] Regression diagnostics reveal no significant collinearity or outliers.[7] Plots of residuals show no heteroscedasticity; no trends in the residuals were found (Gujarati, 1988). A Durbin Watson statistic (D = 2.196) indicates no problems with autocorrelation.

Eighteen nonmetropolitan Georgia counties have between 10 and 19.9% total forest-related employment; thirteen counties have between 20 and 29.9%; one county has between 30 and 39.9%; three counties have between 40 and 49.9%; one has between 50 and 59.9%; and one has greater than 90%. The residual 84 counties have less than 10% for-

Table 4
Correlation analysis (Pearson correlation coefficients: Prob $>|R|$ under Ho: Rho = O/N = 121)

	FORESTERS	LOGGERS	AGRICULTURE	MANUFACTURE	INDUSTRY	GOVERNMENT
FORESTERS		0.038	0.73	-0.10	**0.50*** **	-0.08
LOGGERS	0.04		0.01	**−0.23** **	**0.36*** **	-0.13
AGRICULTURE	**0.73*** **	0.01		-0.14	**0.43*** **	-0.10
MANUFACTURE	-0.10	**−0.23** **	-0.14		**−0.30*** **	-0.01
INDUSTRY	**0.50*** **	**0.36*** **	**0.43*** **	**−0.30*** **		**−0.23** **
GOVERNMENT	-0.08	-0.13	-0.10	-0.01	**−0.23** **	
FARMER	**−0.18** **	0.13	-0.09	**0.19** **	**−0.34*** **	**−0.40*** **
SAWMILLS	-0.01	**0.16* **	-0.02	0.07	0.09	-0.05
PERCAP	**−0.21** **	-0.11	**−0.28*** **	0.08	**−0.24*** **	0.04
PAPER	-0.03	-0.10	0.02	-0.18”	0.11	-0.10
PLY WOOD	-0.03	0.07	-0.01	-0.16’	-0.01	0.0
WOODBOXES	**0.19** **	0.03	0.13	0.03	0.08	-0.10
PARTICLE	0.15	**0.15* **	0.09	-0.18”	0.12	-0.03
FURNITURE	-0.06	-0.08	-0.11	0.06	0.08	-0.08
PAPERBOARD	-0.01	-0.08	0.12	**−0.22** **	**0.08**	-0.05
PAPERBOXES	-0.05	-0.11	-0.07	0.07	-0.02	-0.0 1
BROWN PAPER	-0.04	-0.05	-0.06	-0.05	0.07	-0.08
RACE	-0.09	**0.26*** **	-0.04	-0.14	**0.17* **	**−0.44*** **

	FARMER	SAWMILLS	PERCAP	PAPER	PLYWOOD	WOODBOXES
FORESTERS	−0.18**	−0.01	−0.21**	-0.03	-0.03	0.19**
LOGGERS	0.13	0.16*	-0.11	-0.10	0.07	0.03
AGRICULTURE	-0.09	-0.02	−0.28***	0.02	-0.01	0.13
MANUFACTURE	0.19**	0.07	0.08	−0.18*	−0.16*	0.03
INDUSTRY	−0.34***	0.10	−0.24***	0.11	-0.01	0.08
GOVERNMENT	−0.40***	-0.05	0.04	-0.10	0.02	-0.10
FARMER		0.05	−0.24***	-0.06	0.02	-0.04
SAWMILLS	0.05		-0.05	-0.07	0.06	-0.01
PERCAP	−0.24***	−0.05		0.21**	-0.01	-0.04
PAPER	-0.06	-0.07	0.21**		0.10	-0.09
PLYWOOD	0.02	0.06	-0.01	0.10		-0.07
WOODBOXES	-0.04	-0.01	-0.04	-0.09	-0.07	
PARTICLE	0.02	0.02	0.04	-0.06	0.41***	0.03
FURNITURE	-0.07	-0.02	-0.05	-0.00	-0.05	-0.08
PAPERBOARD	-0.07	-0.06	-0.05	0.44***	0.23**	-0.05
PAPERBOXES	-0.05	-0.03	0.14	0.17*	0.01	0.01
BROWN PAPER	-0.06	-0.02	0.11	0.14	-0.04	-0.06
RACE	0.19**	0.18**	−0.35***	0.02	0.10	0.11

*Significant at the . 10 level.
** Significant at the .05 level.
***Significant at the .01 level.

(table continued on next page)

Table 4

Correlation analysis (Pearson correlation coefficients: Prob > $|R|$ under *Ho*: Rho = O/N = 121) (*Continued*)

	PARTICLE	FURNITURE	PAPERBOARD	PAPERBOXES	BROWN PAPER	RACE
FORESTERS	0.15	−0.06	−0.01	−0.05	−0.04	−0.09
LOGGERS	0.15*	−0.08	−0.08	-0.11	−0.05	0.26***
AGRICULTURE	0.09	−0.11	0.12	−0.07	−0.06	−0.04
MANUFACTURE	−0.18*	0.06	−0.22**	0.07	−0.05	−0.14
INDUSTRY	0.12	0.08	0.08	−0.02	0.07	0.17*
GOVERNMENT	−0.03	−0.09	−0.05	−0.01	−0.08	−0.44***
FARMER	0.02	−0.07	−0.07	−0.05	−0.06	0.19**
SAWMILLS	0.02	−0.02	−0.06	−0.03	−0.02	0.18**
PERCAP	0.04	−0.05	−0.05	0.14	0.11	−0.35***
PAPER	−0.06	−0.00	0.44***	0.17*	0.14	0.0
PLYWOOD	0.41***	−0.05	0.23**	0.01	−0.04	0.10
WOODBOXES	0.03	−0.08	−0.05	0.01	−0.06	0.11
PARTICLE		−0.10	−0.03	−0.06	0.10	0.09
FURNITURE	−0.10		−0.05	−0.02	−0.04	0.14
PAPERBOARD	−0.03	−0.05		0.08	0.16*	0.07
PAPERBOXES	−0.06	−0.02	0.08		0.02	−0.09
BROWN PAPER	0.10	−0.04	0.16*	0.02		−0.09
RACE	0.09	0.14	0.07	−0.09	−0.09	

*Significant at the .10 level.
**Significant at the .05 level.
***Significant at the .01 level.

est-related employment (four of which have zero forest employment). According to Elo and Beale (1983). only one county in rural Georgia had 20% or greater employment in forestry in 1979, whereas 19 counties did in 1989.

The maximum percent of county employment in agriculture is 17%, in Heard County, and the maximum percent of county employment in manufacturing is 78%, in Murray County. Racial composition of counties is also controlled in an attempt to gain the most unbiased estimates of forest-related effects on well-being. Hancock County has the highest percentage of African-Americans (79%).

Over 63% of Georgia is timberland, almost 25% of which is owned by the forest industry, 7% by the federal government, and 21% by farmers (USDA Forest Service, 1989). Forty rural counties have between 30 and 39.9% of their land owned by the forest industry, farmers and the government. Thirty rural counties have between 40 and 49.9% timberland in these ownerships. Eleven counties have greater than 50% of their land in timberland. Thus, 81 of the 121 nonmetropolitan rural counties in Georgia have 30% or greater land in forest industry, farmer-owned, and government timber.

In Table 5, we list the nonmetropolitan Georgia counties that have a pulp or paper mill and those that have high levels of timberland (50% or greater land in timber)* (indus-

Table 5
Nonmetropolitan Georgia counties with high timberland concentration and pulp and paper mills

County	Per capita income
Counties with 50% or greater timberland without a pulp or paper mill	
Brantley	$10,632
Bryan	$11,263
Clinch	$9,334
Echols	$10,979
Liberty	$11,857
Long	$9,760
Quitman	$11,239
Rabun	$12,396
Stewart	$9.959
Union	$11,182
Counties with 50% or greater timberland with a pulp or paper mill	
Wayne	$12,395
Counties without 50% or greater timberland with a pulp or paper mill	
Camden	$12,755
Laurens	$14,536
Macon	$11,714
Floyd	$15,171
Early	$11,897
Lowndes	$13,955
Glynn	$16,664

try, farmer-owned, or government). Of the eight counties having a pulp or paper mill, only one also has high levels of timberland, indicating that the other seven pulp and paper mill counties in Georgia obtain their raw materials from other counties. Of the eleven rural Georgia counties with high levels of timberland, eight are located near a county with a pulp or paper mill: four are directly adjacent to a pulp and paper mill county; three are one county removed from a pulp and paper mill; and one is two counties removed. Therefore, eight of eleven counties in Georgia with 50% or greater land in timber are within two counties of a pulp and paper mill, but only one of eleven has a pulp and paper mill in it. These data suggest that counties with high levels of timberland are dependent on processors in surrounding counties. These data support Drielsma's (1984) observations that pulp and paper mills capture revenue from neighboring counties that specialize in timber growth. In the discussion, we address how location of pulp mills relative to the location of timberland raises important methodological issues concerning the overall impacts of forest dependence on county well-being.

The 1980s witnessed an expansion of forest production industry in the South. During the 1980-1982 recession, large-scale forest companies relocated from the Pacific Northwest to the South because of unionization, high wages, and higher stumpage prices in the Pacific Northwest (Brunelle, 1990; Schallau & Maki, 1986). Thus, the South may represent a special case of an expanding industry, particularly in the pulp and paper industry sectors (Humphrey, 1990).

Results

In the regression analysis of per capita income, four variables are statistically significant at the .0001 level (see Table 6). The three timberland variables (GOVERNMENT, FARMER, INDUSTRY) are negatively related to per capita income. The largest effect is associated with farmer-owned timberland. For each percentage of timberland in farmer ownership, controlling for other variables, county per capita income falls $101 .OO. Govemment-owned timberland is associated with a decrease in per capita income of $69.00. Industry ownership is associated with a decrease of $53.00. The fourth variable significant at the .0001 level is racial composition, suggesting that a decrease of per capita income is associated with increased concentrations of African-American populations in rural counties in Georgia.

Statistically significant at the .05 level are the existence of a pulp or paper mill, employment in logging, and employment in the agricultural sector. Counties with a pulp or paper mill have much higher per capita income($1,806.00) than counties without pulp or paper mills, controlling for all other forest and nonforest manufacturing, agriculture, and race.* Employment in logging is positively related to per capita income, and increasing employment in agriculture is associated with lower per capita income ($11 1.00), controlling for other variables.

The standardized coefficients indicate that the three most important variables in the model are farmer-owned timberlands, industry-owned timberlands, and government-owned timberlands, respectively, followed by racial composition and pulp and paper mills, logging, and agricultural employment. This finding is somewhat surprising given that much of the literature focuses on the deleterious effects of corporate and government ownership, relative to individual ownership, of farmland. The periphery variables, with the exception of logging, are not related to per capita income. Employment in sawmills, plywood mills, wood container mills, miscellaneous mills, paperboard box mills, converted paper mills, or furniture mills is not a significant predictor of per capita income.

Table 6
Regression of per capita income on core, periphery, and timberland variables using the general linear models procedure

Parameter	Standardized estimate	Estimate	T for H_0: parameter = 0	$Pr > \|T\|$	Std. error of estimate
INTERCEPT	0.000	15815.49889	27.09	.0001	583.83656668
Core forestry					
PAPER	0.281	1806.26003	3.45	.0008	523.76048104
PAPERBOARD	-0.111	-39.48658	-1.33	.1873	29.75047670
Periphery forestry					
LOGGERS	0.191	81.51597	2.21	.0289	36.80307241
SAWMILLS	0.051	17.91772	0.70	.4842	25.52357608
PLYWOOD	-0.03 1	-15.65082	-0.37	.7107	42.073 11638
WOODBOXES	0.012	21.96780	0.17	.8664	130.30005726
PARTICLE	0.154	125.69064	1.89	.0612	66.4 1830895
PAPERBOXES	0.047	192.62922	0.64	.5221	299.88949923
BROWN PAPER	0.005	3.87251	0.06	.9517	63.77973321
FURNITURE	-0.023	-11.75825	-0.31	.7540	37.42549993
Timberland ownership					
INDUSTRY	-0.48 1	-52.76178	-4.53	.0001	11.65364999
GOVERNMENT	-0.436	-69.29897	-4.65	.0001	14.91684400
FARMER	-0.545	-100.97371	-5.74	.0001	17.60651337
Control variables					
AGRICULTURE	-0.182	-111.15165	-2.16	.0332	5 1.49703495
MANUFACTURE	0.034	3.45735	0.42	.6722	8.14755187
RACE	-0.417	-38.60667	-4.86	.0001	7.93860730

	R-square	Adj. R-square	F value	$Pr > F$	N = 121
	0.485801	0.4067038	6.14	.0001	

Two findings from the model do not support theoretical predictions and bear further discussion. Although forest industry pay rates suggest that employees in paperboard mills are the highest paid forest industry employees in Georgia, paperboard mills have a negative, but statistically insignificant relationship with per capita income. A dataset with a higher concentration of paperboard mills is needed to better understand the relationship between these mills and per capita income.

Logging, theoretically a periphery activity, has a positive, significant estimate. In a closer look at the logging data, we compared the ratio of loggers to mill employees and amount of timberland in the adjacent counties and found that many counties imported logging labor from neighboring counties. Thus, although high timberland counties appear to have significantly lower well-being than other rural counties, their neighboring counties, where loggers live, appear to have significantly higher well-being than other rural counties.[9]

Also noteworthy are the results concerning miscellaneous wood products mills (PARTICLE). Miscellaneous wood products mills are not significantly related to per capita income, yet they include a new type of wood product (oriented strandboard), which may be a future core product or may be controlled by the core sector in other regions. As Averitt (1968) argued, new technologies and products are often incorporated into core firm product lines through monopolistic behavior and strategy.

In the regression analysis of the poverty rate, two variables are statistically significant at the .0001 level (see Table 7). Farmer-owned timberlands are positively related to poverty; the higher the percent of acres in farmer-owned timberland the greater the number of people living in poverty. The second variable significant at the .0001 level is racial composition, suggesting that an increase in poverty rate is associated with increased concentrations of African-American populations in rural counties in Georgia. Statistically significant at the .05 level is agricultural employment. As county agricultural employment increases so does the poverty rate. The standardized coefficients indicate that the three most important variables in the poverty rate model are racial composition (0.71). farmer-owned timberlands (0.37), and agricultural employment (0.14), respectively.

None of the core or periphery employment variables are significantly related to poverty in forest-dependent counties in Georgia. Thus, although core dependency serves to benefit average income levels, presumably by providing high paying, stable core jobs, it does not appear to provide jobs for those at the low end of the socioeconomic spectrum.

Industry- and government-owned timberlands, although negatively related to per capita income, are not related to county poverty level. One possible explanation for why

Table 7
Regression of poverty rate on core, periphery, and timberland variables using the general linear models procedure

Parameter	Standardized estimate	Estimate	T for H_0: parameter = 0	$Pr > \|T\|$	Std. error of estimate
INTERCEPT	0.000	9.082936	5.318	.0001	1.70793906
Core forestry					
PAPER	-0.063	-1.590198	-1.038	.3017	1.53219417
PAPERBOARD	0.042	0.057828	0.664	.5079	0.08703121
Periphery forestry					
LOGGERS	0.041	0.068592	0.637	.5255	0.10766267
SAWMILLS	-0.076	-0.103142	-1.381	.1701	0 07466595
PLYWOOD	-0.049	-0.098476	-0.800	.4255	0.12307951
WOODBOXES	-0.075	-0.526570	-1.381	.1701	0.38117612
PARTICLE	0.060	0.190735	0.982	.3285	0.19429825
PAPERBOXES	-0.077	-1.242051	-1.416	.1598	0.87728830
BROWN PAPER	0.018	0.059885	0.321	.7489	0.18657944
FURNITURE	0.071	0.140120	1.280	.2035	0.10948350
Timberland ownership					
INDUSTRY	0.044	0.018792	0.551	.5827	0.03409126
GOVERNMENT	0.090	0.056080	1.285	.2016	0.04363732
FARMER	0.369	0.267957	5.202	.0001	0.05 150560
Control variables					
AGRICULTURE	0.139	0.333279	2.212	.0291	0.15064798
MANUFACTURE	-0.033	-0.013112	-0.550	.5834	0.02383462
RACE	0.705	0.255550	11.004	0001	0.02322338

R-square	Adj. R-square	F value	Pr > F	N = 121
0.7136	0.6695	16.192	.0001	

all timberland ownerships are related to per capita income but only farmer-owned timberlands are positively related to poverty may lie in the connection between farming and low well-being.

Discussion

The argument that forest dependence is analytically multidimensional is supported. The results suggest that core pulp and paper mills provide greater per capita income and thus greater economic well-being to the county in which they are located. The results also support earlier findings that timberland ownership is associated with low county well-being (Drielsma 1984, Fortmann et al, 1991). The model does not indicate that periphery dependence, except on logging, is associated with any trends in per capita income. Thus, forest dependence is a multidimensional phenomenon, as the model suggests, with some industries having a beneficial effect economically at the county level and others having no or a negative effect on well-being. In addition, we find different relationships between per capita income and poverty.

State and governmental agencies whose objective is to define forest dependence for any purpose related to rural development should be careful not to lump together different measures of dependence. Studies or rural development projects that do not use a segmented market approach to define dependence inadvertently fail to recognize this problem. Counties dependent on core forest industry are in a better economic position than their high timberland or periphery-dependent counterparts. These results suggest that forest dependence results in different economic benefits depending on type of industry and degree of timberland dependence. Thus, combining forest employment to determine level of forest dependence misleads the consumers of research because different dependencies have substantially different returns to the community.

This analysis suggests systematic uneven development occurs across forest-dependent counties. As long as pulp and paper mills play a core economic role and timberland plays a negative role in economic well-being, uneven development across forest production/processing centers may be in evidence as a symptom of rural forest dependence. The availability of Geographic information Systems (GIS) make it possible to examine the relationship between raw material supply and wood processing. Of course, we need data on suppliers and contracts in the industry to accurately conduct such an analysis. Additional research on the uneven geographic, social, and economic relationship between timberland dependence and core processing is needed.

These findings suggest that communities, in order to increase economic well-being, may wish to target pulp and paper mills over other forest industries. However, as we mentioned earlier, one characteristic of the core sector is it has become increasingly mobile and may not be as beneficial in the long run as it is in the short run. Similarly, timberland is strongly associated with low levels of well-being in rural Georgia counties; higher percentages of timberland by any ownership are related to lower per capita income, and higher percentages of farmer-owned timberland are related to higher rates of poverty. Forest-dependent counties whose primary forest activity is growing timber need to consider the economic implications of this activity on their communities.

In summary, although the results of this analysis suggest that the domination of a few large and economically resourceful pulp and paper companies in Georgia has achieved a level of industrialization that is beneficial for the nonmetropolitan counties in which they are located, periphery- and timberlanddependent counties ate not associated with such benefits.

Conclusion

We have argued that the different types of forest dependence should be taken into consideration in forest dependence research and policy. Although we have addressed only two aspects of well-being, per capita income and poverty rate, our focus is to show that forest dependence is not homogeneous in terms of economic returns to communities. Rather, different kinds of forest dependence have different implications for host counties.

The relationship between forest dependence and community well-being is complex. However, by definition, forest dependence and the subsequent measure of its effects on well-being must be informed by important characteristics such as type of forest industrialization and level of timberland, not just number of people employed in the greater forest sector. Two important elements are needed in future forest dependence research. First, forest dependence and well-being cannot be measured only by employment or earnings in wood products and associated manufacturing; the proportion of land in timber and the type of mill are also important predictors. Second, expanded efforts at modeling a greater range of forest-dependent well-being indicators and relationships to core and timberland dependence should be undertaken.

Expanding the conceptualization of well-being requires additional treatment of the noneconomic aspects of well-being. What amenity values do core and periphery counties provide? Do the recreational and other amenity values associated with timberland counties outweigh the lack of relative economic returns? What is the relationship of core per capita income and poverty to indicators, such as level of county services, level of environmental quality, and rural in- and out-migration levels? Further advances in the conceptual modeling of well-being will assist this line of inquiry.

Notes

1. National statistics are from 1976 and 1977 county and city data books and the 1970 Census of Population and Housing.

2. The 20% employment measure includes employment in the forest sector, pulp and paper manufacture., logging, and furniture manufacture.

3. Although our theoretic aim is to test for the effects of core, periphery, and timberland dependence, we do not empirically specify only three independent variables in our model (i.e., core, periphery, and timberland) because such an approach obscures important variation among periphery and core effects, which became evident in the analysis. See also endnote 9.

4. We argue that forest dependence cannot be considered one construct so far as its conceptualization and measurement because it involves different distributions of different components that have different relationships to well-being. To investigate whether county-level forest dependence in Georgia entails more than one combination of the forest dependencies, we conducted a factor analysis (Rim & Mueller, 1978). Industry-owned timberland and foresters (FORESTERS) occur together at the county level. They load highly on the first factor. Pulp and paper and paperboard mills load together on the second factor. Percent of timberland owned by farmers loads highly on the third factor. Government-owned timberland loads highly on the fourth factor. On the fifth and seventh factors, wood container mills and converted paperboard mills load highly, respectively. The first factor represents one theoretical dimension: land-based periphery dependence, where large degrees of industry timberland (INDUSTRY) are tied to forester jobs (FORESTERS). The second factor represents another theoretical dimension, i.e., core forest industry. The pulp and paper and paperboard milts load highly on this factor (PAPER, PAPERBOARD). These pulp and paper industries typify the core economic firms described by Averitt (1968) in the dual economy paradigm. The third and fourth factors each represent land-based periphery dependence, capturing farmer timberland (FARMER) and government timberland (GOVERNMENT), respectively. The factor analysis, because it reveals that them are different dimensions to forestry in rural Georgia,

supports the development of this research into an analysis of the separate and distinct contributions of core and timberland dependencies on well-being.

5. When both variables are in the model, neither are significant. When only one is in the model, it is significant and has a negative sign.

6. Although the existence of pulp and paper mills and employment in paperboard are correlated at 0.44, the estimate for paperboard is not significant (regardless of whether the pulp and paper variable is in the model). Although government-owned timberlands and percent of African-American population are correlated at 0.44, both are significant in the model. When percent of African-Americans is omitted, government-owned timberlands changes to $-43.00 (from $-69.00). When government-owned timberlands is omitted, percent of African-Americans changes to $-25.00 (from $-38.00). Although agriculture employment and industry timberlands are correlated at 0.43, both are significant in the model. When agricultural employment is omitted, industry timberlands changes to $-69.00 (from S-53.00). When industry timberlands is omitted, agricultural employment changes to $-217.00 (from $-1 11.00).

7. For example, variance inflation diagnostics for the per capita income model show that only 1 of 16 variables in the model has a value greater than 2.0 (industry-owned timberlands, 2.28). For the poverty model, only one variable has a value greater than 2.0 (industry-owned timberland, 2.28). For per capita income eight standardized residuals have values greater than 2.0, and for poverty six standardized residuals have values greater than 2.0. With 121 observations, the eight and six residuals, respectively, can be considered chance outliers (Neter et al., 1985). Further, for per capita income, the largest Cook's *D* is 0.349, for poverty the two largest are 1.074 and 648, which are small enough that there appear not to be any influential outliers(Neter et al., 1985). The highest condition number in the collinearity diagnostic is 3.11 for both models, which is too low to warrant concern about collinearity in the fully specified model. The residuals were checked to ensure they are distributed normally. The model passes a test for normality: the value of a Shapiro Wilk is 0.982486 with a probability of .6155. Therefore, the assumption of normality in the residuals appears not to be violated, which provides confidence in the prediction line and estimates.

8. Several pulp and paper mills in Georgia are located in coastal counties. Because these coastal counties may be far more economically diversified by the presence of service industries such as tourism and transportation industries such as shipping, it is possible that the higher per capita incomes of the coastal pulp and paper counties are not due so much to their level or type of forest industrialization and timberland than to the effects of other coastal industries. Because agriculture, African-American population, and manufacturing are all controlled for in the analyses, the possible effects of service industries and other activities in the coastal counties are controlled for in an additional regression by a binary-coded variable indicating coastal counties. In this analysis, the following coastal counties were controlled for: Camden, Glynn, Liberty, and Chatham. The binary-coded variable for the coastal counties was not significant In a third analysis, the possible effect of Appalachian-based poverty is considered as an alternative explanation to the government-owned timberland estimate. A binary-coded variable for north Georgia was tested in a third model but it was not significant either.

9. Because of these two contrary results. we did not collapse the eight periphery measures into one periphery variable. When these measures are collapsed and analyzed as a single variable, the estimate is positive, though not significant($p = .1806$). These results am not reported, however, because most periphery variables are not related to per capita income. Rather, we report each individual variable. Reporting all eight variables essentially tests their status as peripheral. Similarly, rather than collapse paper, pulp, and paperboard mill employment into one core variable, we kept the modeling separate. Paperboard employment does not fall in the predicted direction. Rather than obscure this information by reporting one estimate, we report the distinct trends associated with paperboard as opposed to pulp and paper milks.

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