Determinants of Spatial Variation in Economic Development in Rural Forests in the United States

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DETERMINANTS OF SPATIAL VARIATION IN ECONOMIC DEVELOPMENT IN RURAL FORESTS IN THE UNITED STATES

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Introduction

Understanding the interaction between the location decisions of firms and households help to determine the spatial distribution of economic activity.

Our objective are to:

- identify the causes of spatial variation in economic development in the rural forests of the United States
- evaluate the contributions of natural amenities, accumulated human and physical capital, and economic geography to these differences.

Methods

We estimate structural equations of demand and supply in the labor and housing markets. These are estimated in a system with equations for percentage bachelor's degree and road density because human and physical capital are determined simultaneously with economic development.

We use a three-stage least squares estimator (3SLS) to correct for endogeneity and contemporaneous correlation. The residuals from the procedure are used to test for spatial autocorrelation using the Moran-I statistic.

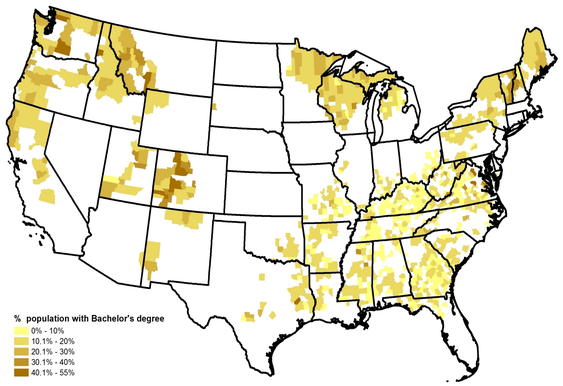


Figure 1. Human Capital Density Map

$$H_t = \vartheta_0 + \vartheta_1 W_t + \vartheta_2 N_t + \vartheta_3 R_t + \vartheta_4 A_t + \vartheta_5 F_t + \theta_t \quad (1)$$

Where:

H_t = human capital, % of population with a bachelor's degree
W_t = wage, $ per employee in time period of t
N_t = natural amenities, index
R_t = state and local road density, miles per square mile of total unprotected land
A_t = agriculture density, % of agriculture of total unprotected land
F_t = forest density, % of forest of total land
θ_t = classical error term
ϑ = structural coefficient

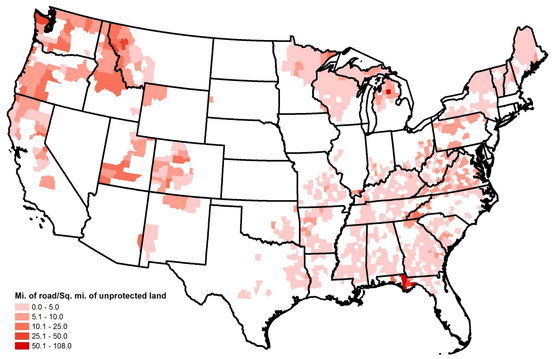


Figure 2. Road Density Map

$$R_t = \mu_0 + \mu_1 G_t + \mu_2 D_t + \partial_t \quad (2)$$

Where:

R_t = state and local road density in the area
G_t = interstate road density in time period of t
D_t = development density, % developed of total unprotected land
∂_t = classical error term
μ = structural coefficient

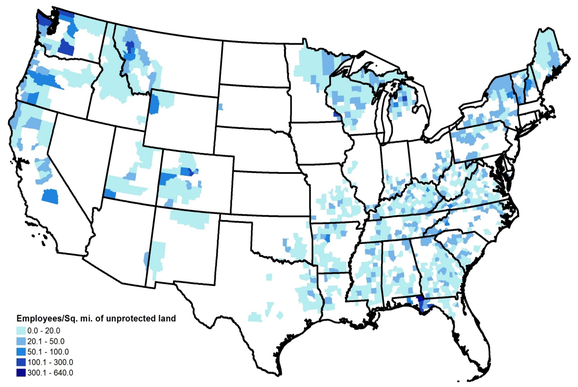


Figure 3. Employment Density Map

$$E_{Dt} = \alpha_0 + \alpha_1 W_t + \alpha_2 M_t + \alpha_3 H_t + \alpha_4 R_t + \alpha_5 L_t + \alpha_6 P_t + \alpha_7 A_t + \alpha_8 F_t + \epsilon_{Dt} \quad (3)$$

$$E_{St} = \beta_0 + \beta_1 W_t + \beta_2 N_t + \beta_3 R_t + \beta_4 A_t + \beta_5 F_t + \epsilon_{St} \quad (4)$$

Where: E_{Dt} = the quantity employees demanded
E_{St} = the quantity employees supplied
M_t = the price of housing in time period of t
L_t = remoteness of the area
P_t = protected land density
ϵ_t = classical error terms
α, β = structural coefficients

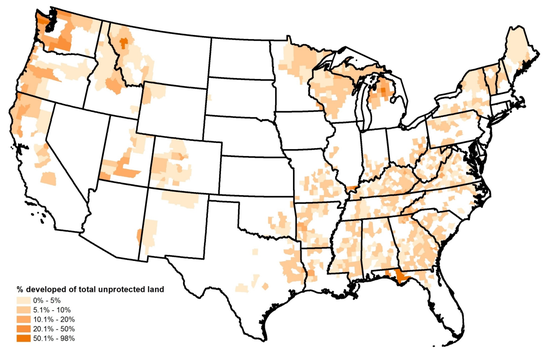


Figure 4. Development Density Map

$$D_{Dt} = \gamma_0 + \gamma_1 M_t + \gamma_2 N_t + \gamma_3 H_t + \gamma_4 W_t + \gamma_5 I_t + \gamma_6 R_t + \gamma_7 A_t + \gamma_8 F_t + \gamma_9 L_t + \gamma_{10} S_t + \gamma_{11} C_t + \varepsilon_{Dt} \quad (5)$$

$$D_{St} = \delta_0 + \delta_1 M_t + \delta_2 R_t + \delta_3 P_t + \delta_4 A_t + \delta_5 F_t + \delta_6 J_t + \delta_7 U_t + \varepsilon_{St} \quad (6)$$

Where:

D_{Dt} = the quantity of housing units demanded
D_{St} = the quantity of housing units supplied
I_t = non-wage income in time period of t
S_t = public services expenditure
C_t = retiree concentration
J_t = agricultural net return
U_t = forestry net return
ε_t = classical error terms
γ, δ = structural coefficients

Data

We use the U.S. Department of Commerce and the U.S. Department of Labor county-level data for the year 2000 for the empirical analysis. The county is the smallest geographic unit at which most economic data are reported at the national level. County is also the basic political unit at which many local policies develop.

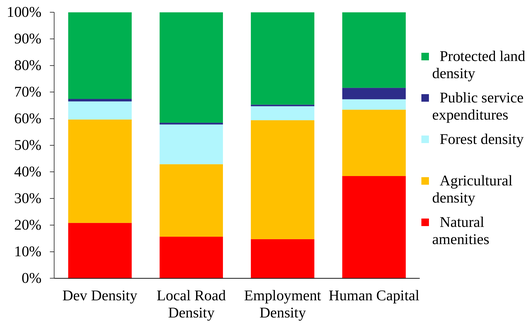
Table 1. Descriptive Statistics of Rural Forest County Data

Name of variable	Unit	Mean	Standard Deviation	Minimum	Maximum
Employment density	Employees per square mile of unprotected land	20.06	29.6	0.33	637.96
Wage	$ per employee	22,167	4,187	11,508	51,701
Development density	Percent developed of total unprotected land	7.31	8.88	0.28	98
Housing price	$ per house	80,366	34,928	33,400	369,100
Human capital	Percent of population with bachelor's degree	14.04	7	4.9	54.8
State and local road density	Miles per square mile of total unprotected land	5.33	6.98	1.44	107.08

Number of counties: 905

Results

Figure 5. Relative Contributions of Alternative Factors to Spatial Variation in Economic Development Between the Top and Bottom 30% of Forest Counties



Agricultural density is a primary cause of spatial disparities in development and employment densities across counties, accounting for 40% of the predicted differences in development and employment densities between the top 30% of counties and the bottom 30% of counties.

Protected land density and natural amenities account for 20% and 30% of the predicted differences in development and employment densities between the top and bottom 30% of counties, respectively.

Policy Implications

Firms respond to changes in human capital and infrastructure in their location decisions. Increasing the proportion of land in a county that is protected appears to be a way to attract more firms to the county, increasing the demand for labor and wage rates in the county.

Policies that promote conservation and environmental protection are likely to become more effective for economic development as advances in information technology allow for a more footloose population in the United States.

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