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11.481J / 1.284J / ESD.192J Analyzing and Accounting for Regional Economic Growth
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Industry Diversification and Concentration

A Case Study of Chemical Industry In Appalachia

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study of Appalachia

TWO ECONOMIC GROWTH PATTERNS

- Clustering trend
 - Growth-pole theory (Perroux 1950)
 - Agglomeration economies (Isard 1956)
 - Clustering economies (Porter 1998)
- Dispersing trend
 - Henderson, Shalizi, and Venables (2001) and Polenske (2003)
 - Regional economic growth follows two patterns: concentration and dispersion
 - Clustering and dispersing are mutually complementary

MISSING AREAS IN CLUSTERING STUDIES

- The majority of the existing literature identifies industrial clusters at highly aggregated levels, based mainly on three-digit North American Industry Classification System (NAICS) codes, and conduct cross-section studies.
- Most of the articles concerning geographic concentration are based upon employment data.
- Thus, few analysts have investigated the change of clusters from a time-series perspective.

II. RESEARCH HYPOTHESIS

In the Appalachian region, industrial diversification is generally accompanied by a high degree of industrial geographic concentration, and vice versa.

- Does the degree of clustering increase or decrease?
- Does the industrial mix of a cluster become more or less diversified over time?

MEASURE OF INDUSTRY DIVERSIFICATION

$$DI = \left(1 - \frac{1}{n}\right) + \sum_{i=1}^n \left(\frac{1}{n^2} - s_i^2\right) \quad (\text{Gollop and Monahan 1991})$$

s = share of establishment in subsector i to the total establishments of all subsectors;

n = number of 6-digit subsectors.

- A zero DI indicates that all firms in the region are from the same subsector.
- The higher the DI value, the more diverse the industry in the region.

MEASURES OF GEOGRAPHIC CONCENTRATION

- Location Quotient
- Horizontal Clustering (Fingleton et al. 2004)
- Herfindahl-Hirschman Index (Kim et al. 2000)
- Locational Gini Coefficient (Kim et al. 2000)
- **Ellison-Glaeser Index (Ellison and Glaeser 1997)**
 - Captures spillover effect
 - Makes cross-region, cross-time, and cross industry comparisons possible

ELLISON-GLAESER INDEX

$$EG = \frac{\sum_{i=1}^n (s_i - x_i)^2 - (1 - \sum_{i=1}^n x_i^2) \sum_{j=1}^m z_j^2}{(1 - \sum_{i=1}^n x_i^2)(1 - \sum_{j=1}^m z_j^2)}$$

Estimated Geographic Concentration Index (GCI)

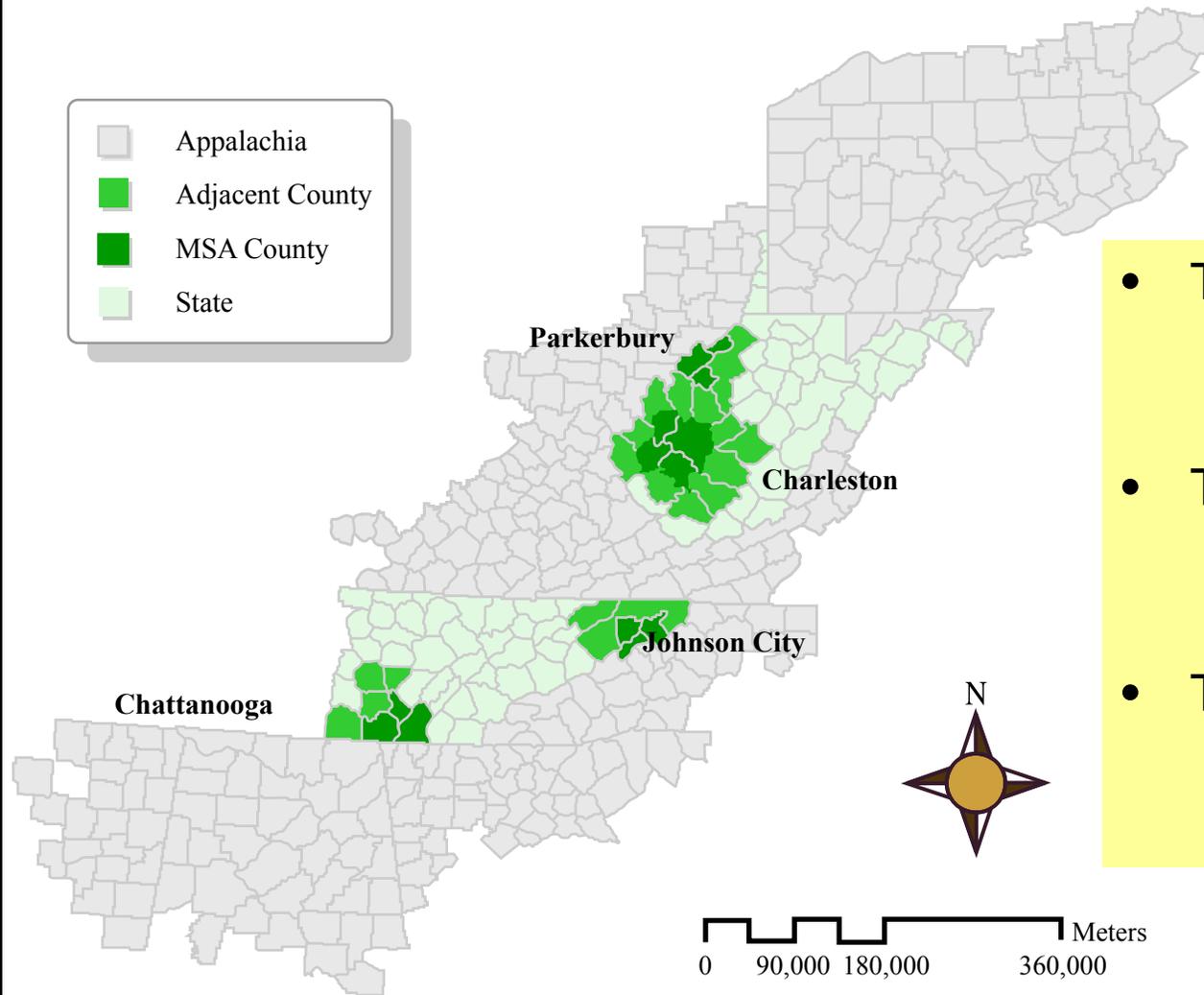
Expected GCI

- s : share of an aggregated industry's establishment in county i to the same industry in the study region;
- x : share of total manufacturing industry in county i to the total manufacturing industry in the study region;
- z : share of the 6-digit subsector establishments in the aggregated industry;
- n : number of counties;
- m : number of 6-digit subsectors of the aggregated industry.

DATA ANALYSIS

STUDY AREAS

Chemical Manufacturing Clusters Tennessee and West Virginia, 2003



- Two indices
 - Ellison-Glaeser Index
 - Diversification Index
- Two time points
 - 1998
 - 2003
- Two levels of analysis
 - State level
 - MSA level

Figure by MIT OpenCourseWare.

CLUSTERING OR DISPERSING

—Ellison-Glaeser Index

State	MSA group*	Year	Estimated	Expected	EGI	Change
Tennessee		1998	0.025	0.055	-0.034	cluster
		2003	0.037	0.052	-0.017	
	Chattanooga, TN	1998	0.030	0.038	-0.012	disperse
		2003	0.031	0.041	-0.016	
	Johnson City, TN	1998	0.049	0.070	-0.029	disperse
		2003	0.078	0.101	-0.032	
West Virginia		1998	0.044	0.086	-0.048	cluster
		2003	0.053	0.086	-0.038	
	Parkerbury, WV	1998	0.080	0.176	-0.172	cluster
		2003	0.052	0.106	-0.088	
	Charleston, WV	1998	0.092	0.123	-0.042	cluster
		2003	0.109	0.117	-0.010	

* I use the name of MSA to refer to the county group that consists of MSA counties and its adjacent counties.

INDUSTRIAL DIVERSIFICATION AND GEOGRAPHICAL CONCENTRATION

State	MSA group*	1998 DI	2003 DI	Industrial mix	Concentration
Tennessee		0.941	0.945	Diverse	Cluster
	Chattanooga, TN	0.941	0.934	Homogeneous	Disperse
	Johnson City, TN	0.912	0.872	Homogeneous	Disperse
West Virginia		0.910	0.911	Diverse	Cluster
	Parkerbury, WV	0.760	0.852	Diverse	Cluster
	Charleston, WV	0.857	0.864	Diverse	Cluster

CONCLUSION

- Clustering and dispersing patterns coexist
- Existing chemical clusters do not have strong spillover effect on attracting new firms to its surrounding areas.
- Industrial geographical concentration moves together with industrial diversification.

Future Research

- Why is the spillover of existing chemical clusters not a significant determinant of new firms' location selection process?
- What may be the causal relationship between geographic concentration and industrial diversification?
- Which of the four patterns—high concentration with high diversity, high concentration with high specialization, low concentration with high diversity, and low concentration degree with high specialization—is more beneficial to creating employment in the regional economy?