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Modeling US Counties' Innovation Capacity with a Focus on Natural Amenities

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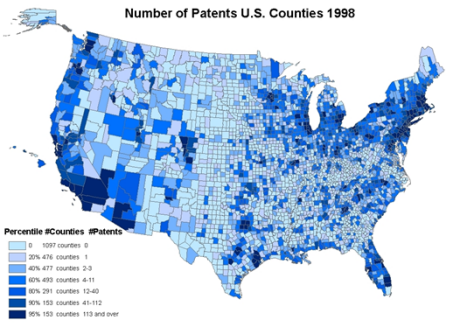
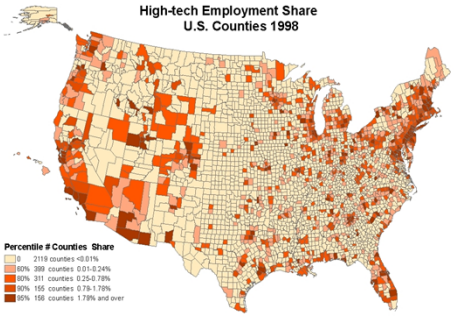
Modeling US Counties' Innovation Capacity with a Focus on Natural Amenities

E. Julia ZHU, Man-Keun KIM and Thomas R. HARRIS

1. Motivation

- Regional **innovation capacity** becomes an important factor to enhance regional **competitive advantages** as the U.S. is building a knowledge-based economy.
- In the past few decades, measuring innovation capacity using numerous methods have been attempted
  - R&D expenditure
  - Patent counts
  - Employment in high-tech industry
- The key issue is that innovation capacity **varies widely** over regions
  - Previous literature have tried to explain these differences but conclusive empirical evidences are not provided.
  - One of crucial factors to affect the regional innovation capacity is **(natural) amenity** and it can explain variation in innovation capacities.
  - The association between natural and built-in amenities with the overall quality of life and economic growth patterns has been well established within the development literature (e.g., Deller et al., 2001; Deller et al., 2008).
- However, somewhat surprisingly, the relationship between innovation capacity and amenity has not been quantified and analyzed rigorously
  - The intent of this study is to address these connections while focusing on the **potential value of amenities**





2. Innovation Capacity

- Innovation is a process that begins with an invention and results in the introduction of a new product, process or service to the market place (Small Business Administration, 2009)
  - Invention
  - Innovation
- Many studies have categorized innovation measurements into two groups: innovation inputs, e.g., R&D expenditure and **employment in high-tech**, and innovation outputs, e.g., **patent counts** (Barkley et al., 2006; Patanawaraha and Polenske, 2007; Slaper and Thompson, 2009).
- The State New Economy Index (Ewing Marion Kauffman Foundation and Information Technology and Innovation Foundation, 2010) uses various indicators to measure the economic competitiveness over U.S. states.
  - The innovation capacity category in this index consists of five indicators such as high-tech jobs, scientists and engineers, patents, R&D expenditure and venture capital.
- In this study, we use two indicators as the innovation capacity or measurement
  - Number of patents or patents count
  - Share of high-tech employment

3. Amenities

- Numerous studies, e.g., Roback (1982), Blanchflower and Oswald (1994), Gottlieb (1994), Deller et al. (2001), and Deller et al. (2008), have documented amenities play an increasingly important role in driving regional economic growth and enhancing innovation capacity.
- This study proposes to categorize amenities and other variable that might contribute to innovation capacity as following
  - **Urban amenities**: crime rate, number of universities, number of museums, number of golf courses
  - **Natural amenities**: temperature, humidity, water area, wild land area
  - **Man-made or built-in natural amenities**: number of boat units, number of picnic units, trailheads, camping grounds, ski resorts
  - **Local economic conditions**: population, wage rate

4. Data

- Major data sources are the National Outdoor Recreation Supply Information System (NORSIS), U.S. Census County Business Patterns, Economic Research Service, and Bureau of Economic Analysis. Number of observation is over 3,000 for the year of 1998
- Descriptive statistics are available upon request.

5. Model

- The knowledge production function (KPF) proposed by Griliches (1979) is utilized to estimate the existence of local characteristics of innovation capacity.

$$y = x_1^{\alpha} x_2^{\beta} \varepsilon$$

  where y = innovation capacity, x1 = amenities, and x2 = local economic condition; **α** and **β** are parameters to be estimated and ε is the error term
- The ordinary least squares (OLS) model is used to estimate the KPF for the share of high-tech industries.
- The **count model** is adapted to estimate the KPF for the number of patents following the approach proposed in Cameron and Trivedi (1998)

6. Results and Discussion

	Share of High-tech Employment	**Number of Patent**
	OLS	Negative Binomial
Pop	–0.0018	**0.9243***
Unemployment	**–0.0490***	**–0.2061***
Wage	**0.0085***	**–0.0170***
Crime rate	–0.0307**	**–0.3247***
# Universities	–0.0137	**0.1824***
# Museums	**0.0225***	**0.0922***
# Golf courses	**0.0421***	**0.1201***
Temp in Jan.	**0.0119***	**0.0151***
Sunlight hrs in Jan	**0.0016***	–0.0010
Temp in July	**–0.0352***	**–0.0289***
Humidity in July	–0.0048	**–0.0741***
Water area acres	–0.0040	**0.0779***
Wild land acres	**–0.0082***	**–0.0164***
# Boat Units	–0.0045	–0.0252**
# Picnic Units	0.0045	**0.2305***
# Swim Units	–0.0086	–0.0094
# Trailheads	**0.0187***	0.0190**
# Camping	0.0043	**0.2129***
# Winter activity	0.0013	0.1147
# Fish and Hunting	0.0406**	0.0280
# Ski resorts	0.0067	0.0418
# Parks	**–0.0184***	–0.0005
Intercept	**2.4471***	**3.8239***
R2	0.2806	
LR Test for $\alpha = 0$, Prob > χ^2		0.0000

- Bold numbers with * are statistically significant at 1% level. Numbers with ** are statistically significant at 5% level.
- In general, followings increase the innovation capacity for US counties
  - Higher wage rate and lower unemployment rats
  - More museums, more golf course
  - Warm winters and cool summers
- **Urban amenities is crucial** to enhance innovation capacity
- **Natural amenities is also important not** man-made or built-in natural amenities

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