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# Patenting in Rural America: Inventors, Teams, and Technologies

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# Patenting in Rural America: Inventors, Teams, and Technologies

# Motivation

- Revitalizing Rural America is a USDA policy objective.
- Several programs have been started to promote rural innovation and regional cooperation. For example, the Stronger Economies Together program (est. 2009) and the Rural Jobs and Innovation Accelerator Challenge (est. 2012).
- Economic research to guide rural innovation policy is limited
  - Most existing research focuses on patenting and innovation in metropolitan regions
  - Prior research on rural patenting used aggregate data for a limited time period (1990-1999), (e.g., Orlando & Verba 2005; Barkley, Henry, & Lee 2006).
- New and emerging research suggests rural entrepreneurs and innovative entrepreneurs are critical for improving rural growth and development:
  - Homegrown entrepreneurs improve rural economic outcomes more than urban (Rupasingha & Goetz 2013)
  - Innovative entrepreneurs create more population growth and better economic outcomes than entrepreneurs in general (Low & Isserman 2013).
- Our research builds on emerging research by focusing on rural and regional patenting and using inventor-level data covering 1975-2010.

# Research Questions

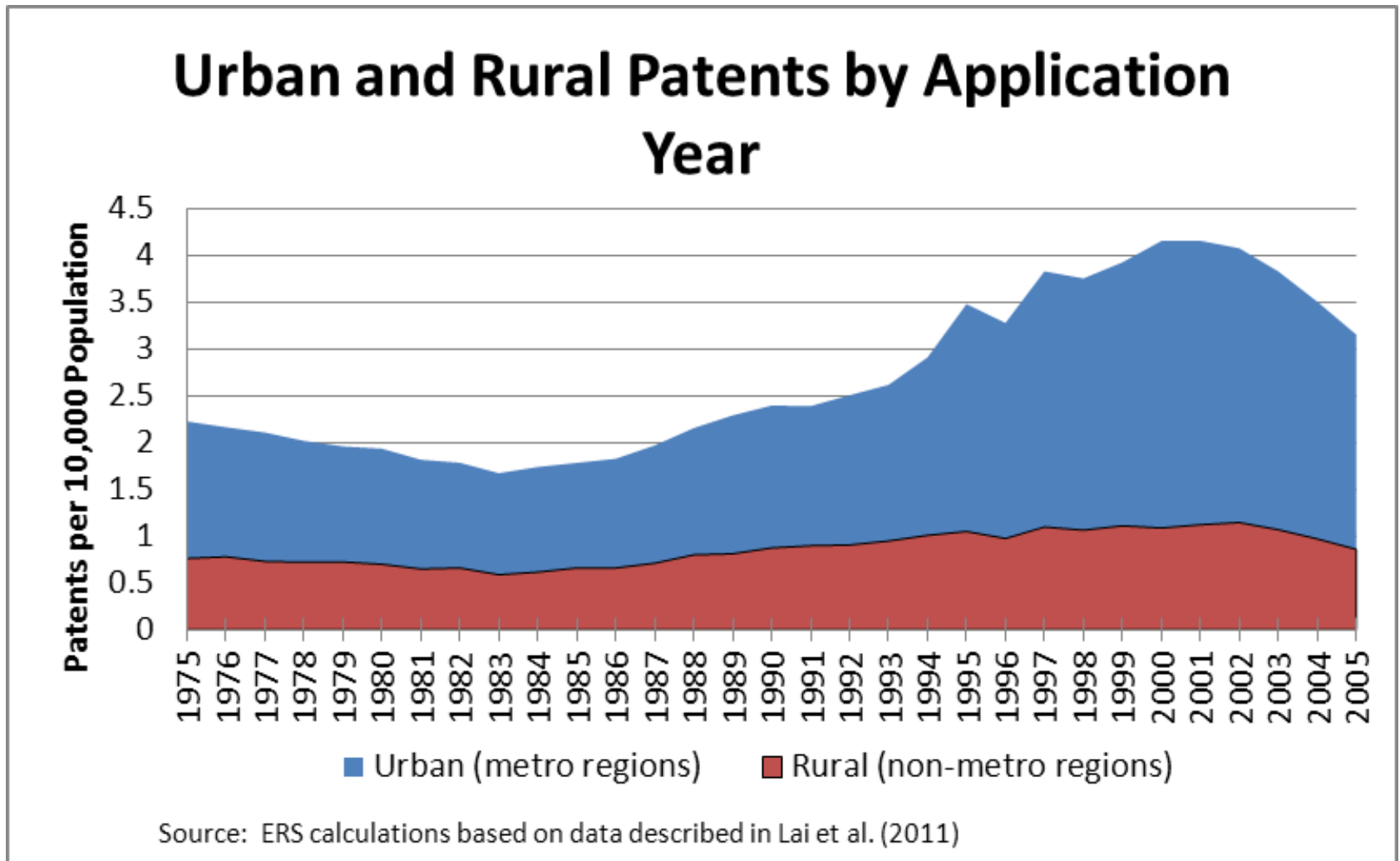
- How do the levels and trends of patenting differ in rural and urban America?
- What factors help to explain any differences?
  - The intellectual capital of inventors (first-time vs. experienced inventors)
  - The organization of the inventive process (solo vs. teams)
  - The technologies

# “Disambiguated” Patent Data

- Disambiguated patent data allow researchers to identify and track individual inventors across space and time.
- Advantages:
  - Able to distinguish “First-time” inventors and “Experienced” inventors → intellectual capital of the inventors
  - Able to distinguish patent contributions from “solo inventors” and “team inventors” → how inventors organize
  - Able to distinguish trends in regional “Technological-orientation” → geocoded patent output by technology
- Data Coverage: 1975-2010 successfully granted patents, analyzed by application year (application year more accurately reflects where and when the inventive process took place)
- We examine patenting in urban (metropolitan) and rural (nonmetropolitan) counties

# Findings

# Rural patents per capita are lower than urban rates

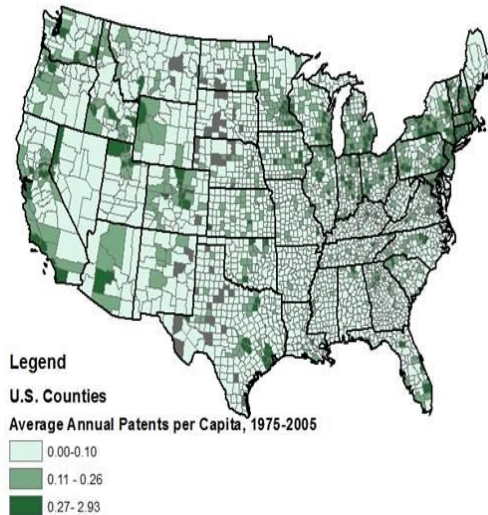




# Two ways of viewing patenting output

## Average annual patents per capita

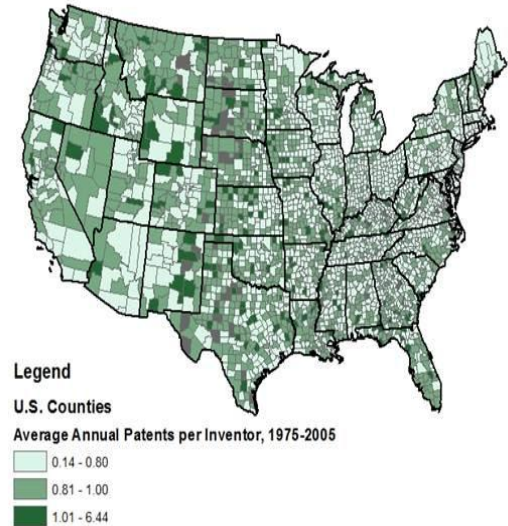
- Patents are usually measured on a per capita basis
- Patents per capita are highest in urban areas of the U.S.



Source: ERS calculations based on data described in Lai et al. (2011)

## Average annual patents per inventor

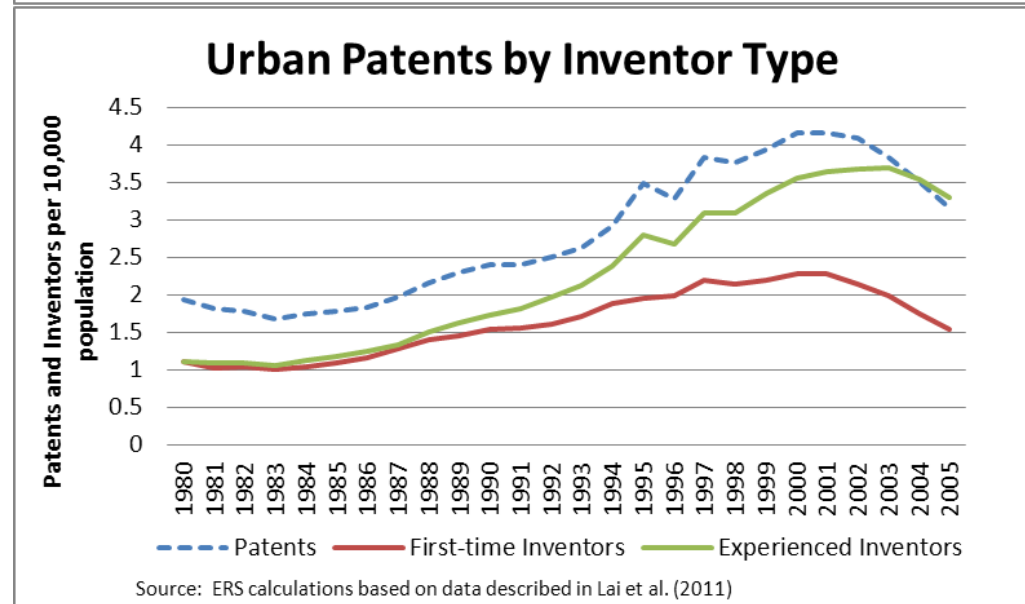
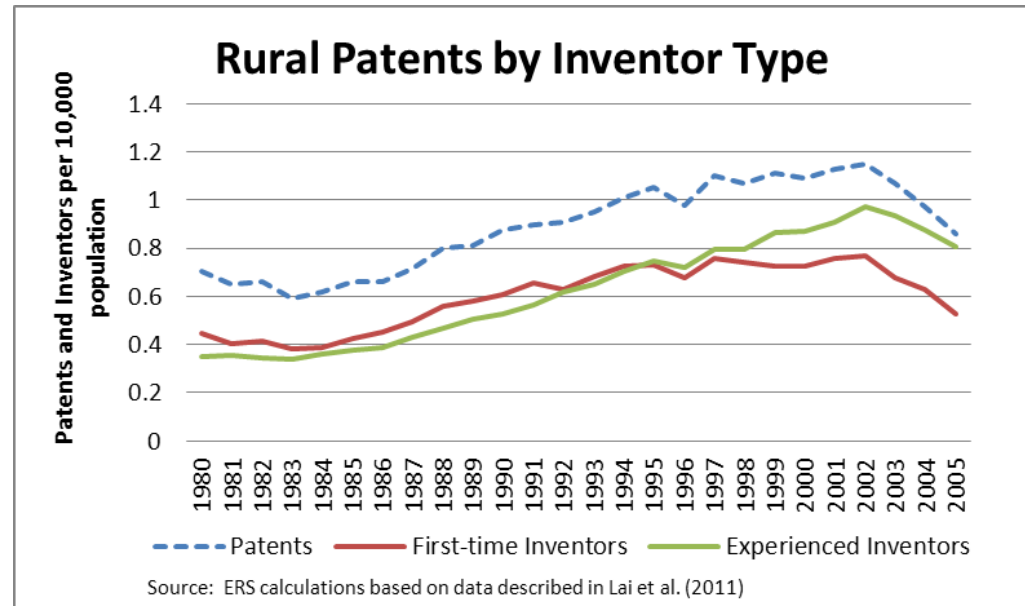
- These data allow us to use *inventors* as a denominator, for the first time
- Per inventor, rural patenting rates are just as high as urban
- The map shows high patents per inventor in the Great Plains and other rural regions



Source: ERS calculations based on data described in Lai et al. (2011)

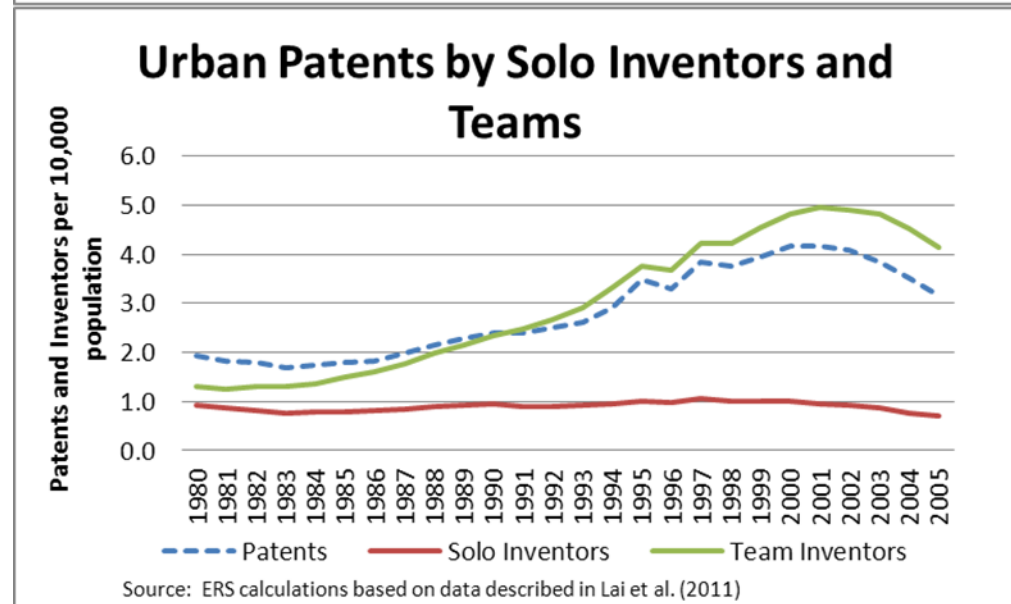
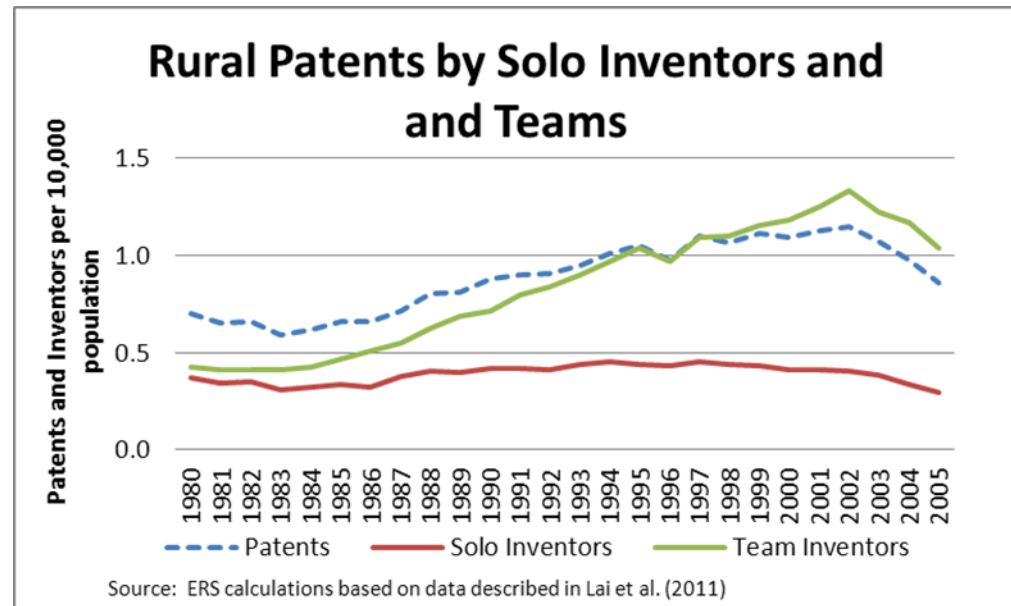
# The Inventor Mix (First-time and Experienced) Helps to Explain Rural/Urban Trends

- Rural:
  - After 1997, better conversion from first-time to experienced inventors
- Urban:
  - Experienced inventors drive growth from around 1993
  - Higher conversion rate from first-time to experienced inventors

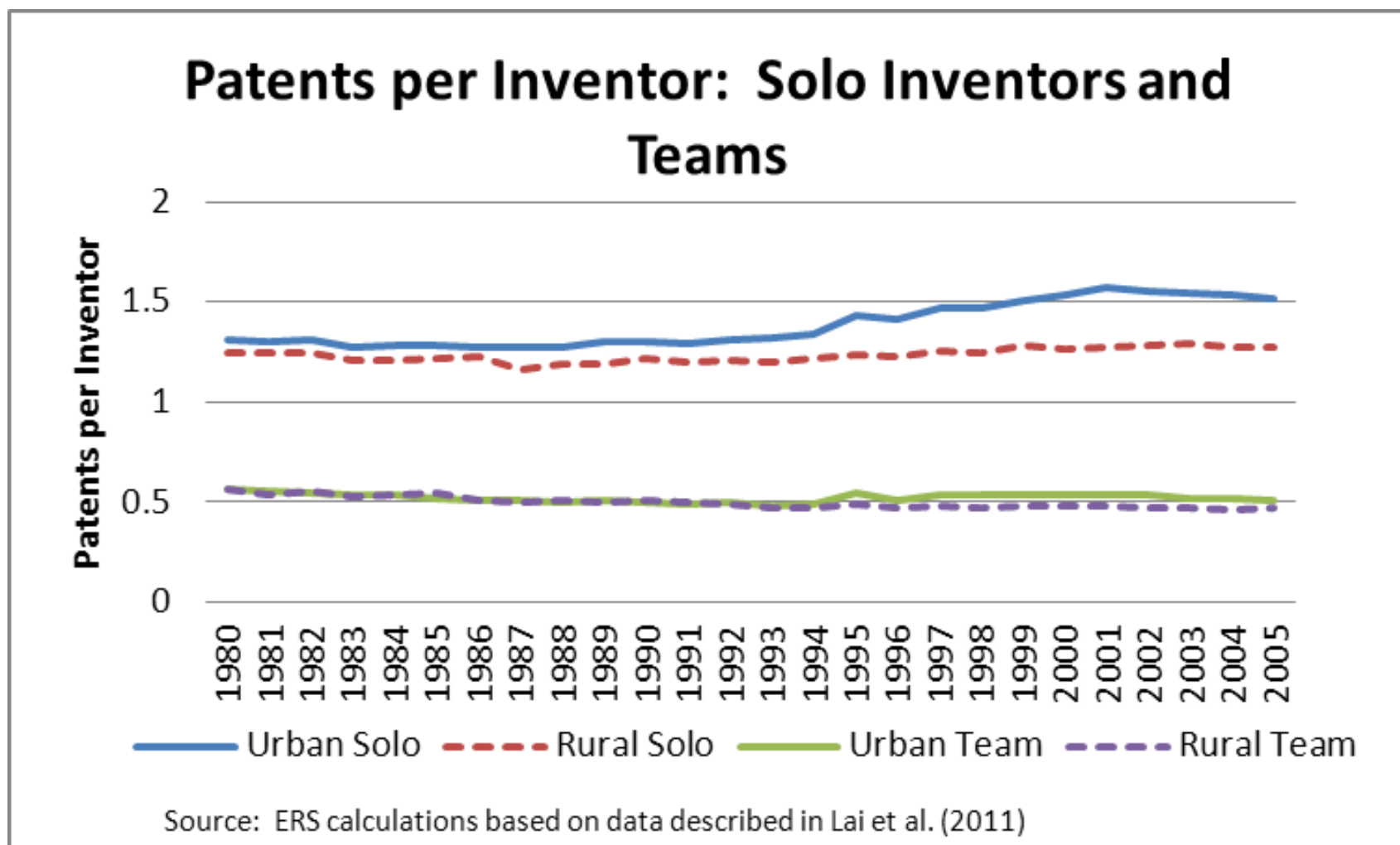


# Organization (Solo versus Inventor Teams) Helps to Explain Rural/Urban Trends

- Rural:
  - Team inventors drive patent trend
  - Organizing in teams is dominant after 1983
  - Solo inventors decline after 1997
- Urban:
  - Similar to Rural, except more dramatic



# Urban Advantage? Rural and Urban “inventor productivity” start to diverge in the mid-1990s

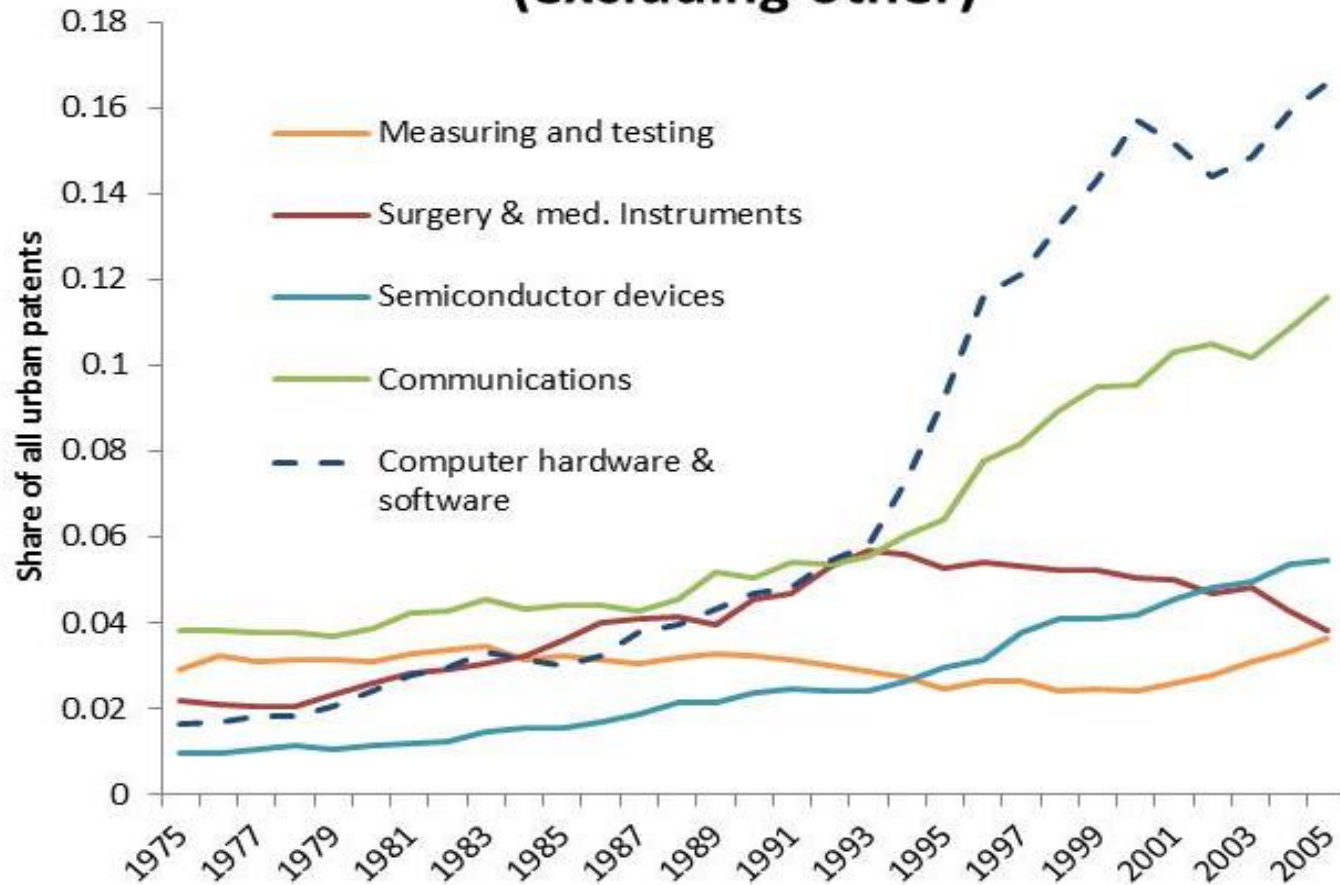


# Technologies

Rural and urban technology concentration was similar until the 1990s when urban patents became increasingly concentrated in high-tech and biomedical technologies

# Top urban technologies are high-tech

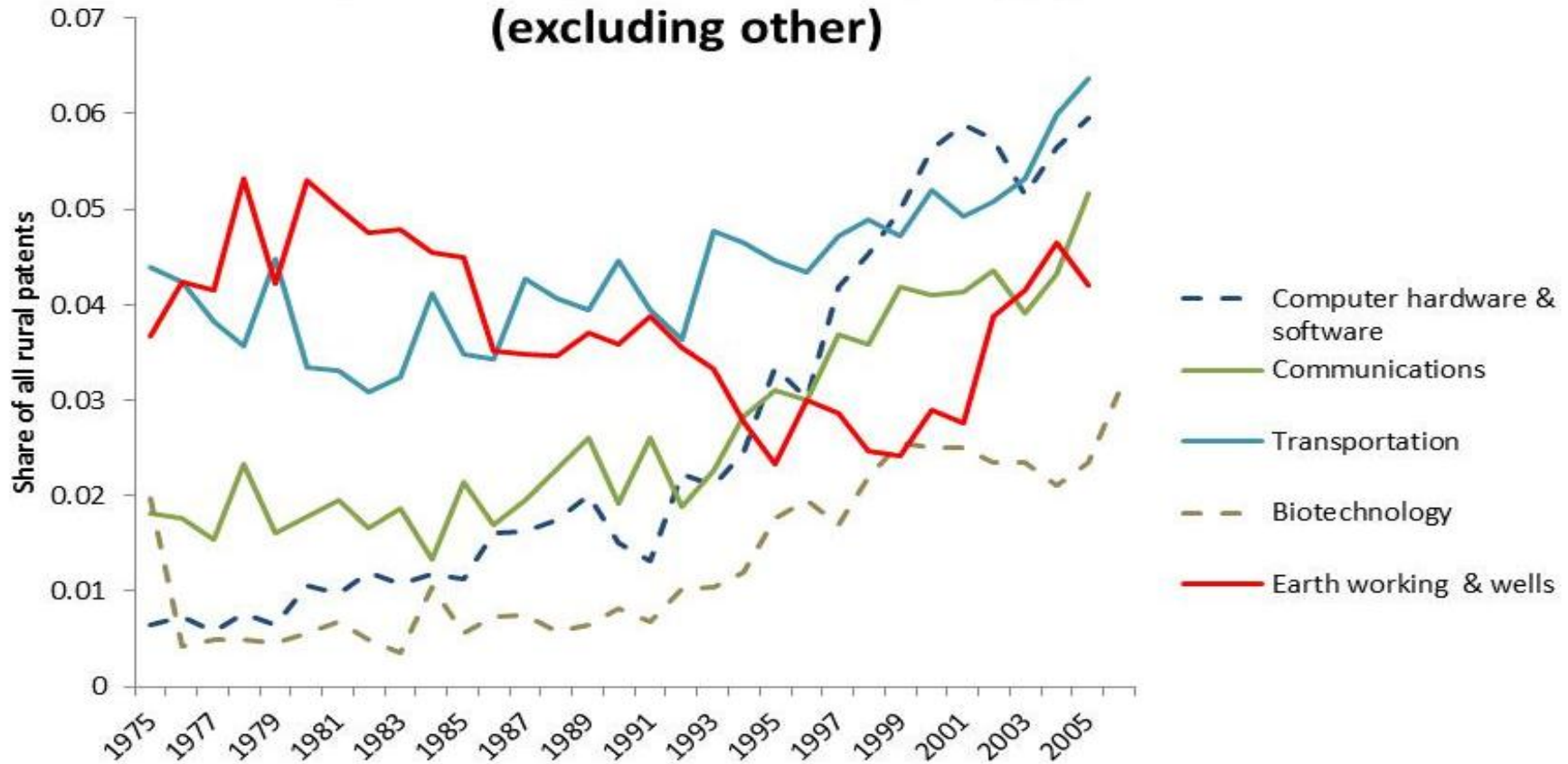
**Urban—Top 5 NBER patent classes (2-digit) in 2005  
(excluding other)**



Source: ERS calculations based on data described in Lai et al. (2011)

# Top rural technologies include high-tech but also mature/traditional fields

Rural—Top 5 NBER patent classes (2-digit) in 2005  
(excluding other)



Source: ERS calculations based on data described in Lai et al. (2011)



# Conclusions

- Patenting per capita is over 3 times greater in urban areas than in rural areas. When normalized by the number of inventors, however, the rates are about the same.
- Rural America has higher proportions of first-time and solo inventors. Accordingly, policies aimed at encouraging inventors to become “repeat” inventors may increase patent output—and perhaps even overall rural innovation and entrepreneurship.
- Similarly, rural inventors may benefit from collaborating with other inventors in nearby urban areas or more remote geographies, generating higher knowledge spillovers and potentially more patents and innovation.
- Rural patents are concentrated in moderate technology industries, e.g., transportation and earth working, but also some high-technology fields, e.g., biotechnology, computers, and communications.



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