Exploring Geographic Patterns of Transportation & Logistics Cluster in the USA

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Chicago Rail Summit 2014, Chicago, June 6th, 2014
Outline

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Motivation

- Sheffi’s research finds that logistics cluster has a “catalyst role” and is largely resilient to recession shocks (Sheffi, 2012)

- Explore transportation and logistics cluster competitiveness across USA:
  - Can specialization in transport and logistics cluster emerge in micropolitan, non-core, or rural regions?
  - What role transport infrastructure has in explaining specialization and jobs in the cluster?
Literature Review

- Interest in industry cluster strategies emerged during 1990s
- Many studies on popular clusters only a few on logistics cluster
- Defined through inter-industry linkages, IO table, and value chains
- Space as an indicator versus a container (Feser & Sweeney, 2006)
- Public policies have a role in success and acceleration (Porter, 2009 and Rodrigue et al., 2013), logistics in particular (Hayes’, 2006)
- Driver industries comprised of key freight activities are known by different names (Higgins, 2012)
Cluster definition came from a previously funded research by the Economic Development Administration (EDA), 2005-2007
48 industry sectors define the Transportation & Logistics Cluster
Post recession, T & L cluster jobs are recovering

Source: Based on EMSI 2012.4, cluster definition by PCRD
Midwestern metros have increased specialization from 2001-2012

Memphis has the largest LQ, but decreased in specialization from 2001-2012

Source: Based on EMSI 2012.4, cluster definition by PCRD
Specialization Patterns

- Cluster specialization has unique footprints
- At a county level, specialized counties are clustered
- Geographical proximity has some role
- Transportation & Logistics is highly dispersed
- Transportation Equipment is highly concentrated in the Midwest
- Location quotient compares concentration of jobs in a cluster with respect to the national average

Geographical Distribution of LQ, 2010
Global and local autocorrelation indices indicate spatial clustering of high-high and low-low LQ values.

Global Moran’s I of 0.13 has a significant p-value of 0.0002 at 4,999 permutations.

LISA statistics show localized clusters - usual metro areas have spatial concentration so as some of the rural areas.

Getis-Ord, Gi and Gi* show similar patterns.

Some of the mining intensive regions and agricultural areas do emerge as spatial clusters of transport and logistics operations.

LISA and Gi and Gi* gave similar results.
Specialization, Jobs and Transport Infrastructure- 2

- Transportation and logistics LQ and jobs as dependent variables, whereas availability of different modes of transport infrastructure is independent variable.

- Spatial autocorrelation analysis shows some degree of spatial dependence and heteroscedasticity. Spatial regressions are attempted for cross-sectional data.

- First equation is a spatial lag with LQ 2010 as dependent variable and rook first order weight matrix, rail miles per unit area; enplanements per 10,000 jobs; ports per 10,000 jobs; and national highway planning network per unit area came as significant. Overall, a lower R-squared value of 0.12.

\[ LQ_{2010} = 0.75 + 0.29W(LQ_{2010}) + 0.73(RAILMILEAR) + 0.0000025(ENP_{2010EMP}) + 0.017(PORT_{10EMP}) - 0.47(NHPNMILEAR) + \varepsilon \]

*W is a weight matrix*
Specialization, Jobs and Transport Infrastructure- 2

- Second model uses natural log of transportation and logistics jobs as dependent variable and natural log values for infrastructure as explanatory variables.

- Log-transformed, Spatial Lag and Spatial Error model (SARAR specification).

- Explanatory variables include log of (number of airports, number of intermodals, NHPN AADT values, number of ports, and length of rail miles).

- This model has a higher pseudo R-squared value of 0.712.

\[
\ln\text{Jobs2010} = 1.0 + 0.15\ln\text{Jobs2010} + 0.46(\ln\text{Airports}) + 0.58(\ln\text{Intermodal}) + 0.22(\ln\text{NHPNAADT}) + 0.07(\ln\text{Ports}) + 0.18(\ln\text{Railmile}) + \varepsilon
\]

\[
\varepsilon = 0.39W\varepsilon + \mu; W \text{ is a weight matrix}
\]
Discussions

- Transportation and logistics cluster/jobs is present in some of the non-metro areas.
- Railroads came as positive for both the models.
- Density of NHPN came as negative in first model but NHPN AADT, which shows intensity of usage came as positive in the second model.
- Ports and airports variables came as positive for both the models.
- Intermodals came as positive only in the second model.
- Second model seems more intuitive in terms of direction but log coefficients require further investigations.
- Research can be extended by exploring spatial panel datasets.
Authors acknowledge partial support from the EDA University Center Grant for this study

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