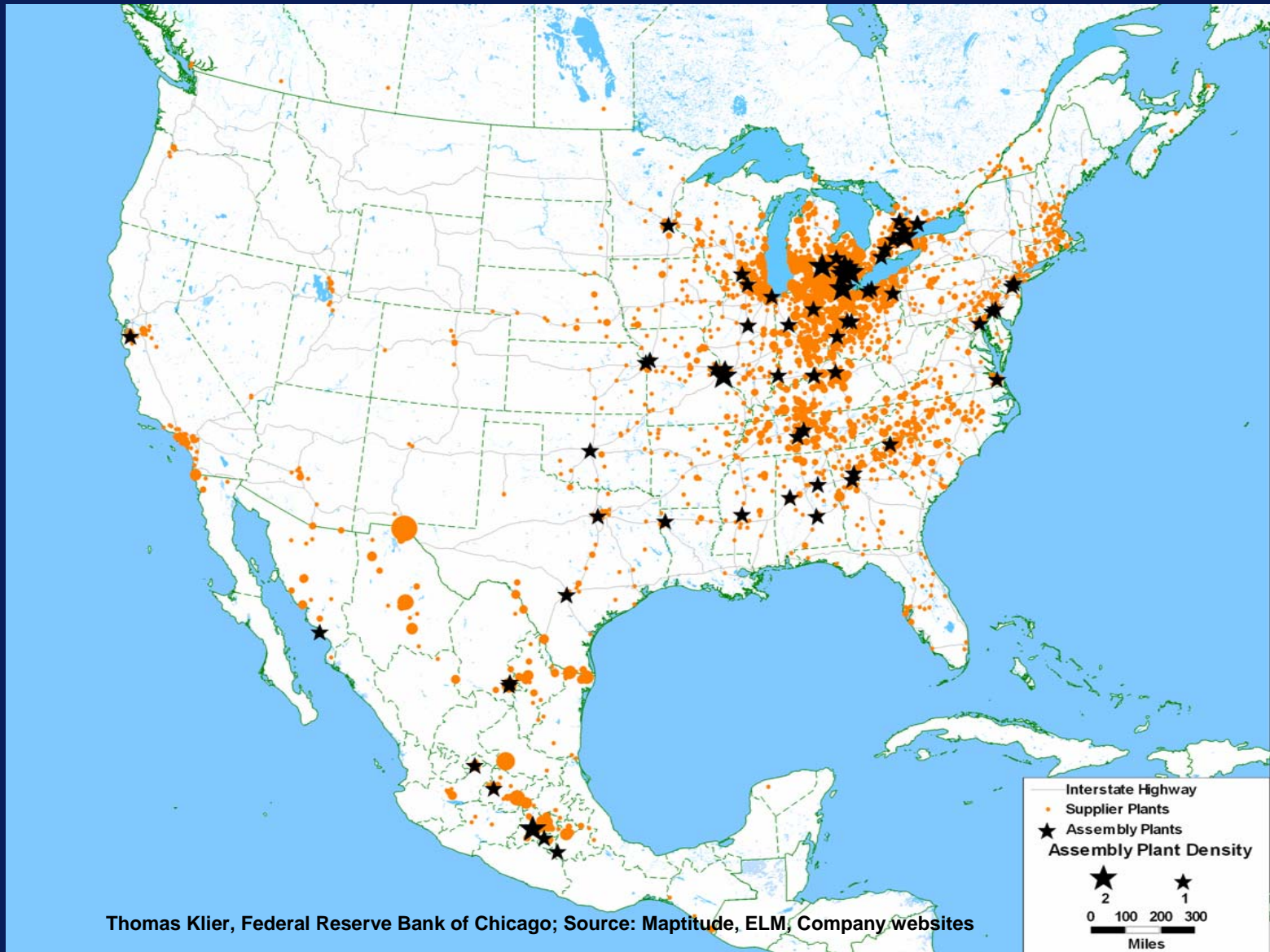

Shifts in the North American Supply Base

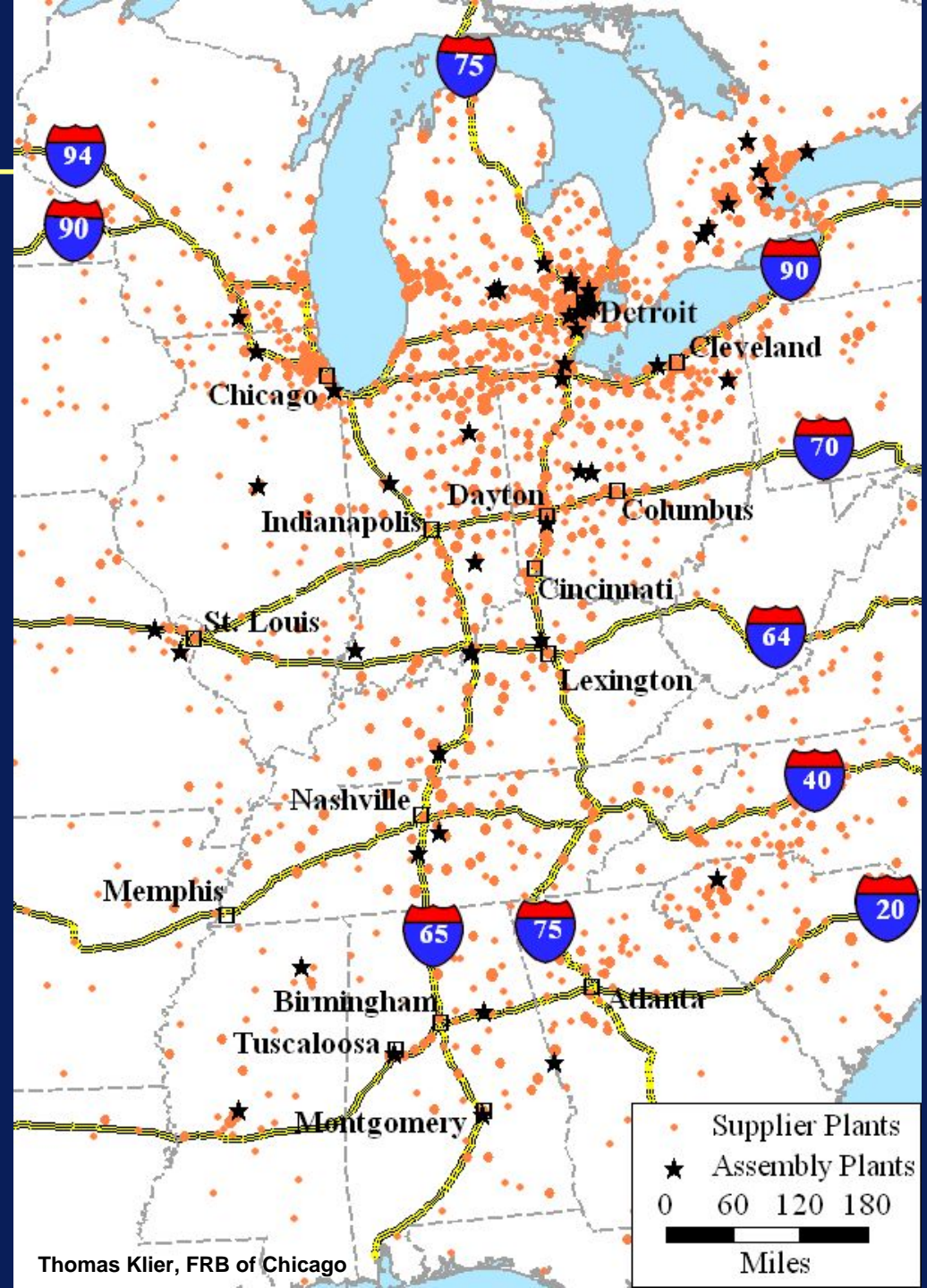
3rd Biennial Complexity Symposium
University of Michigan-Dearborn
Dearborn, Michigan
October 10, 2008

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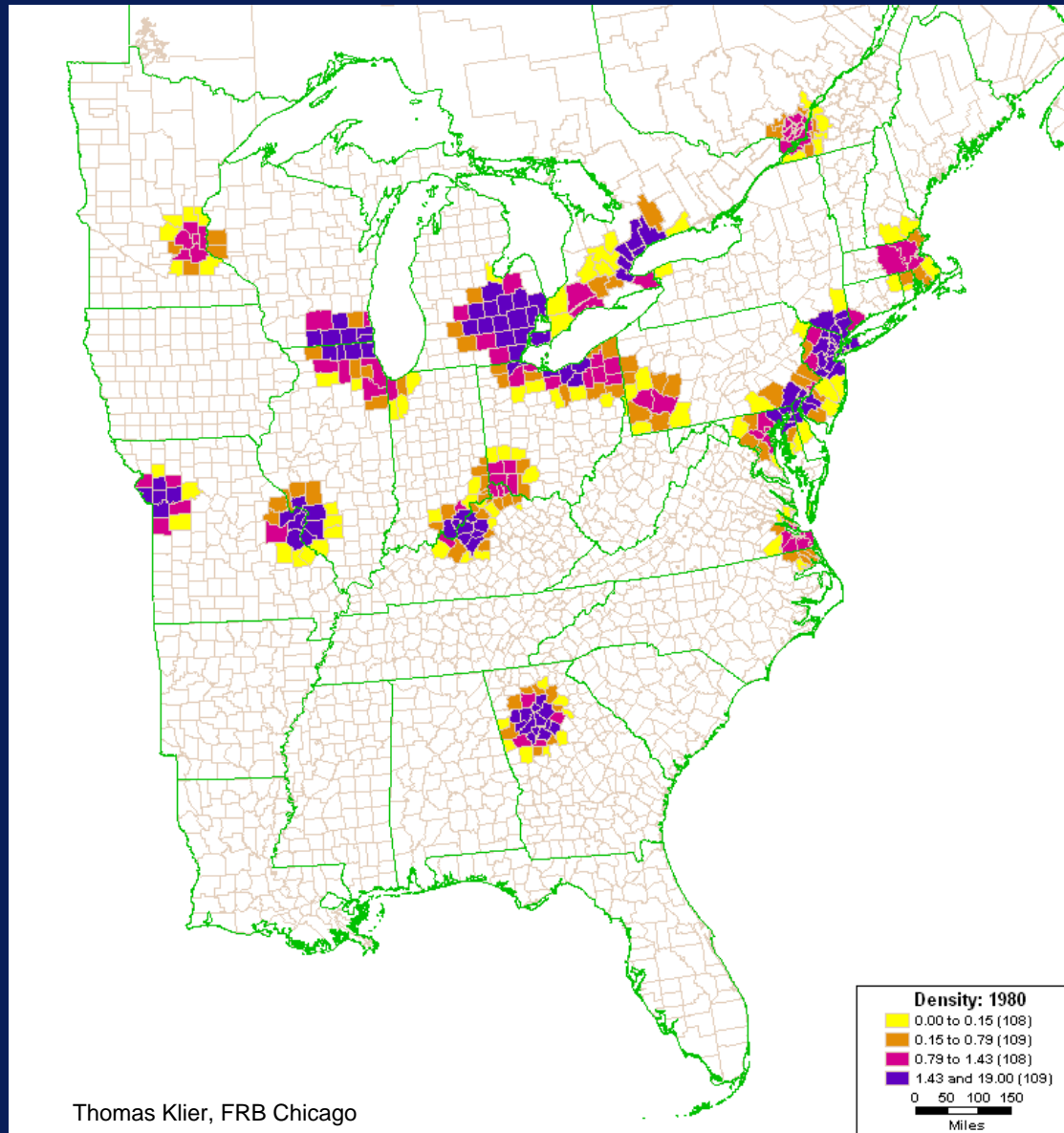
Geography of today's N.A. auto industry



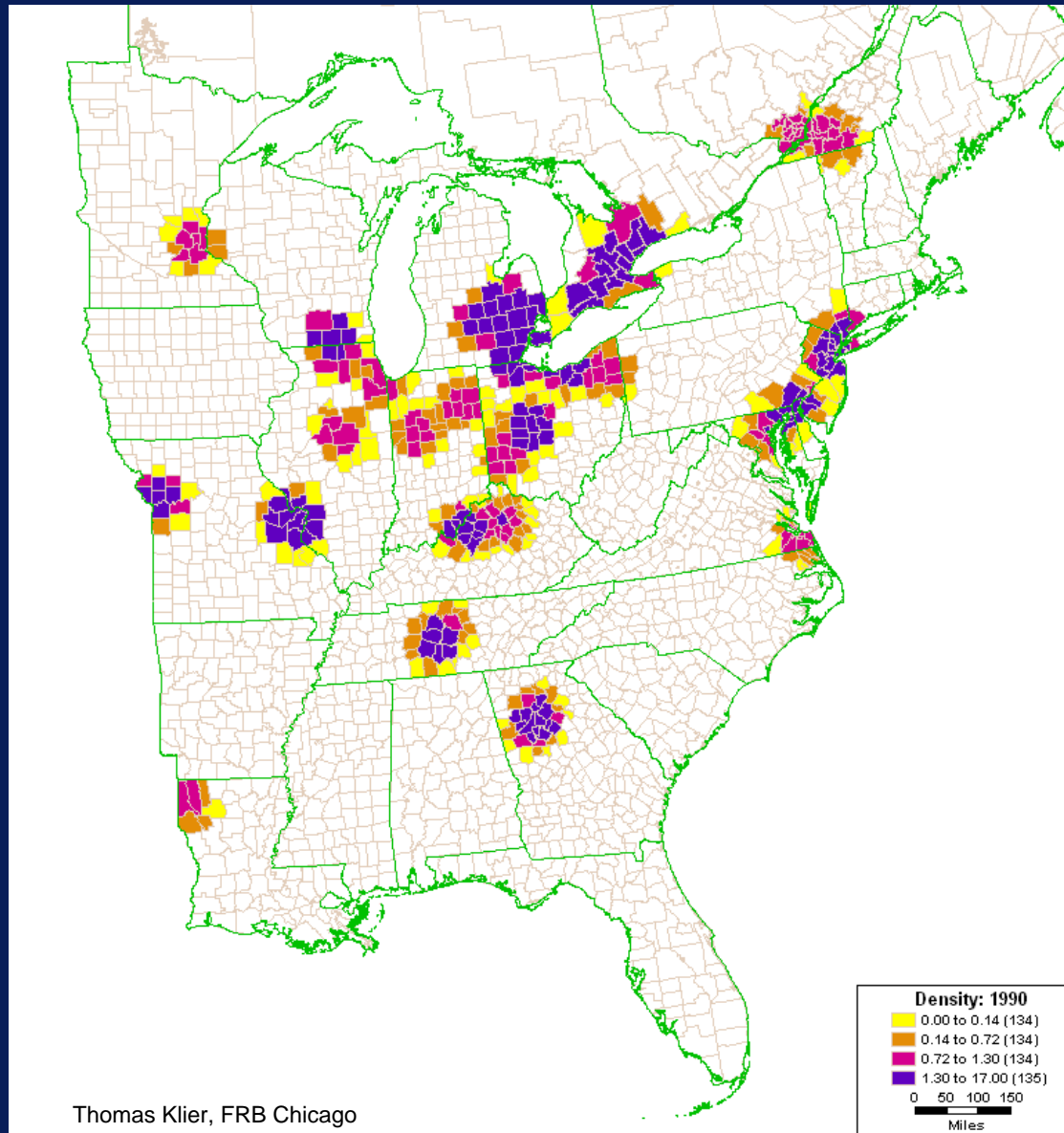
Close-up: The auto corridor



Assembly line density in 1980

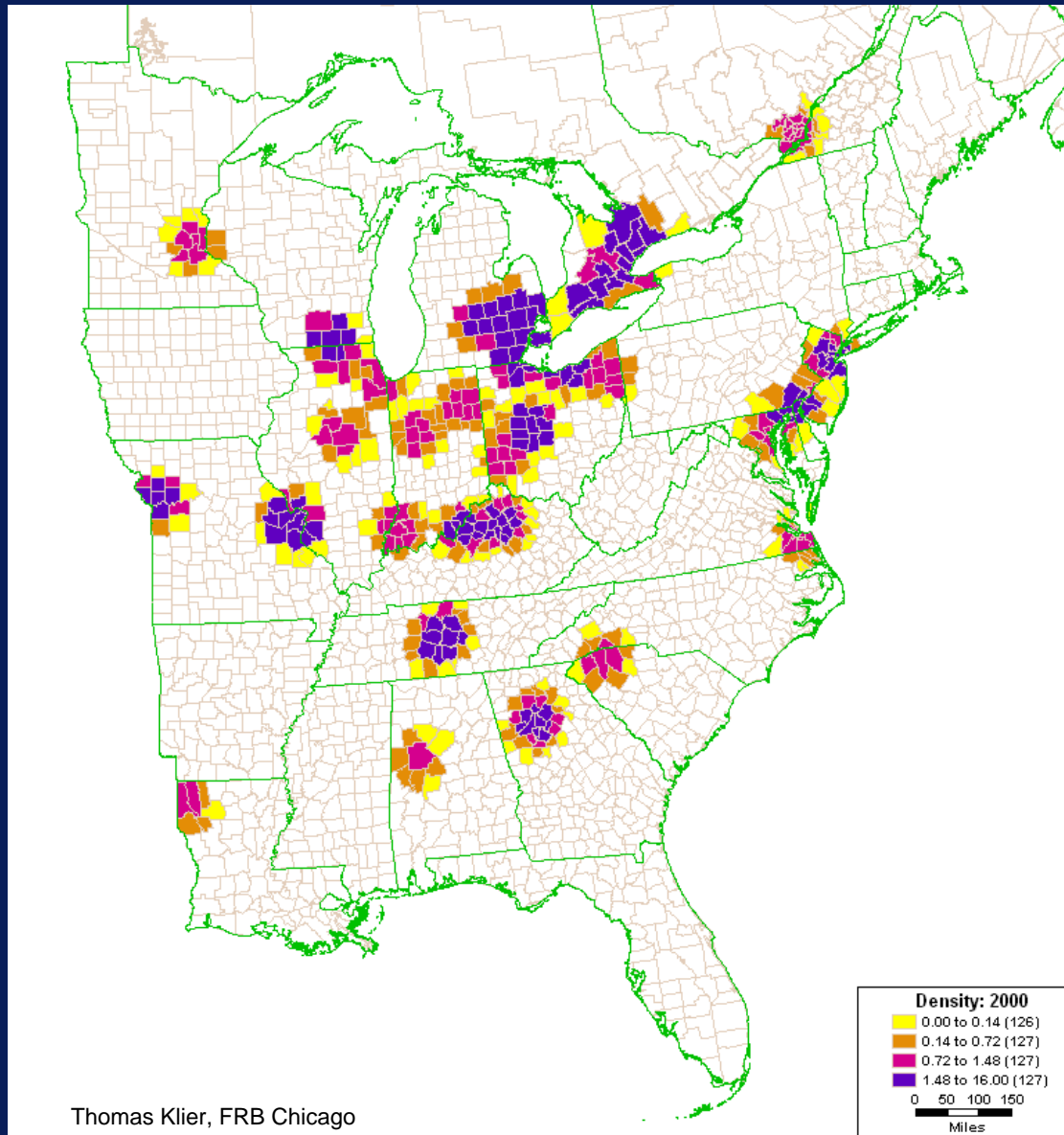


Assembly line density in 1990



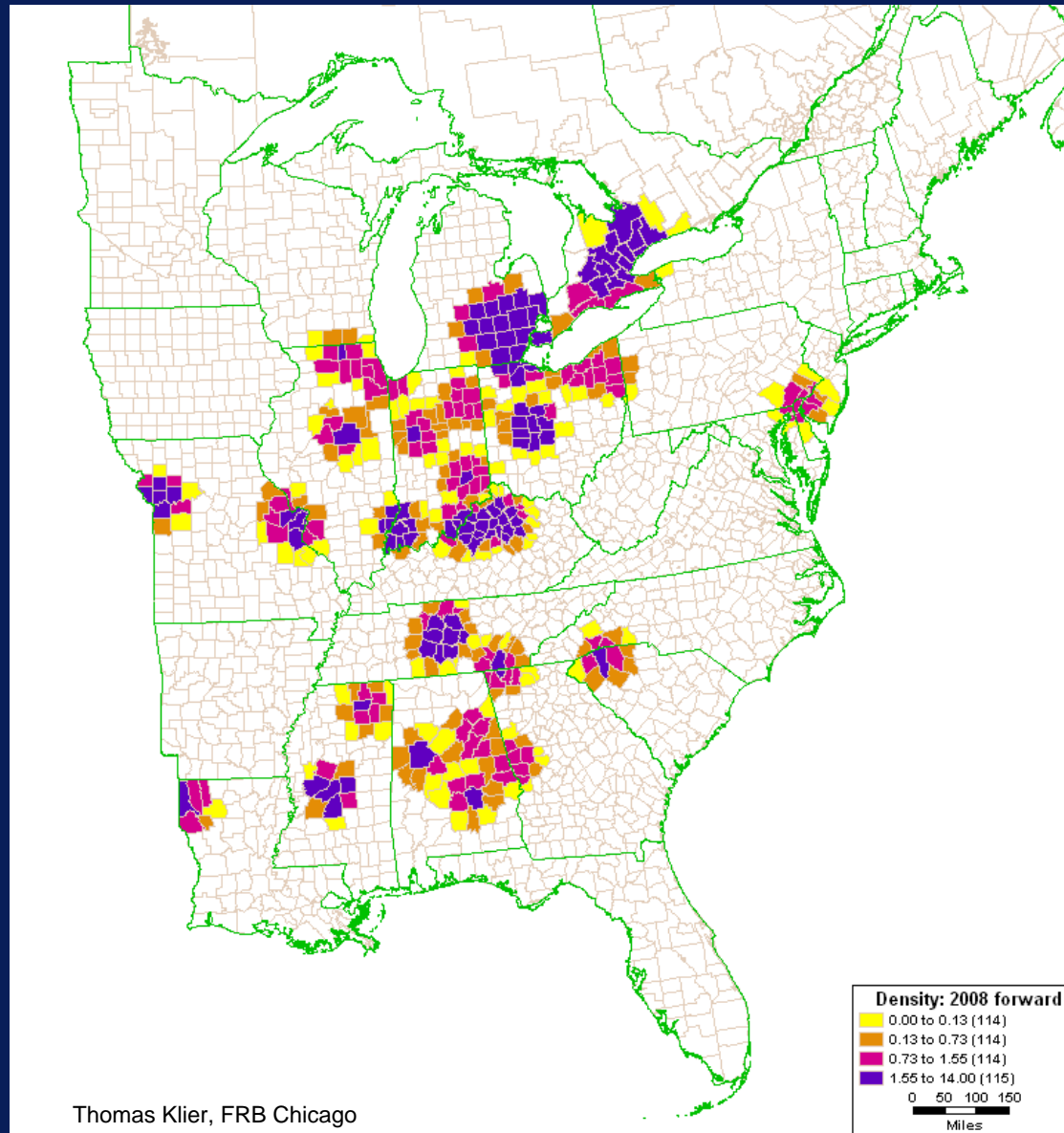
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Assembly line density in 2000



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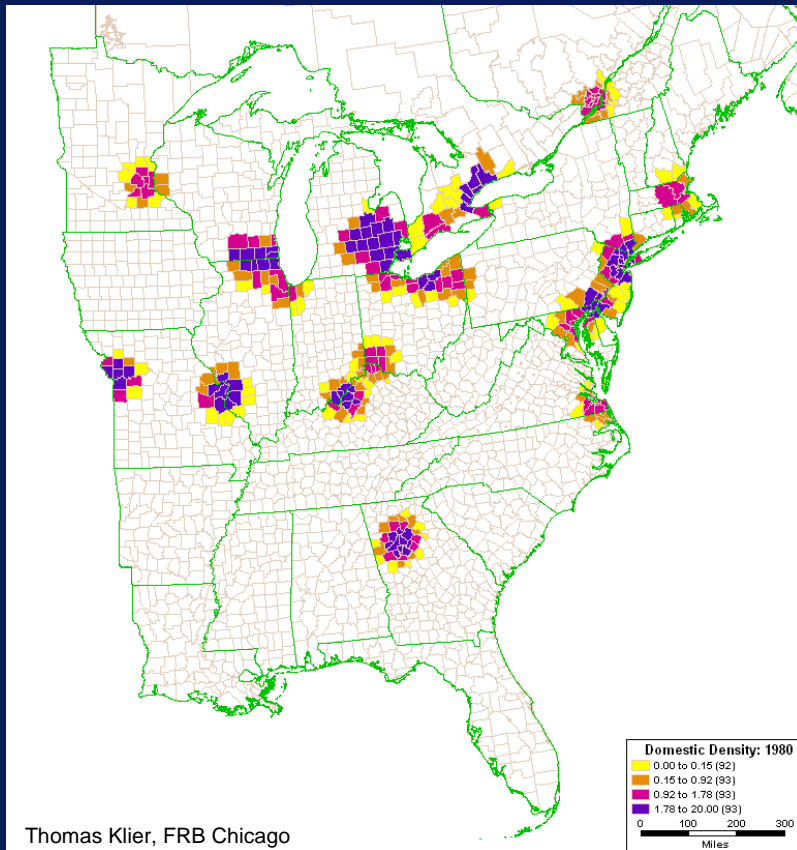
Assembly line density in 2008+



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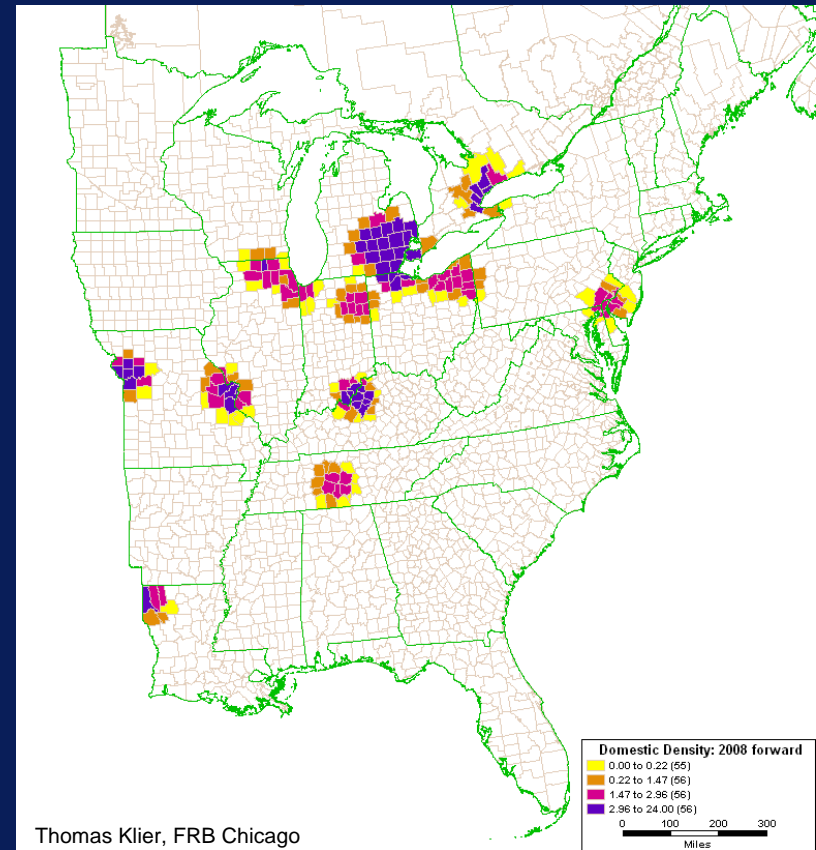
Domestic carmakers retreat to Midwest base

1980



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2008+



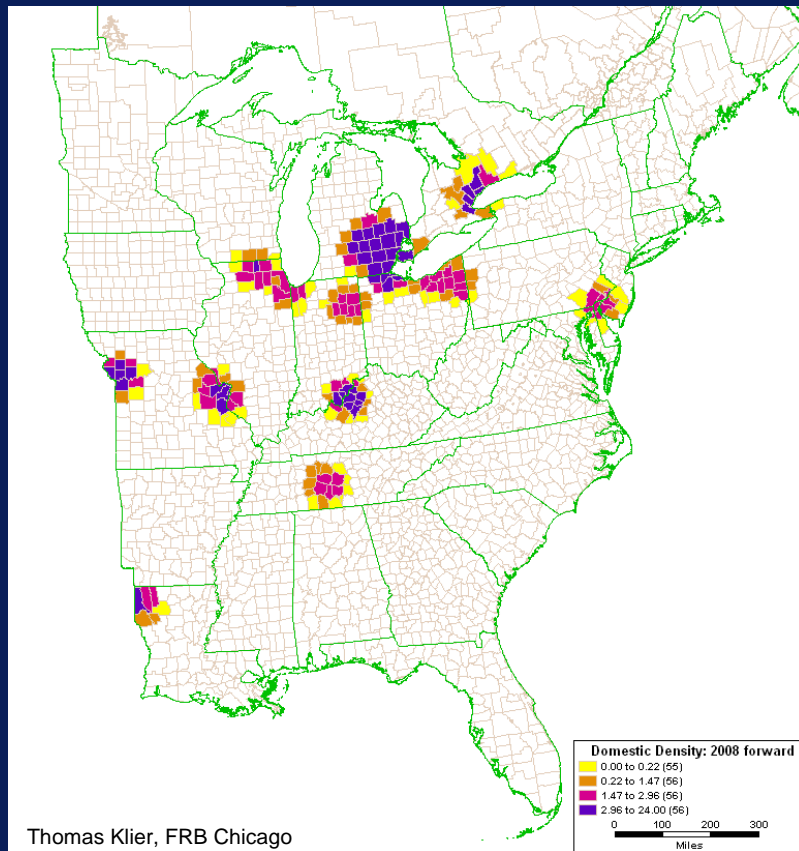
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The tyranny of geography

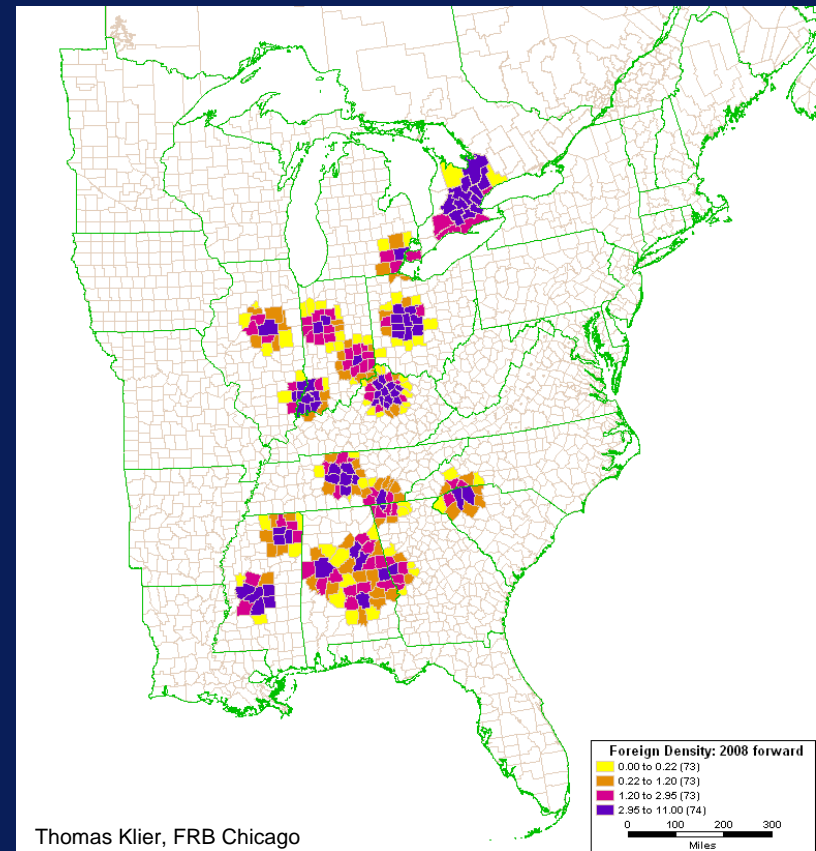
2008+

Domestic

Foreign



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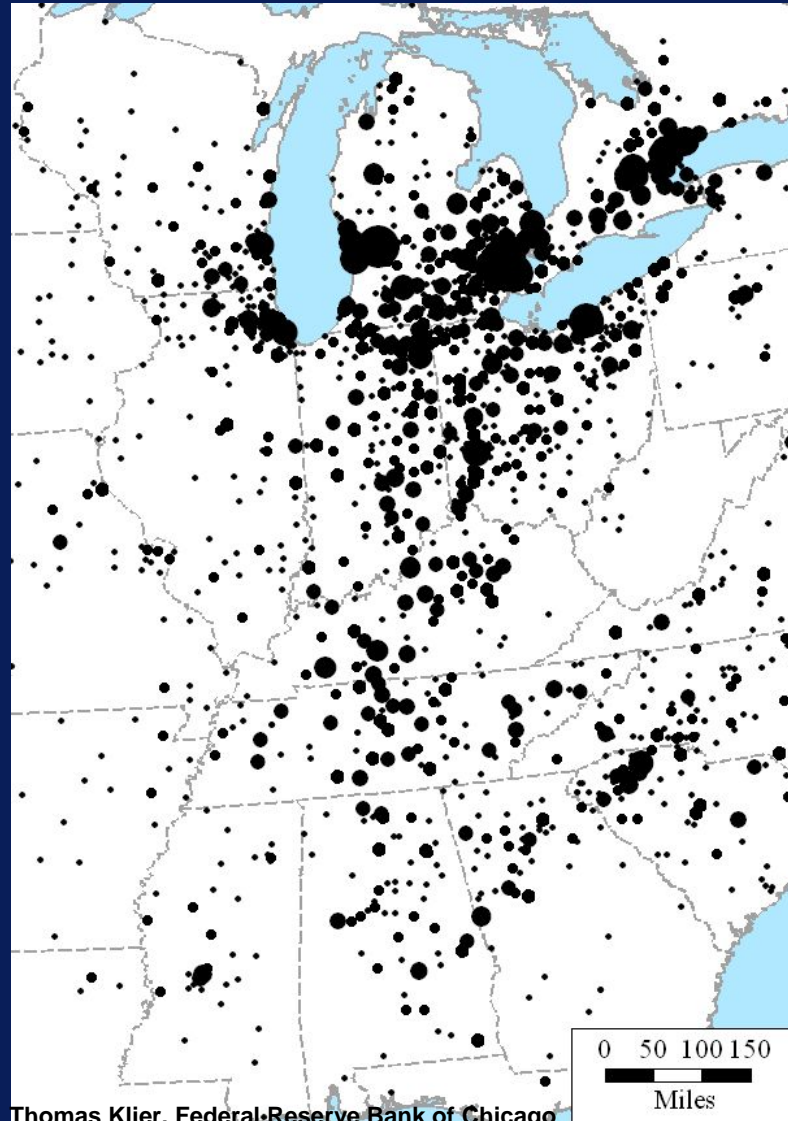


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What about the parts?



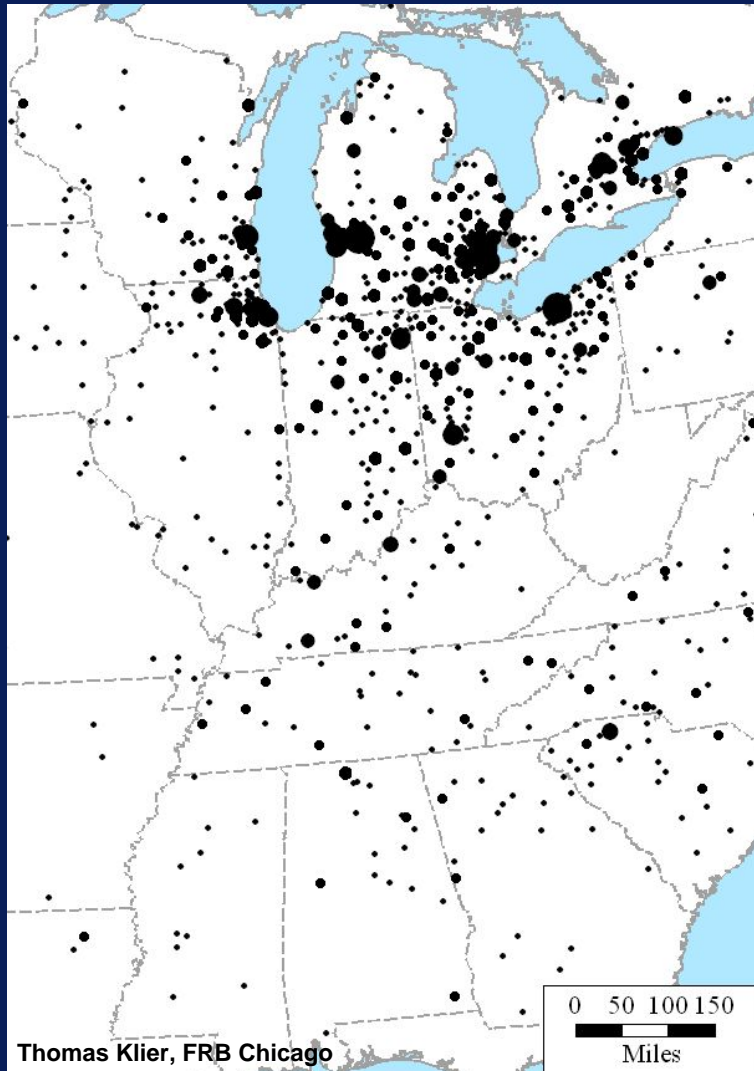
Today's auto supplier cluster



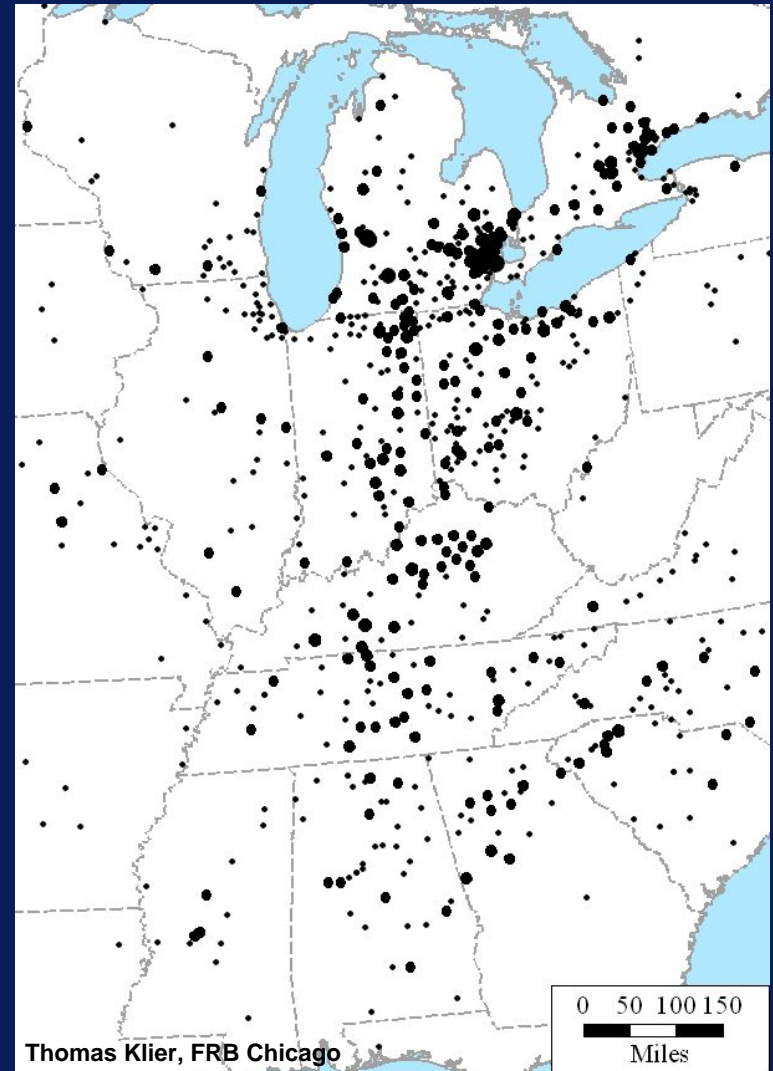
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A north-south auto corridor emerges

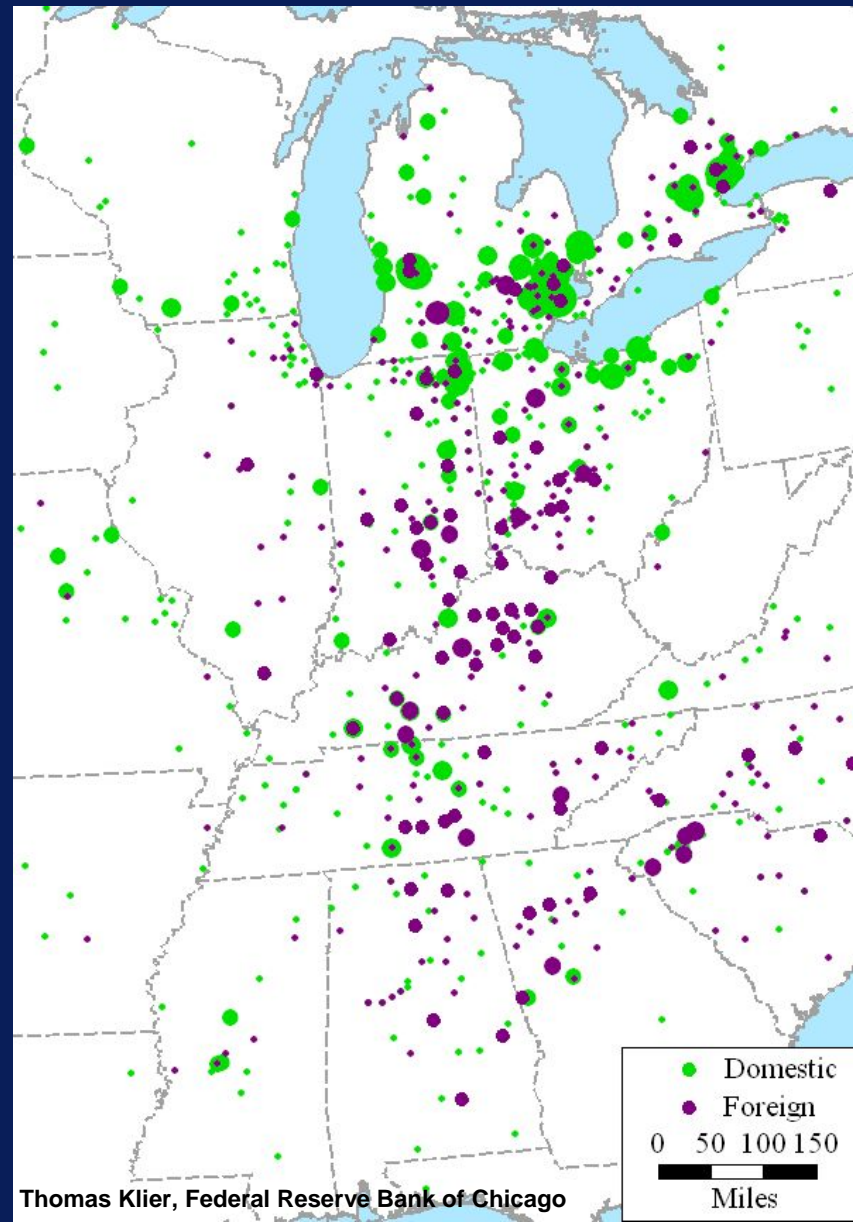
Before 1980



Since 1980



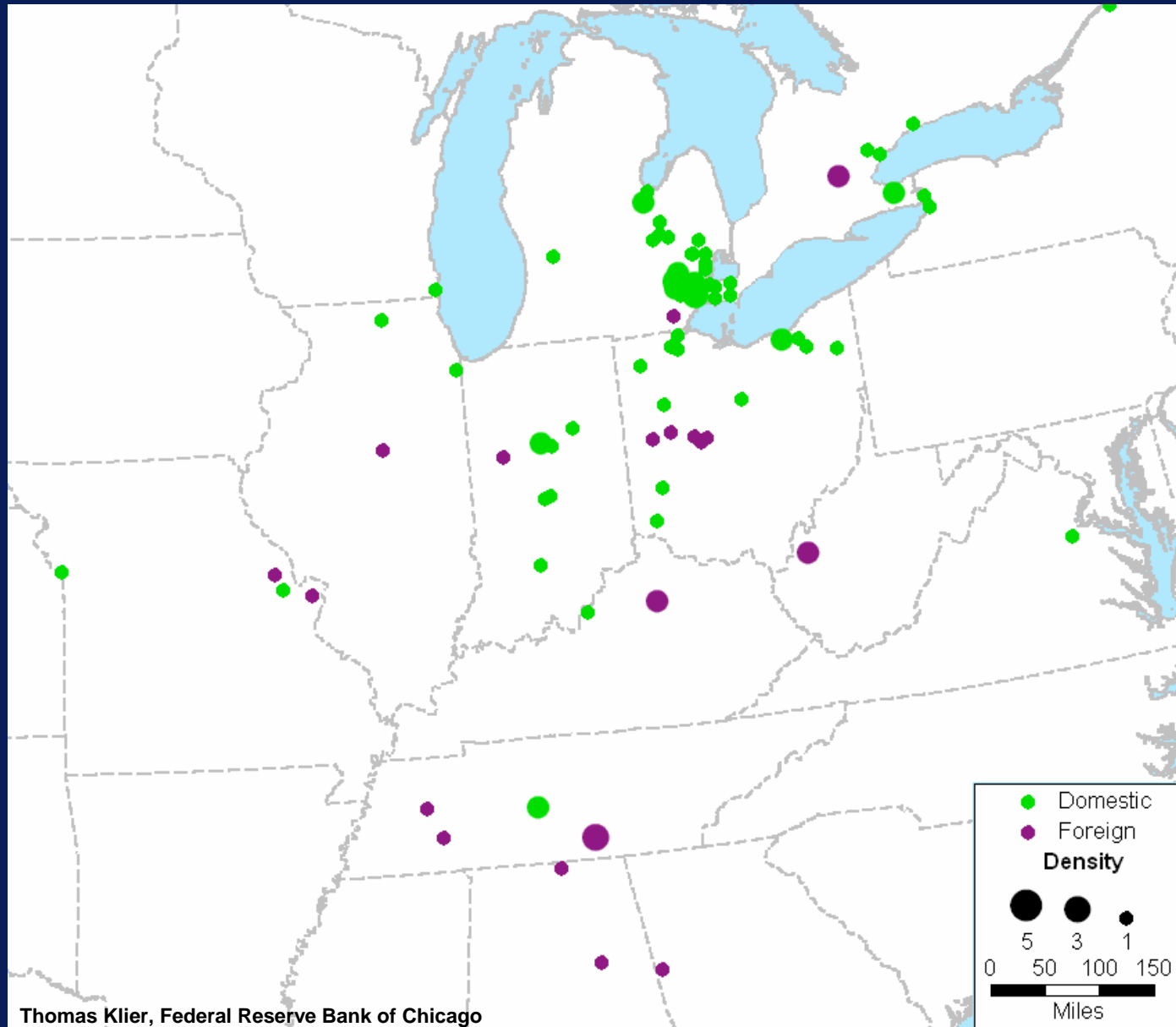
Parts plants also cluster by nationality



Since 1980

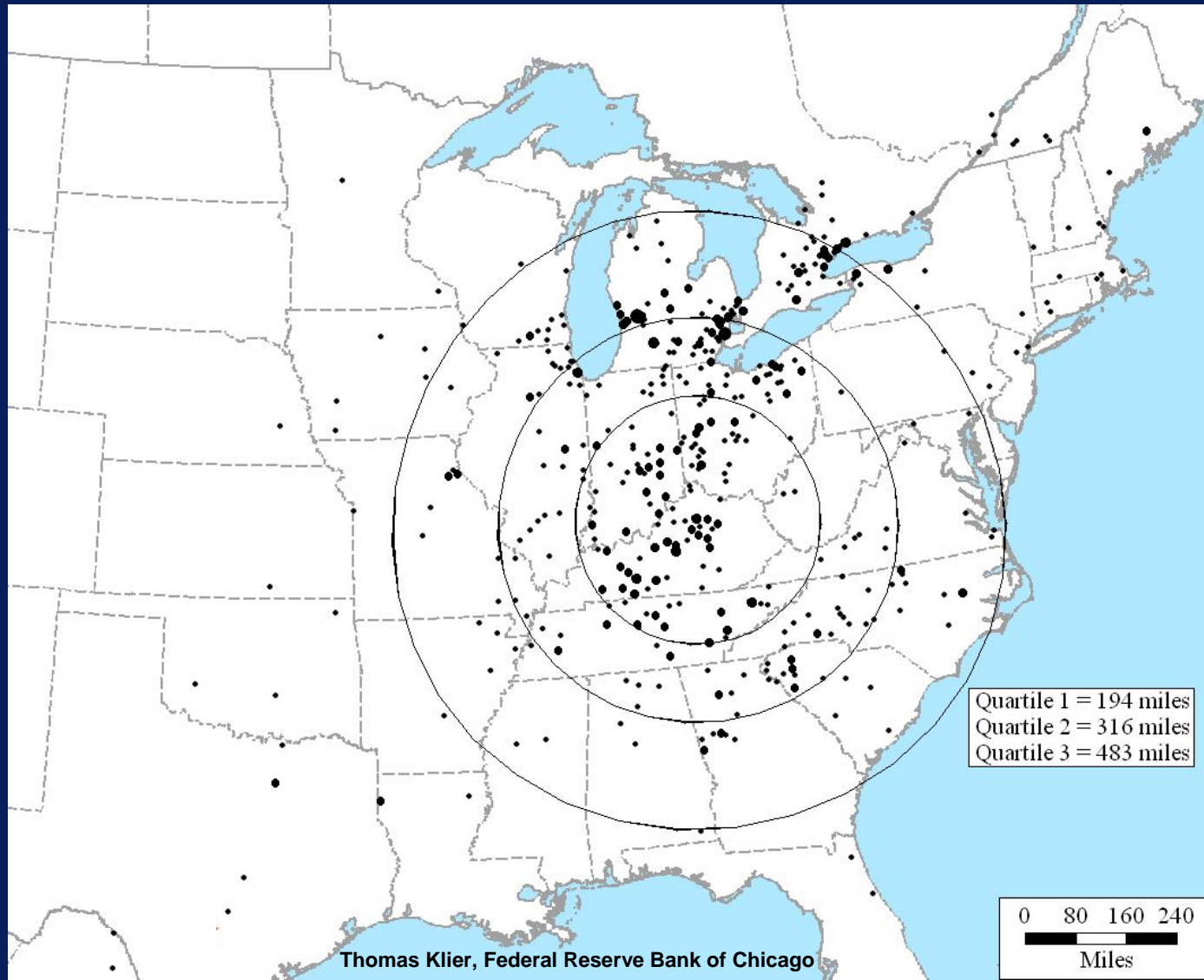
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Foreign captives also further south



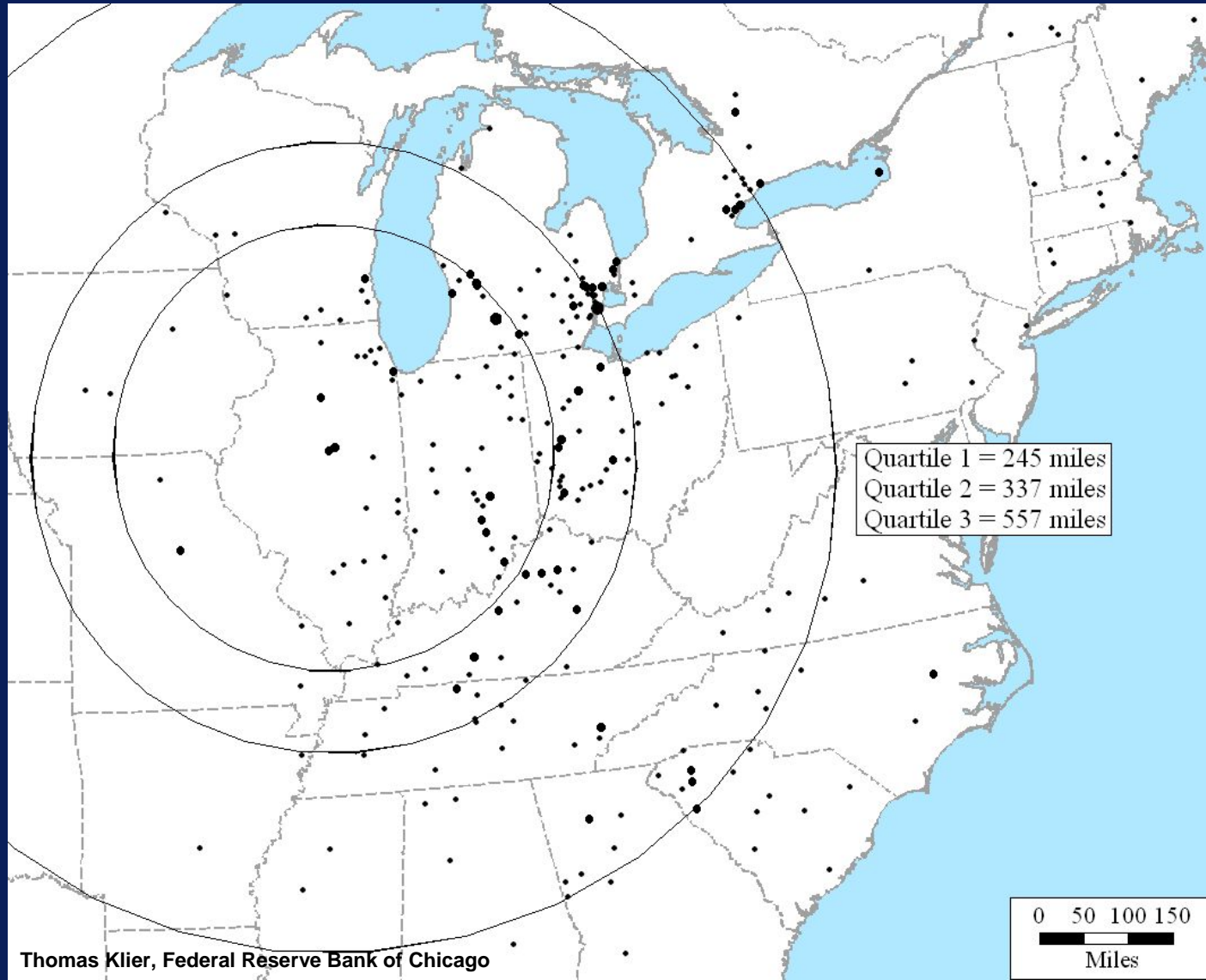
Auto supplier networks are regional

Toyota, Kentucky, supplier network



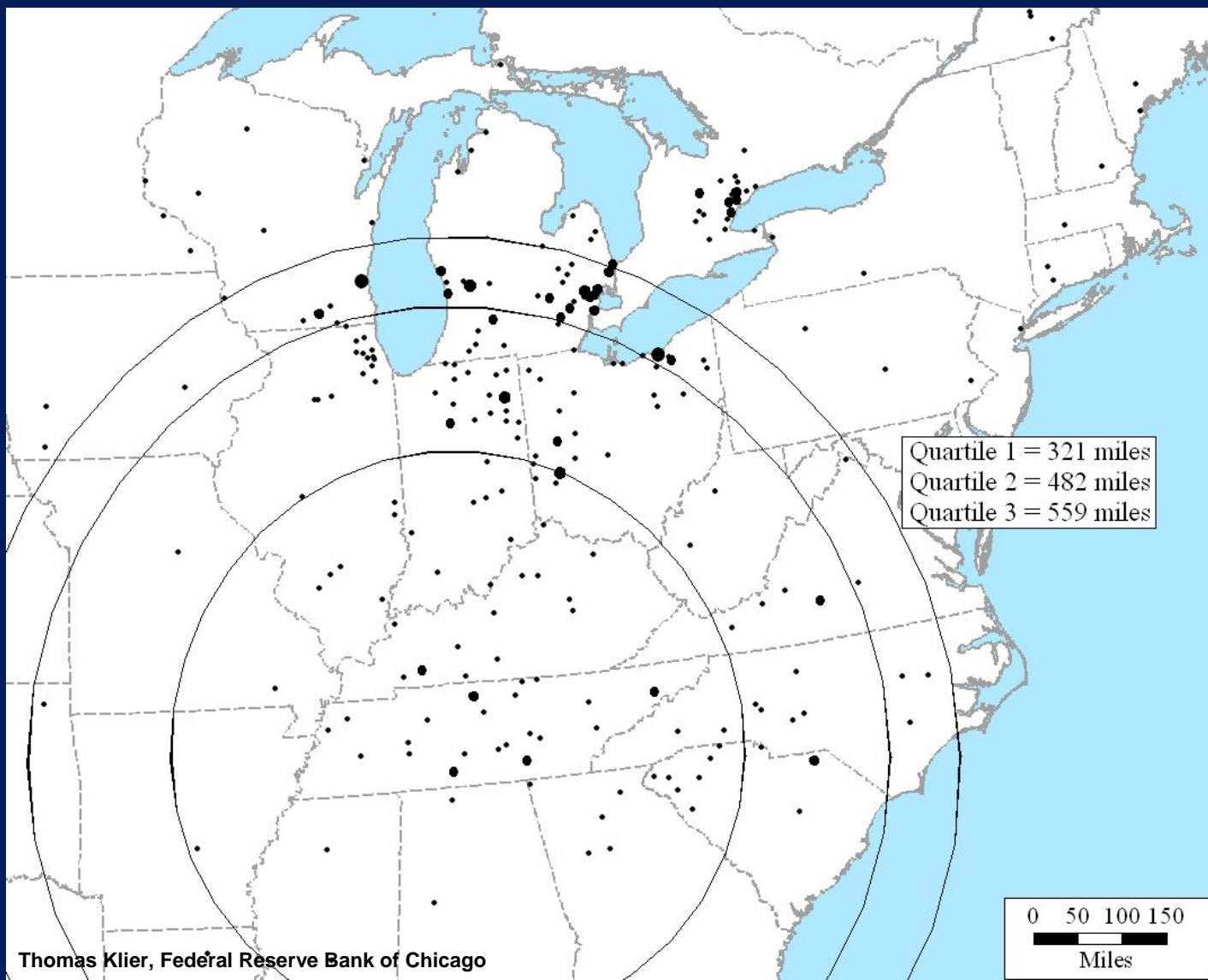
Assembly plant on western edge of corridor

Mitsubishi, Illinois, supplier network



Assembly plant far away from corporate supply base

Saturn, Tennessee, supplier network



Non-parametric statistics

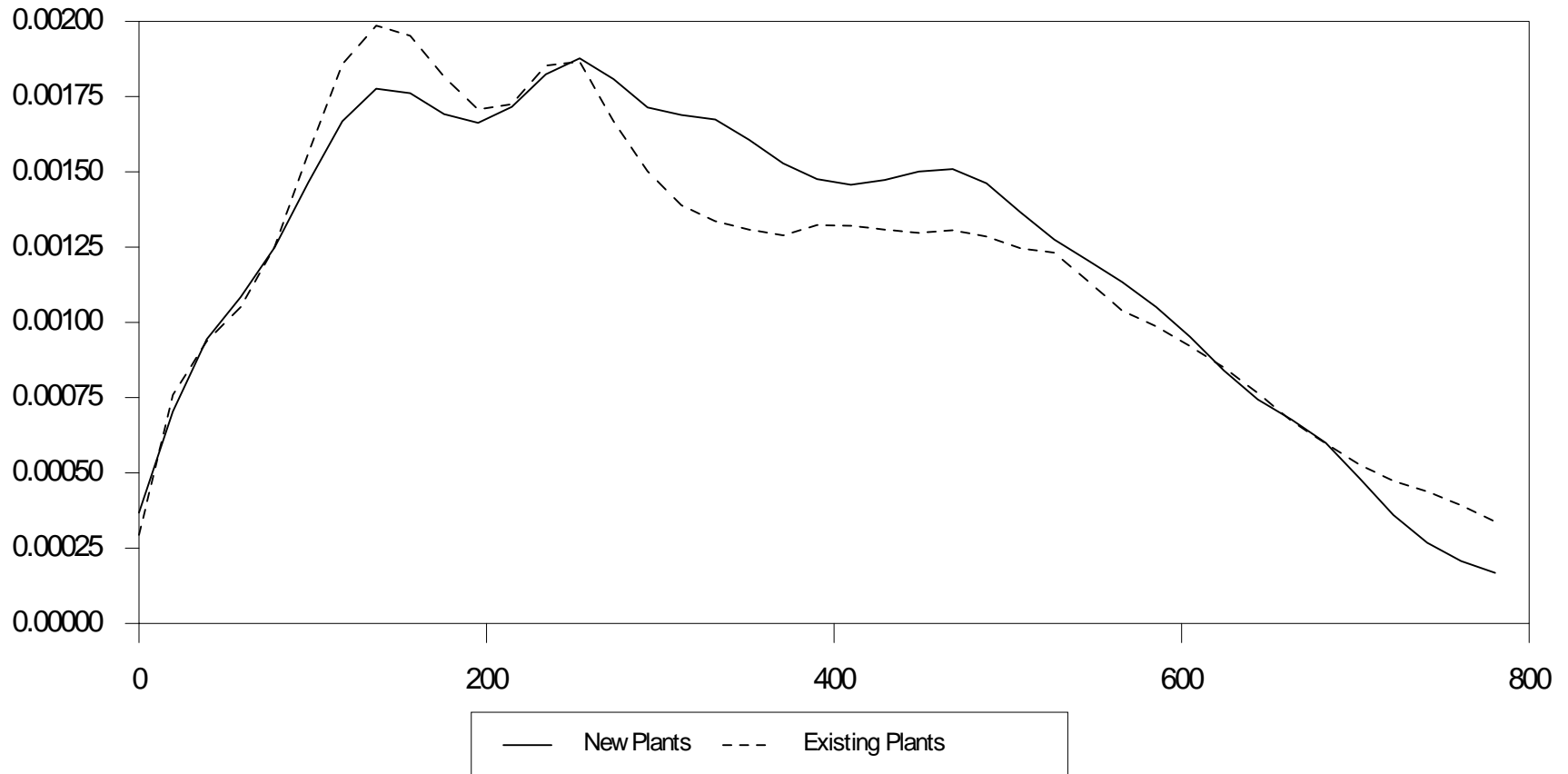
- Calculate kernel density

$$K(d) = \frac{2}{n(n-1)h} \sum_{i=1}^{n-1} \sum_{j=i+1}^n f\left(\frac{d - d_{i,j}}{h}\right)$$

$d_{i,j}$ is the distance between observations i and j ,
 h is the bandwidth, and f is the kernel function.

- Compare concentration of old and new plants
- Illustrate the concentration of auto supplier plants

K-densities for new and old – very similar

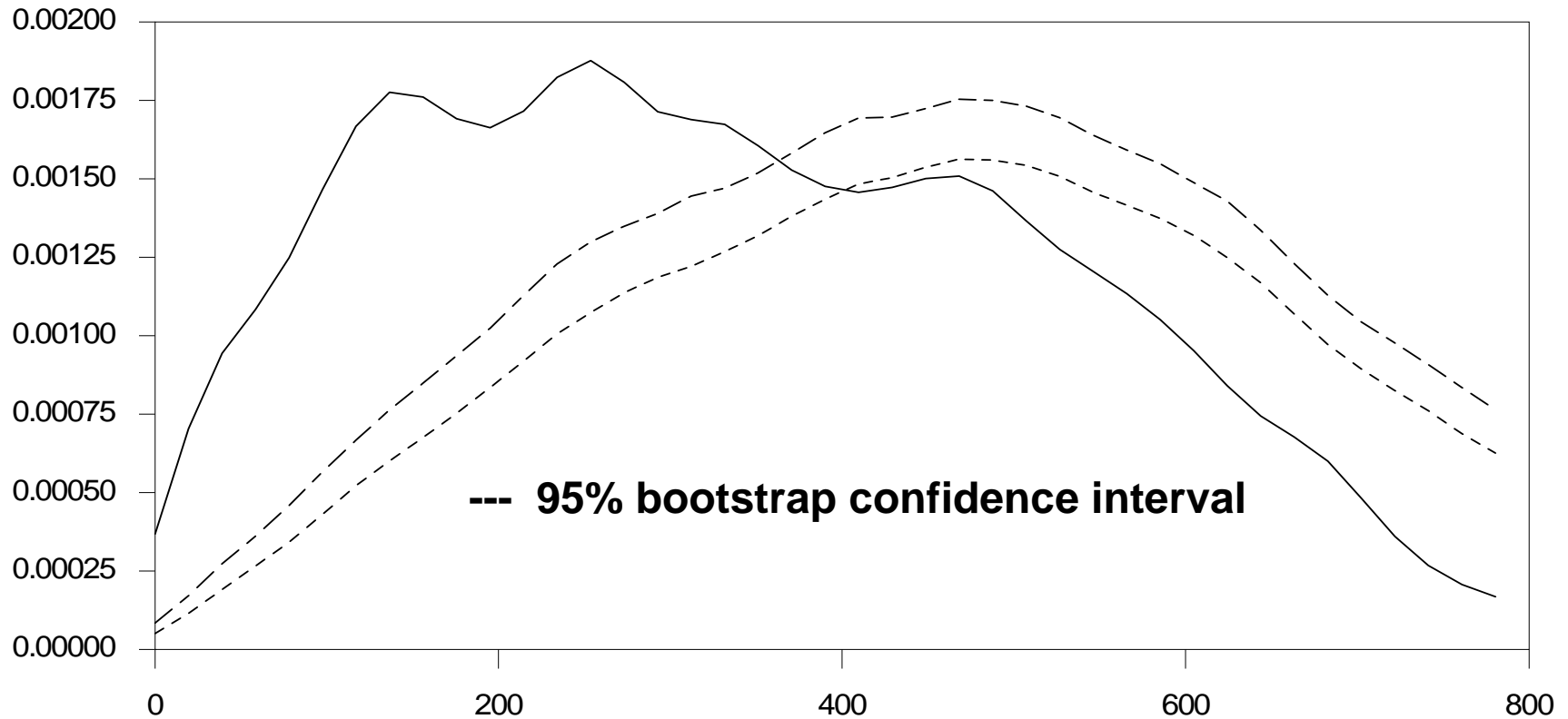


Measuring geographic concentration

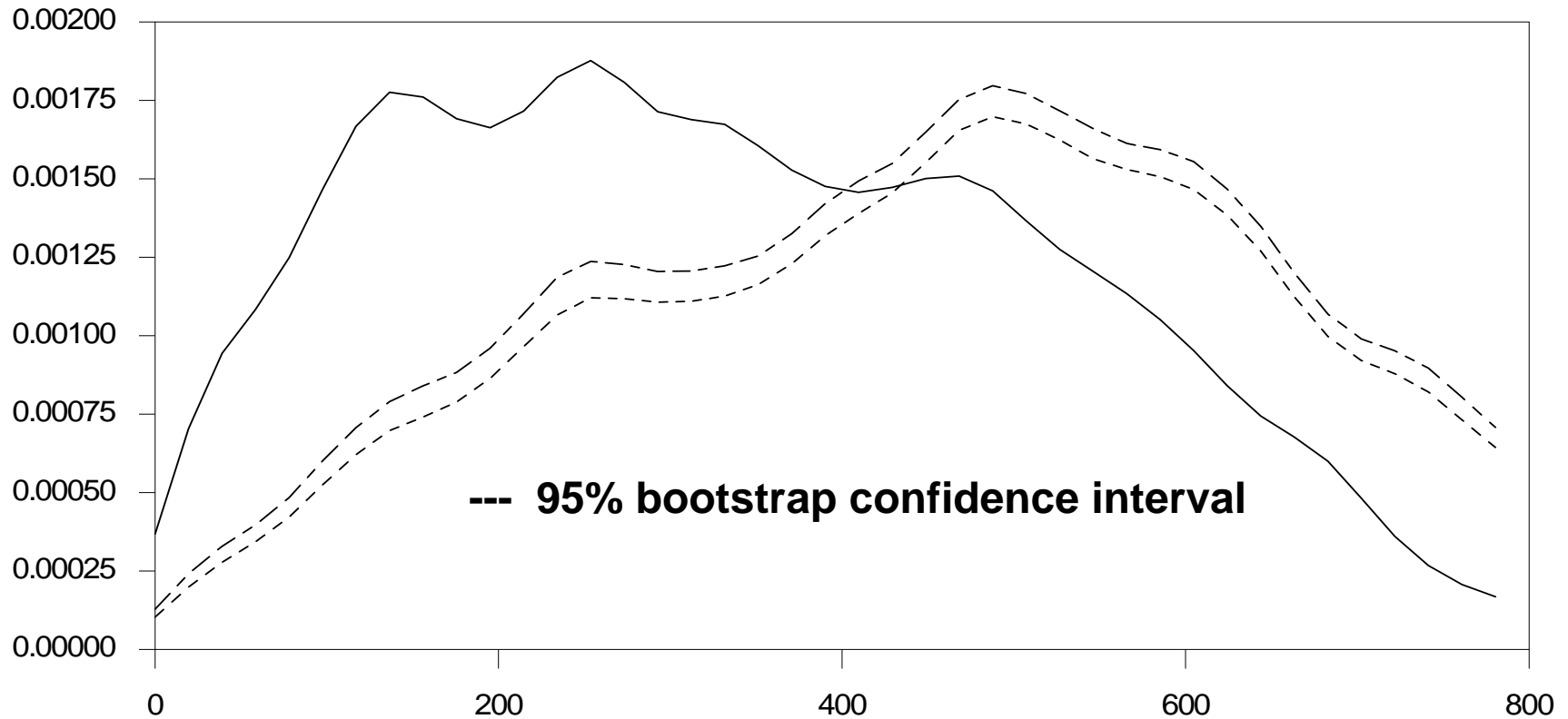
- Assign probability to each zipcode
- Draw n Zip-Codes with replacement
- Re-calculate K-Density:

$$K(d) = \frac{1}{n^2 h} \sum_{i=1}^n \sum_{j=1}^n f\left(\frac{d - d_{i,j}}{h}\right)$$

K-densities for new vs random (any Zipcode)



K-densities for new vs random (by employment)



Non-parametric statistics – Findings

- **The distribution of distances between supplier plants has not changed significantly since 1991**
- **Clear evidence that new supplier plants are highly concentrated geographically**
- **New (and old) supplier plants are far more concentrated than would be expected from pure randomness in location**
- **new plants show no additional tendency to cluster beyond the level of concentration of old plants.**
- **See Journal of Regional Science, Vol 48, No 1, 2008, Klier and McMillen**

Everything you always wanted to know about the motor vehicle parts industry (but were afraid to ask)

WHO REALLY MADE YOUR CAR?

**Restructuring and
Geographic Change
in the Auto Industry**



**Thomas Klier and
James Rubenstein**

www.upjohninst.org