

# Does the New Economic Geography Explain U.S. Core-Periphery Population Dynamics?

By

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# Introduction—Overview of Broad Forces that shape urban expansion

- “Tyranny of Distance” disadvantages rural areas and small cities.
- Reduces agglomeration economies
  - Remoteness increases transport & communication costs from suppliers and to customers.
    - Underlies location theory, Central Place Theory, New Economic Geography, and so on
  - Reduces labor market pooling and knowledge spillovers are key elements of agglomeration economies.

# Good News: The Tyrant is Dead

- “Death of Distance” (Cairncross 1995; 1997)
  - advances in ICT & transportation technology
  - declining role of the mature-goods sector and globalization
  - congestion in large cities: crime, land prices, traffic, environment
- Thomas Friedman (2005...): *The World is Flat* on how globalization is making one “world village.”
- Live in the country and telecommute for rural lifestyle
  - Supports rural areas, transportation usage, and sprawl.

- The Death of Distance May be premature...
  - Frequency of contacts may be increasing (McCann 2007)
    - In 1900, one farm harvest that was expensive to transport vs. the continuous contacts in today's information economy.
  - New ICT may be a complement with person-to-person contact (follows work by Ed Glaeser)
  - Urban bias in provision of ICT infrastructure
  - New industries depend on info externalities
  - Distance matters for migration & commuting
- These suggest that agglomeration economies have strong spatial effects with distance attenuation.
  - Supports denser development near larger cities.

# What does distance have to do with land use?

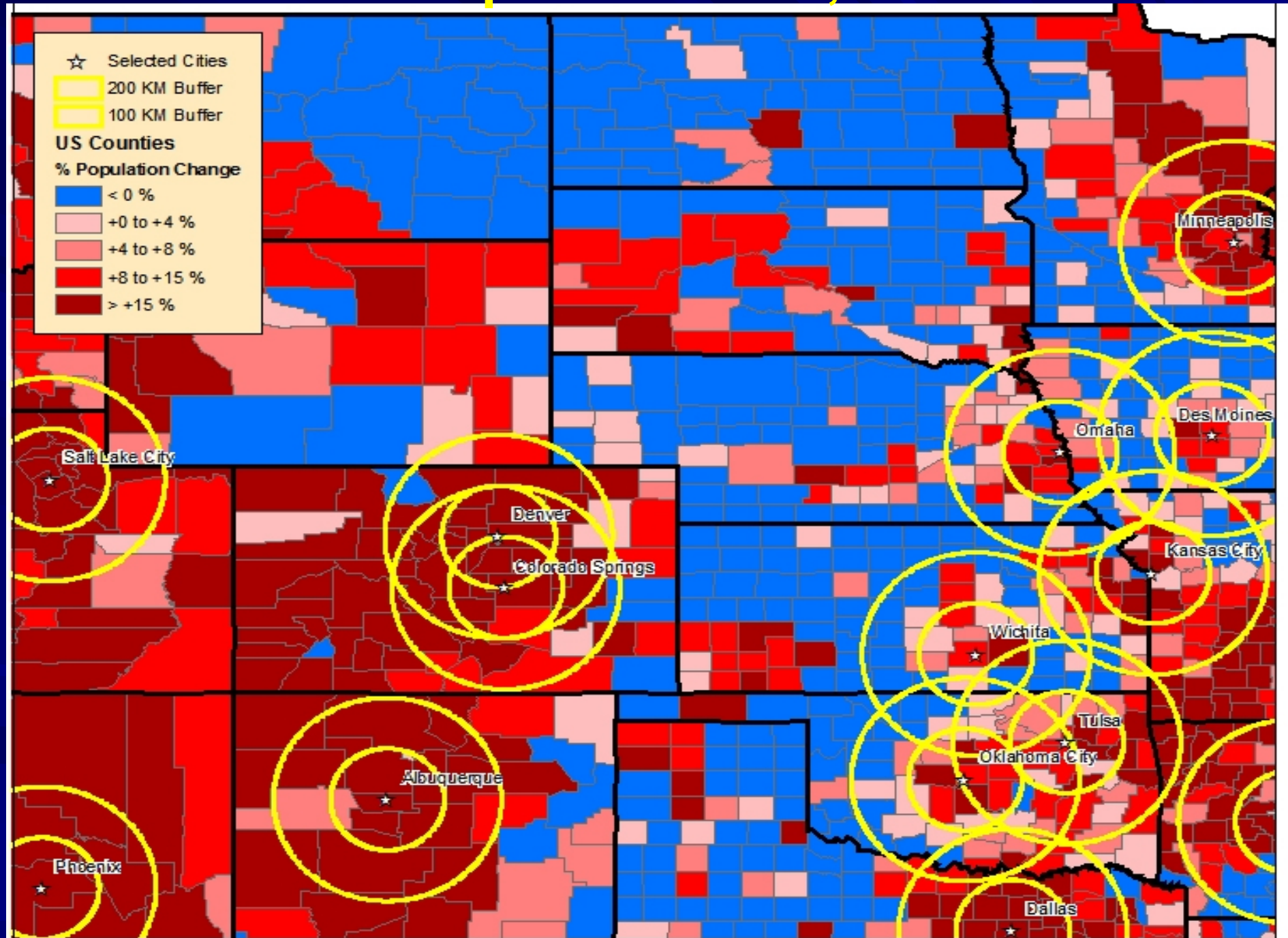
- These are the broad global forces that shape which cities are growing and how.
- These forces shape how nearby cities affect growth.
- They influence the extent of urban and “rural” sprawl and the degree of exurban development.
- Planners would be wise to keep these forces in mind in assessing where market forces will be encouraging growth.

## ■ But, how should ‘distance’ effects be examined?

- Distance from what, what about multiple agglomeration points in a surrounding 360° direction?
- Regarding the spatial reach of agglomeration economies, congestion effects are localized but agglomeration economies may have larger geographical reach.

# 1990-2000 Plains States Engines of Growth

## MSAs Population > 500,000 in 2000



# New Economic Geography

- Past research on Agglomeration is lengthy.
  - Generally assumes agglomeration economies are very localized: say inside a city's borders.
- New Economic Geography (NEG) motivated by the desire to explain the emergence of urban systems
- NEG formalizes agglomeration in the dynamic formation of an urban system:
  - input-output externalities, increasing returns to scale; positive real wage effects through diverse consumption opportunities

## NEG continued

- small cities produce only the most basic goods and services for which there is less competition, leading to an urban hierarchy consistent with Central Place Theory (Fujita and Thisse, 1996)

## NEG continued

- Successful in predicting formation of urban system
- How useful is it for explaining modern day core-periphery population dynamics and resulting settlement patterns?

# Theory: Moving Beyond the NEG

- Factors we consider that are omitted by NEG models:
- Migration plays passive role in NEG models, only responding to demand
- NEG models mostly omit interregional commuting
- Ignores features such as sprawl
- If moving people is becoming more important than moving goods, need to move beyond NEG models to explain current population dynamics

# Theory: Distance Predictions

- NEG predicts a hierarchy of cities. More higher-ordered services when moving towards the top of the hierarchy
  - The top tier (n) has the full range of services including the highest-order consulting, financial, and legal
- Hierarchy is usually associated with agglomeration growth shadows, where spatial competition near higher-tiered centers limits the growth of local business
- **Distance from higher-tiered urban areas positively related to growth**

## Distance Predictions continued

- Yet with commuting, spatial input-output linkages, and accessibility of urban amenities, spatial competition shadow effects may be overcome.
- Rural areas and smaller urban centers will ‘benefit’ from close proximity to successively higher-tiered centers
  - productivity spillovers occurring through personal interactions
  - congestion effects in largest urban areas
- **Distance from higher tier negatively related to growth**

- **Very little research on attenuation of agglomeration**

- An exception: Partridge et al. (2007), *CJE* examine whether proximity to ‘small’ and large Canadian cities influences growth—answer yes!
  - But not really germane for land use because cities are so spread apart and sprawl less important in Canada.

# Empirical Model

- Population growth is a reduced-form outcome of structural firm and household location in Roback sense (see the paper for the Roback model formulation).

- $\Delta \text{POP}_i = h_i(N_i, \mathbf{DIST}_{ij}, S_i, \cdot)$

# Empirical Model

- regress county population growth between periods 0 and t on initial period geographic and socioeconomic conditions at time 0
- DepVar: 1990-00 and 1990-2006 total county population growth
  - **This mitigates endogeneity**
  - **Stage models from parsimonious model (exogenous variables) to more fully specified. This assesses omitted variable bias, endogeneity, and multicollinearity.**
  - **Key distance variables are exogenous/predetermined**
    - assumes transition from one steady-state/balanced growth path to another (relies on high factor mobility)

- Subdivide counties into four sub-samples to examine the different transmission mechanisms across the urban hierarchy (sub-sample divisions are not critical).
  - 1: not part of either a micropolitan area or a larger metro area as **rural/hinterlands**
  - 2: **Micropolitan** areas of 10-50,000 pop. in urban core
  - 3: divide the metro area sample into counties part of a **metropolitan of less than 250k people**
  - 4: counties in **metros more than 250k people**
- Use 2003 MA/Micro definitions
  - Samples (counties in the lower 48 states and D.C.):

■ Total Population Growth:

$$\% \Delta \text{POP}_{is(t-0)} = \alpha + \delta \text{POPDEN}_{is0} + \phi \text{GEOG}_{is0} + \gamma \text{AMENITY}_{is0} + \theta \text{DEMOG}_{is0} + \psi \text{ECON}_{is0} + \sigma_s + \varepsilon_{is(t-0)}$$

*Red indicates controls for sensitivity analysis*

$\alpha$ ,  $\delta$ ,  $\varphi$ ,  $\theta$ ,  $\psi$ , and  $\gamma$  are coefficient vectors

$\sigma_s$  is the state fixed effect that accounts for common factors within a state. These include amenities or business climate.

- $X$  coefficients reflect average county variation *within* states

$\varepsilon$  - is the residual, which is assumed to be spatially correlated with nearby counties in which the strength of the correlation is inversely related to the distance between the two counties (bandwidth of 200km) to obtain robust standard errors (generalization of the Huber-White heteroskedastic-consistent estimator by Conley, 1999 following Rappaport)

- GEOG contains spatial measures that reflect proximity to urban areas higher in the hierarchy

- Nearest Urban Area

- Rural counties: distance in kms to nearest urban center of any size;

- Urban center Micro or MA counties: distance in kms to center of urban core if multi-county, 0 for single county urban area;

## ➤ Incrementally Proximate Higher-Tier Areas

- incremental distance in kms from the county to reach an MA (for rural and micropolitan counties)
- the incremental distances to reach MAs of at least 250k, at least 500k, and at least 1.5m. pop. (for all counties)
  - We have also considered a ‘highest’ tier of NY, LA, & Chicago in other settings.
- include population of the nearest or actual urban center (MICRO or MA) to the county



- **AMENITIES** measured by climate, topography, % water area, and a 1 to 7 amenity scale constructed by USDA ERS
  - So-called first nature variables.
  - Access to coast or waterway is statistically insignificant.
- **In Sensitivity Analysis:**
  - **DEMOG** measures of racial composition, past immigration, age and educational attainment (measured in 1990)
  - **ECON** measures: initial 1989 median household income, initial 1990 unemployment rate, 1990 employment shares in agriculture and in goods production; 1990 employment in surrounding counties within the county's BEA region; 1990-2000 industry mix employment growth in the sectoral models
  - Consider population growth over the 1990-2006 period.
- *We start with parsimonious specification with “super” reduced form model and move toward a model with more control variables that mitigates omitted variable bias.*

Variables/var groups	Core Rural Areas		
	Dist	Add other X	Base with State FE
Distance to nearest urban center or actual urban center	<b>-0.075**</b> (-4.32)	<b>-0.092**</b> (-5.98)	<b>-0.102**</b> (-7.62)
Inc Dist to MA	<b>-0.050**</b> (-4.87)	<b>-0.040**</b> (-4.51)	<b>-0.038**</b> (-4.79)
Inc Dist to MA>250k	<b>-0.026**</b> (-4.91)	<b>-0.025**</b> (-5.67)	<b>-0.030**</b> (-5.17)
Inc Dist to MA>500k	-0.006 (-0.71)	-0.004 (-0.50)	<b>-0.018**</b> (-2.42)
Inc Dist to MA>1500k	-0.006 (-1.22)	-0.007 (-1.32)	<b>-0.011**</b> (-2.50)
Distance to nearest own tier	0.021 (0.75)	-0.019 (-0.83)	0.003 (0.15)
Pop Density	N	<b>-0.066**</b> (-2.19)	<b>-0.054**</b> (-1.95)
Pop of nearest urban	N	9.3E-07 (0.18)	6.8E-06 (1.49)
Incremental Population in nearest MA	Y	Y	Y
Weather/Amenity <sup>a</sup>	Y	Y	Y
Economic/Demographic <sup>b</sup>	N	Y	Y
Surrounding Econ <sup>c</sup>	N	Y	Y
State fixed effects (FE)	N	N	Y
R <sup>2</sup>	0.33	0.49	0.60
No. of observations	1300	1300	1300

Variables/var groups	Micropolitan Areas		
		Base with state FE	
Distance to nearest or actual urban center		0.137** (2.14)	
Inc Dist to MA		-0.026** (-2.02)	
Inc Dist to MA>250k		-0.029** (-3.24)	
Inc Dist to MA>500k		-0.009 (-0.78)	
Inc Dist to MA>1500k		0.003 (0.51)	
Dist to nearest own tier		0.015 (0.85)	
Pop Density		-0.023* (-1.81)	
Pop of nearest urban center		-2.3E-05 (-1.18)	
Incremental Population in nearest MA		Y	
Weather/Amenity <sup>a</sup>		Y	
Economic/Demographic <sup>b</sup>		Y	
Surrounding Econ <sup>c</sup>		Y	
State fixed effects (FE)		Y	
R <sup>2</sup>		0.63	
No. of observations		672	25

Variables/var groups	Inside MA with pop ≤250,000		
	Dist	Add other X	Base with State FE
Distance to actual urban center	<b>0.092**</b> <b>(2.17)</b>	0.082 (1.53)	0.064 (1.55)
Inc Dist to MA	n.a.	n.a.	n.a.
Inc Dist to MA>250k	<b>-0.028**</b> <b>(-2.95)</b>	<b>-0.038**</b> <b>(-4.17)</b>	<b>-0.057**</b> <b>(-5.53)</b>
Inc Dist to MA>500k	0.004 (0.24)	0.002 (0.18)	<b>-0.027**</b> <b>(-2.23)</b>
Inc Dist to MA>1500k	-0.001 (-0.09)	-0.007 (-0.92)	<b>-0.026**</b> <b>(-2.66)</b>
Dist to nearest own tier	0.020 (0.99)	<b>0.045**</b> <b>(2.69)</b>	<b>0.044**</b> <b>(3.14)</b>
Pop Density	N	<b>-0.018**</b> <b>(-3.17)</b>	<b>-0.022**</b> <b>(-4.07)</b>
Pop of actual urban center	N	1.6E-05 (1.07)	<b>4.6E-05**</b> <b>(3.45)</b>
Incremental Population in larger MAs	Y	Y	Y
Weather/Amenity <sup>a</sup>	Y	Y	Y
Economic/Demographic <sup>b</sup>	N	Y	Y
Surrounding Econ <sup>c</sup>	N	Y	Y
State fixed effects (FE)	N	N	Y
R <sup>2</sup>	0.17	0.51	0.64
No. of observations	416	416	416

Variables/var groups	MA>250,000
	Base with state FE
Distance to actual urban center	<b>0.188**</b> <b>(4.26)</b>
Inc Dist to MA	n.a.
Inc Dist to MA>250k	n.a.
Inc Dist to MA>500k	0.011 (0.72)
Inc Dist to MA>1500k	-3.3E-04 (-0.04)
Dist to nearest own tier	0.013 (0.74)
Pop Density	<b>4.2E-04*</b> <b>(1.74)</b>
Pop of actual urban center	-5.0E-07 (-1.50)
Incremental Pop in larger MAs	Y
Weather/Amenity <sup>a</sup>	Y
Economic/Demographic <sup>b</sup>	Y
Surrounding Econ <sup>c</sup>	Y
State fixed effects (FE)	Y
R <sup>2</sup>	0.63
No. of observations	641

# Summary of Primary Results

## ■ Rural (noncore) Counties

- **Distance Lives!!! Penalties for each successive tier.**
    - No statistically significant effect from proximity to same-sized tier.
  - Population growth in a county at the mean distance of 60kms from the nearest urban center is associated with 6% less population growth over the 1990s than an otherwise equal county immediately adjacent to the nearest urban center.
  - Population growth in a county at the mean distance from all of the urban tiers is associated with 12% less population growth over the 1990s than an otherwise equal county immediately adjacent to an urban center of at least 1.5 million.
- Agglomeration economies spatially extend much farther than typically assumed by urban economists suggesting far reaching effects for land use.

## ■ Counties in Small Urban Areas

- Micropolitan areas growth is associated with sprawl in outer counties, but not statistically significant small MAs
- Similar sized distance penalty as the rural sample.
- Population growth in a small MA county at the mean distance from all of the higher urban tiers is associated with 8% less population growth over the 1990s than an otherwise equal county immediately adjacent to an urban center of at least 1.5 million.
  - No evidence of growth shadow effects
  - Thus, small urban areas experience some sprawl, whereas proximity to larger cities can exacerbate this process.

## ■ Large Metropolitan Counties

- **positive coefficient reflects suburban sprawl (distance from center of its own urban area)**
- own initial population density positive and significant
- no incremental distance effects
- **Only very large MAs appear to cast a growth shadow that reduces population growth of other urban areas.**
  - *This effect is reflected in incremental population variable coefficient that is not shown.*
  - *Yet, the effect is “weak.”*

# Robustness

- replace 2003 MA boundaries with 1999 boundaries; fast-growing counties moved to non-MA model; produces steeper urban-center gradient for non-MAs
- divide MA sample at 500k pop; less severe distance penalty in “small” sample and more in “large” sample (not shown)
- Distance relationships not related to job growth of nearest urban centers;
  - Proximity that matters, not so much whether nearest higher-tiered city is growing.
    - [use the urban center’s industry mix growth rate as the instrument]
- Using 1990-2006 population growth does not alter the results, or patterns are continuing into this decade.

# Conclusions

- Growth for a city or rural area is influenced by multiple agglomeration sources over the entire 360° spectrum. Not localized to area conditions or zoning.
- Effects of agglomeration economies extend much farther than usually imagined.
- Being closer to a large urban center may produce a growth shadow for areas, reducing sprawl and land use pressures. But these forces are weak.
- Planners should consider these broader forces in zoning and infrastructure placement.

# Distance Penalty

