



DEPARTMENT OF
AGRICULTURAL, ENVIRONMENTAL,
AND DEVELOPMENT ECONOMICS
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U.S. Migration Patterns and Scenarios Under Climate Change

Towards Scenarios of U.S. Demographic Change
U.S. Global Change Research Program Workshop

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Presented by: Mark Partridge

The Ohio State University

Partridge.27@osu.edu

Outline

- **Goal is to provide climate change scenarios for approximately the next 75 years.**
 - **75 years is arbitrary, 'long time' may be better.**
- Introduction of basic trends in U.S. migration.
 - Strong persistence
- Then I am going to back cast to 1939 to ask what a similar group would want to know to predict migration through today.
 - Show humility is called for and the persistence could change.
- Then I will present scenarios for climate change for the next 75 years.
- Summary/Conclusions

Introduction

- Migration changes can completely undo policy changes.
 - 7 million moved across county borders between 12-13 (US Census Bureau, 2014)
- The story of migration patterns for the last 100 years or so is persistence—e.g., fast growing places tend to remain fast growing & vice versa (Borts and Stein, 1964).
- Even the housing boom/bust and the Great Recession did not change these patterns as they have recently *reasserted* themselves.
- The biggest driver of this persistence appears to be natural amenities (climate, landscape, nice places).
 - Rappaport (2007) shows that migration to nice climate appears to have begun in the 1920s.
- This can be seen in the following tables and maps.



Table 1: Correlation of Percent Change

P Corr % 1950-2000 and 2000-2013	0.718
P Corr % 1950-2000 and 2012-2013	0.311
P Corr % 2000-2012 and 2012-2013	0.622
P Corr % 2000-2007 and 2012-2013	0.470
P Corr % 2005-2006 and 2012-2013	0.389

Source: U.S. Census Bureau Population Estimates Program



Table 2: Correlation of Rank

P Corr # 1950-2000 and 2000-2013	0.899
P Corr # 1950-2000 and 2012-2013	0.918
P Corr # 2000-2012 and 2012-2013	0.981
P Corr # 2000-2007 and 2012-2013	0.954
P Corr # 2005-2006 and 2012-2013	0.801

Source: U.S. Census Bureau Population Estimates Program

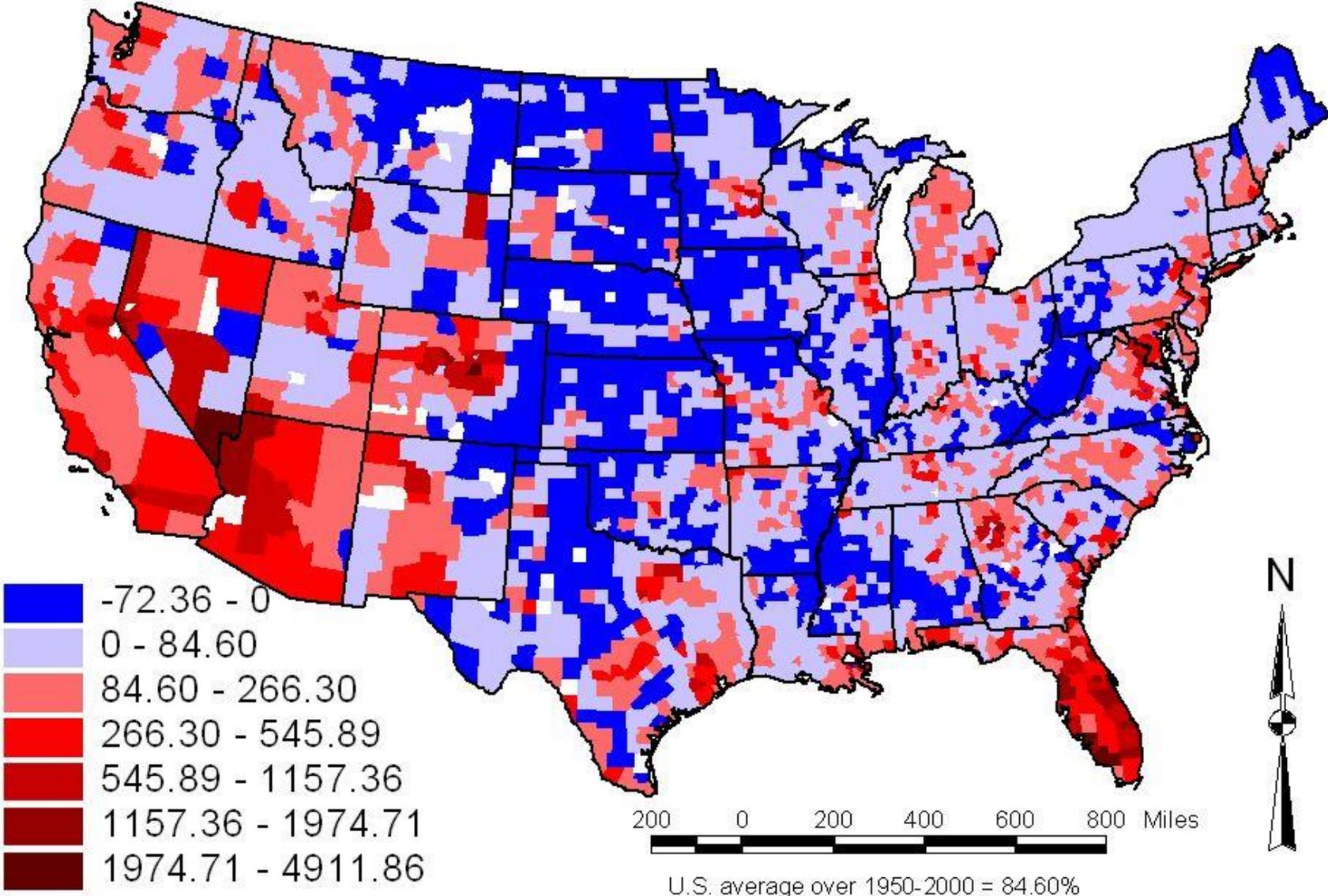


Table 3: Spearman Correlation of Rank

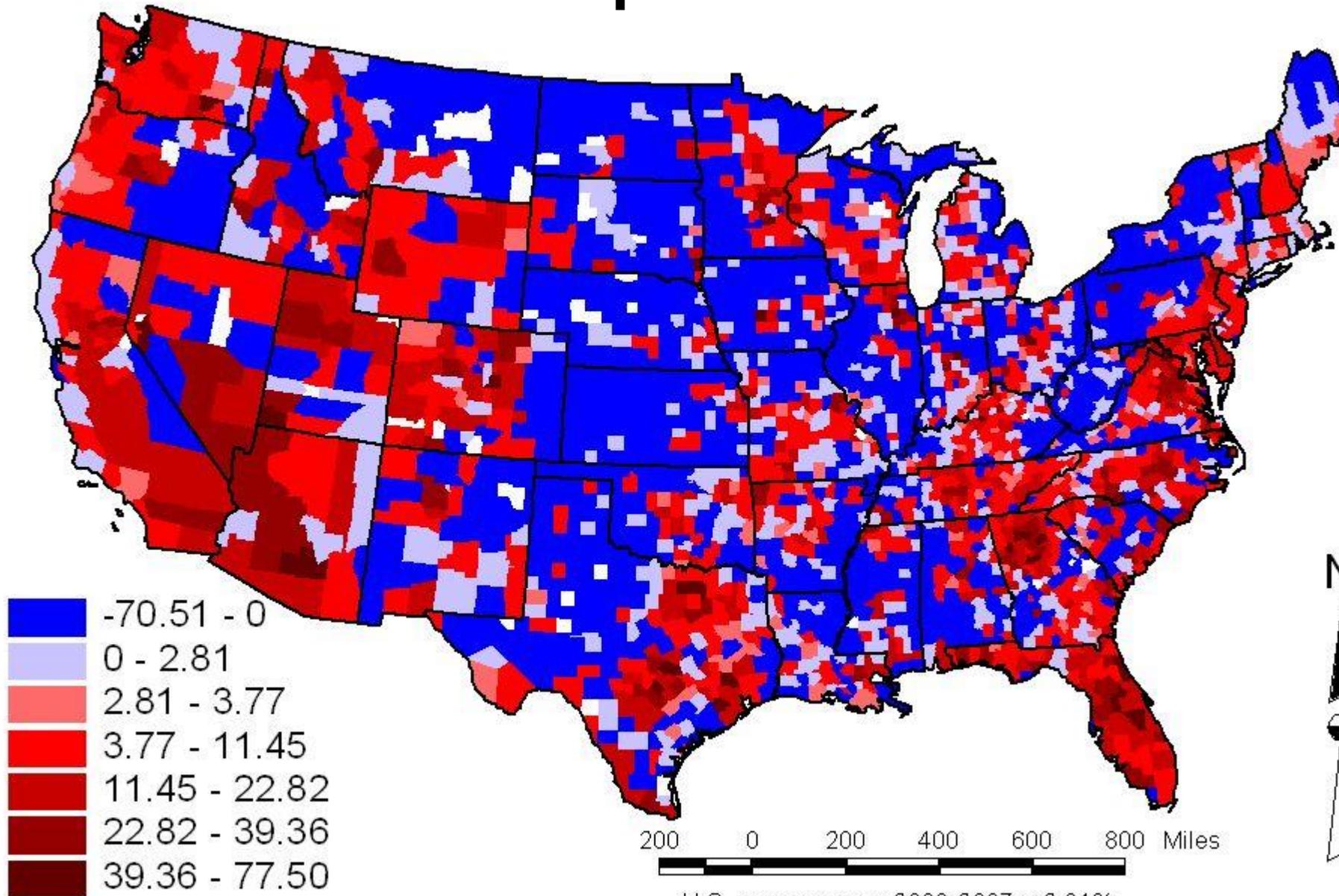
S Corr # 1950-2000 and 2000-2013	0.825
S Corr # 1950-2000 and 2012-2013	0.793
S Corr # 2000-2012 and 2012-2013	0.866
S Corr # 2000-2007 and 2012-2013	0.780
S Corr # 2005-2006 and 2012-2013	0.686

Source: U.S. Census Bureau Population Estimates Program

1950-2000 Population Growth

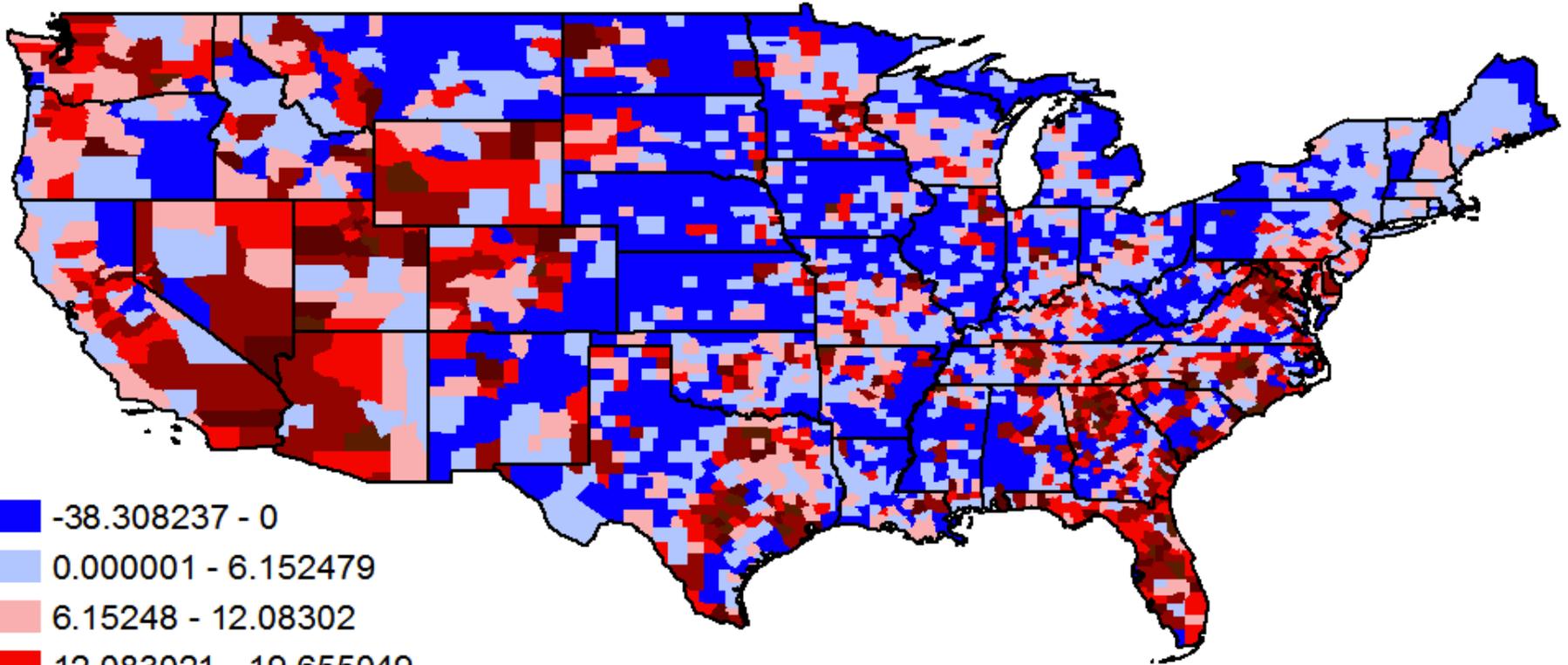


2000-2007 Population Growth





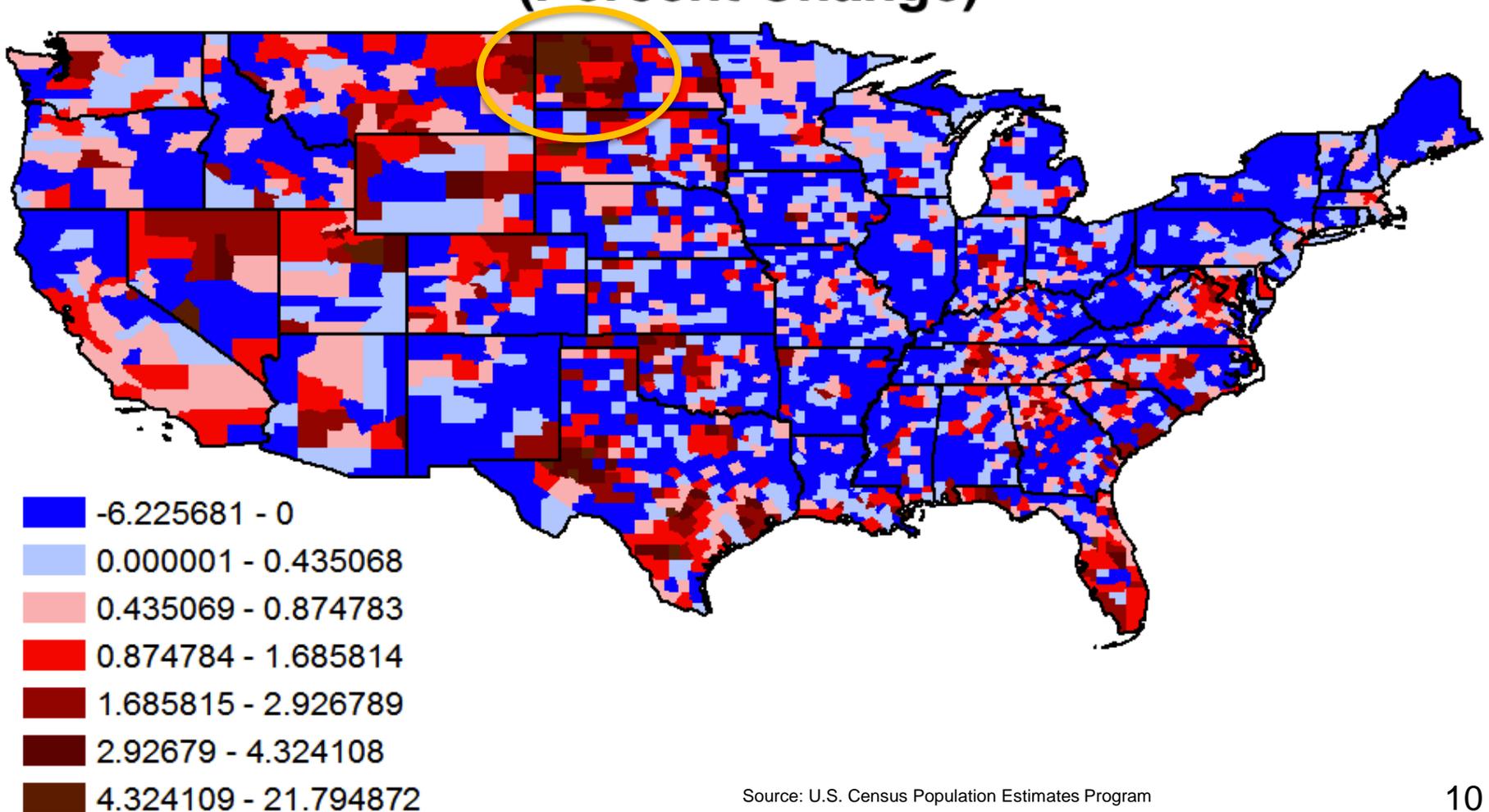
2000-2012 Population Growth (Percent Change)



Source: U.S. Census Population Estimates Program

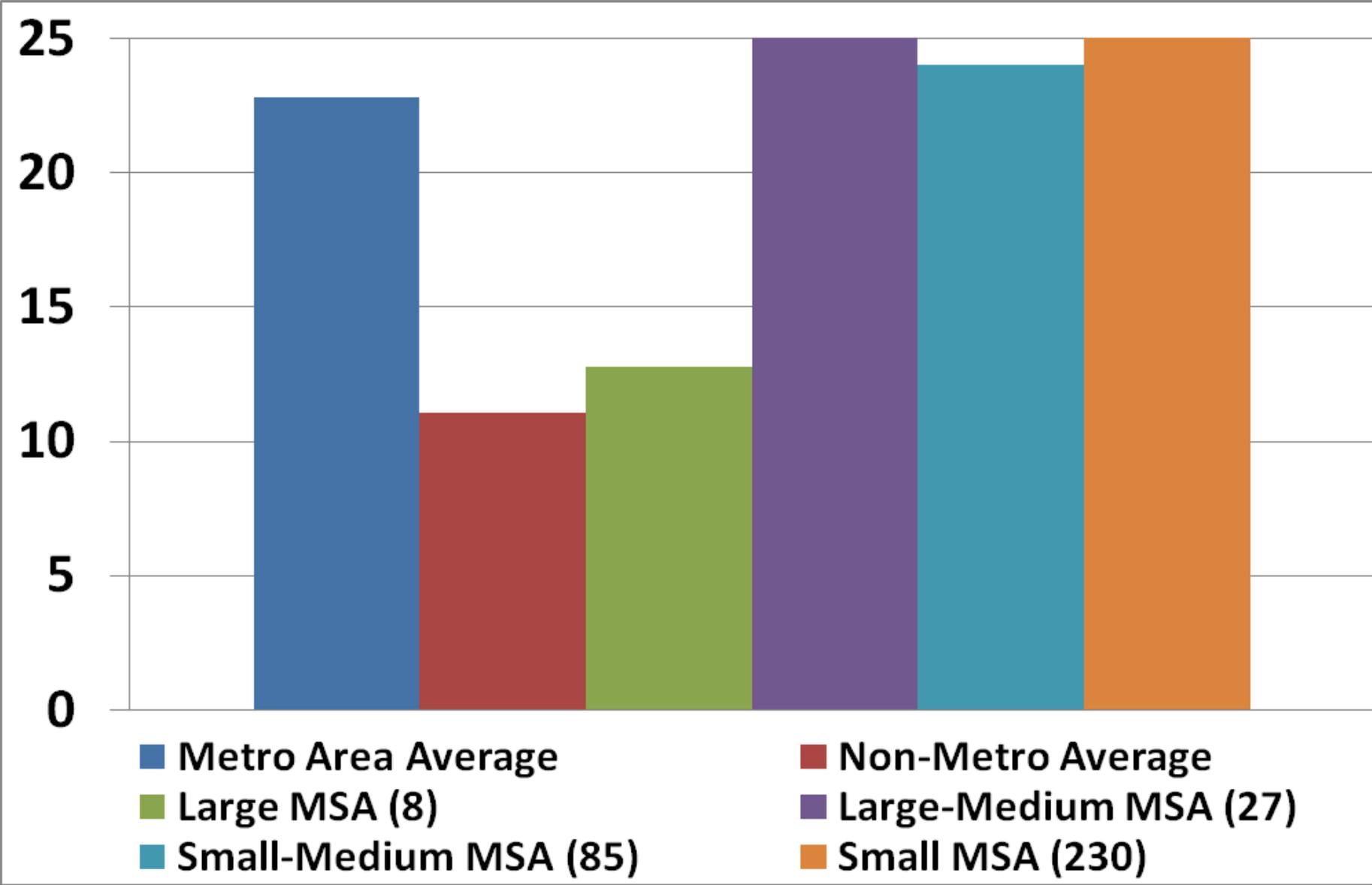


2012-2013 Population Growth (Percent Change)



Source: U.S. Census Population Estimates Program

1990-2007 Growth By Metro Area Size in 1969 (%)



Large MSA is > 3 million population in 1969. There are 8 MSAs in this category: New York, Los Angeles, Chicago, Philadelphia, Detroit, Boston, San Francisco and Washington DC. The Large-Medium MSA have a 1969 population of 1 million - 3 million (27 MSAs). The Small-Medium Metro Areas are 250,000 - 1 million 1969 population (85 MSAs). Small MSAs have a 1969 population of 50,000 - 250,000 (230 MSAs).

Table 2: Difference in population growth over 1950-2000

Variables\Samples	Non-metro	Small metro	Large metro
Mean pop growth % (std. dev.)	32.20 (122.93)	122.47 (271.64)	138.00 (257.38)
Jan temp (diff Detroit – Orlando)	-135.58	-768.63	-731.88
July temp (diff Detroit – Orlando)	94.87	323.93	255.89
July humidity (diff Detroit – Orlando)	57.61	215.23	162.94
Sunshine hours (diff Detroit–Orlando)	7.69	-257.88	-248.06
Percent water area (1 std. dev.)	11.03	0.53	-3.04
Great Lakes (within 50 kms)	-45.19	37.25	52.44
Atlantic Ocean (within 50 kms)	56.09	205.85	133.31
Pacific Ocean (within 50 kms)	-28.28	-162.18	-177.55
Typography (most mtn. to coast plain)	26.1	24.6	22.29
Amenity rank (diff between Detroit (3) and Orlando (5) on a 1-7 amenity scale)	-69.74	-153.05	-143.11

Source: The results in Partridge et al., 2008b.

Note: **Boldface** indicates significant at 10% level. The difference between Detroit and Orlando uses their actual values. “1 std dev.” represents a one-standard deviation change in the variable. The models were re-estimated with USDA ERS amenity rank replacing all 9 individual climate/amenity variables to calculate the amenity rank effects (available online at ERS). The amenity scale is 1=lowest; 7=highest.

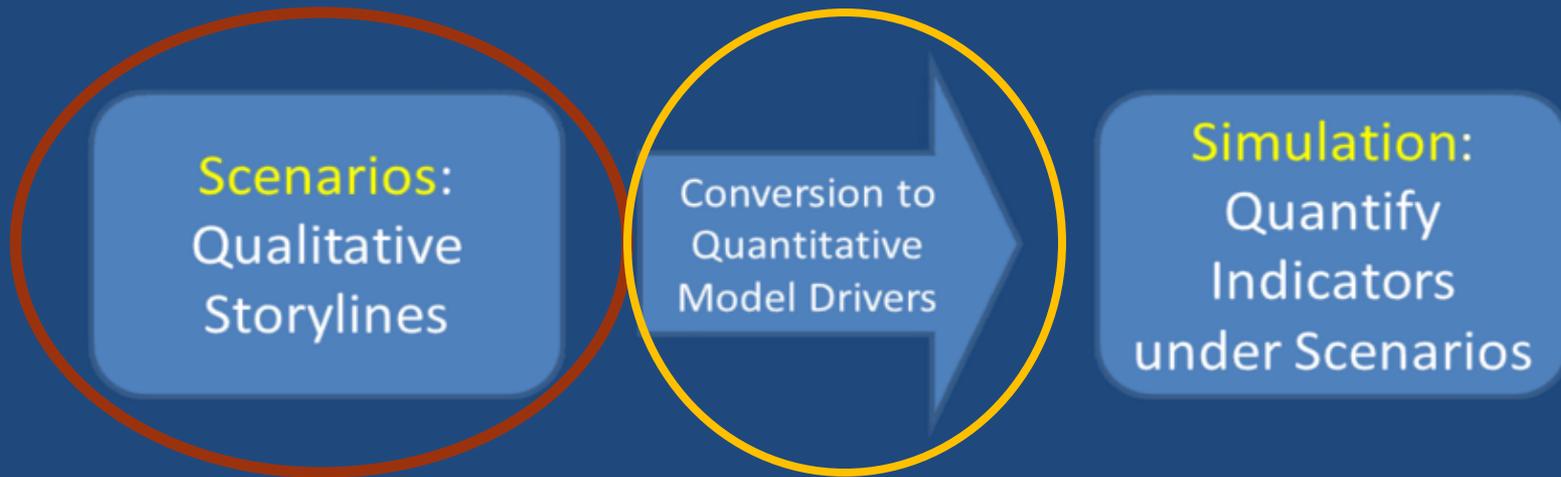
Backcast to 1939 to understand these trends.

- Climate was a clear factor in driving U.S. migration trends for 1939-2014. Climate change should also alter migration in the future.
- Yet, scholars of the late 1930s would have thought “people follow jobs” not so much “jobs follow people”.
 - Among economists, it was not really until the work of Phil Graves in the 1970s that this migration pattern was understood (Partridge, 2010).
 - Spatial equilibrium model.

Backcast to 1939 to Understand these trends.

- Scholars of the late 1930s and early 1940s would have been greatly wrong. They would not have understood:
 - innovations in public health and air conditioning (most important).
 - Would not understood congestion effects that close off growth in cities.
 - structural change in manufacturing that helped trigger the decline of the manufacturing belt.
 - rise of information technologies that thrived on the West Coast.
 - “Pro-business” policies in the South after WWII.
 - How rising incomes would allow people to increasingly trade better-quality-of-life for lower wages.

Models in Context of Land-Use Scenarios



- Based on “Story and Simulation” approach (Alcamo 2008)
- Models are used to simulate.
- Challenges:
 - Not all drivers are necessarily quantifiable.
 - Models will require drivers and inputs not specified in the storyline.

Taken from: Brown, Dan. “USGCRP Pre-Workshop Webinar on Findings from the NRC Report on Advancing Land Change Modeling. June 9, 2014

Migration scenarios for climate change in the 21st Century

- **How close are we to spatial equilibrium?** If so, migration patterns could look very different in the future because other factors will be important.
- **Differing migration propensities.** In the last 25 years, gross migration flows have greatly declined. Partridge et al. (2012) report that “economic” migration in response to economic shocks has fallen.
- **Differing migration responses to storms and draughts.** We know (current) migration responses to cold and hot temperatures, humidity, sunshine, landscape, etc. **Know virtually nothing about the effects of storms and droughts and variability in general.**
 - **Is it simply cooler summers and more water would reverse Sunbelt migration from (say) the Great Lakes states?**
 - What are the scenarios for these weather events?

Migration scenarios for climate change in the 21st Century

- **Differing scenarios for public funding of mitigation and adaptation infrastructure and services.**
 - For example, will enhanced sea walls and new roads be primarily paid by the federal government, state, or local governments?
 - Will it be the federal government subsidizing people's decision to live in the most impacted locations, which will increase the expense of mitigation and adaptation (moral hazard)?
 - My opinion is that one of the best things for policy guidance that could come out of migration modeling is that the public finance options could potentially have strong impacts on the overall costs and migration distribution.

Migration scenarios for climate change in the 21st Century

- **Scenarios for changes to landscape, lakes, forest cover.**
 - McGranahan (2007, p. 234) finds:
 - If typical rural Iowa county was 50% forest, 25% cropland vs actual 5% forest, 75% cropland, it would had 7% more net-migration in the 1990s vs 1% on avg. (*cet. par.*)
 - If it had 7% water area (like Sawyer County WI) vs actual 2% water area, it would have had 1% more net in-migration.
- **Scenarios for heterogeneity in regional responses.**
 - Partridge et al. (2008a) found heterogeneity in different regions. For one, while warm winters are a big draw for most of the country, the far upper Midwest seems to benefit from cold weather and winter activities.

Migration scenarios for climate change in the 21st Century

- **Scenarios on land-use regulations that can limit in-migration to preferred areas.**
 - Glaeser and Gyourko (2005) show the importance of zoning to migration patterns as (for example) looser zoning in parts of the Sunbelt facilitated its net in-migration.
 - Intersection of land-use groups and migration and their joint determination.

Conclusion

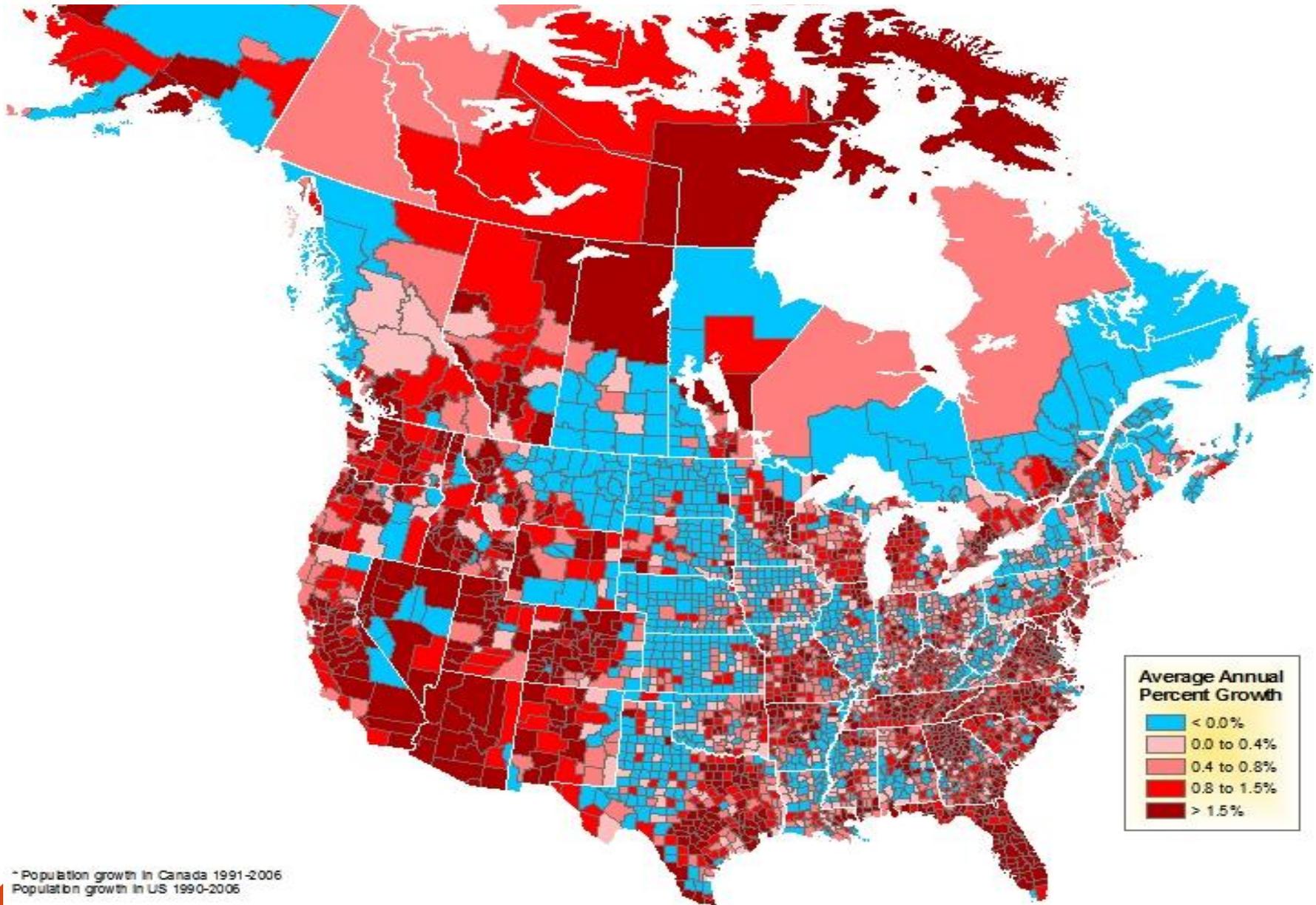
- It will be tough to break the persist migration of most of the 20th Century and early 21st Century.
- Back casting to 1939 for migration modelling revealed how challenging it is to predict how innovations will affect subsequent migration.
 - Yet, the past 75 years reveal that climate and landscape were the most important factors.
- Future modelling should consider scenarios including migration propensity; responsiveness to climate including storms and droughts; public finance of associated gov't efforts; heterogeneity in responses; and land use rules and regulations.

Thank You!

References

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1990/91-2006 North American Population Growth



* Population growth in Canada 1991-2006
Population growth in US 1990-2006

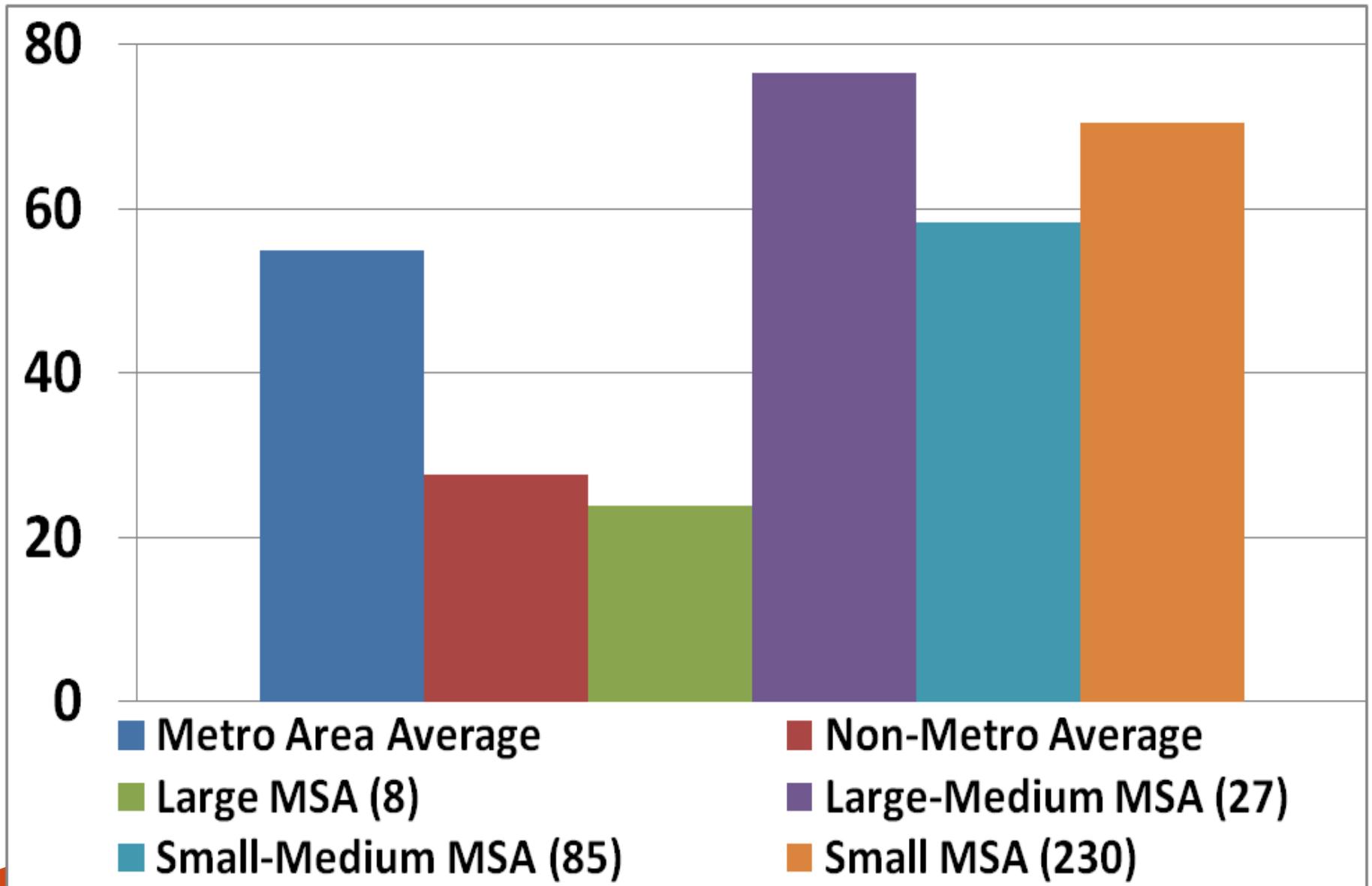
Source: Canada Rural Economy Research Lab, 1991 & 2006 Census, Statistics Canada; 1990 Census, U.S. Census Bureau; 2006 U.S. Census Bureau estimates.

Notes: The map shows 1990-2006 average annual percent growth for US counties.

The 1991-2006 percent population change for Canadian census divisions use Statistics Canada data and are based on 1996 consistent boundaries.

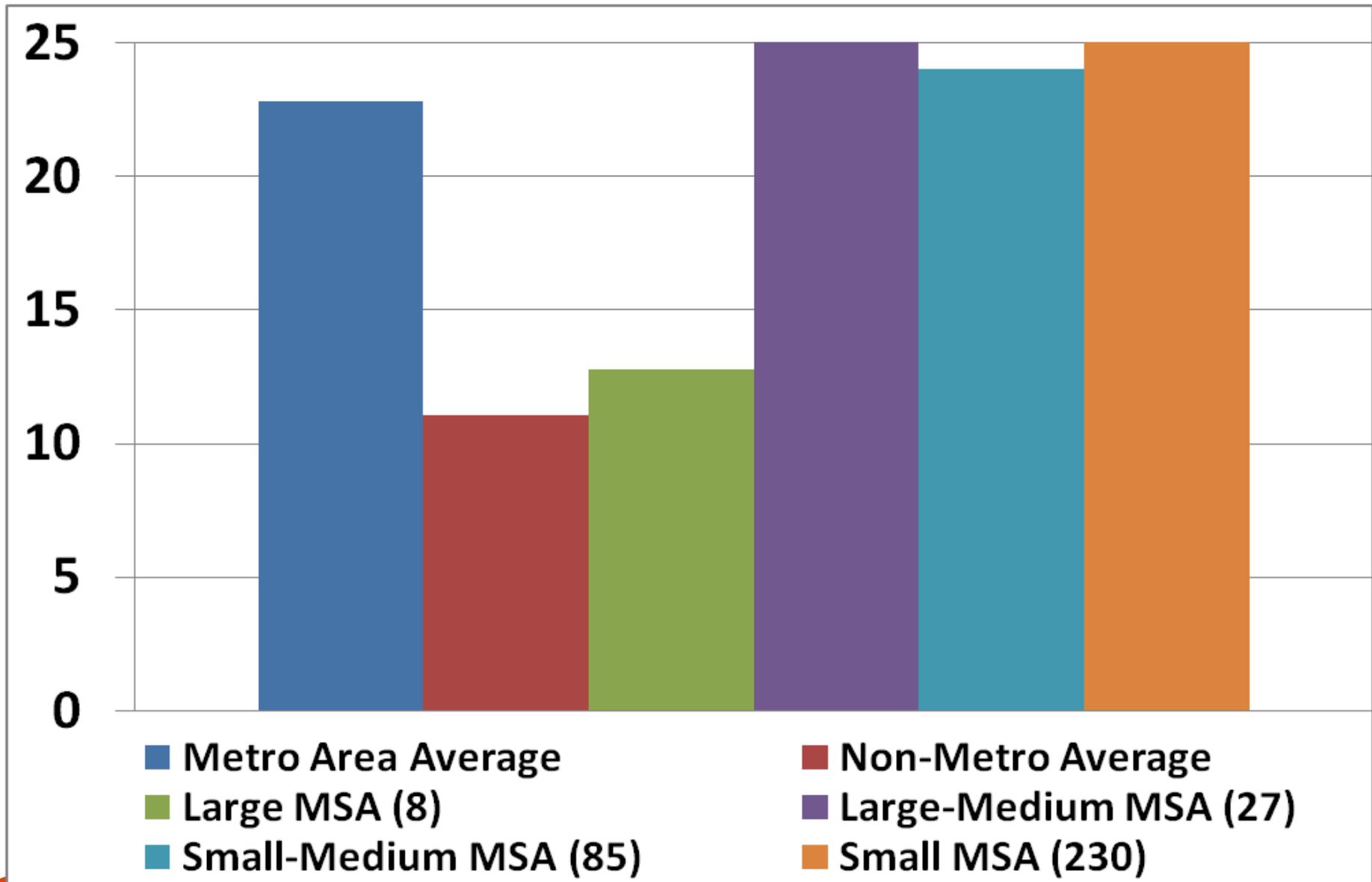
Broomfield County, CO (08014) is comprised of the counties of Adams (08001), Boulder (08013), Jefferson (08059) and Weld (08123). Source: <http://www.census.gov/geo/www/tiger/ty/chng.html#1990>

1969-2007 Growth By Metro Area Size in 1969 (%)



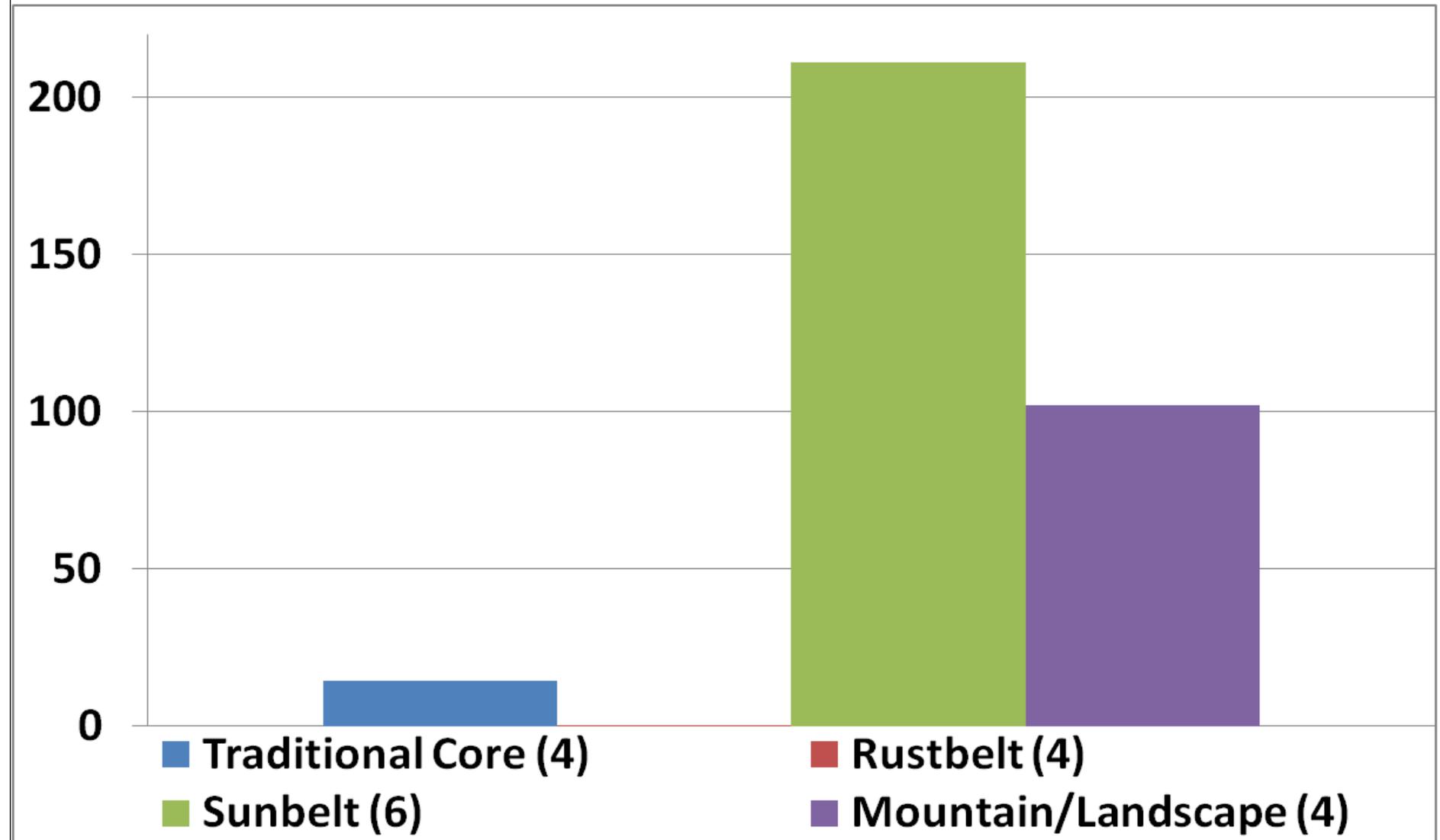
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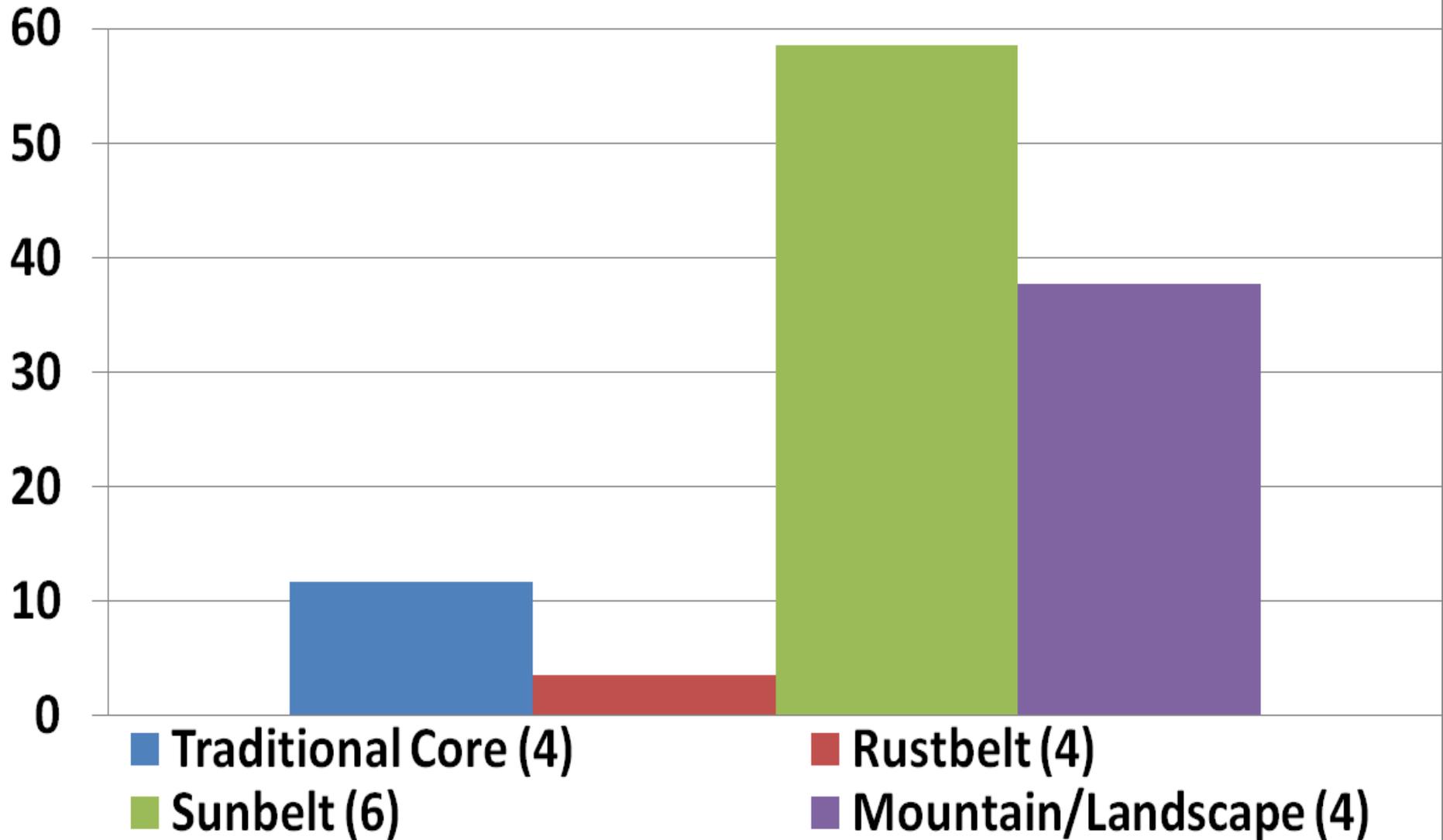
1969-2007 Growth For Representative Metro Type (%)



The Traditional Core includes New York, Boston, Philadelphia and Chicago. The Rustbelt includes Detroit, Cleveland, Pittsburgh and St Louis. Sunbelt includes Miami, Atlanta, Phoenix, Tampa, Orlando and Las Vegas. Mountain/Landscape includes Seattle, Denver, Portland, and Salt Lake.

1990-2007 Growth For Representative Metro Type

(%)



The Traditional Core includes New York, Boston, Philadelphia and Chicago. The Rustbelt includes Detroit, Cleveland, Pittsburgh and St Louis. Sunbelt includes Miami, Atlanta, Phoenix, Tampa, Orlando and Las Vegas. Mountain/Landscape includes Seattle, Denver, Portland, and Salt Lake.