The Value of Rural and Urban Public Infrastructure

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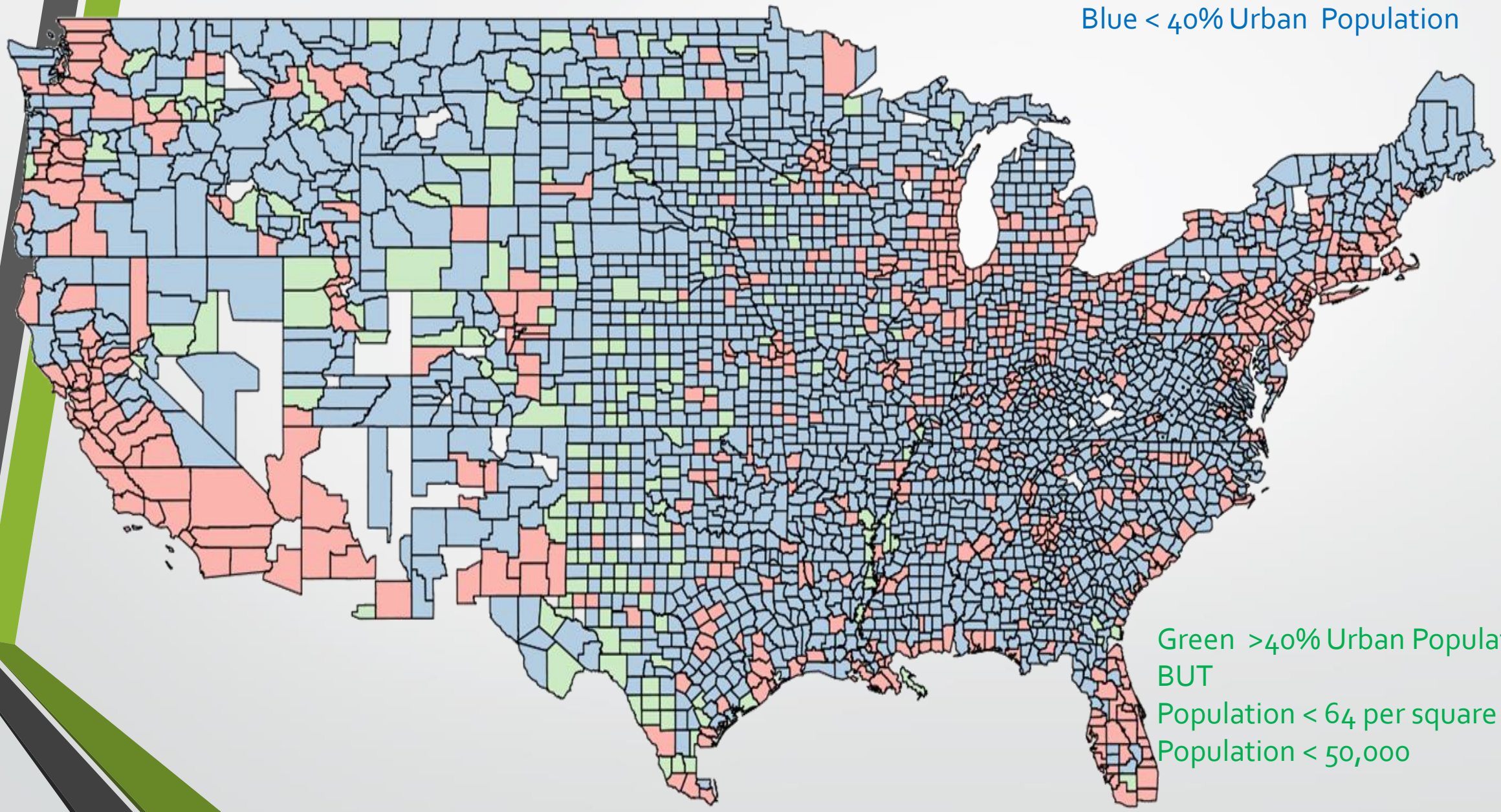
Disclaimer: The views expressed in this paper are the authors' and should not be interpreted as IBOs

What is the value of infrastructure?

- How do investments impact population, incomes, housing, land values?
- What is the return on investment in all its forms?
  - Productivity (3 Kinds): Agricultural, other tradables, non-tradables
  - Quality of Life: non-market, does not show up as income
- Who benefits from these improvements? Landowners? Residents?
- How do results in rural areas differ from urban areas?

Urban/Rural Classification of Counties



Red >40% Urban Population

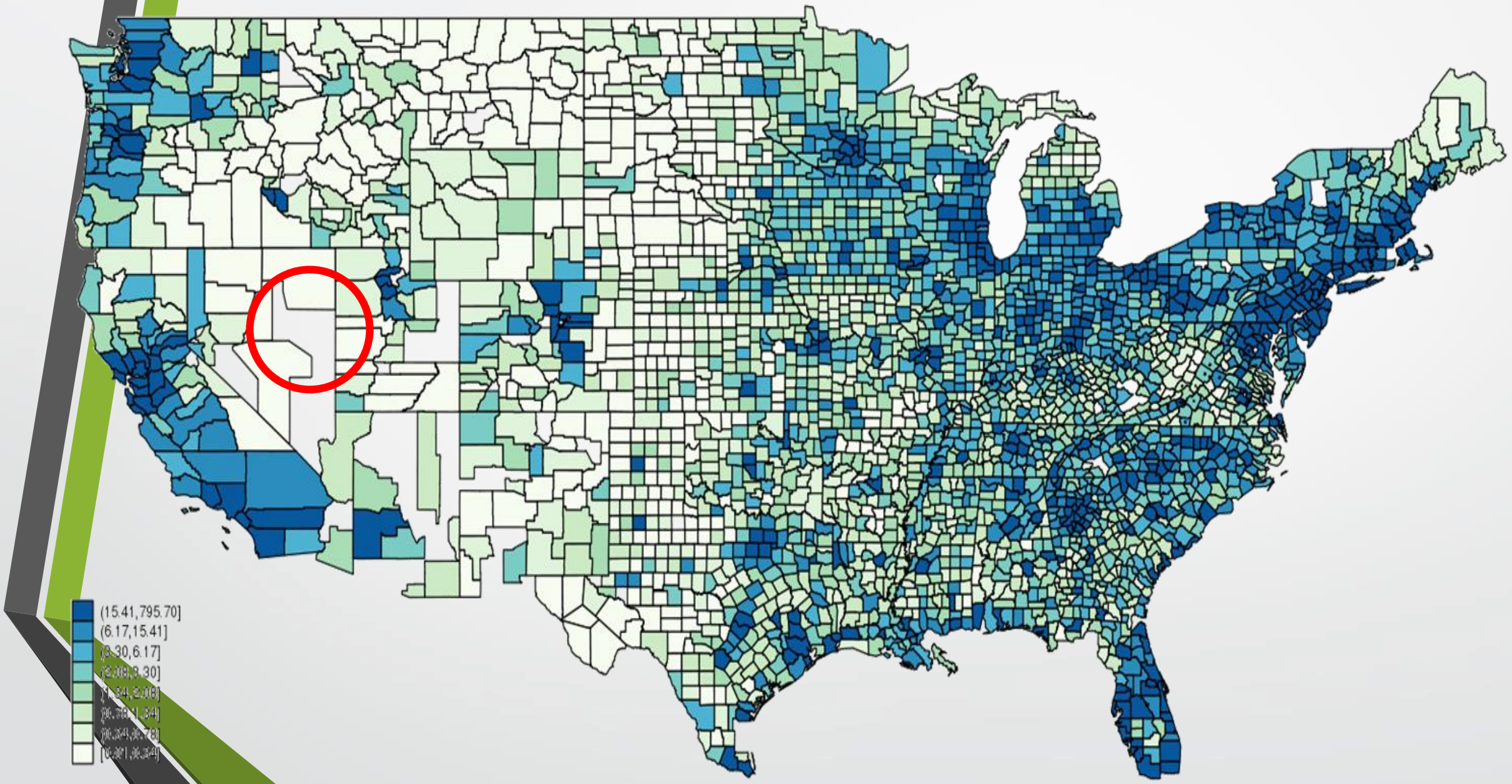
Blue < 40% Urban Population

Green >40% Urban Population
BUT
Population < 64 per square mile
Population < 50,000

Measuring Public Infrastructure Stocks from Public Investment Flows

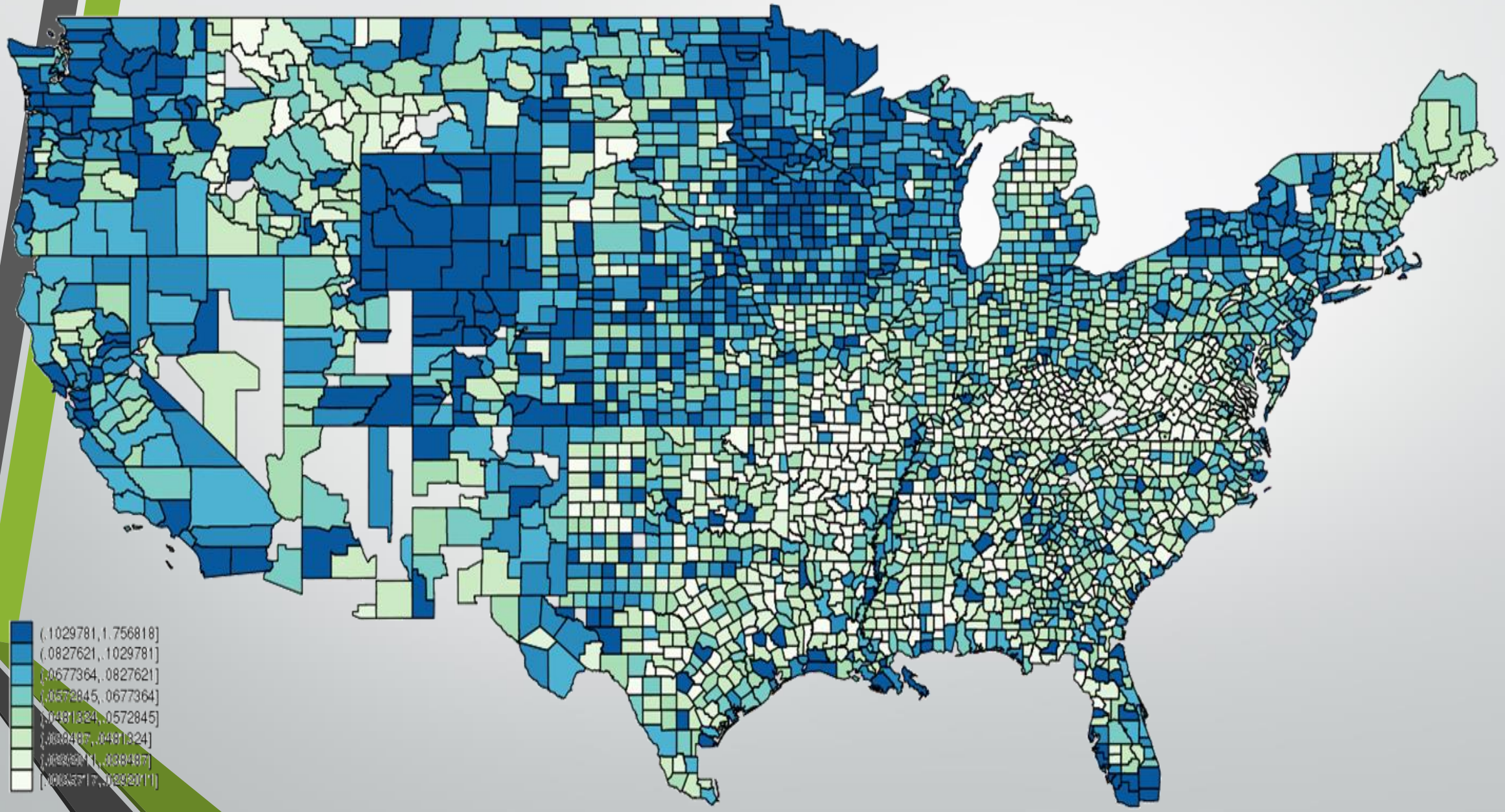
- County Area Finance (Census) data from 1957 to 2012 in 5-year frequency
  - 1972 to 2012 data are complete
  - 1957 to 1962 county-level data missing details
    - Must impute more detailed infrastructure categories
    - Based on share of category in later years
- 1902 to 1956 state-level data: Impute county-level based on 1957 to 1977 shares
- Interpolate (in logs) capital outlays for intra-censal years
- Aggregate with perpetual inventory method
  - 1.82 % depreciation for construction
  - 11.0 % depreciation for rest (needs work)

Infrastructure per Square Mile in 2012

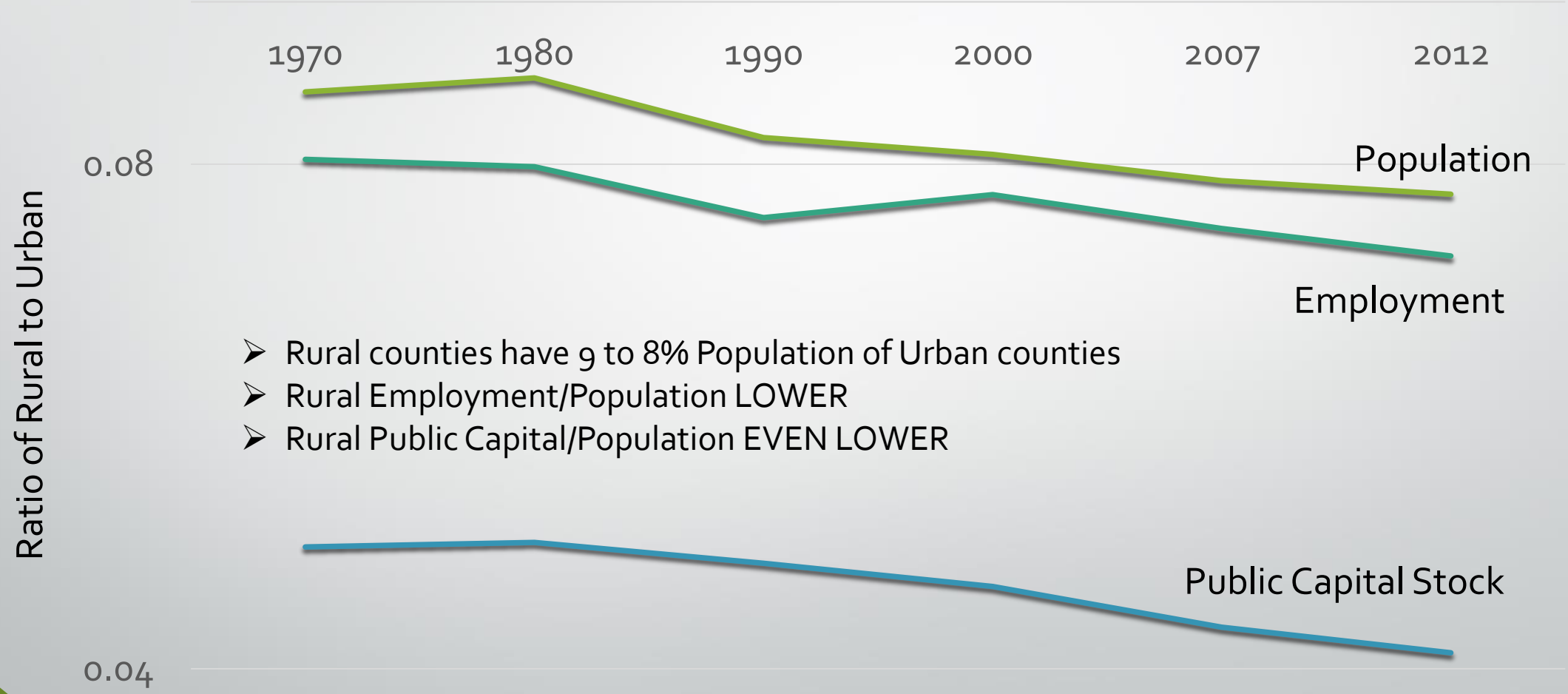



WYOMING
NEBRASKA
IOWA
MICHIGAN
NEW YORK
MASS
RHODE ISLAND
CONN
NEVADA
Eureka
Alberta
Ely
Tonopah
Golden
Coor's Brewery
Adair
Omaha
Largest Ball of Stamps
Dexter
Marsalles
Glenwood RV Resort
Napoleon
Cleveland
Rock & Roll Hall of Fame
Linesville
Quackers
Port Jervis
PENNSYLVANIA
NEW JERSEY
Bishop
Minden
Fruita
Dinosaur Journey Museum
Idaho Spring
Clear Creek Caynon
CALIFORNIA
UTAH
COLORADO
KANSAS
ILLINOIS
INDIANA
W VIRGINIA
DELAWARE
MARYLAND
Lone Pine
Indian Wells Brewing Co.
Gus's Fresh Jerky
Los Angeles
Lancaster
ARIZONA
KENTUCKY
VIRGINIA
MISSOURI
N

Infrastructure per Capita in 2012

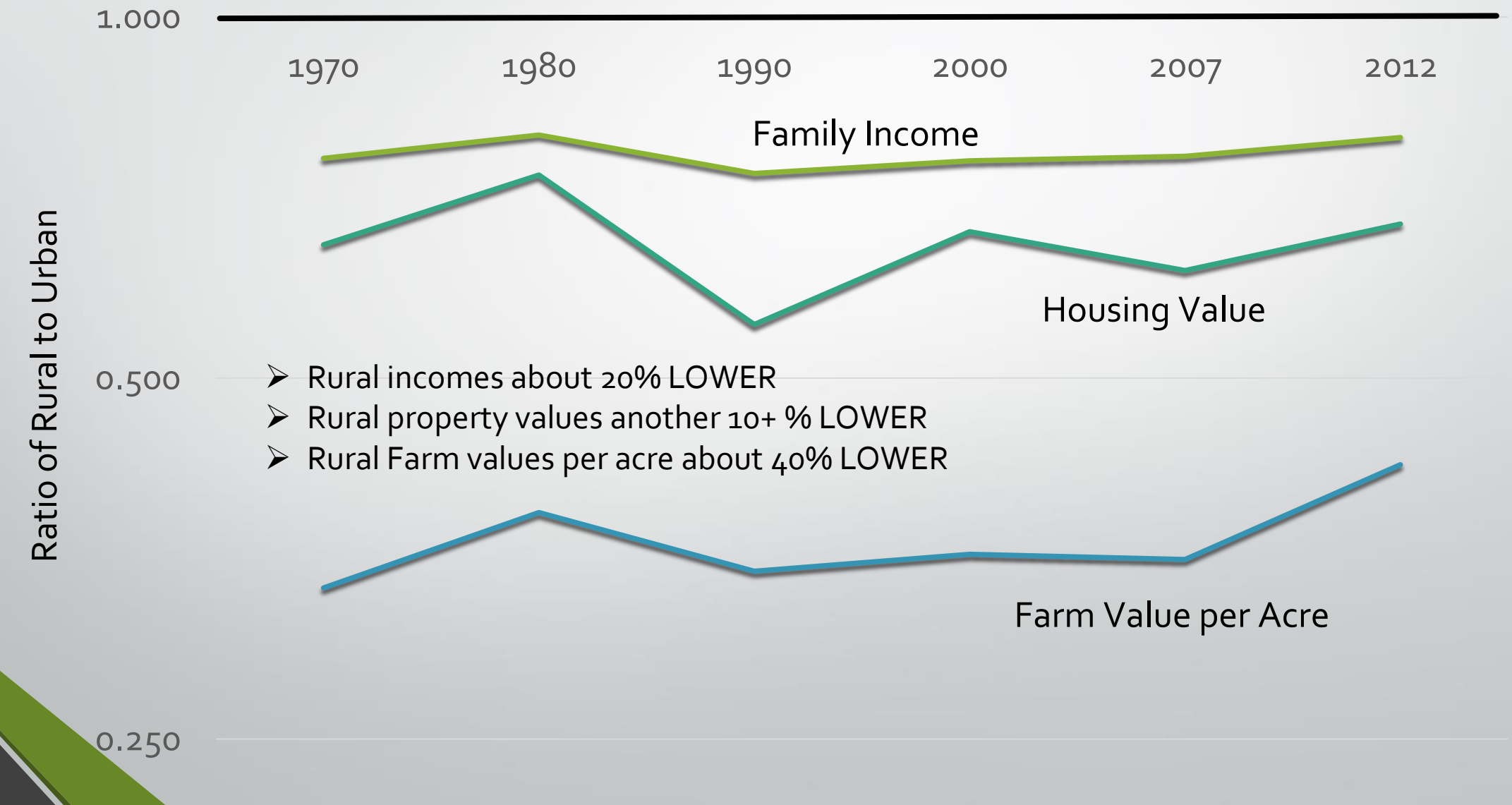


Population, Employment, and Public Capital Stock
Rural to Urban Ratios from 1970 to 2012



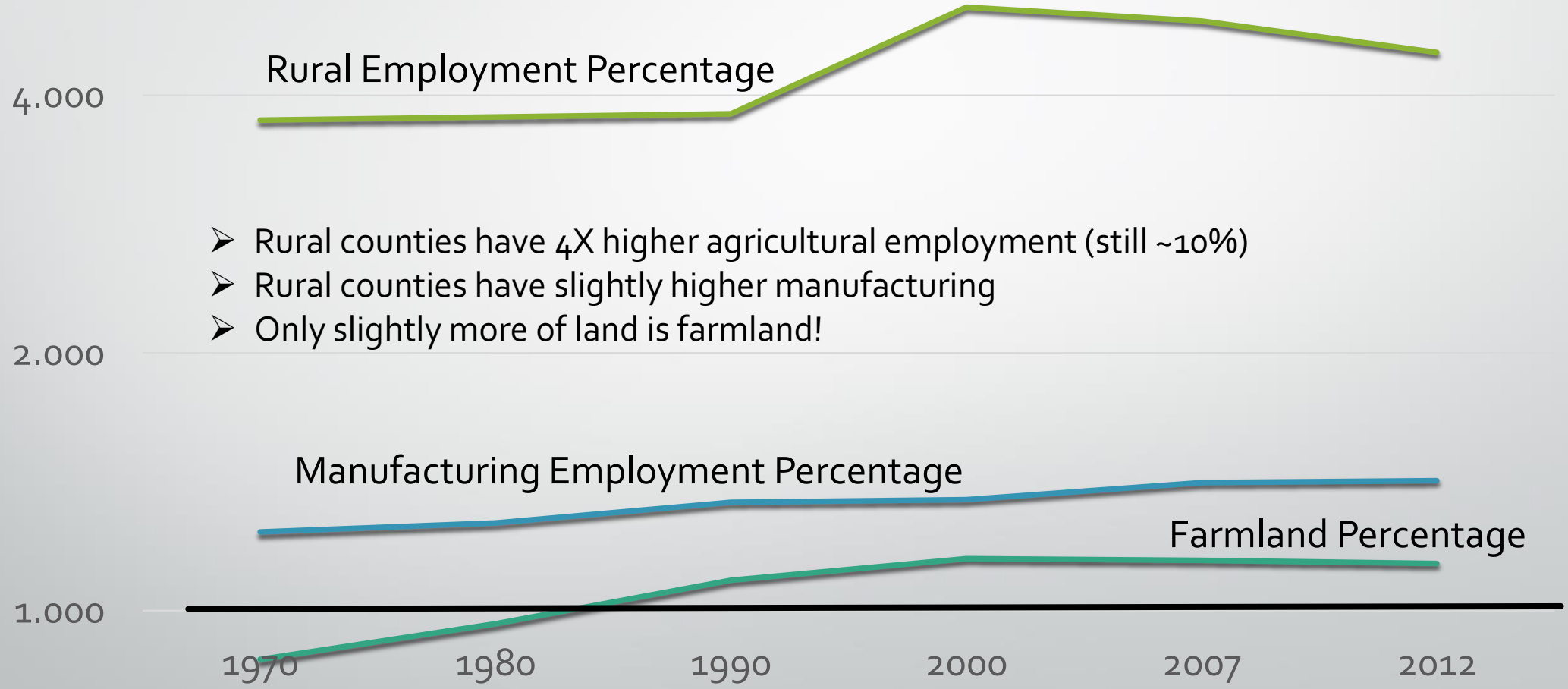
- Rural counties have 9 to 8% Population of Urban counties
- Rural Employment/Population LOWER
- Rural Public Capital/Population EVEN LOWER

Income, Housing Value, Agricultural Land Value Rural to Urban Ratios from 1970 to 2012



- Rural incomes about 20% LOWER
- Rural property values another 10+ % LOWER
- Rural Farm values per acre about 40% LOWER

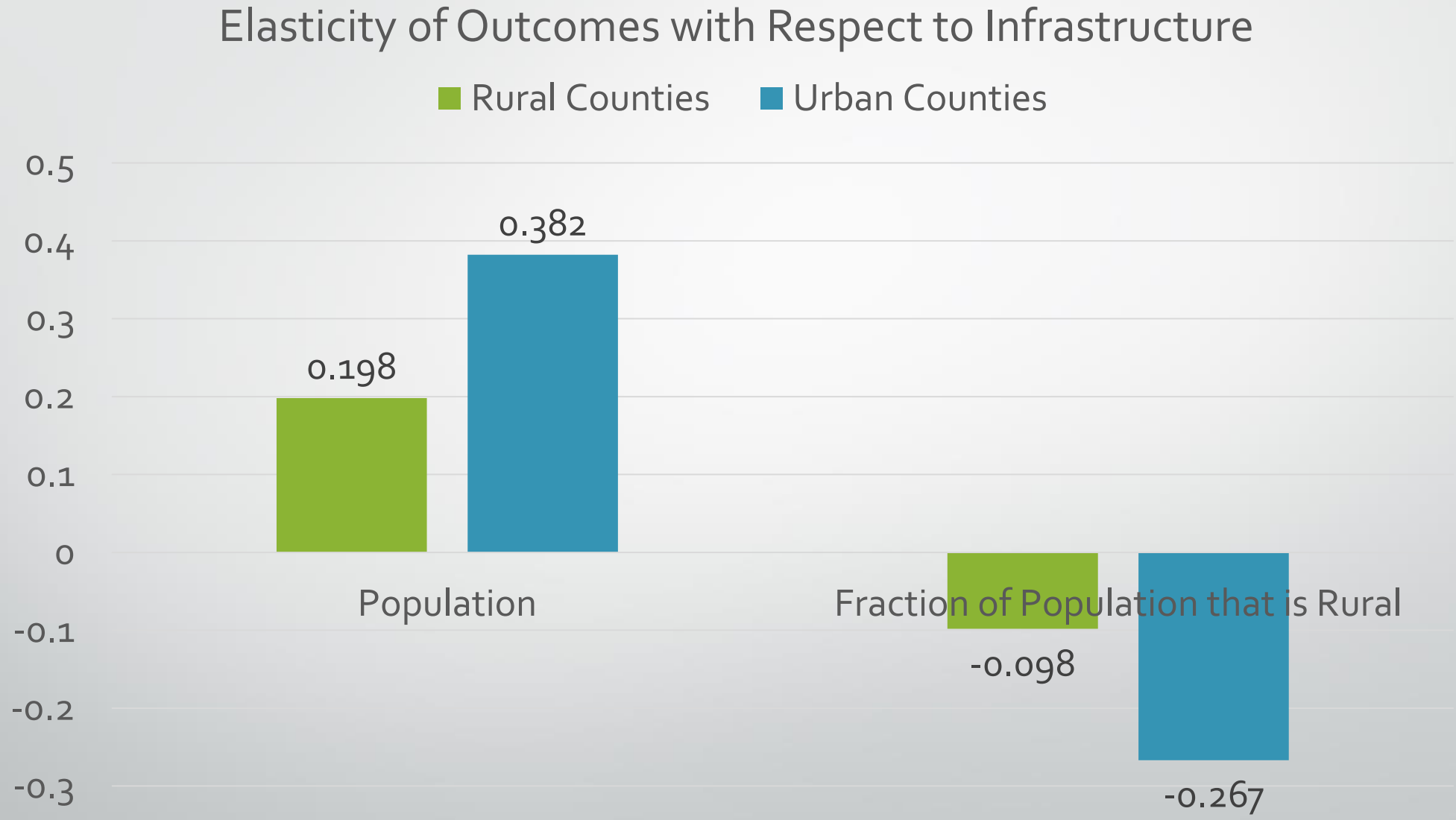
Employment and Farmland
Rural to Urban Ratios from 1970 to 2012

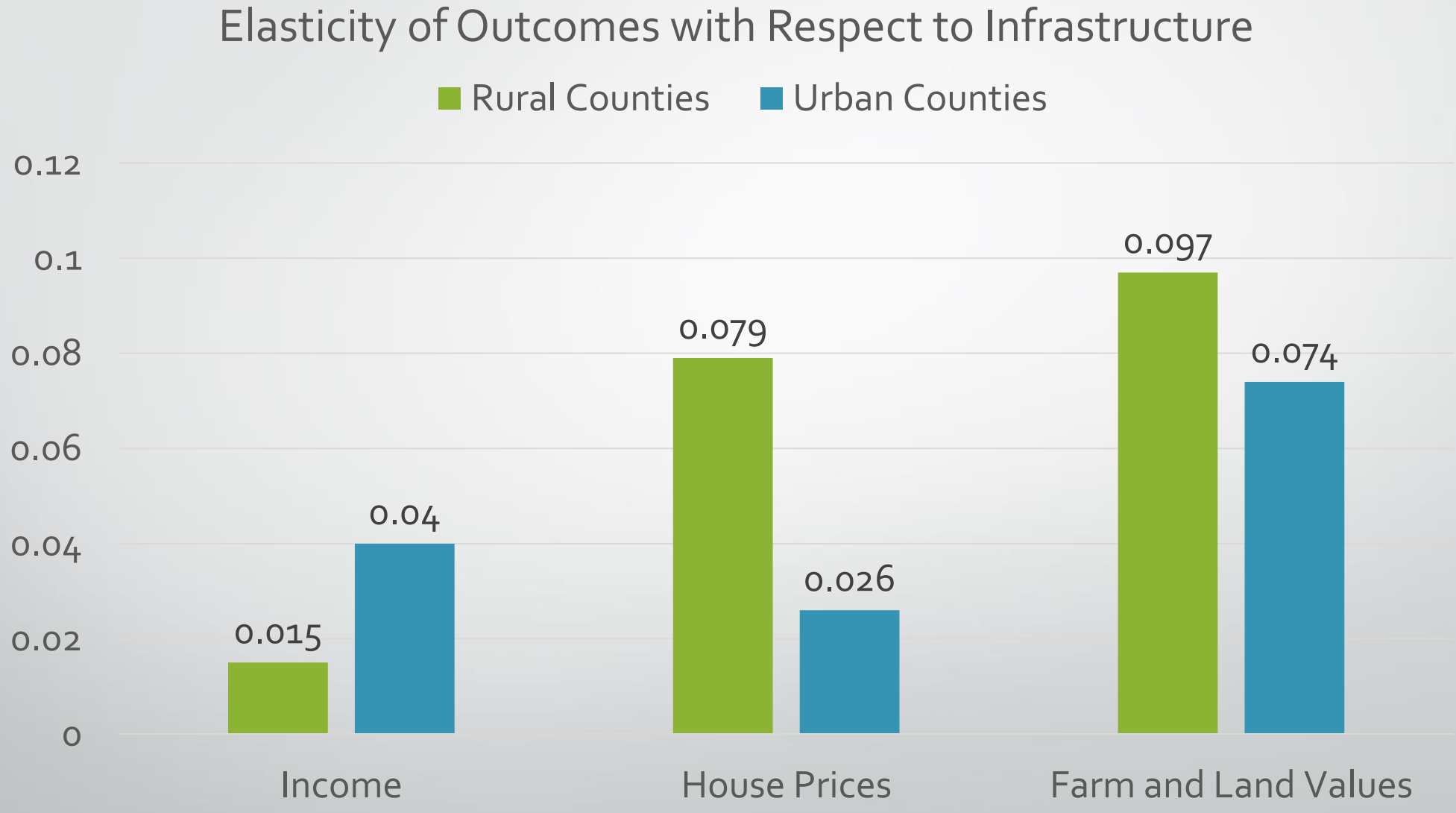


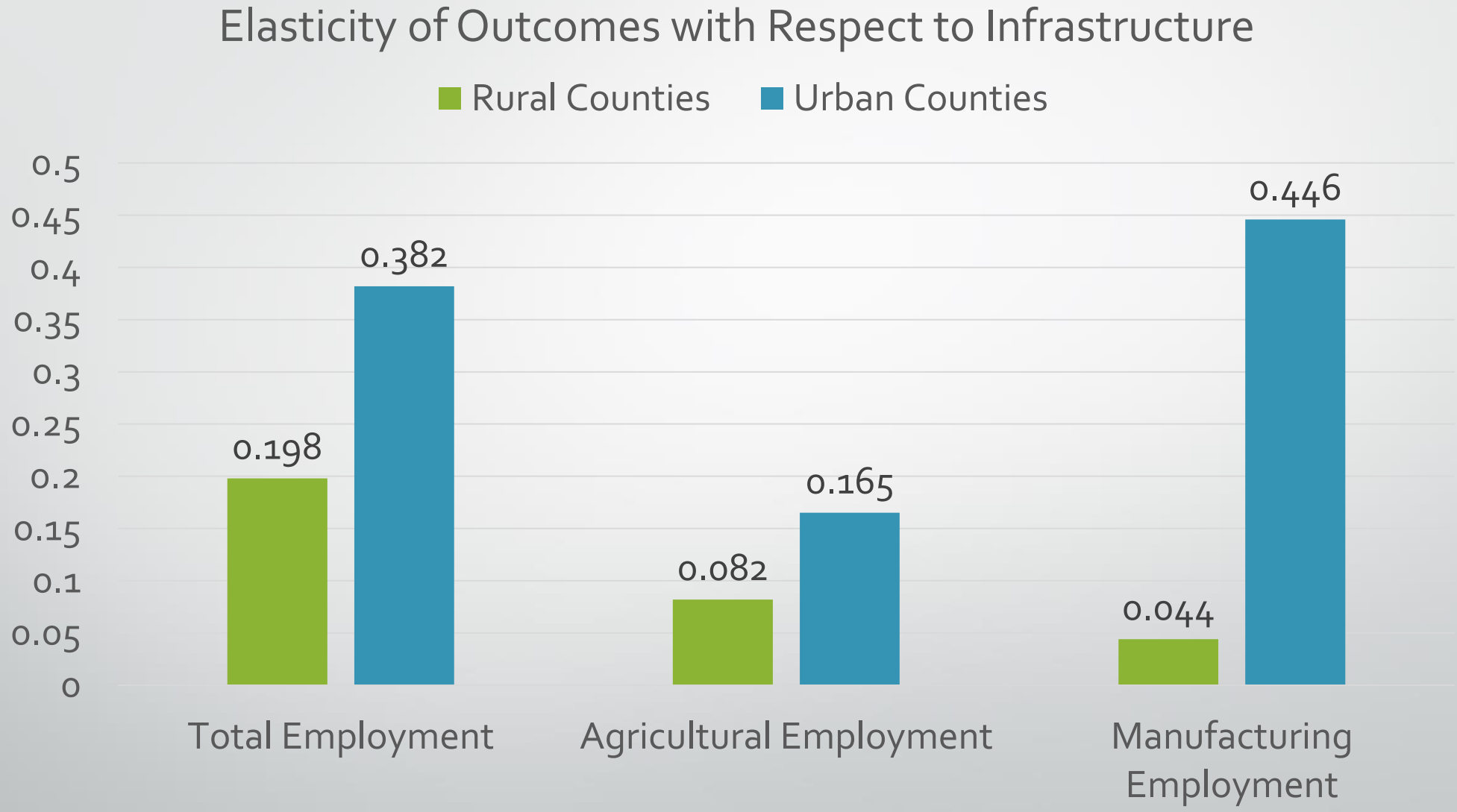
- Rural counties have 4X higher agricultural employment (still ~10%)
- Rural counties have slightly higher manufacturing
- Only slightly more of land is farmland!

Empirical Estimates of the Elasticity of Outcomes to Infrastructure for Counties

- Panel regression over 3,000+ counties in lower 48
- 5 changes between 1970, 1980, 1990, 2000, 2007, 2012
- Controls for permanent county differences
- Time-varying controls
  - Demographics age, race, and education levels
  - Local and state tax rates and state infrastructure
- Standard errors to account for spatial correlations (Conley 1999)
  - Not reported here


Elasticity of Outcomes with Respect to Infrastructure
Rural Counties
Urban Counties
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0.198
0.382
-0.098
-0.267
Population
Fraction of Population that is Rural


Elasticity of Outcomes with Respect to Infrastructure
Rural Counties
Urban Counties
0.12
0.1
0.08
0.06
0.04
0.02
0
0.015
0.04
0.079
0.026
0.097
0.074
Income
House Prices
Farm and Land Values


Elasticity of Outcomes with Respect to Infrastructure
Rural Counties
Urban Counties
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.198
0.382
0.082
0.165
0.044
0.446
Total Employment
Agricultural Employment
Manufacturing Employment

What do these changes tell us about local economies?

- Use a spatial model to translate estimates to deeper concepts
  - Assumes workers and firms are fairly mobile
- Productivity effects
  - Agricultural, e.g. farming
  - Traded (non-agricultural), e.g. manufacturing, technology services
  - Non-traded (e.g. housing): e.g. construction
- Quality of Life effects
  - Households bid up housing in places they like

Productivity in Traded Output (Non-Agricultural)

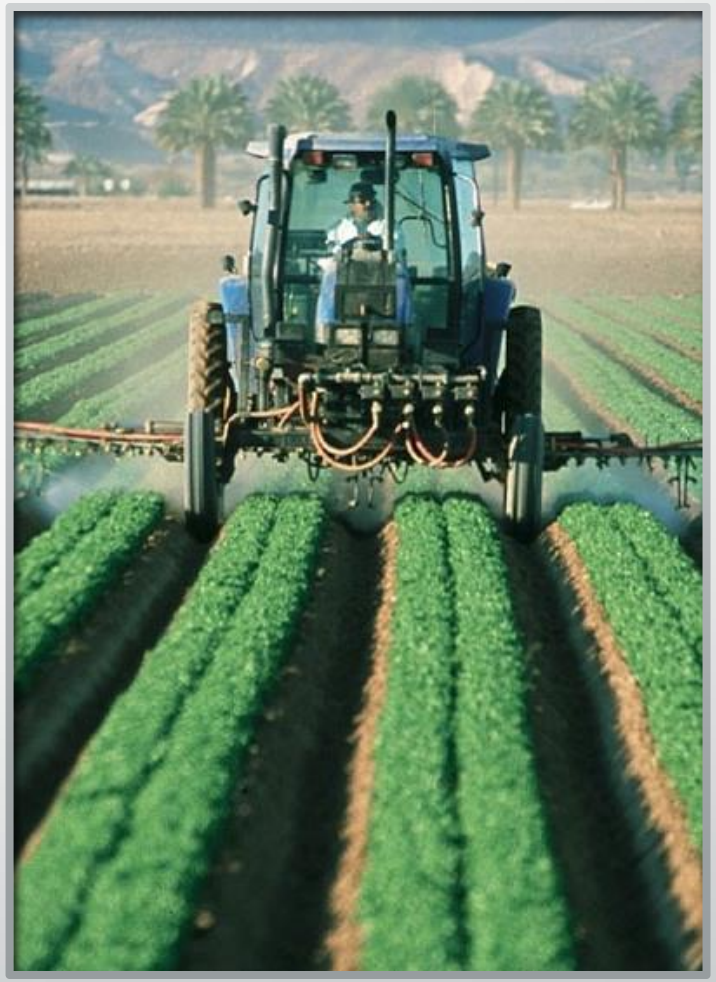
Higher income to labor (wages)

*also greater federal tax revenue

Productivity in Traded Output (Agricultural)

Higher income to labor (wages) and land (values)

*also greater federal tax revenue



Quality of Life (Direct Benefits)

Raises demand to live in an area

Housing prices rise relative to incomes

Current residents gain relative to newcomers

Productivity in Non-Traded ("Home") Output

Easier production and access market goods

Can lower housing prices

Population exceeds that predicted by quality of life and other productivity gains

Housing values lowered relative to land and construction costs

Financing source not always clear in the data

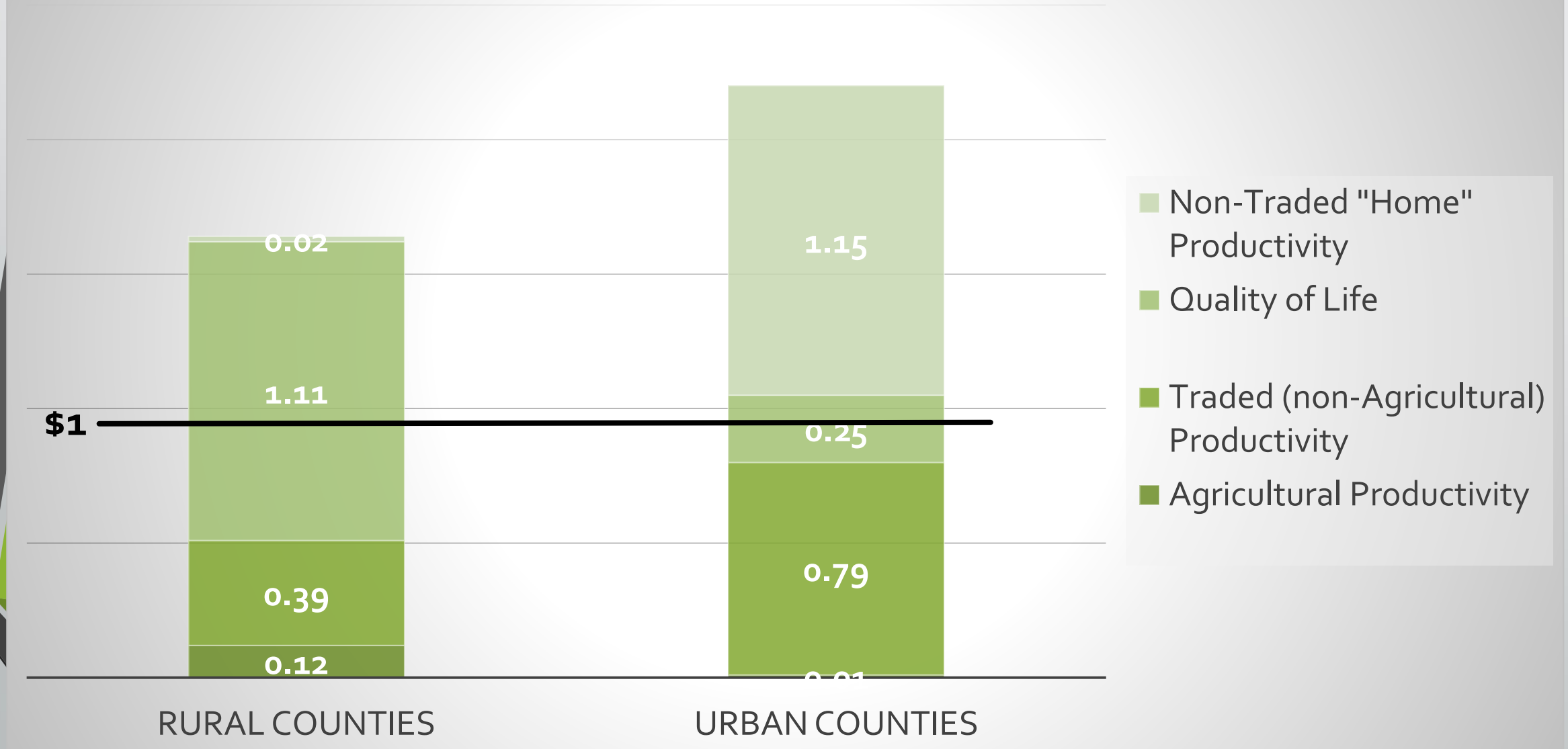
Cost-benefit analysis depends on whether funding was external or internal

- External: Gross benefits – need to exceed $1.00
- Internal: Net benefits – need to exceed $0.00

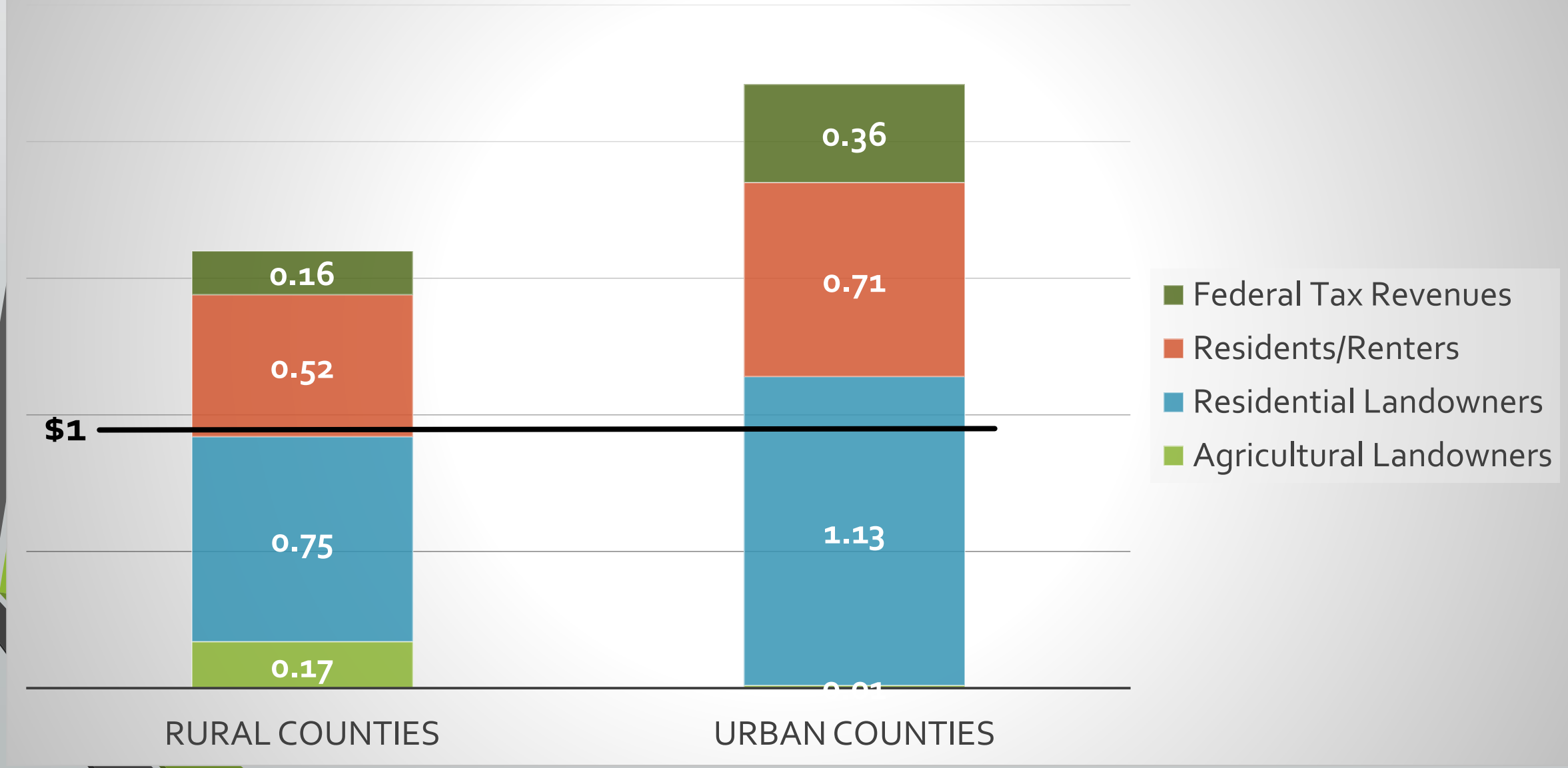
Who Benefits from those Investments?

- Land/Property owners
  - Residential (home-owners)
  - Agricultural
- Local Residents
  - Exclusive of ownership – as renters
- Federal Government/Revenues
  - Collect tax revenues from higher income
  - The public at large!

Form of Benefits of Public Capital per Dollar Invested



Distribution of Benefits of Public Capital per Dollar Invested



More refinements on their way

- Core vs non-core
  - Core slightly higher in urban counties
  - Non-core slightly higher in rural counties
- Spatial spillovers
  - Appear to be generally positive: urban areas usually get more
  - Need to see if urban or rural areas provide more
- More credible identification?

Conclusion

- Infrastructure investments seem to be a good deal!
  - On average exceed cost-benefit test
- Urban areas benefit slightly more
  - Despite having more infrastructure!
  - Rural areas get more quality-of-life benefits
  - Urban areas get more productivity beneifts