

Local Roads Spending and Sprawl: An Analysis of the Causal Relation in the Detroit Metropolitan Area

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Outline of the Presentation

Introduction and Background

Research Focus

Objectives

Conceptual Framework

The Case Study Area

Data and Methods

Results

Conclusions and Implications

Concerns about sprawl

- **Negative consequences of sprawl**

Natural resource sustainability

Spatial inequality

Fiscal distress

Health issues-obesity

Erosion of social capital

How is sprawl characterized?

Excessive land consumption

Low density in comparison with older centers

Lack of public spaces and community centers

Fragmented open space, wide gaps between development and a scattered appearance

Separation of uses into distinct areas

Repetitive one story development

Commercial buildings surrounded by acres of parking

Lack of choice in ways to travel

Lack of choice in housing types and prices

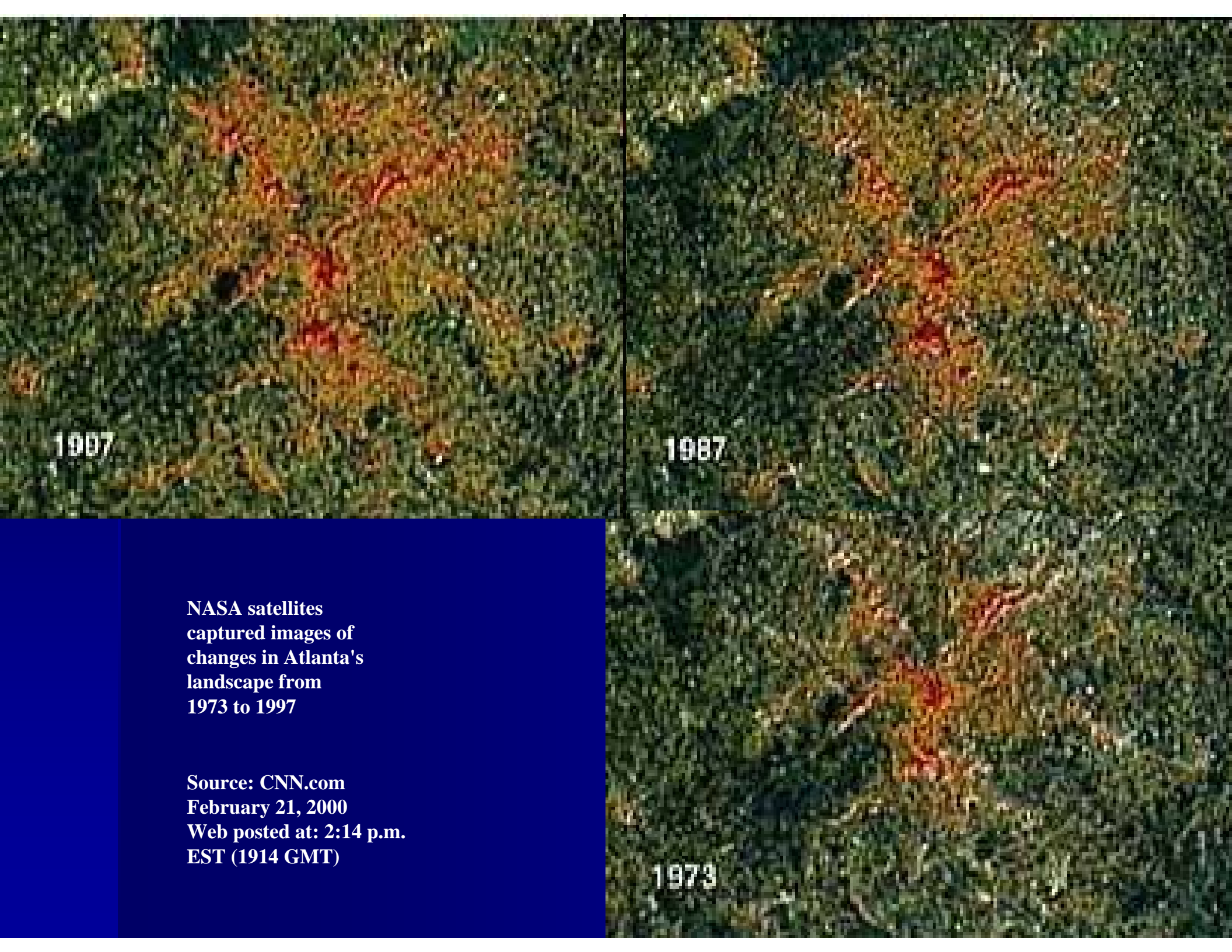
Low density, dispersed, auto-dependent, leap frog development outside of compact urban village centers

(i.e. Vermont Forum on Sprawl, <http://www.vtsprawl.org>)

Population growth in communities outside of a central city

Suburbanization

Deconcentration



1987

1987

1973

**NASA satellites
captured images of
changes in Atlanta's
landscape from
1973 to 1997**

**Source: CNN.com
February 21, 2000
Web posted at: 2:14 p.m.
EST (1914 GMT)**



Causes of sprawl

- **“Push” and “Pull” factors (Squires 2002, Koles and Muench 2002, Johnson 2001, Mieszkowski and Mills 1993)**

Crime rate

Traffic and congestion

Environmental quality

Population density

Quality of public goods (schools, roads infrastructure etc.)

Housing options

Jobs

- **Other identified factors**

Natural/geographic factors (Burchfield et al., 2005)

Preference for homogeneous communities (Massey and Denton, 1993, Carruthers 2002)

Increasing income and family life cycle (Bayoh et al. 2006)



Causes of Sprawl

- **Government spending on highways**

Highway increased urban-suburban and rural spatial interactions (Black 2003)

Highways increased the accessibility of amenities in communities outside of a central and highly urbanized areas (Garreau 1992, Squires 2002)

Highway spending shaped local population dynamics and metropolitan growth outcomes (Downs 1999; Garrison et al. 1959)

Research Focus

A photograph of a paved road with a yellow curb leading to a grassy area and a line of trees. The road is in the foreground, curving to the right. The grass is green and yellow, and the trees are a mix of evergreen and deciduous. The sky is blue and clear.

The role of local roads spending on sprawl

What is unique about local roads?

- **Choices and decisions on road investment at the local community level are motivated by social, economic, and political processes**

Local political leaders and constituents could invest State allocated funds on types of road projects that are either sprawl promoting or sprawl deterring

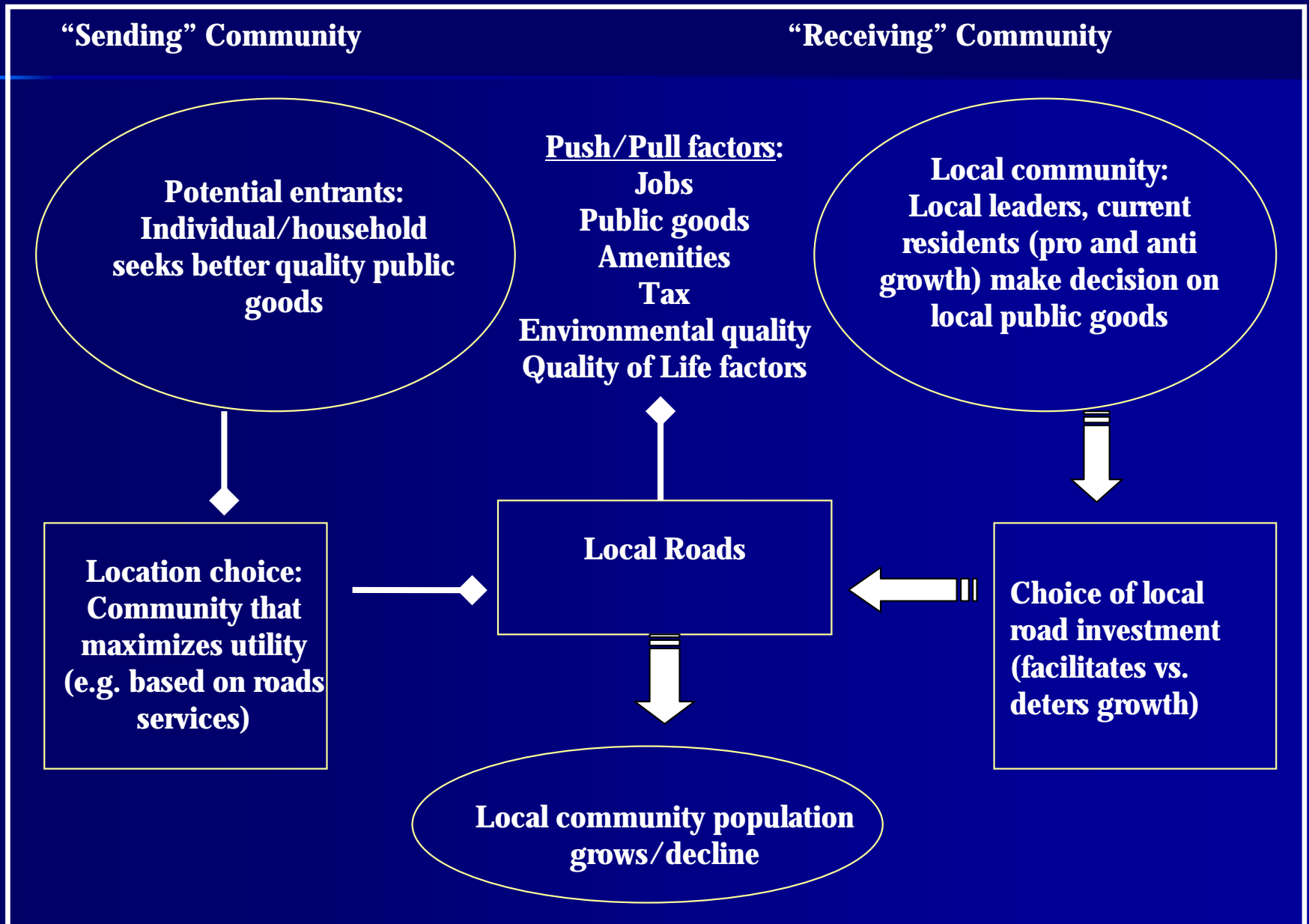
The strength of pro growth and anti growth advocates play a significant role in investment decisions

- **Therefore, the effects of local roads spending is complex, and decisions on local road investment is not as clear cut as highways investment**

Research Objectives

- **Determine the causal relationship between local roads spending and urban sprawl**
- **Develop a conceptual model of sprawl and test the model in the context of the Detroit Metropolitan area**

Conceptual Framework



Conceptual Framework

Theoretical Model (Potential entrants)

$$\text{Eq. (1)} \quad \text{Max} U(P, G, A, D, L) \text{ s.t. } Y$$

$$\text{Eq. (2)} \quad R = \text{Max} U_i \{P, G[r(V), A, D], L\} - \text{Max} U_o \{P, G[r(V)]\}, \\ A, D, L \text{ s.t. } Y$$

where; R stands for location decision, P for private goods, G public goods, A is amenity, D for demographic factors, L for distance between receiving i and sending o communities, r for roads services, V for total votes on either growth facilitating or deterring investment, and Y for budget constraint..

$R_i > 0$, move to a community

$R_o < 0$, stay

Hypotheses

H₀ Local roads spending does not affect community population growth (sprawl)

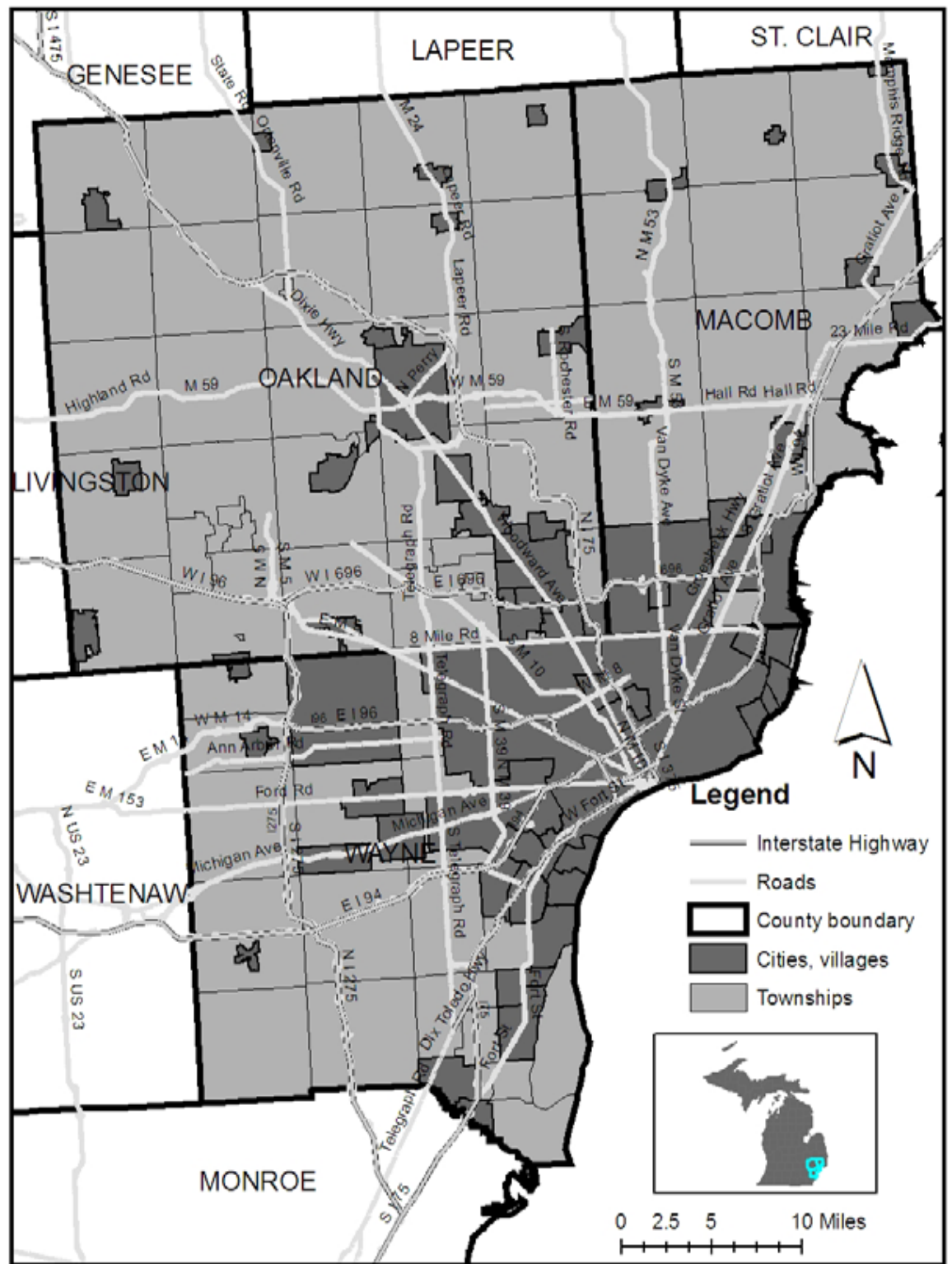
Alternatives:

H₁ Local roads spending facilitates community population growth (sprawl)

H₂ Local roads spending controls or deters community population growth



The Study Area



Why Detroit?

- **About half (4.8 M) of the state's population reside in Detroit 7 county or the Southeast Michigan region
about 4 million within the Detroit metro region (Tri county)**
- **Population and job decentralization
Less than 1 million people in the city of Detroit; 22% of jobs are within 10 miles of the city of Detroit**
- **Massive infrastructure investment and the need for understanding policy impacts**

22,500 miles of roadways (15,500 miles of local roads; 950 mi bike path)
- **Segregation and spatial inequality**

Data and Methods

- **Data**

Community population growth (A measure of sprawl)

Population Change 1992-2002 (Dye, 1980; Burchell, 2002 method)

Local roads spending- (Michigan Transportation Fund, Act 51 of 1951)

Social, economic, demographic data (US Bureau of the Census)

Local expenditures on other public goods - parks, sewer, police, library (Census of Governments, US Bureau of the Census)

Empirical Estimation

Empirical Model

Eq. (3)

$$\Delta POP_c = \beta_0 + \beta_1 VALUE_{c(t-1)} + \beta_2 HIGHWAYS_{c(t-1)} + \beta_3 MTF_{c(t-1)} + \beta_4 FIRE_{c(t-1)} + \beta_5 POLICE_{c(t-1)} + \beta_6 PARKS_{c(t-1)} + \beta_7 INCOME_{c(t-1)} + \beta_8 NONWHITE_{c(t-1)} + \beta_9 TAX_{c(t-1)} + \beta_{10} POPULATION_{1992} + DISTANCE_c + \varepsilon_c$$

Final Model- Accounts for spatial lag model

Eq. (4)

$$\Delta POP_c = \beta_0 + \rho(WPOP_c) + \beta_1 VALUE_{c(t-1)} + \beta_2 HIGHWAYS_{c(t-1)} + \beta_3 MTF_{c(t-1)} + \beta_4 FIRE_{c(t-1)} + \beta_5 POLICE_{c(t-1)} + \beta_6 PARKS_{c(t-1)} + \beta_7 INCOME_{c(t-1)} + \beta_8 NONWHITE_{c(t-1)} + \beta_9 TAX_{c(t-1)} + \beta_{10} POPULATION_{1992} + DISTANCE_c + \varepsilon_c$$

Empirical Results of Population Change Model

Variable	Coefficient	t-statistic
Intercept	-3341.95*	-1.78215
Population 1992	0.19	1.4
MTFP92	0.01*	1.88
VALUE	-0.002	-0.53
DISTANCE	103.36***	3.75
TAX	0.39***	4.35
FIRE	-0.74***	-3.32
HIGHWAY	-0.17	-0.83
PARKS	-0.16	-0.61
POLICE	0.21	1.26
NONWHITE	-10.66	0.41
INCOME	0.03	1.23
WChangeinPop	-0.24*	-1.78
R ²	0.92	

denotes significance at
 * less than 10% level,
 ** 5% level,
 *** 1% level.

Conclusions and Implications

- **Past spending on local roads facilitates community population growth (sprawl)**
- **The location (distance) of communities explain community population growth**
- **Fiscally advantaged communities grow**
- **Communities with increasing cost of fire protection services tend to lose population**

Conclusions and Implications

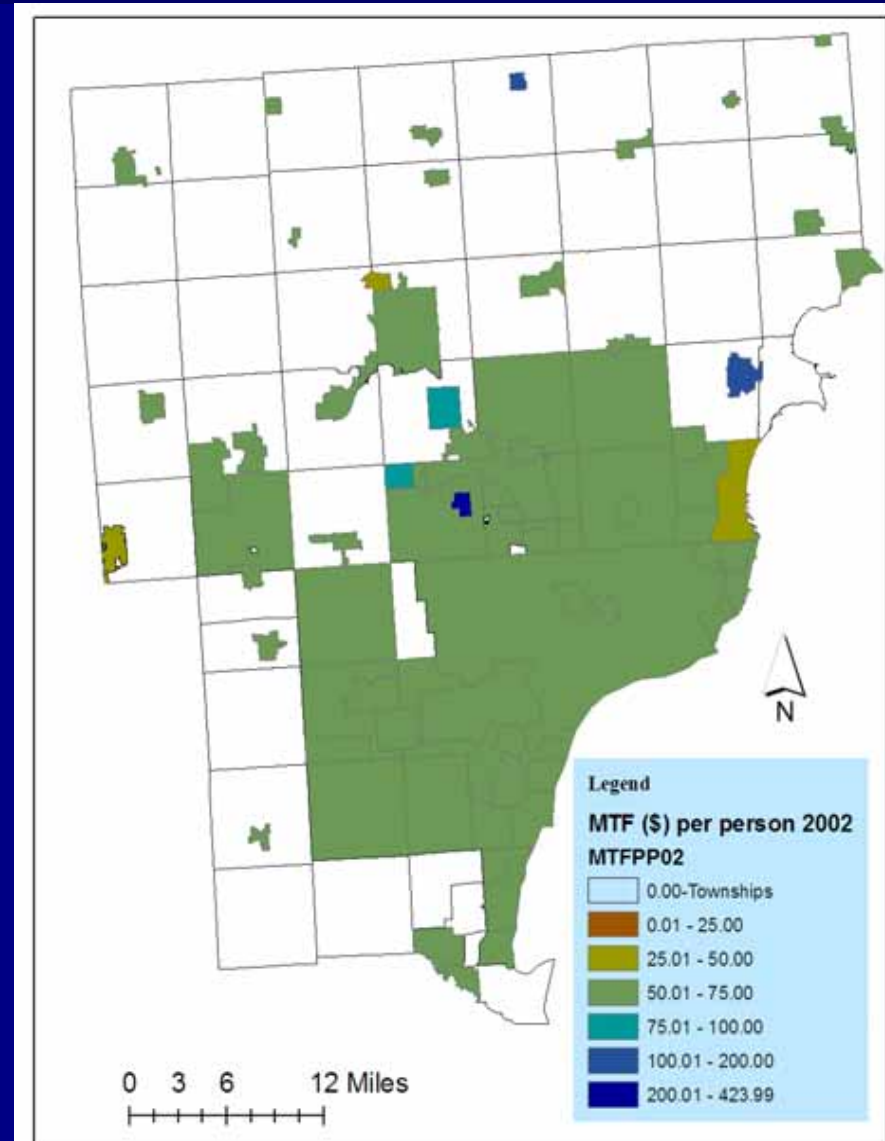
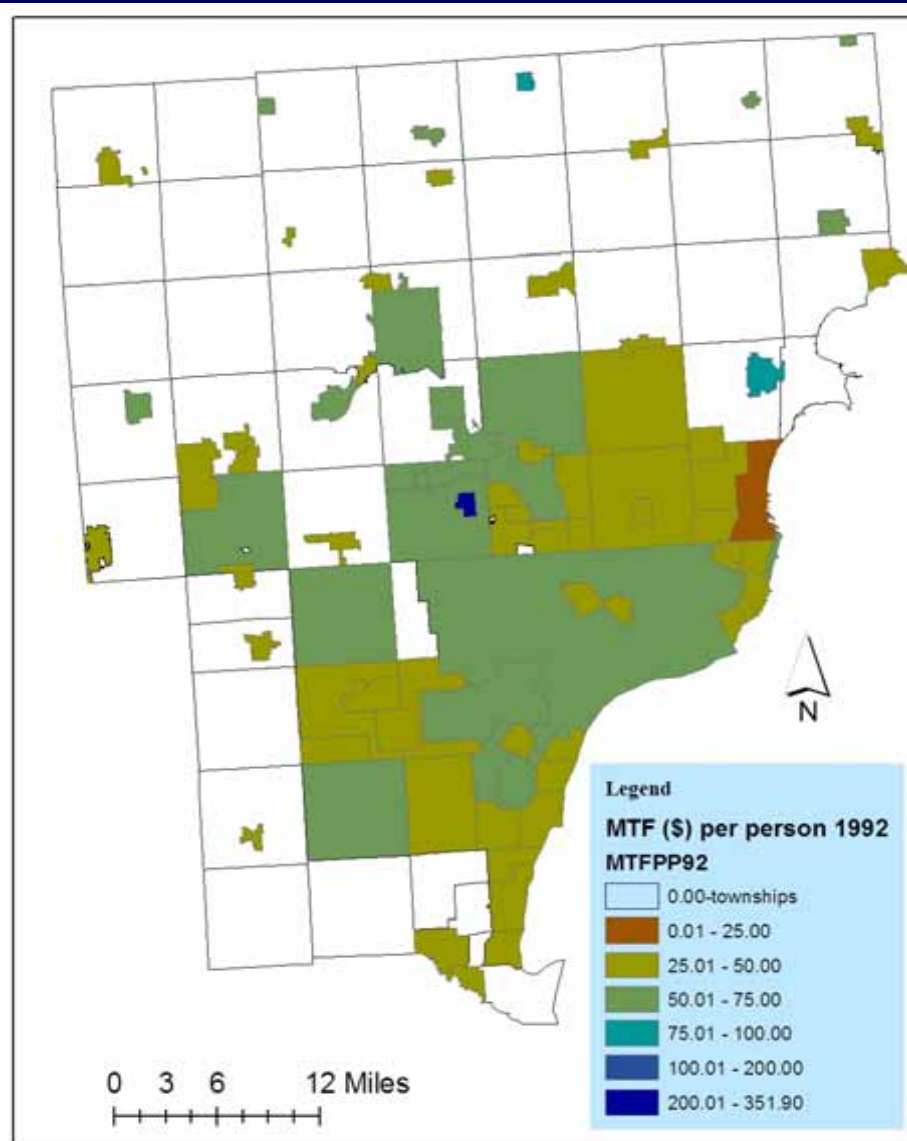
- **Negative consequences of sprawl will more likely continue to be experienced unevenly**
- **Stiff competition for road grant allocation between communities**
- **Government policy on local road allocation must account for unintended consequences**

Thank you!

Back up slides-

add detroit roads and descriptives later

Patterns of Local Roads Spending-Detroit MSA, 1992 and 2002





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Roads Spending and Population: Detroit City in Relation to Region, 1950-2005

