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Estimating Scale and Scope Effects in Public Health Delivery: Implications for Regionalization

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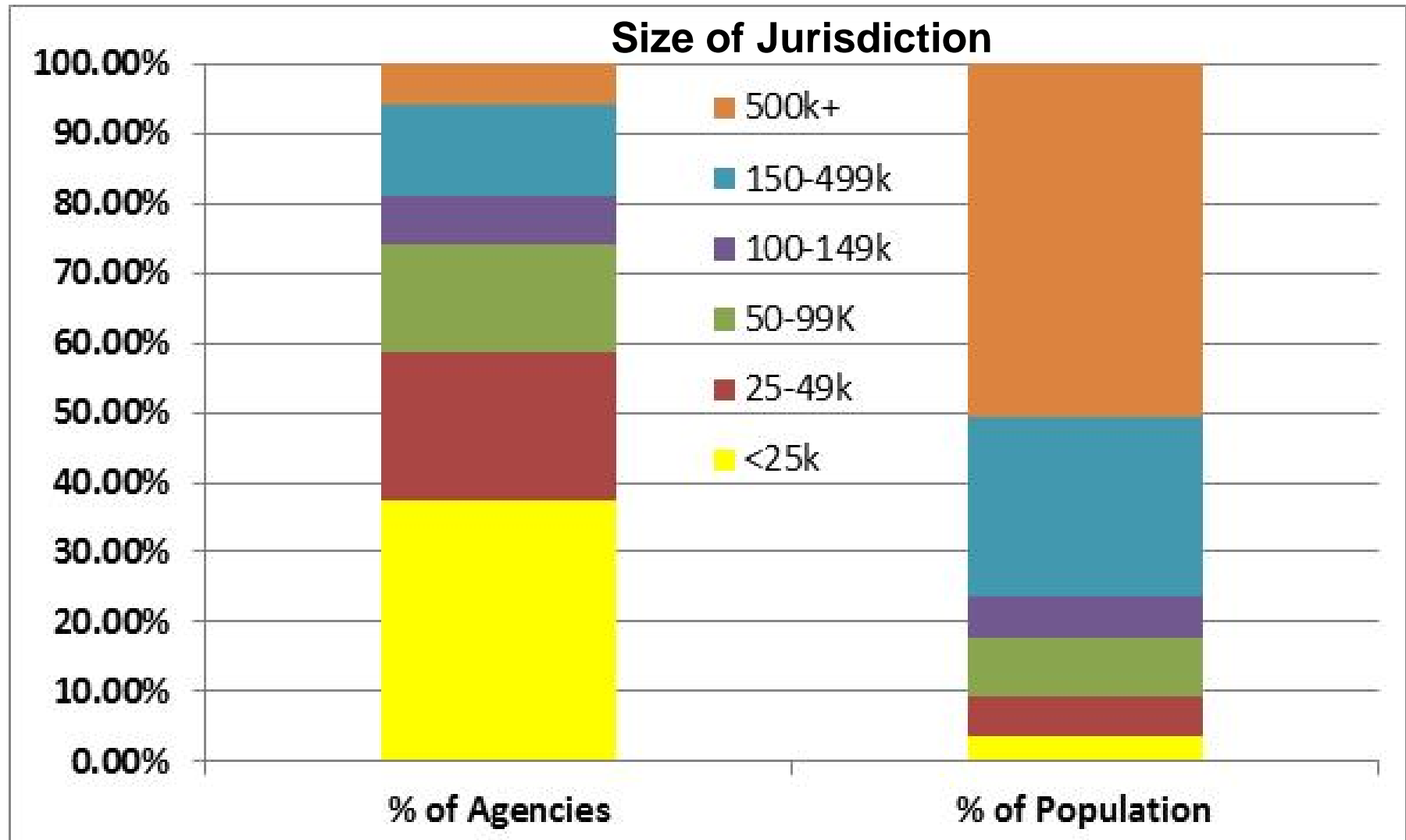
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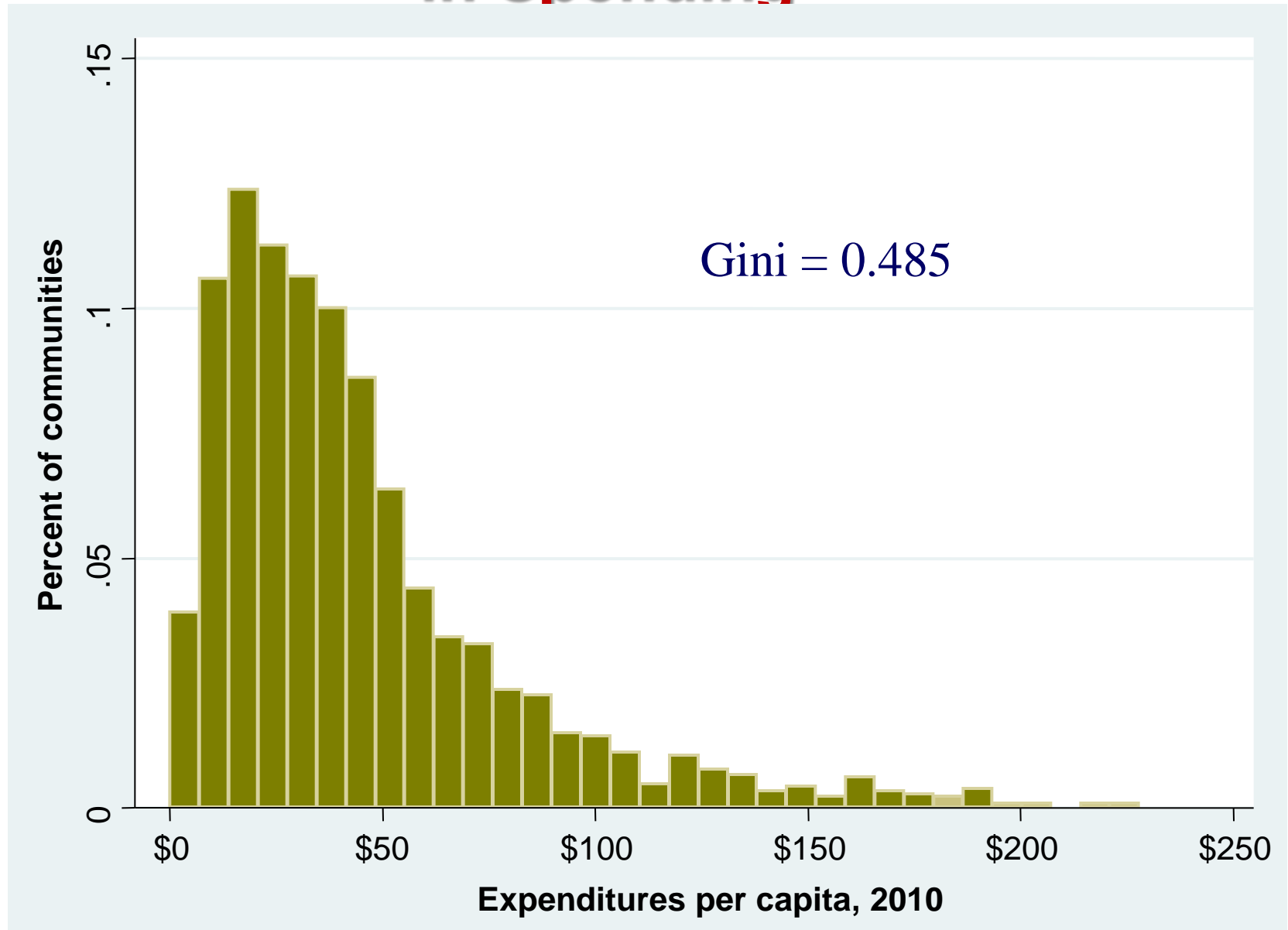
Collaborators include Rachel Hogg, MA and Rick Ingram, DrPH

Local public health delivery systems vary widely in size



Source: 2010 NACCHO National Profile of Local Health Departments Survey

Local Public Health Agencies Vary Widely in Spending



Some questions of interest...

- ◆ Are there economies of scale and scope in the delivery of public health services?
 - How does jurisdiction size, scope of activities, and quality affect the cost of delivering public health?
- ◆ Can regionalization improve availability, efficiency & effectiveness of public health services?

Sources of Scale and Scope Effects

Economies of Scale

- ◆ Spread fixed costs of public health activities
- ◆ Allow specialization of labor and capital
- ◆ Enhance predictability of infrequent events
- ◆ Pool surge capacity
- ◆ Learn by doing
- ◆ Internalize spill-over effects
- ◆ Network effects

Economies of Scope

- ◆ Use common infrastructure for multiple activities
- ◆ Cross-train workforce
- ◆ Realize synergies across activities
- ◆ Network effects

Analytic Approach

- ◆ Estimate the effects of **scale** (population served), **scope** (array of activities delivered) on public health expenditures
- ◆ Address the potential endogeneity of **scope** and **quality** of activities
- ◆ Simulate the effects of regionalizing jurisdictions that fall below selected population thresholds
 - <25,000
 - <50,000
 - <100,000
 - <150,000

Data used in empirical work

- ◆ National Longitudinal Survey of Public Health Systems
- ◆ Cohort of 360 communities with at least 100,000 residents
- ◆ Followed over time: 1998, 2006, 2012
- ◆ Measures:
 - **Scope**: availability of 20 public health activities
 - **Effort**: contributed by the local public health agency
 - **Quality**: perceived effectiveness of each activity
 - **Network**: organizations contributing to each activity
- ◆ Linked with data from NACCHO Profile
 - **Scale**: population size served
 - **Cost**: Local public health agency expenditures
 - Agency characteristics

Data used in empirical work

- ◆ Survey data linked with secondary sources of area characteristics (Census, ARF)
- ◆ Small sample of jurisdictions under 100,000 ($n=36$) used to evaluate prediction accuracy

Analytical approach

Cost Function Model (semi trans-log)

$$\text{Ln}(\text{Cost}_{ijt}) = \alpha_1 \text{Scale}_{ijt} + \alpha_2 \text{Scale}_{ijt}^2 + \beta_1 \text{Scope}_{ijt} + \beta_2 \text{Scope}_{ijt}^2 + \varphi_1 \text{Quality}_{ijt} + \varphi_2 \text{Quality}_{ijt}^2 + \lambda X_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt}$$

Instrumental Variables Model

$$\text{Scope}_{ijt} = \theta \text{Network}_{ijt} + \lambda \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt}$$

$$\text{Quality}_{ijt} = \theta \text{Network}_{ijt} + \lambda \text{Agency}_{ijt} + \delta \text{Community}_{ijt} + \mu_j + \varphi_t + \varepsilon_{ijt}$$

IVs: Network: degree centrality, betweenness centrality, average path length

All models control for type of jurisdiction, governance structure, centralization, population density, metropolitan area designation, income per capita, unemployment, racial composition, age distribution, educational attainment, physician and hospital availability

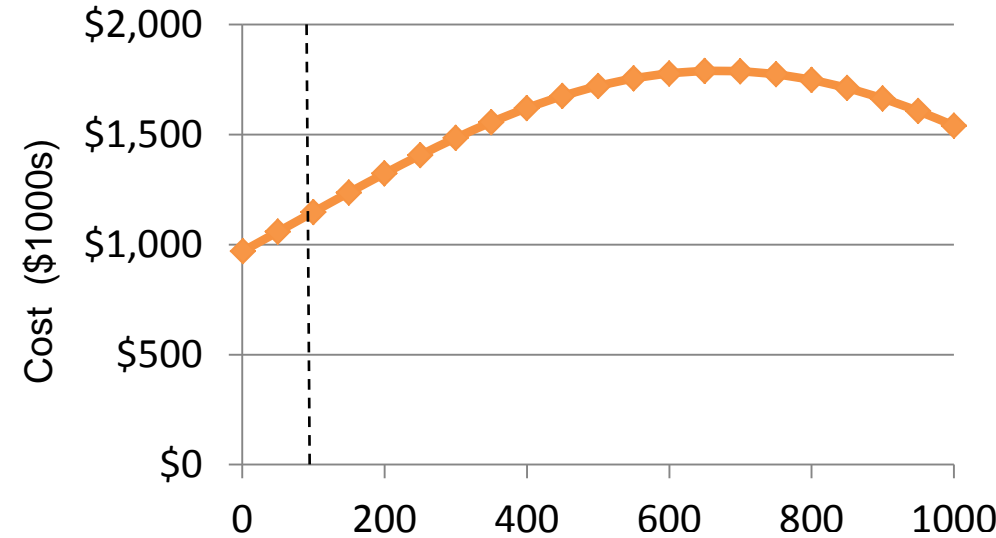
Results: Scale and Scope Estimates

Variable	Partial Elasticity	
	Coeff.	S.E.
Population size	0.0184	0.0029***
Population size squared	-0.0014	0.0002***
Scope	3.89	1.41***
Scope squared	-2.58	0.99***
Quality	-2.98	1.39**
Quality squared	2.72	1.23**

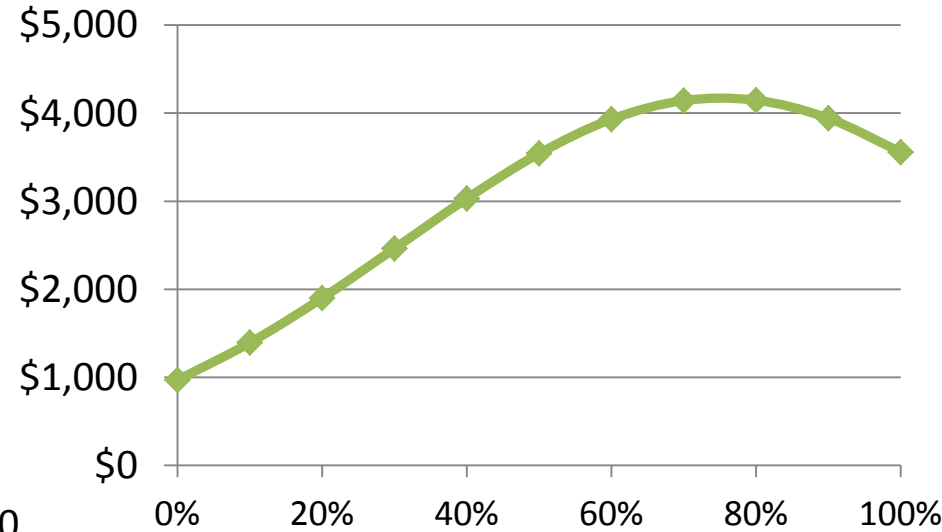
p<0.05 *p<0.01

Results: Scale and Scope Estimates

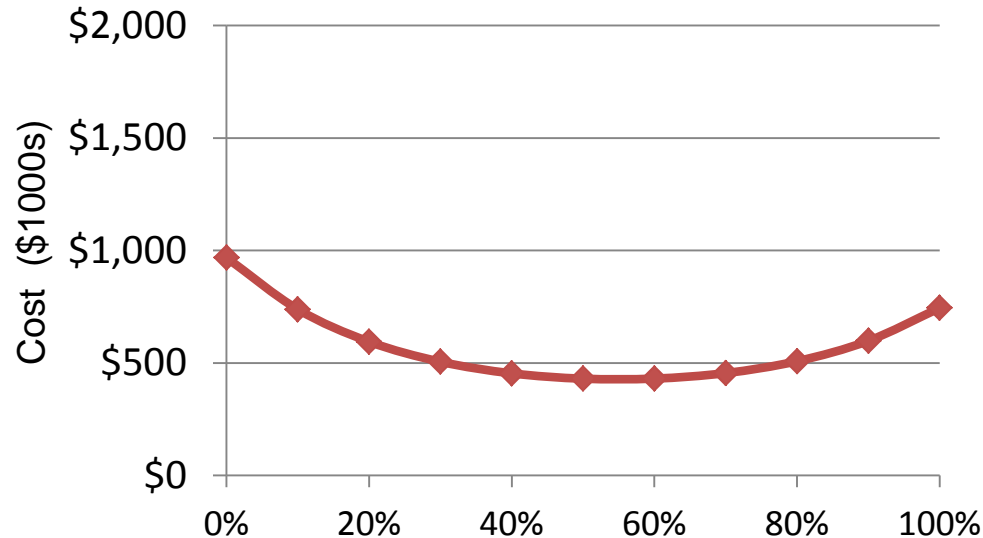
Scale (Population in 1000s)



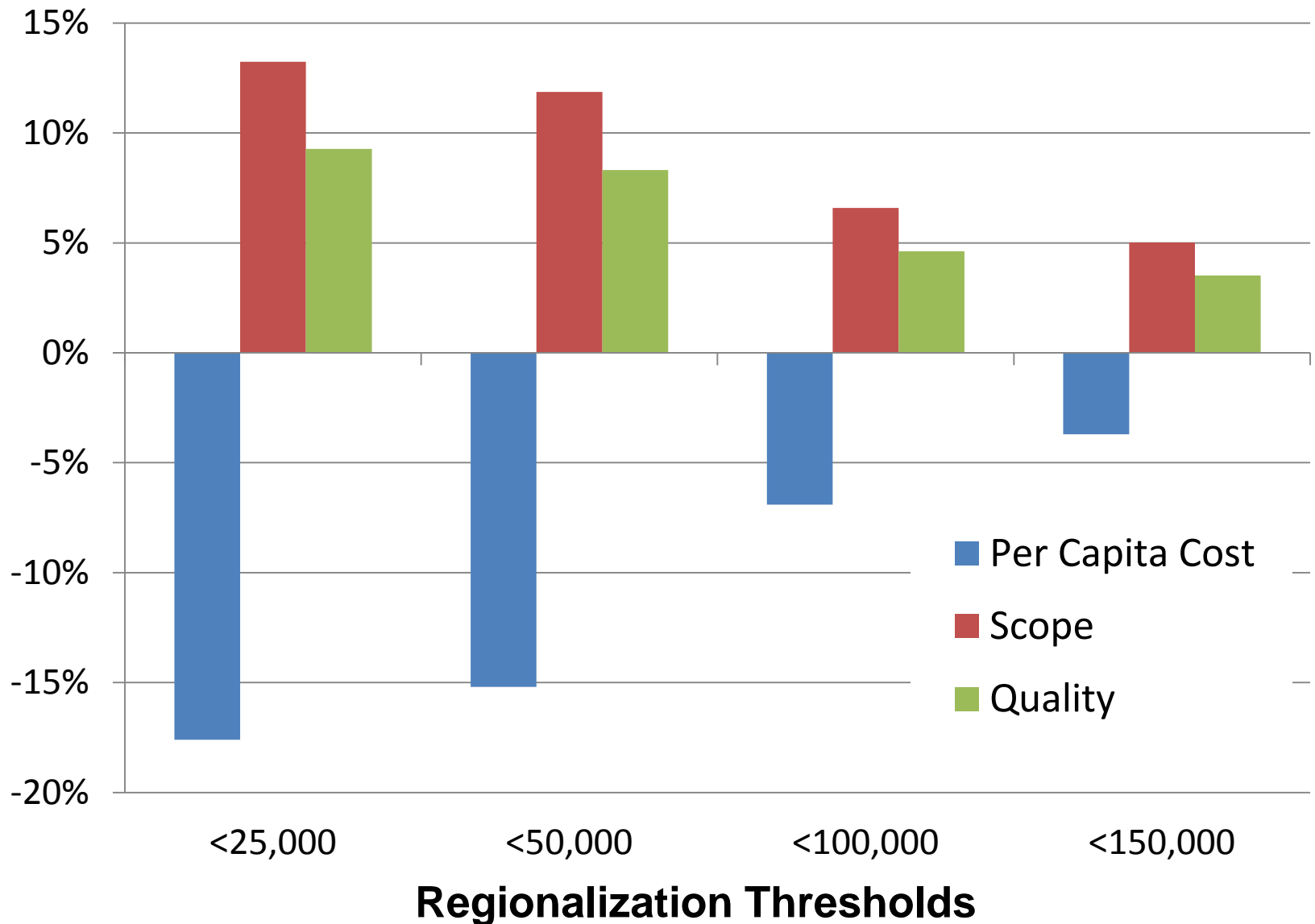
Scope (% of Activities)



Quality (Perceived Effectiveness)



Simulated Effects of Regionalization



Conclusions

- ◆ Significant scale and scope effects are apparent in local public health production
- ◆ Gains from regionalization may accrue through efficiency, scope, and quality
- ◆ Largest regionalization gains accrue to smallest jurisdictions
- ◆ If savings are re-invested in public health production, possibility of important health gains

Limitations and next steps

- ◆ Limited data on small jurisdictions
- ◆ Inability to observe existing “shared service” arrangements
- ◆ Aggregated cost data
- ◆ Lack of data on service volume/intensity