The Political Economy of Transportation

Ed Glaeser
Harvard University and NBER
(reflects joint work with G. Ponzetto and A. Garin)

Why don't more governments do what transport economists want them to do?

- The failure to adopt congestion pricing in most of the world; continued emphasis on new road building, and even a bit of mandated free parking.

- Overinvestment in lower density infrastructure; underinvestment in higher density infrastructure.

- Too little attention to maintenance relative to new construction.

- Denigration (and bad management) of buses relative to rail lines: 50 years after Meyer, Kain and Wohl.

- Inappropriate spending models: Reliance on funding from national level, even for highly local projects. Insufficient reliance on user fees.

Transportation is Complex and Politics Handles Complexity Poorly

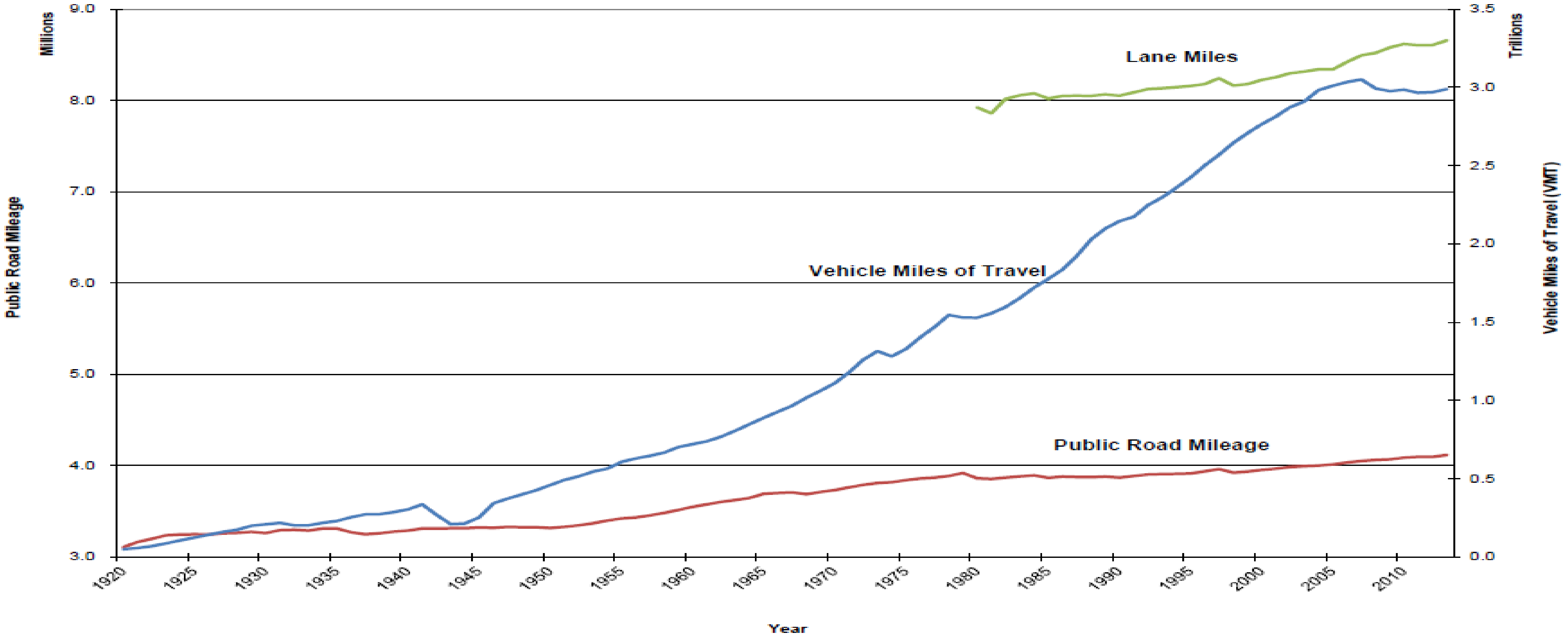
- Complexity Enables Corruption and Patronage (Coate and Morris, 1995)
  - In the old days, this was just theft and this is still true in the poorer world.
  - In the wealth world, this typically means overpaying workers, especially with benefits.
- The Ignorant (but Rational) Voter Model: Infrastructure Knowledge is Uneven
  - Models where some voters observe elements of policies while others do not can deliver some, but not all, of our key facts including overpaying with benefits.
- The Cursed (Irrational) Voter Model (Dal Bo, Dal Bo and Eyster, 2014)
  - Kahneman’s WYSIATIS, Camerer/Ho cognitive hierarcy, Eyster/Rabin Cursed Equilibrium, Fundamental Attribution Error (emphasizes person not situation).
  - Core Idea: People don’t do a great job of predicting other people’s behavior.
  - Predicts too little interest in congestion pricing and too much road building.

Road Map of Talk

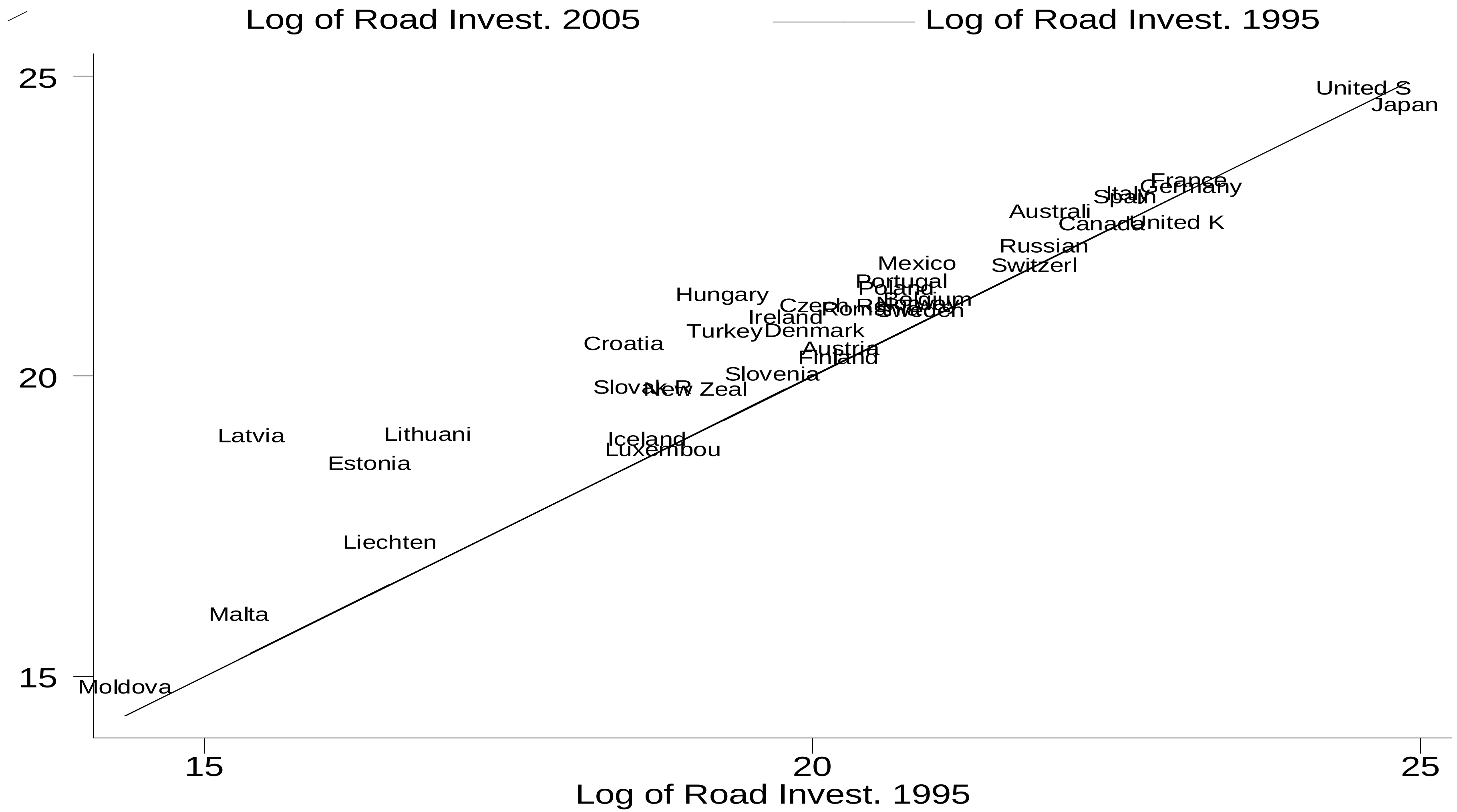
- Documenting and Discussing the Five Political Errors
  - US + Norway + OECD Data
- Using the Ignorant Voter Model to Explain Rest of the Errors
- Using the Cursed Voter Model to Explain Roadbuilding over Congestion Pricing
- Implications for Policies and Politics
  - Not spending more or less on transport but spending more wisely
  - Making our political messaging more effective.

Thank You Sheldon Silver: New York State Speaker who blocked congestion pricing in NYC – recently arrested and indicted on corruption charges

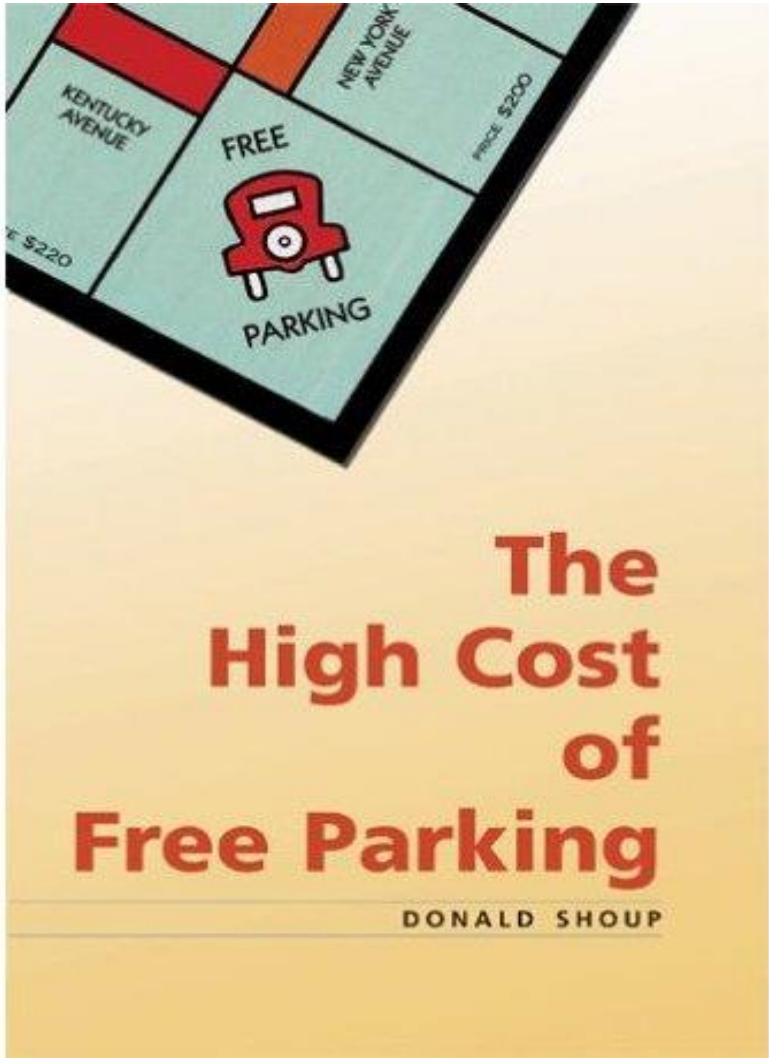
But we do build plenty of new roads, despite the behavioral response (Duranton+Turner)



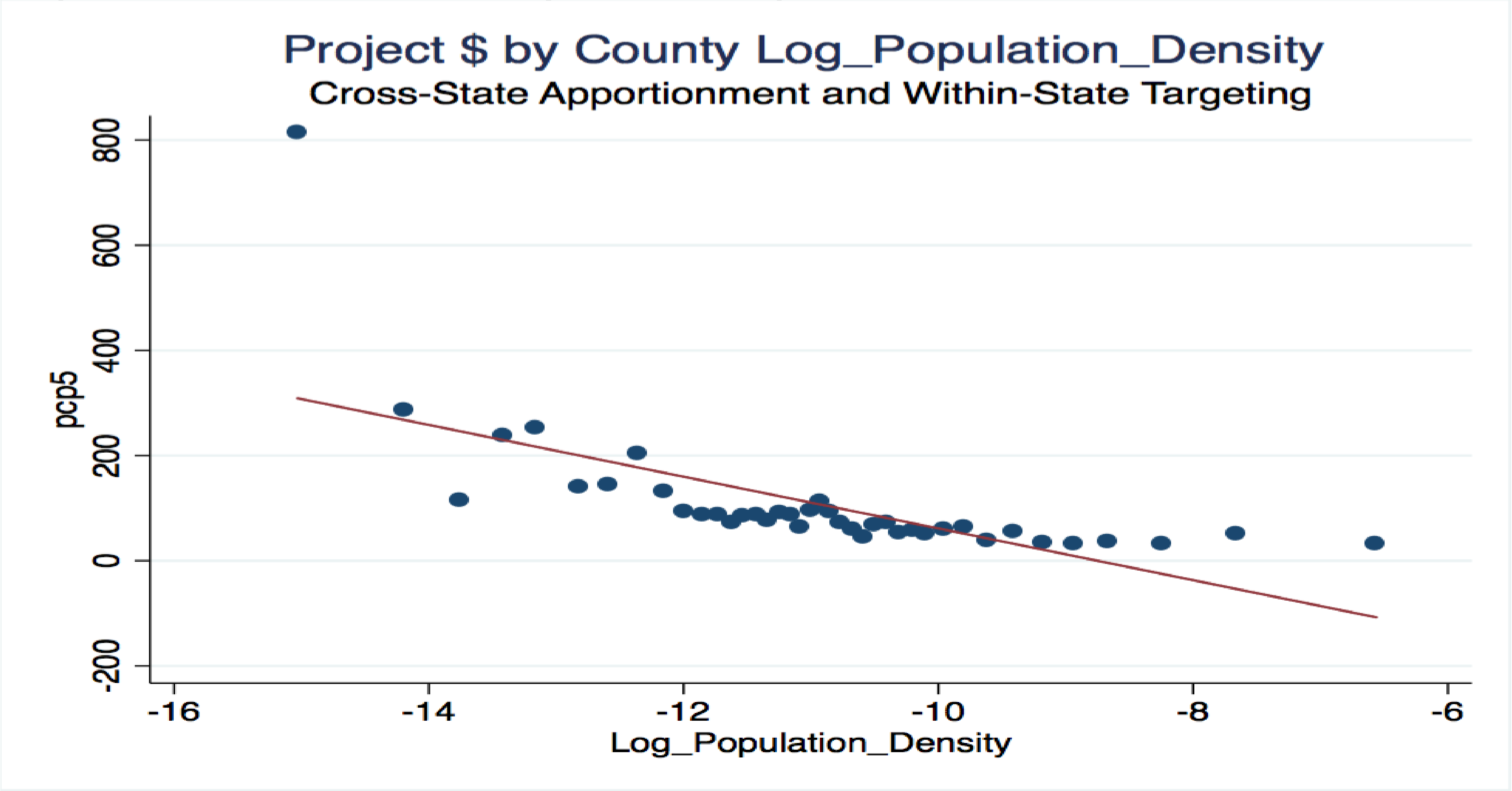
Road Investment 1995-2005 (OECD Real)



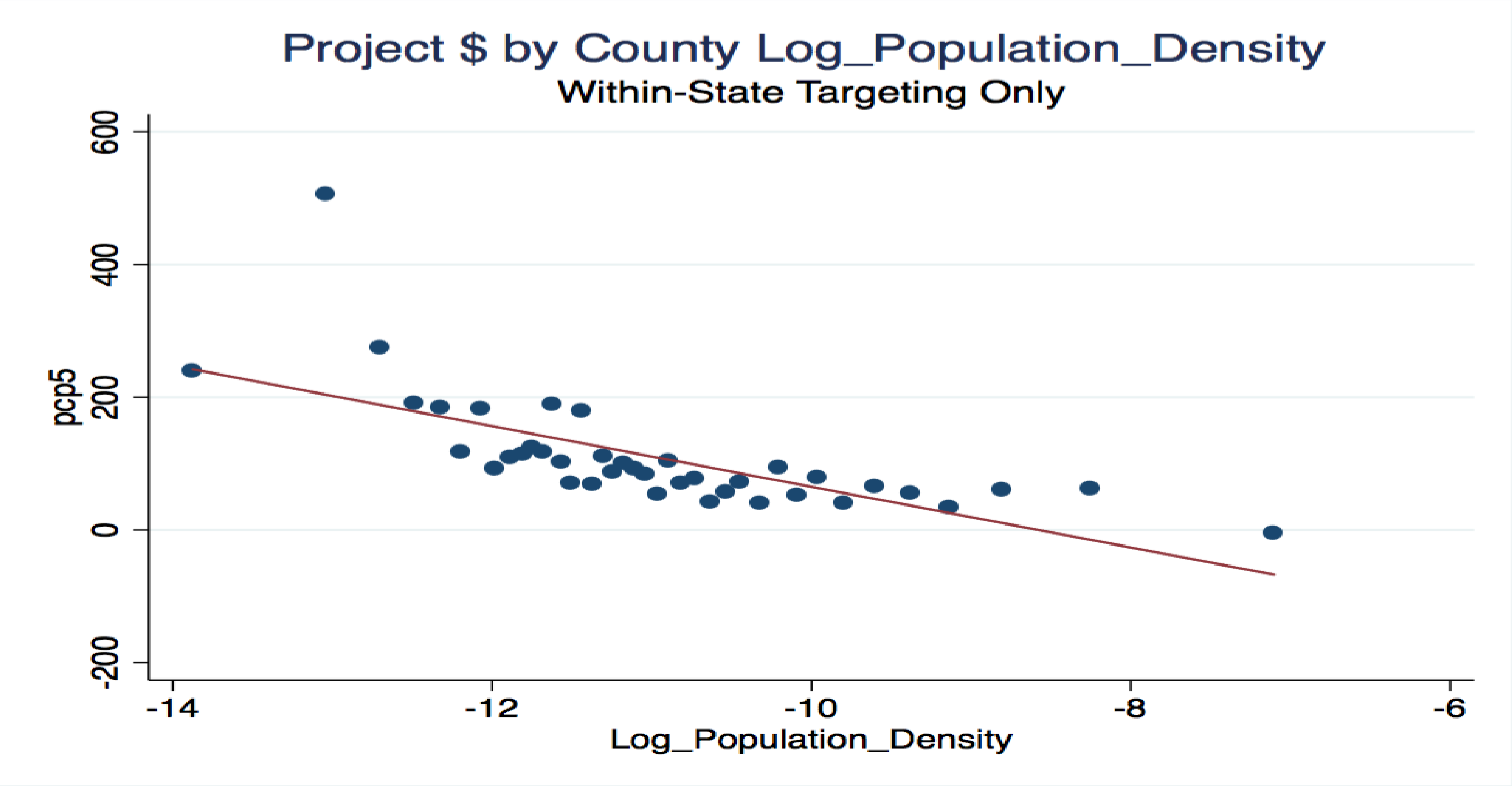
The Behavioral Response is also blithely ignored with free parking requirements



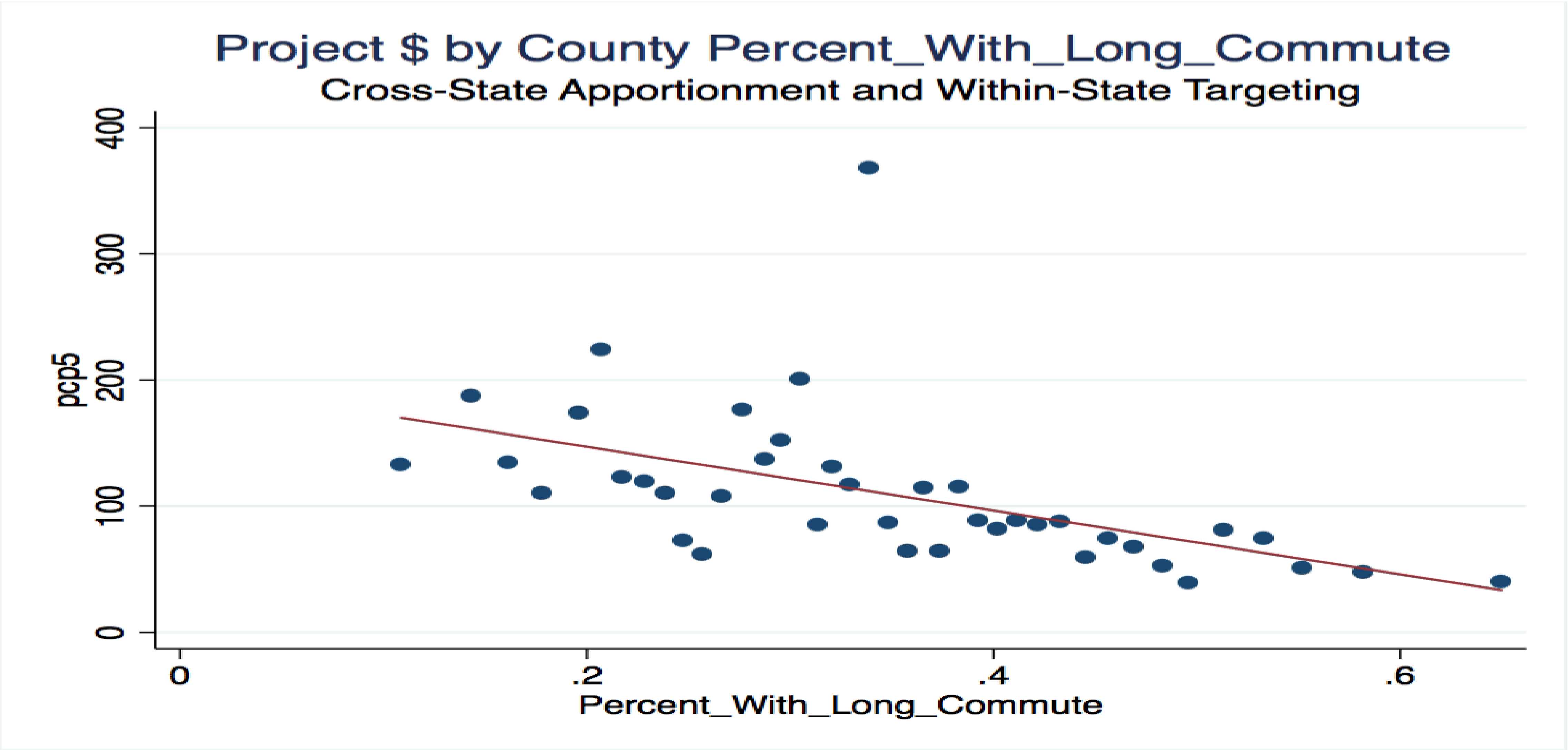
Density and ARRA Infrastructure Spending (thanks to Andy Garin)

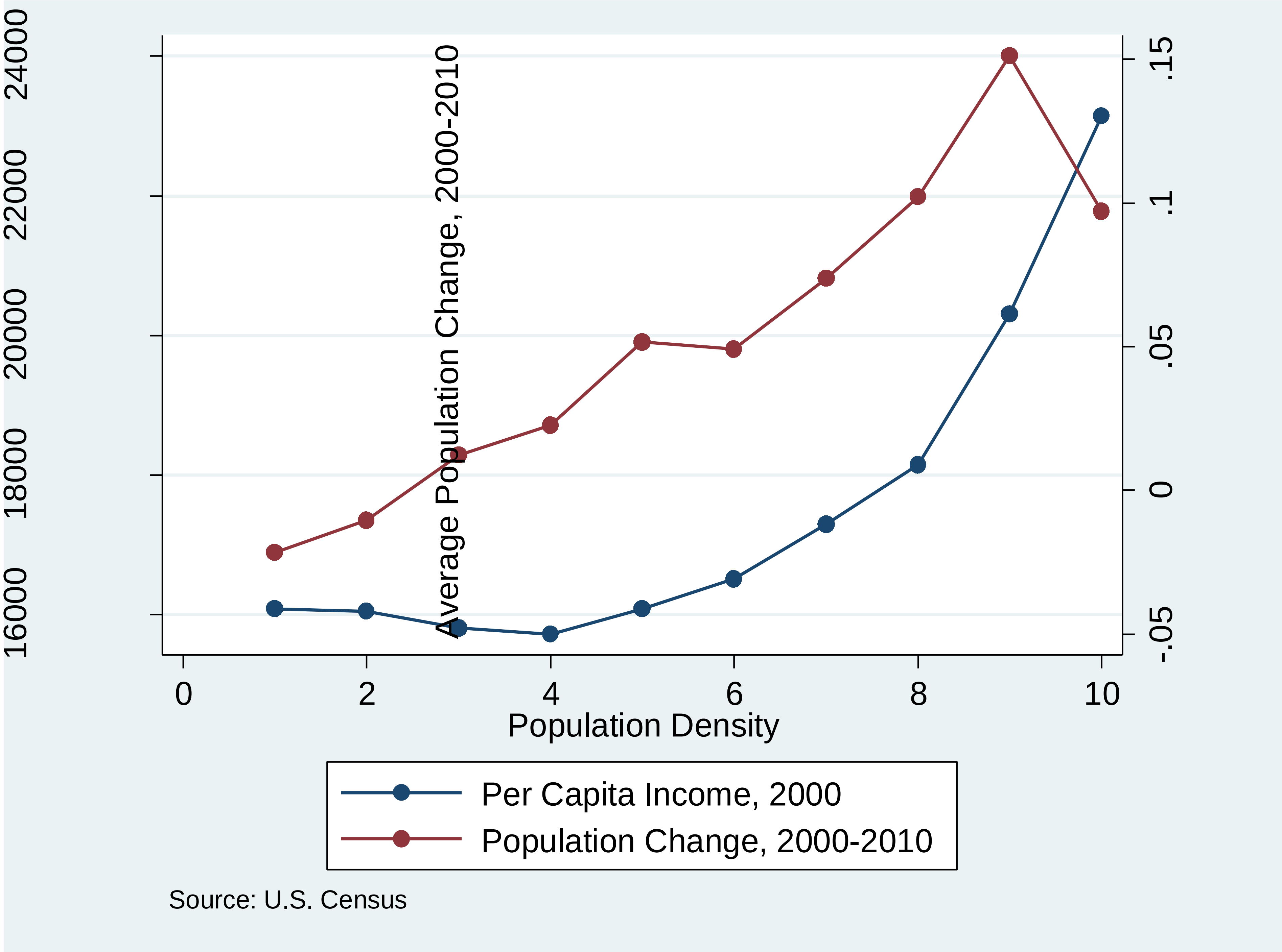


Within State ARRA/DOT Spending

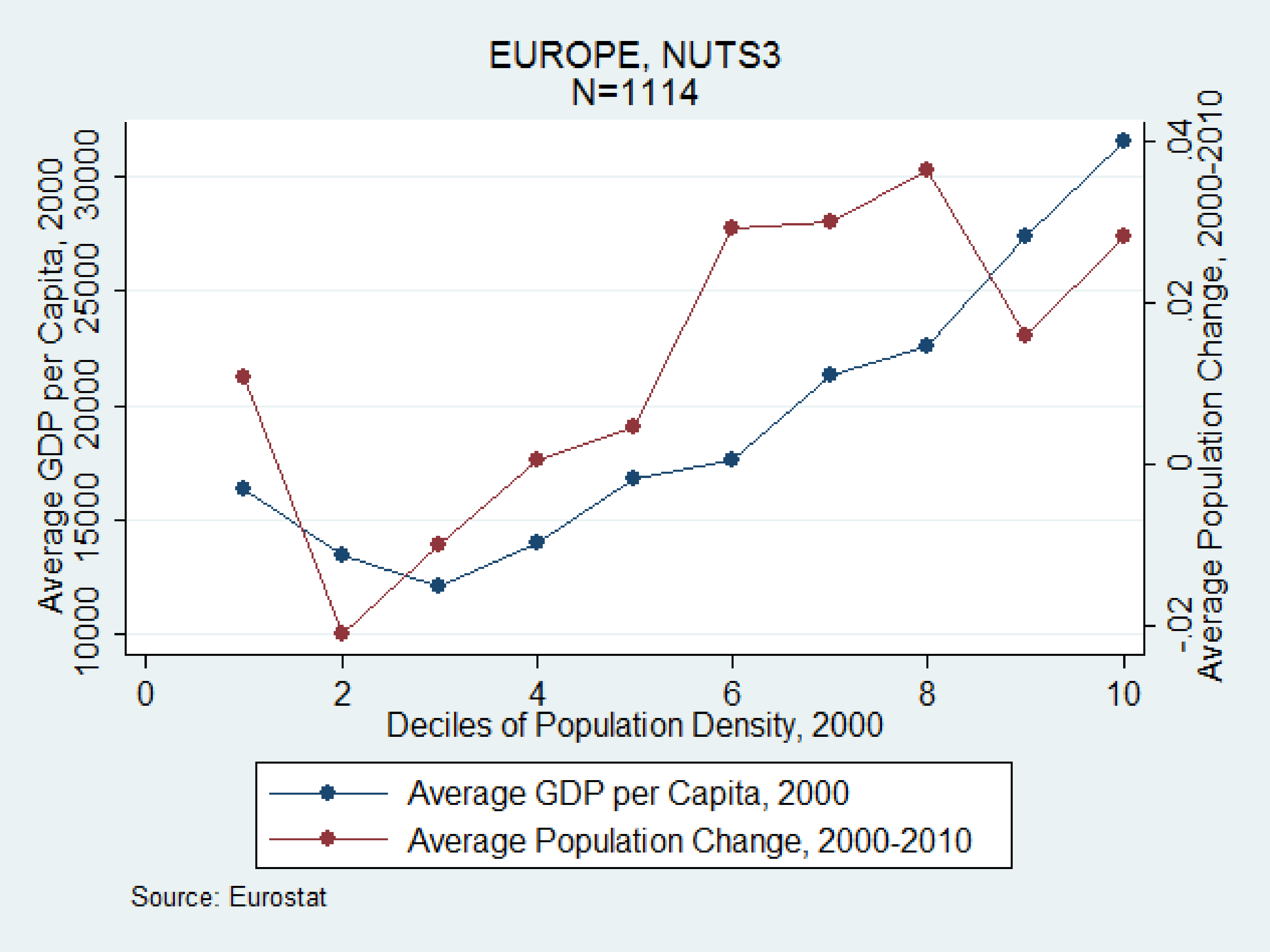


More Spending in Areas where commutes were initially shorter



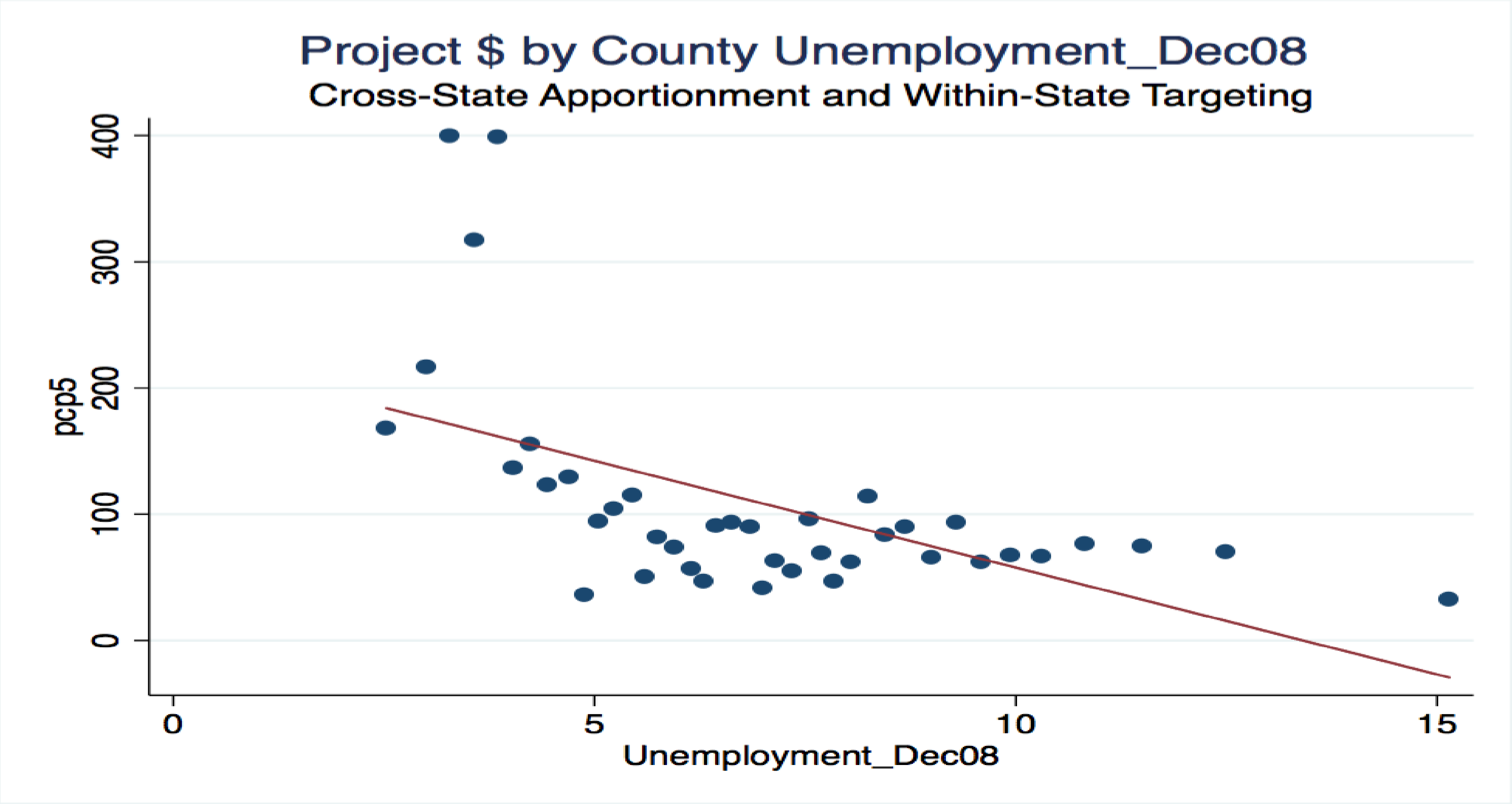


24000
22000
20000
18000
16000
Average Population Change, 2000-2010
.15
.1
.05
0
-.05
0
2
4
6
8
10
Population Density
Per Capita Income, 2000
Population Change, 2000-2010
Source: U.S. Census

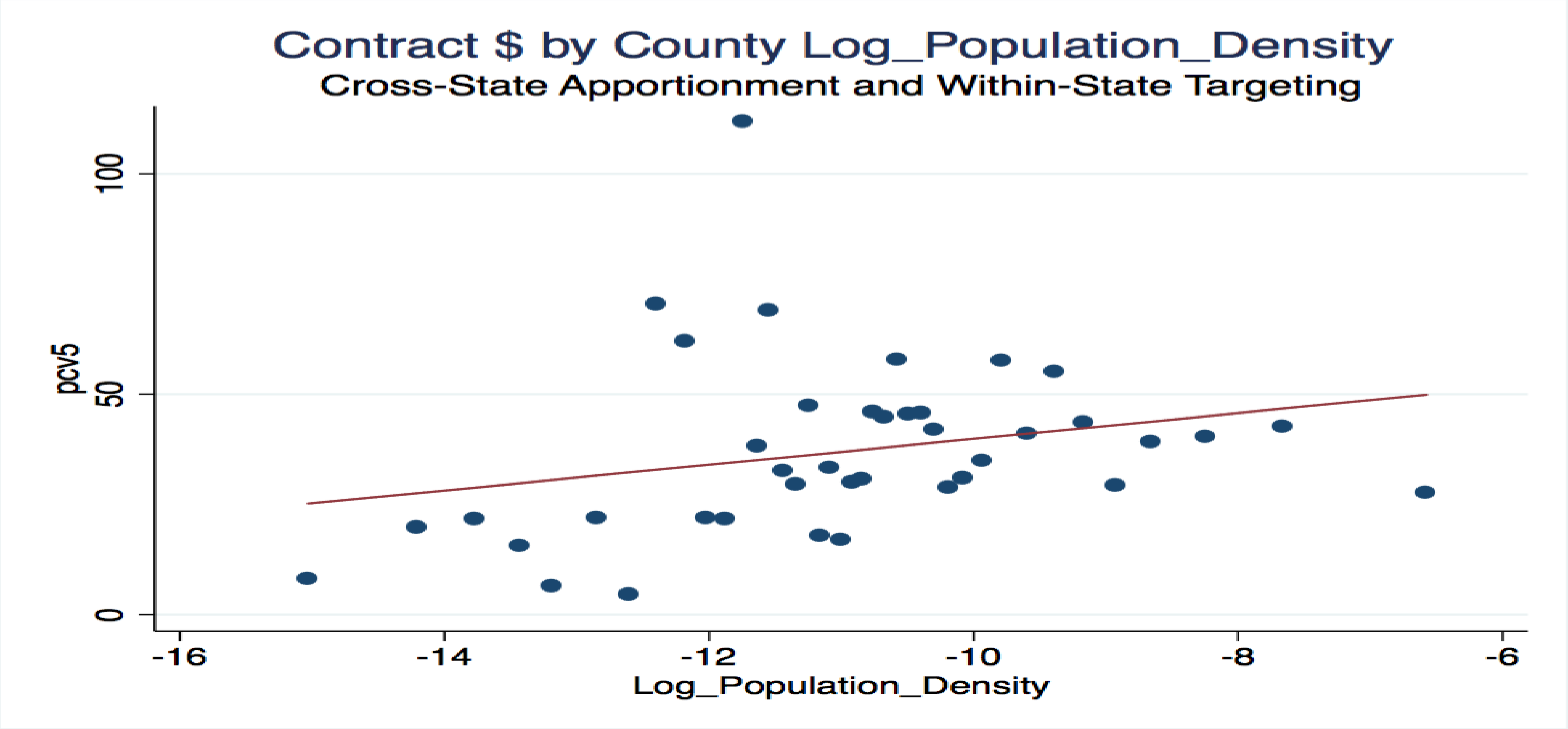


EUROPE, NUTS3
N=1114
Average GDP per Capita, 2000
10000
15000
20000
25000
30000
Average Population Change, 2000-2010
-.02
0
.02
.04
0
2
4
6
8
10
Deciles of Population Density, 2000
Average GDP per Capita, 2000
Average Population Change, 2000-2010
Source: Eurostat

And this is not because the stimulus was targeting high unemployment areas



The projects are in low density places; the contractors are in high density places

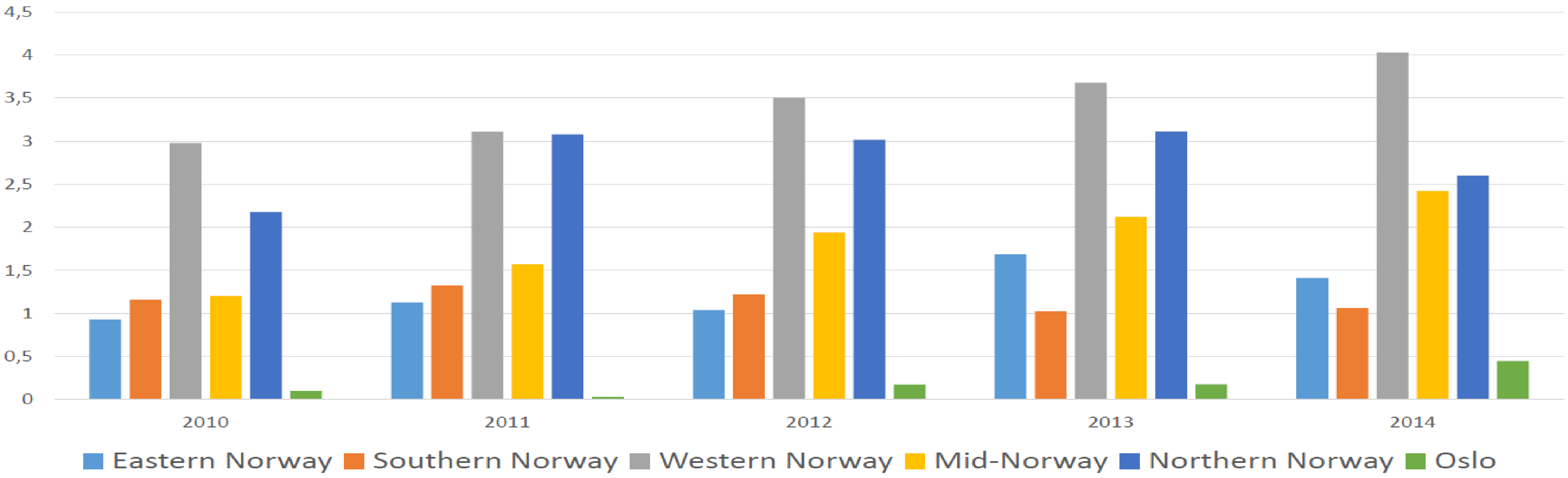


By the way: Garin's Estimates of $1 million on highways on local employment

Effect on Change between 2008 and Year:	Highway Construction, CBP			All Construction, CBP		
	1	*2*	*3*	*1*	*2*	*3*
2009	-1.726	1.666	1.723*	-3.925	2.987	2.011
	(1.445)	(1.154)	(0.924)	(2.426)	(1.817)	(1.937)
2010	0.032	4.544***	4.040***	-4.628	5.040**	3.813
	(1.877)	(1.709)	(1.428)	(3.514)	(2.406)	(2.439)
2011	0.331	4.789***	4.383***	-8.820**	2.164	1.312
	(1.407)	(1.532)	(1.481)	(3.960)	(2.687)	(2.851)
2012	0.510	7.338***	7.036***	-9.168**	1.800	-0.234
	(2.043)	(1.749)	(1.510)	(4.083)	(2.988)	(2.780)
2013	-0.909	6.711***	6.216***	-9.622**	-0.918	0.036
	(2.499)	(1.849)	(1.572)	(4.283)	(3.405)	(3.030)
Effect on Change between 2008 and Year:	Covered Private Employment, CBP			Covered Private Employment, QCEW		
	1	*2*	*3*	*1*	*2*	*3*
2009	-30.789	-2.759	-5.827	-25.654**	9.058*	6.795
	(19.330)	(8.453)	(8.916)	(12.591)	(5.188)	(5.033)
2010	-45.447**	3.062	2.296	-31.453***	8.850	6.522
	(22.171)	(10.450)	(11.569)	(11.765)	(7.524)	(7.363)
2011	-41.770**	4.671	6.359	-23.812*	8.999	9.596
	(18.633)	(11.293)	(12.514)	(13.330)	(10.149)	(9.895)
2012	-31.600*	0.136	-4.998	-9.977	13.968	15.990
	(17.591)	(14.129)	(15.877)	(16.067)	(12.834)	(13.397)
2013	-18.553	4.879	-2.273	-2.971	20.195	21.093
	(18.303)	(15.190)	(15.708)	(19.101)	(14.665)	(15.191)
N	3,107	3,107	2,622	3107	3107	2622
State Effects	X	X	X	X	X	X
2005-2008 Basic Controls		X	X		X	X
2003-2008 Extended Controls			X			X

Generalizing to Norway

City vs regions: Gross consolidated investment expenditures in public transportation and infrastructure, NOK 1000/capita



Source: Statistics Norway

The Mismatch Between Commuting Trends and Shipping Trends

- In the US, between 1990 and 2007, real operating revenues per ton-mile for trucking declined by 20 percent and for rail by 35 percent.
    - Airline shipping costs did however increase.
- Over the same time period, ton-miles shipped by truck rose by 46 and by rail rose by 71 percent.
- This is primarily inter-metropolitan area, and by any reasonable measure this goods transport system is working reasonably well.
- By contrast, the Texas Transport Institute suggests a 218 percent increase in hours lost to traffic congestion between 1982-2011 in large metropolitan areas and 238 percent rise for small areas
- Census shows a jump from 22 minutes in 1980 to 26 minutes in 2000 and a slight drop back to 25 minutes since then.

Maintenance vs. New Construction

- Gramlich (1994) citing CBO (1988) notes returns to highway maintenance of 35 percent, returns to urban construction projects of 15 percent and returns to non-urban projects as being negligible.
- A lack of clarity about the returns to new construction.
- Mamouneas/Nadiri/Eberts find rates of returns to new roads over 40 percent in the immediate postwar period but that fall to under 10 ten percent (and even under five percent) in more recent years.
  - Since the old roads seem much more valuable than the new roads maintaining the old roads seems important (David Levinson)
- Iacono and Levinson (2014) find weak returns to recent roads in Minnesota.

The Original 1988 CBO Study

Highway System	Vehicle Miles of Travel (Billions)	Capital Mainte-nance Cost, 1984-1985[a]	User Cost of Travel, 1985[b]	Percent Return on Investment[c]
	Rural Systems			
Interstates	154.1	3.4	72.8	-4
Other Principal Arterials	145.9	3.4	71.1	16
Minor Arterials	136.9	3.3	68.1	28
Major Collectors	163.2	2.3	90.5	7
Minor Collectors	43.3	0.8	27.0	57
All Rural Systems	643.4	13.1	329.4	16
	Urban Systems			
Interstates	216.4	4.5	91.4	31
Other Freeways and Expressways	97.4	1.1	41.4	117
Other Principal Arterials	279.0	2.5	203.9	136
Minor Arterials	201.7	1.4	147.2	50
Collectors	89.5	0.6	65.0	130
All Urban Systems	884.1	10.0	548.8	75
All Systems	1,527.5	23.1	878.3	43

SOURCE: Congressional Budget Office, based on data from the Federal Highway Administration.

Kahn and Levinson

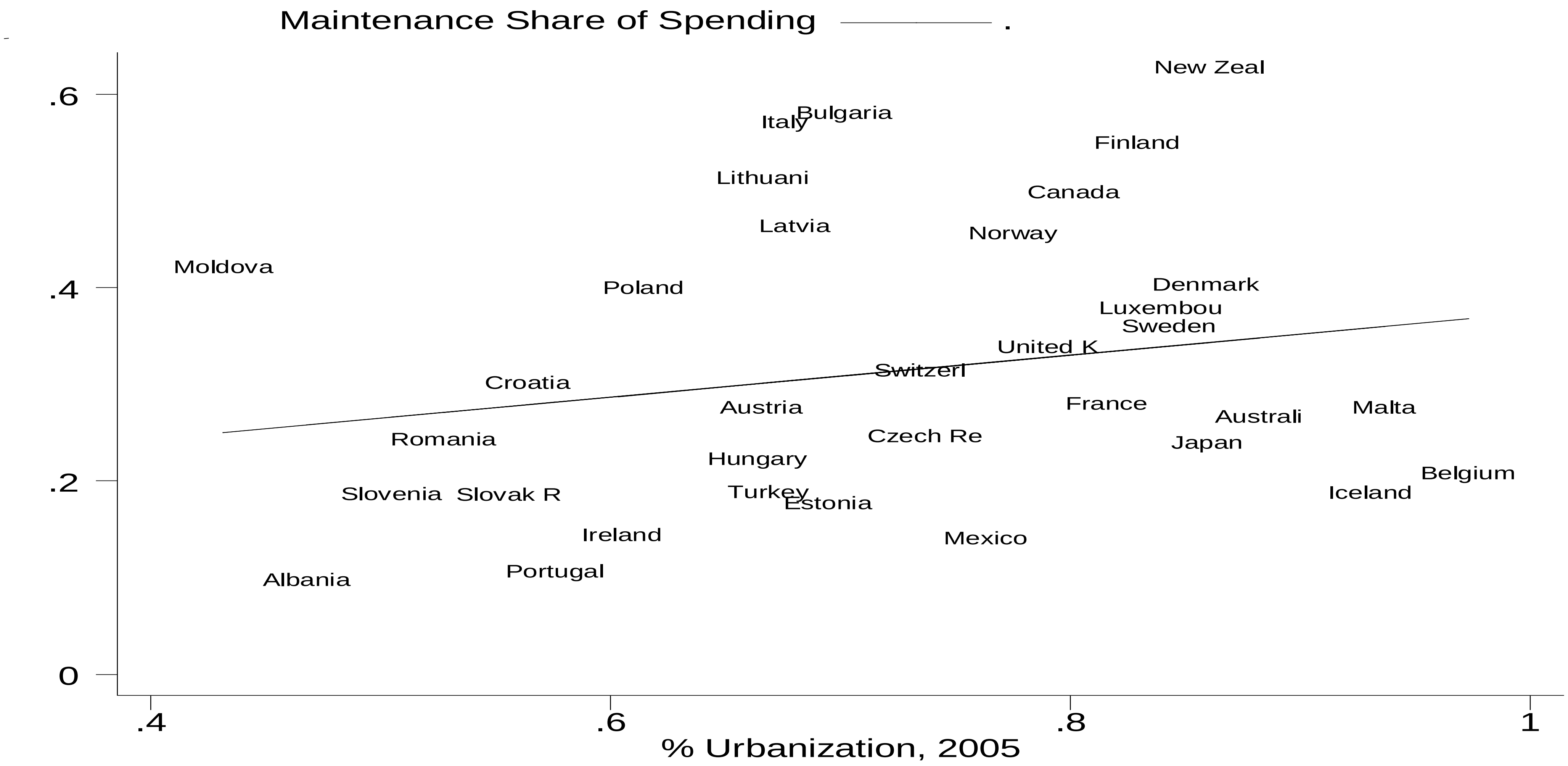
FY2010 Federal-aid highway fund apportionments

Spending Category	Dollars (thousands)	Percentage of total
Interstate maintenance	7,040,519	18
National Highway System	8,704,980	23
Surface Transportation Program	9,010,263	23
Bridges	5,726,448	15
Congestion mitigation and air quality improvement	2,372,787	6
Highway Safety Improvement Program	1,502,675	4

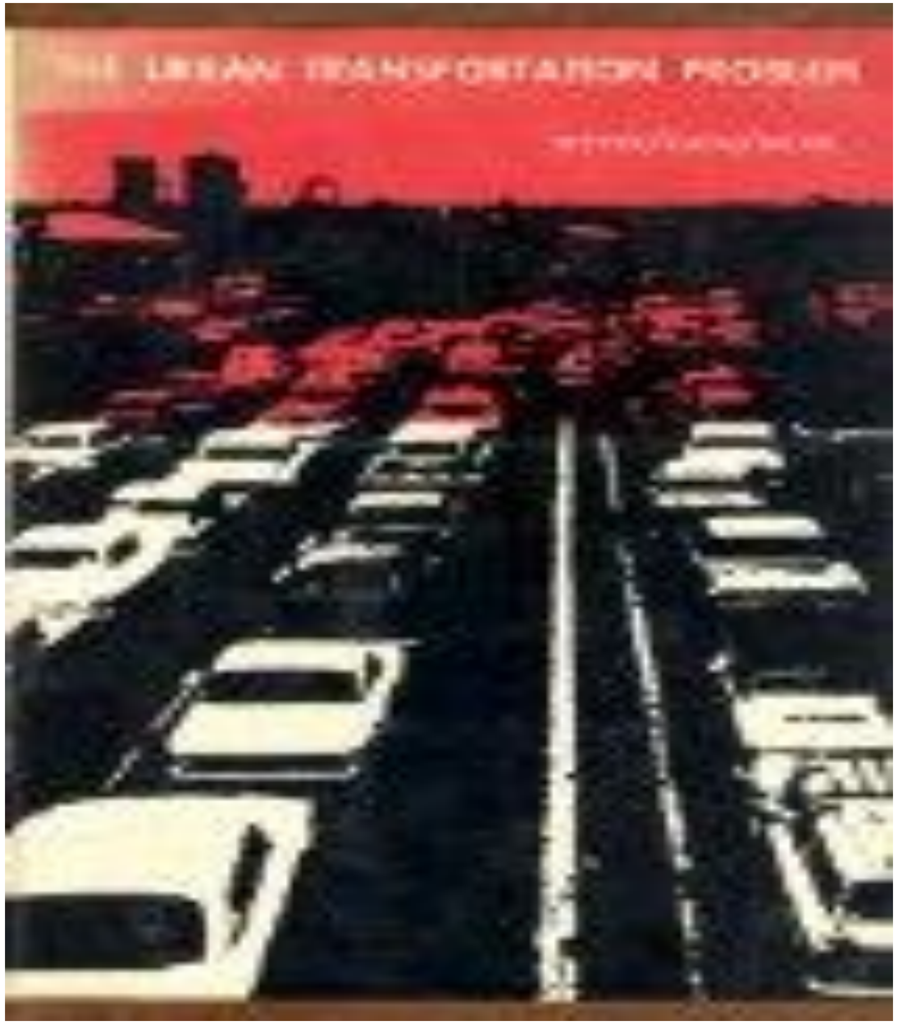
Kahn and Levinson on Road Roughness

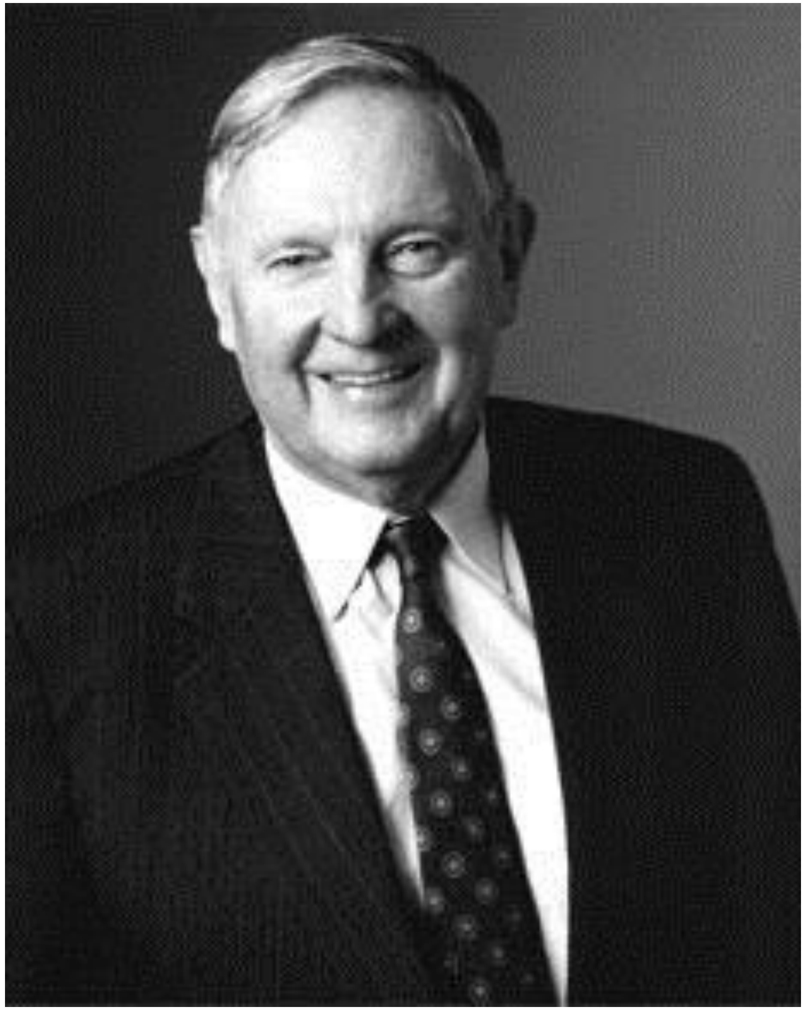
Rating	International Roughness Index		Total U.S. Rural NHS Miles in Category	Total U.S. Urban NHS Miles in Category
	(in/mi)	(m/km)		
Very Good	<60	<0.95	25,317	6,075
Good	60–94	0.95–1.5	53,314	17,576
Fair	95–170	1.5–2.7	30,190	20,786
Poor	171–220	2.7–3.5	2,279	4,101
Very Poor	>220	>3.5	475	2,515

Maintenance Share of Investment and Urbanization



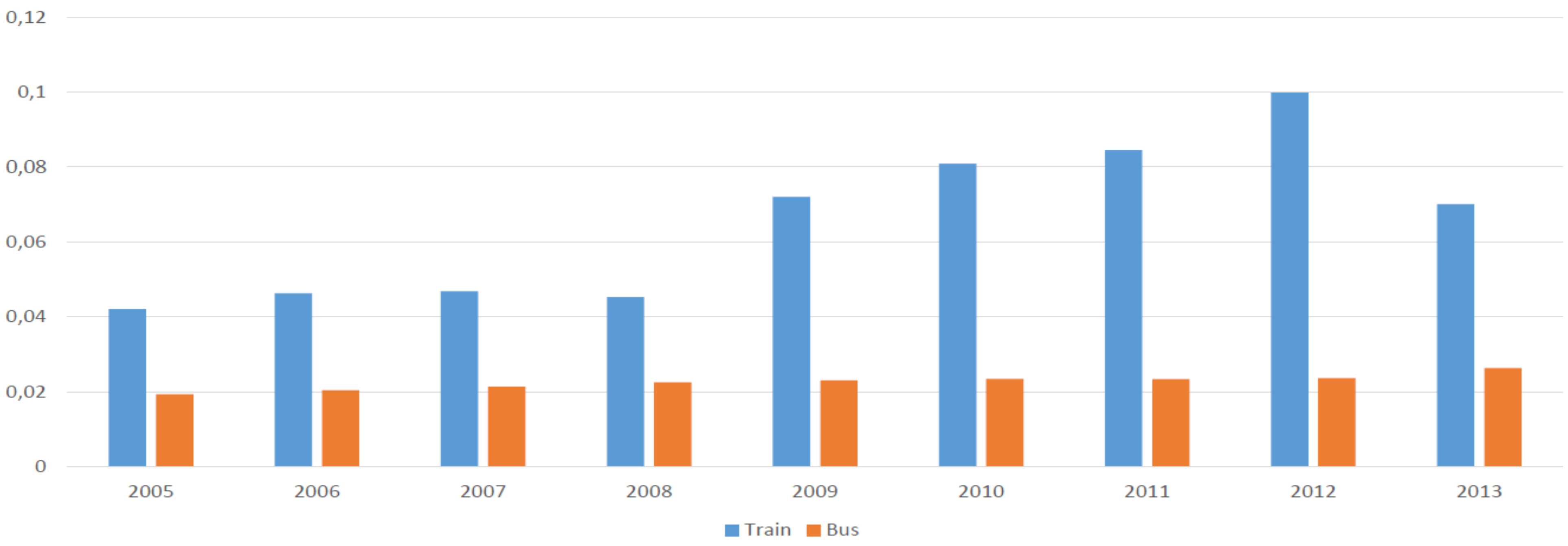
The Economic Case for the Bus





The Norwegian Experience

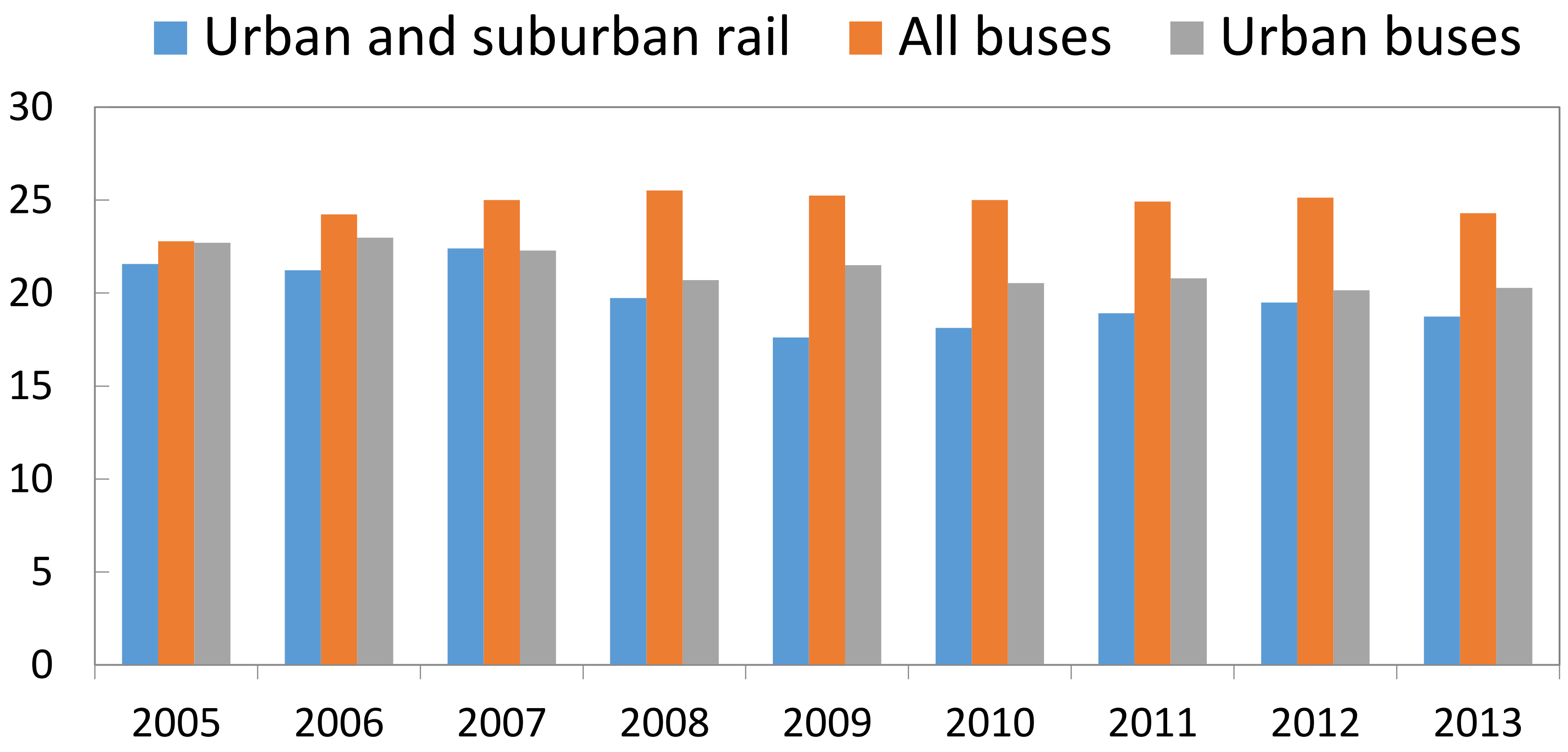
Bus vs train: Cost, operating expenses*/seat km



* Operating expenses for buses, net subsidies to urban and suburban rail for trains

Source: Statistics Norway

Urban buses vs suburban trains and tramways, speed: vehicle km / vehicle hours



Source: Statistics Norway

The Political Passion for the Train (Fresno) Artists' Image for California High Speed Rail

Kahn and Baum-Snow

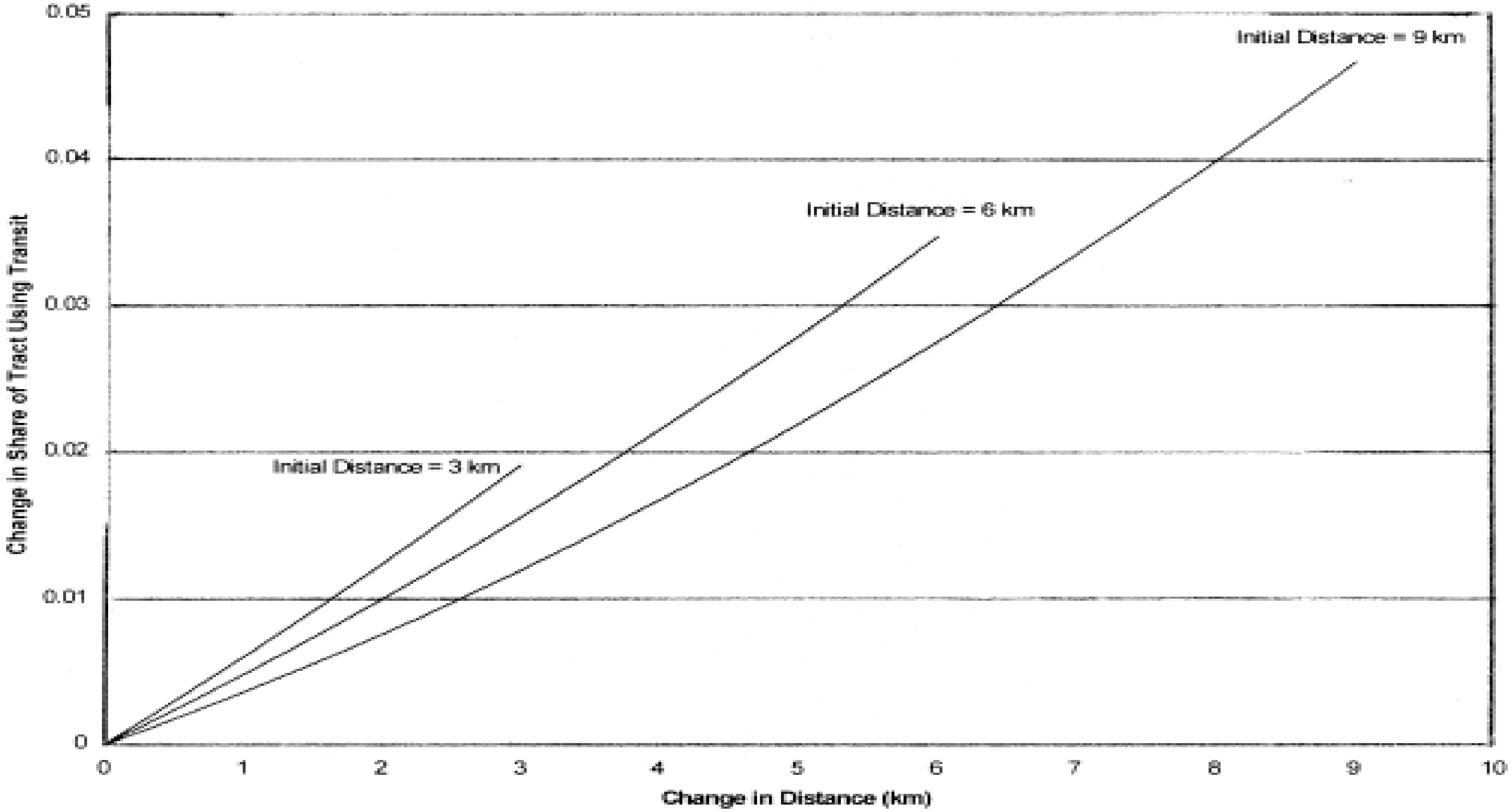


Fig. 1. Treatment effect of the change in distance to rail transit on the change in all transit use.

The Mismanagement of the Bus

- Unlike the private sector, the public sector does little to make buses fun, safe, exciting, beautiful, etc.
- Li, Kahn and Nickelsberg: “Our empirical analysis of bus fleet turnover and capital investment suggests that transit agencies:

(1) do not respond to energy prices in either their scrappage or purchase decisions;

(2) respond to environmental regulations by scrapping diesel buses earlier and switch to natural gas buses;

(3) prefer purchasing buses from manufacturers whose assembly plants are located in the same state;

(4) exhibit significant brand loyalty or lock-in effects;

(5) favor domestically produced buses when they have access to more federal funding.”

The Appropriate Way to Fund Transport

- Question # 1: To what extent should public transportation options be solely funded by user fees?
- Question # 2: If the transport isn't being funded solely by user fees, who should pay?
- Traditional economic analysis has certainly come up with plenty of reasons to subsidize transport: (1) marginal cost<average cost, (2) second best to subsidize transport since we're not taxing congestion, (3) redistributional reasons, and (4) pure administrative hassle of tolling.
- Nonetheless, I think it is surely fair that on net economists tend to argue for far more user fee based funding than politicians typically prefer on their own.

Alternative Funding Schemes

- Local support for roads typically funded by property taxes.
  - Justifiable usually because of (1)/(3)
- State support for Canals/Highways/Mass Transit
  - NY State builds the Erie Canal – ends up being self-funding.   Other states follow
  - NYC originally took over its own failings subways but in 1968, they transferred to a state agency.
- National support with general tax revenues and gas taxes.
  - Support for Intercontinental railroads.   Support of highways starting in the 1920s.
  - Modern highway aid is often primarily within state and increasing paid for general taxes instead of gas taxes. With gas taxes, there is always a transfer.
  - After 1973, the Federal government supports subway building.
- In the EU context, much regional aid has come in the nature of support for transport infrastructure.

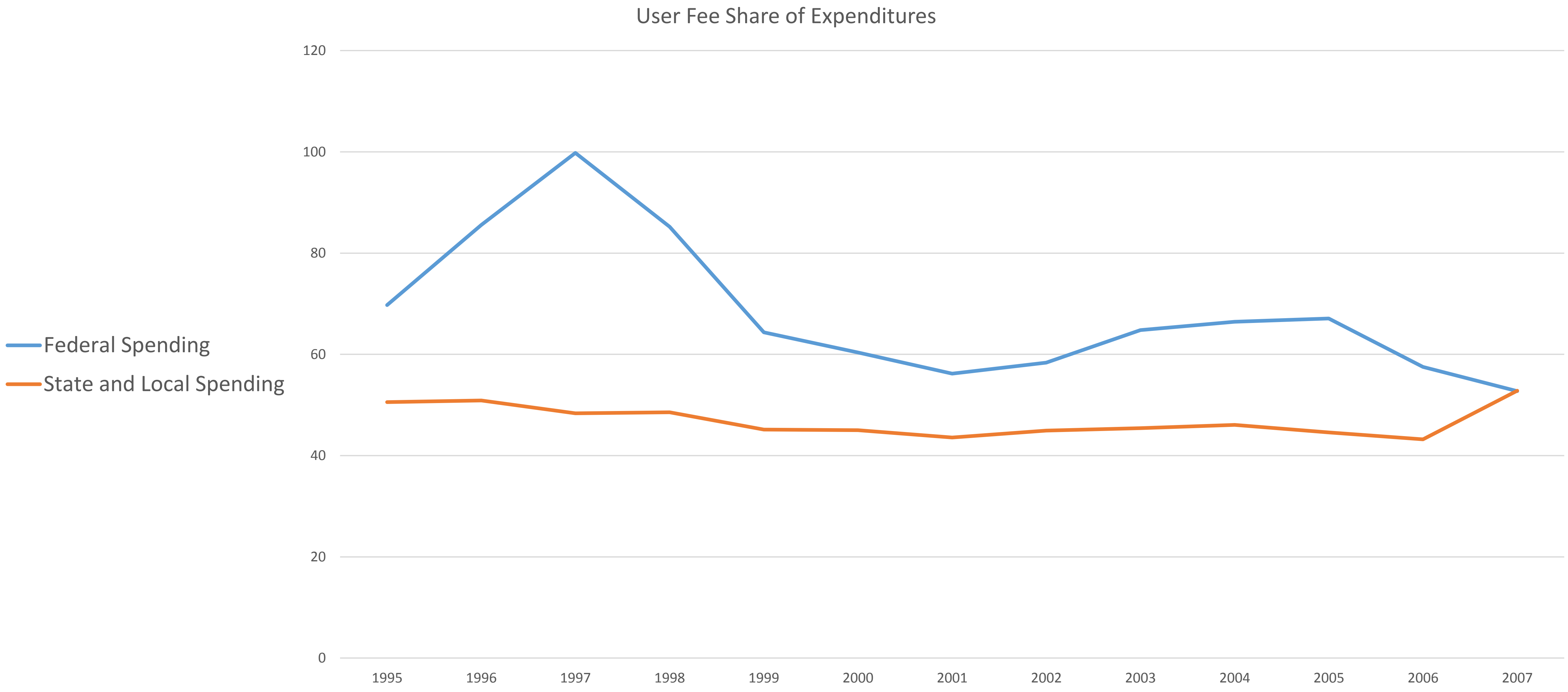
Problems with Nonlocal and Nonuser Funding

- The mismatch between who pays for the spending and who gets the benefits is often seen as problematic for incentives both for building (avoiding White Elephants) and for maintenance (PPs)
- Many local projects are justified primarily because they are being funded by the state or Federal level (the “Big Dig” notably– which ended up being primarily locally funded.
- State discretion over transport funds may reduce the problem somewhat but it doesn’t seem to in practice.
- Many external evaluations of the Federal highway problem in the US see little sense in its spending priorities.
- Local funding seems somewhat fairer; MC vs AC gap may not be that large.

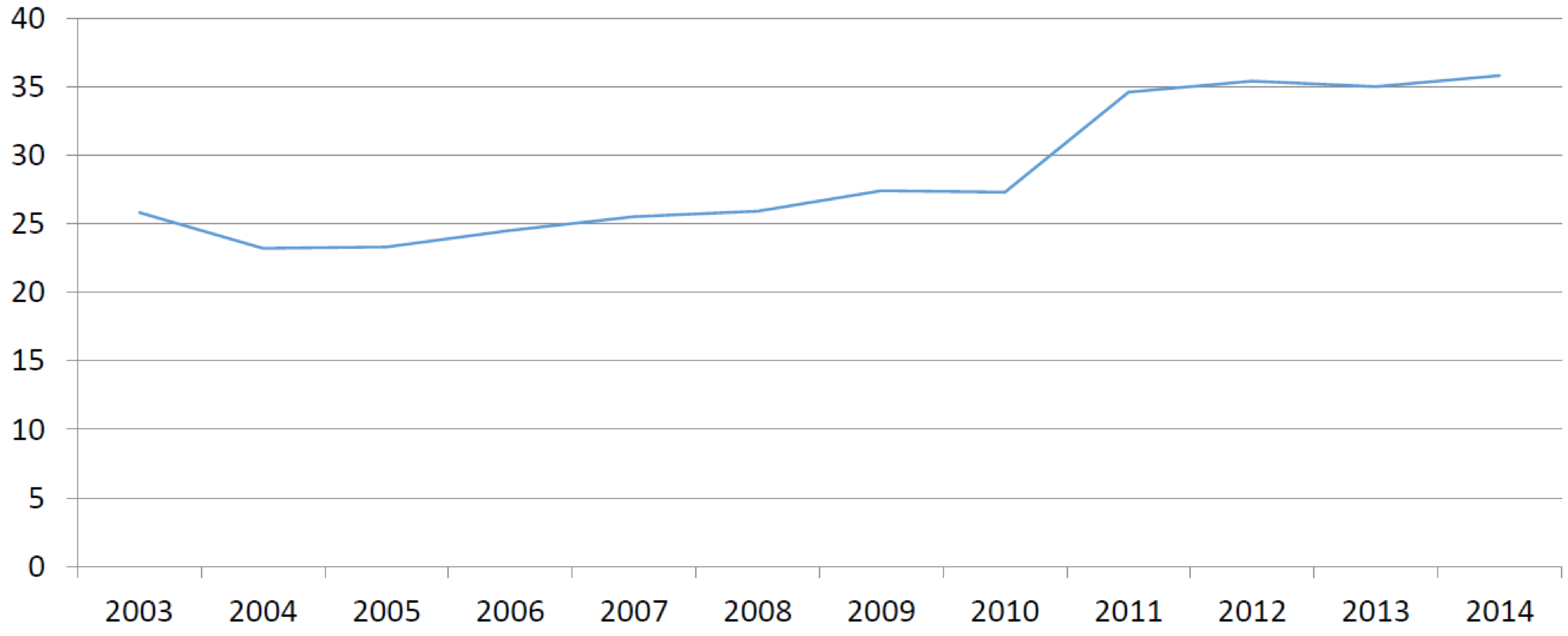
Detroit tried to reverse its decline with foolish investments like its People Mover, which here glides over essentially empty streets.

Dennis MacDonald/ World of Stock

Declining Reliance on User Fees



Municipalities: State transfers as share of gross income



Source: Statistics Norway

Problems and Explanations

- Too little in high density areas; too much in low density areas
  - Observability and the battle between the law of 1/N and local Nimbyism
- Increasing Reliance on Non-User Fee, Non-Local Funding
  - Observability and the Law of 1/N
- Too much new construction relative to maintenance
  - Observability of construction relative to maintenance
- Buses vs. Trains
  - I don't know– trains are cool? Trains are also very visible.
- Too little congestion pricing relative to new construction
  - Not anticipating behavioral responses

Corruption and Transport (Coate and Morris)

- This may be the largest issue in much of the developing world– but I think that the economics of this issue are relatively well understood.
- Typically, the transition towards modernity means a switch from overpaying corrupt suppliers (which becomes visible) to overpaying workers (which becomes part of a political game – see next section).
- One critical implication is the public-private partnerships are not some sort of panacea (see Engel et al.).
  - The PPP corrupts the government or the government expropriates the PPP.
- One natural alternative is for independent but public infrastructure provision (the Port Authority Model).
  - Likely to be most successful when the mission is targeted– not an infrastructure bank and when leadership is both empowered and clearly responsible to the public.

The Uninformed Voter

- Class of models in which voters are rational but not directly aware of everything that politicians say.
- Even though the voters correctly infer what the politicians do say– since they do not directly hear, they do not provide incentives for the politician to change his or her policies/proposals.
- Typical structure is either binding ex ante policies or career concerns plus retrospective voting with limited access to knowledge.
- Applications include breakdown of the median voter them (GPS, 2005, Strategic Extremism), tariffs and non-tariff barriers (Ponzetto), shrouded costs of government, e.g. pensions (GP, 2014).
- Also can help make sense of transportation policies/problems.

Formal Structure Before Politics

- There are J locations and each person makes $\tau(d)$ exogenous trips across each location (typically as part of a larger trip across multiple locations).
- Time of each trip is t(S)g(q): S is spending on infrastructure, q is number people on the same route, t(.) and g(.) are functions.
  - The multiplicative function makes my life much easier; they nest options like time=$(s/q)^{-z}G(q)$, where $G(q)=g(q)*q^z$
- Total time in transport for person k is $\sum_{j=0}^{J} t(s_k)g(q_k)\,\tau(d(j,k))$.
- Total cost per unit time is δw, where w is wage and δ is a constant.
- There is also an inconvenience to building of μwS for every person in the impacted locality. The variable μ can be a choice variable.

Government Without Politics

- The local government pays a fraction γ of spending on transport.
- The rest satisfies $tax * \sum_{j=0}^{J} w_j n_j = (1-\gamma) \sum_{j=0}^{J} s_j$
- Welfare in place k is (plus fixed travel benefits net federal taxes)

$$V_k(\tilde{s}) = w_k - taxes - w_k s_k \mu_k - \delta w_k \sum_{j=0}^{J} t(s_k)\, g(q_k)\, \tau(d(j,k))$$

- Utilitarian first order condition implies:
- $-t'(s_j) g(q_j) \delta\left(n_j w_j \tau(0) + \sum_{i \neq j} n_i w_i \tau\left(d(j,k)\right)\right) = \mu_j n_j w_j + 1$
- Homogeneity gives: $-t'(s) g(q) \delta\left(\tau(0) + \sum_{i \neq j} \tau\left(d(j,k)\right)\right) = \mu + \frac{1}{nw}$
  - Optimal s rises with δ, n and w and falls with μ.

Inserting Politics and Information

- Politicians propose (bindingly) or enact a vector of policies $\{s_1, s_2, \ldots s_J\}$
- These are observed imperfectly. The probability of learning spending in your own neighborhood is θ_0. For any other neighborhood it is $\theta(\tau(d))$ – a function of the number of trips.
- Individuals who don't observe the policy correctly infer it
- $\theta_0 > \theta(\tau(0))$ because people are particularly likely to learn about local projects. Let θ_{jk} denote $\theta(\tau(j,k))$
- The standard result is that for each policy s_j politicians choose the argmax

of

$$n_j \theta_0 V_j(s_j) + \sum_{i \neq j} n_i \theta_{ij} V_i(s_j)$$

$$-t'(s_j)g(q_j)\,\delta\left(n_j w_j \theta_0 \tau(0) + \sum_{i\neq j} n_i w_i \theta_{ij} \tau\big(d(j,k)\big)\right) = n_j\theta_0\left(\mu_j w_j + \frac{\gamma}{n_j}\right) + (1-\gamma)\frac{\sum_i n_i w_i \theta_{ij}}{\sum_i n_i\, w_i}$$

We assume that in equilibrium there is some support for spending in area j outside area j, but that not every community supports more spending in area j outside of area j.

Proposition 1: The equilibrium level of spending is increasing with δ and falling with μ_j.

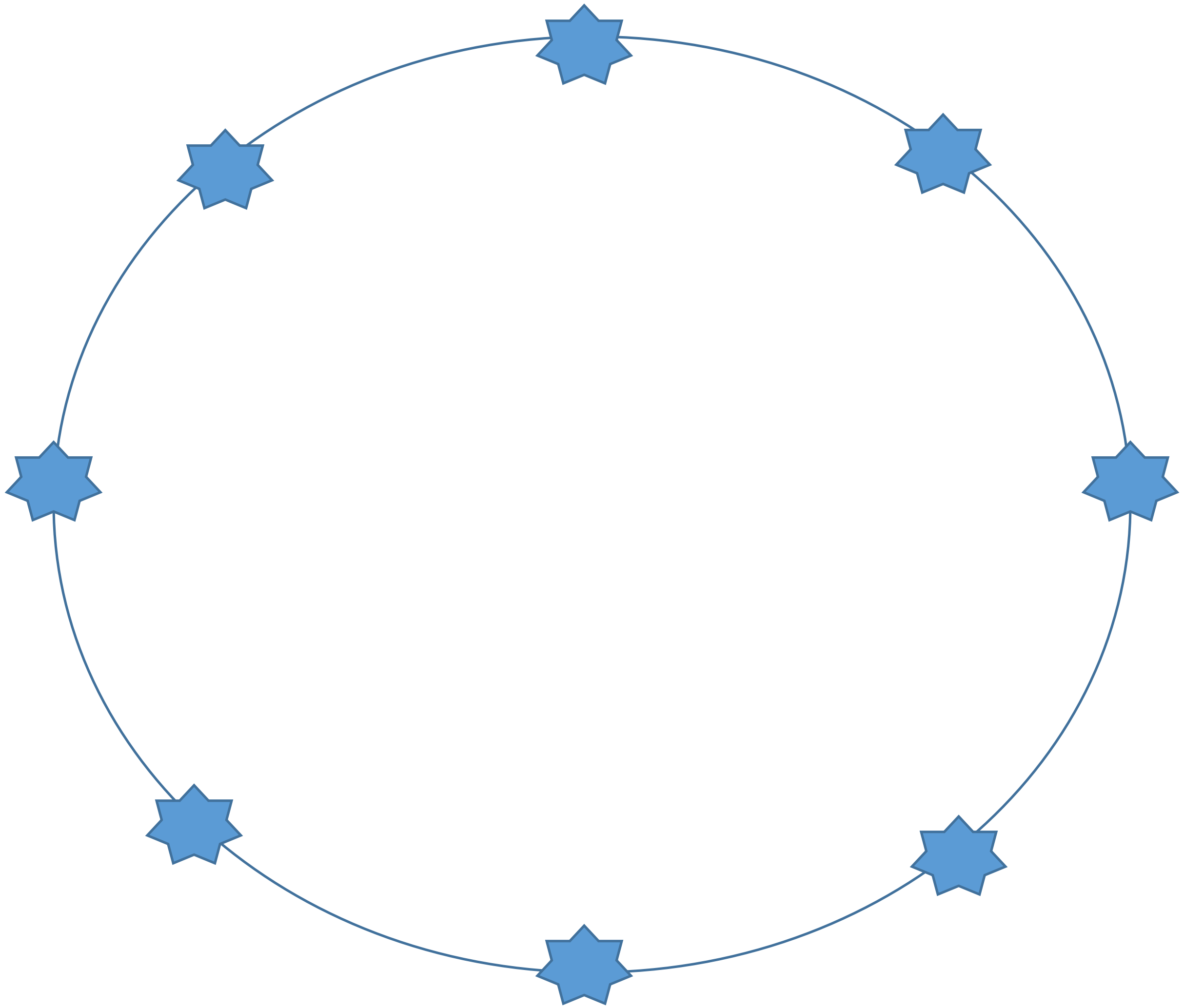
Spending will fall with γ as long as $\sum_{i\neq j}(\theta_0 - \theta_{ij})n_i w_i > 0$.

If the "heterogeneity conditions" hold, then there will exist a cutoff distance level, and communities (other than location j) will prefer more spending if and only if there are closer than this cutoff level.

Spending on infrastructure in location j will increase if θ_{ij}, n_i or , w_i rise in areas closer than this cutoff and fall with θ_{ij} beyond this cutoff, and also fall with n_i or w_i as long as the number of jurisdictions is sufficiently large.

The level of spending will be increasing with θ_0, w_j and n_j if μ_j is small, and decreasing with θ_0 if μ_j is large, and decreasing with w_j and n_j if μ_j is large and the number of jurisdictions is large.

A circle country with regular and homogeneous locations



We assume homogeneity and that $\tau(j) = \tau(0)\vartheta^j$ and $\theta_j = k\theta_0(\rho\vartheta)^j$.

The first order condition for the political equilibrium is then:

$$-t'(s)\delta g(q)\tau(0)\theta_0\left(1+2k\frac{\rho\vartheta^2-(\rho\vartheta^2)^{Z+1}}{1-\rho\vartheta^2}\right)=\mu+\frac{\gamma}{nw}+\frac{1-\gamma}{wn(2Z+1)}\left(1+2k\frac{\rho\vartheta-(\rho\vartheta)^{Z+1}}{1-\rho\vartheta}\right)$$

The first order condition for the utilitarian social optimum is then

$$-t'(s)g(q)\delta\tau(0)\left(1+2\frac{\vartheta-\vartheta^{Z+1}}{1-\vartheta}\right)=\mu+\frac{1}{nw}$$

Proposition 2: Spending in both the utilitarian optimum and the political equilibrium is rising in w, n, δ, $\tau(0)$ and Q, and falling in μ. Spending in the political equilibrium falls with γ.

Proposition 3: If γ is above a threshold, then there will always be underspending in the political equilibrium relative to the social optimum, as long as either k<1 or $\rho < 1/\vartheta$.

If γ is below that threshold, and if $\mu > 0$ and either k<1 or $\rho < 1/\vartheta$, then there exists a population density threshold, n*, at which spending is the political equilibrium equals optimal utilitarian spending,

For levels of n>n*, spending is lower in the political equilibrium than optimal utilitarian spending and for levels of n<n*, spending is higher in the political equilibrium than optimal utilitarian spending.

The value of n* is falling with μ, γ and w.

If k=1 and $\rho = 1/\vartheta$, then the political equilibrium also maximizes overall utility, and if $\mu = 0$, and either k<1 or $\rho < 1/\vartheta$, then there is always overspending.

Underdevelopment at high densities; overdevelopment at low densities.

- This framework delivers the first of our stylized facts– we overbuild where density is low and underbuild where density is high.
- Politics (or inattention) causes the benefits of transportation to be underestimated; but it also causes the cash costs (but not the nuisance costs) of transportation be underestimated.
- At low density levels, the cash costs are a large share of total costs, and as such underestimating those costs leads to overdevelopment of highways and bridges to nowhere.
- At high density levels, the cash costs are less important relative to the nuisance costs, and this means that the main impact of politics is to overemphasize the importance of local nuisances.
- This is essentially a micro-founding of the growth of NIMBYism which has become so important in shutting down urban projects in the USA.

This model also delivers a variant of Weingast's (1979) law of 1/n as a limiting case:

Proposition 4: The ratio of the marginal impact of spending on time in the political equilibrium relative to the marginal impact on time in the pareto optimum will equal 1/(2Z+1) if $\mu = 0$, $\vartheta = 0$ and $\gamma = 0$ or $\frac{1}{(2Z+1)}\left(1 + 2\frac{\vartheta - \vartheta^{Z+1}}{1-\vartheta}\right)$ if $\mu = 0$, $\gamma = 0$, and k=0. This ratio will equal the inverse ratio of spending levels to a power if t(s) is a power function.

The first assumptions—no externalities, all nationwide spending – delivers the 1/n law exactly. Our critical assumption was that information also disappears when there is no externality.

The second assumption, with externalities and all nationwide spending—modifies the law of 1/n because voters are not internalizing the benefits elsewhere. Overspending relative to the social optimum is reduced.

Maintenance vs. New Projects (warning– this is pretty obvious)

- Assume t(s) = t(quantity * quality)
- Assume that quantity is observable by a larger share of the population than quality
- The implication is that quantity will be over-invested in relative to quality.
- Other versions of this could include a more temporal dimension to maintenance vs. new projects or explicitly model the ways in which quality is revealed (i.e. rare adverse events that short lived politicians don't come into contact with).
- But the easiest and most direct and probably truest ways to get at maintenance is just to note that one class of benefits are far more visible than another and the model implies that visibility drives spending.

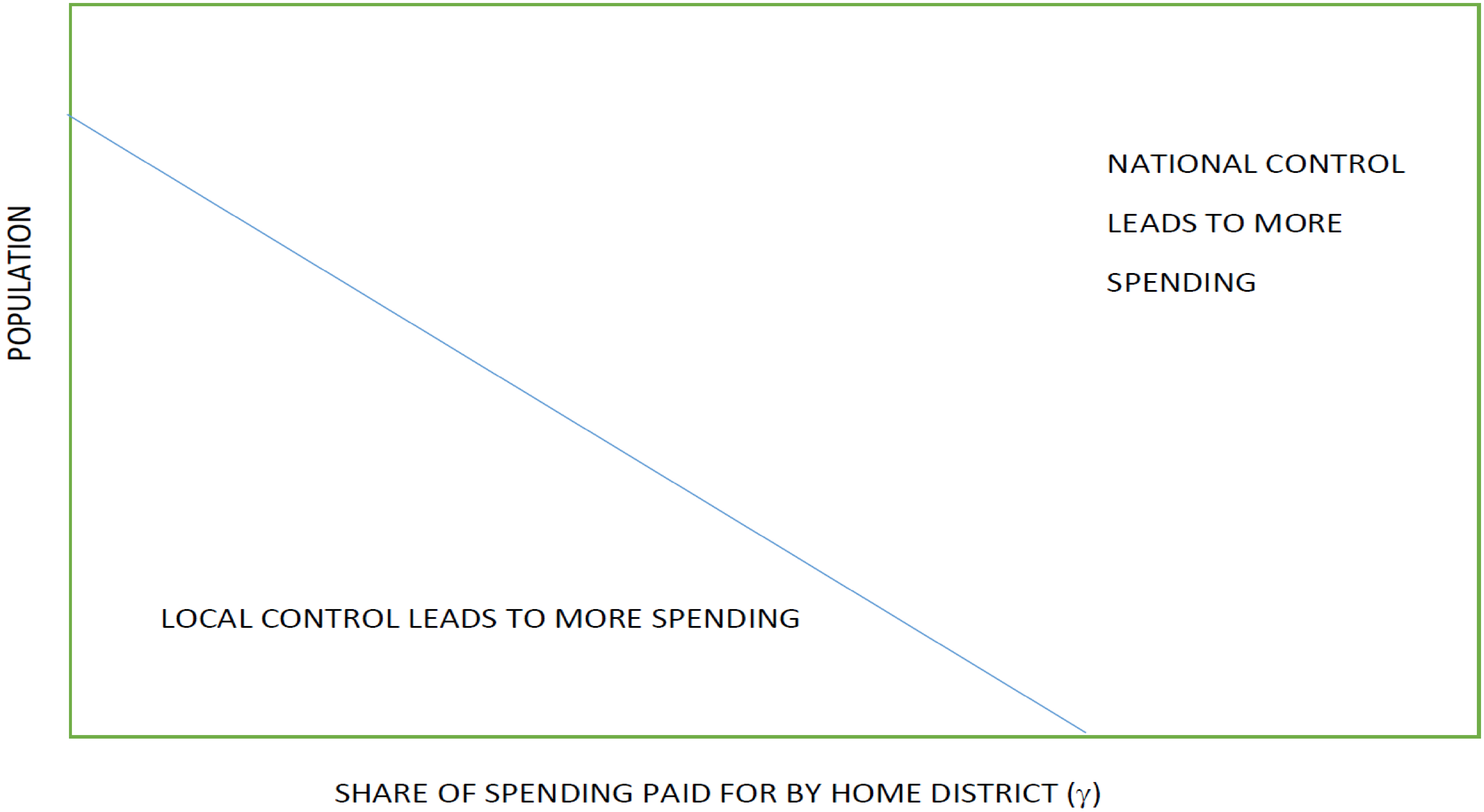
Federalism and Transportation

- To consider the tendency of higher levels to spend on transportation, we continue using the core model and ask what happens if transportation decisions are made by local politicians or by national politicians.
- If the national politician decides, the local share of costs is γ; if the local politician decides the local share of costs is $\omega\gamma > \gamma$
- Again it turns out that population densities determine whether local control increases or decreases the total amount of transportation spending.

Proposition 5: If γ is sufficiently high, then national control will always lead to more spending than local control.

For lower levels of γ, there will exists a threshold population level (as long as $\mu > 0$), and national control leads to more spending if and only if population is above that threshold.

The population threshold falls with μ, w, ω and γ.


NATIONAL CONTROL
LEADS TO MORE
SPENDING
LOCAL CONTROL LEADS TO MORE SPENDING
POPULATION
SHARE OF SPENDING PAID FOR BY HOME DISTRICT (γ)

Inducing Optimal Investment by Funding Rule

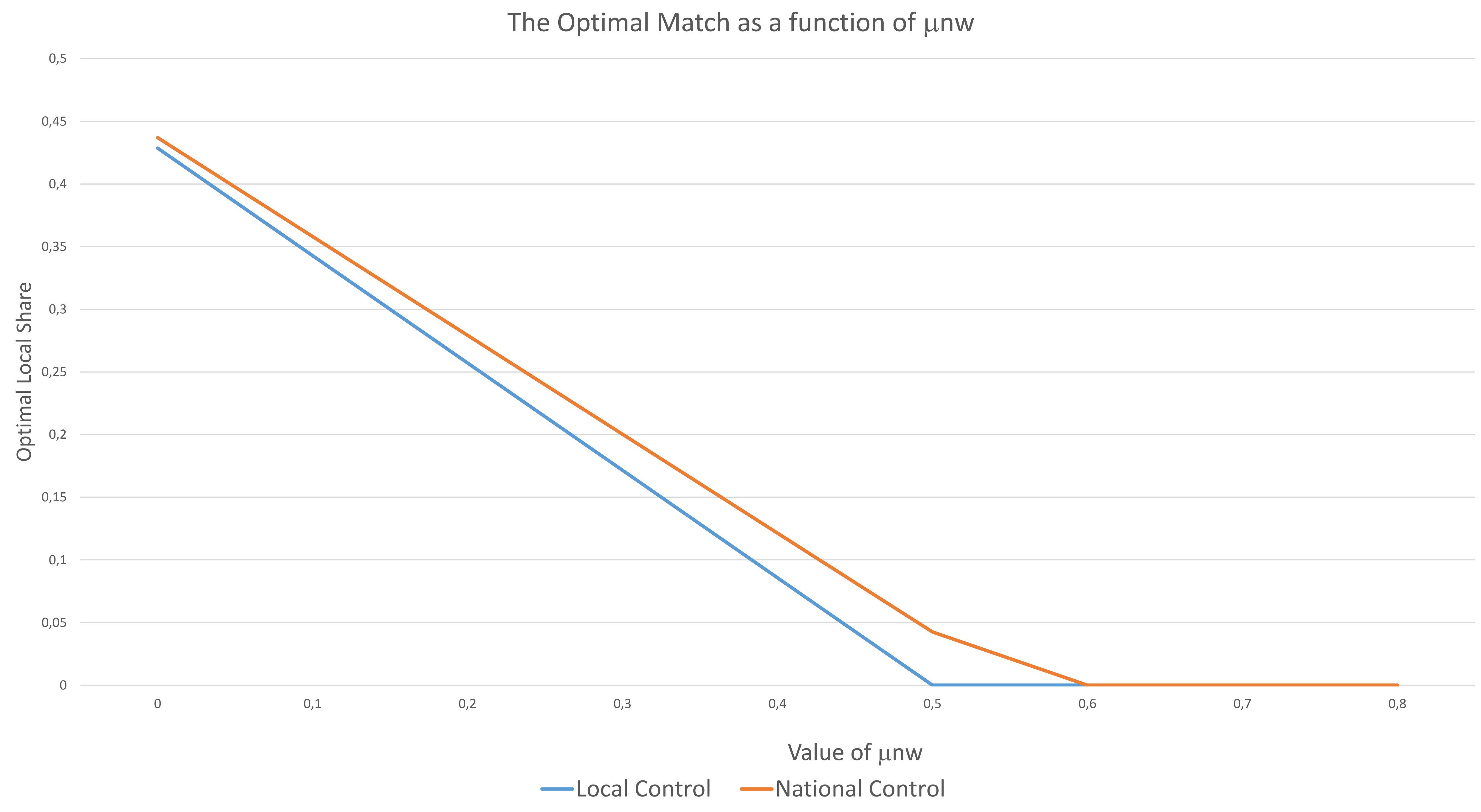
- Since there are real externalities from the new projects and since localities are better informed about home projects, full local funding (i.e. $\gamma=1$) always leads to underprovision either if politicians are local or national.
- By setting a low value of γ, it is possible to induce overprovision, as long as μ isn't too large. Otherwise, the community turns down the project even if it is free (we don't allow more than one-for-one matching).
- Typically this means that there will exist a funding formula that will generate optimal spending– but the range of parameters for which this exists is larger with Federal than local control.

Proposition 6: There exists a value of $\omega\gamma$ that induces the local government to spend the socially optimal amount on transportation infrastructure if and only if $\frac{1-\vartheta}{(\vartheta-\vartheta^{Z+1})} - \frac{1+\vartheta-2\vartheta^{Z+1}}{2(\vartheta-\vartheta^{Z+1})(2Z+1)} > \mu n w$.

There will also exist a value of γ that will induce optimal spending given national control, which will be greater than then level of $\omega\gamma$ that induces optimal local behavior assuming all other parameter values are the same. Socially optimal spending can be generated at the national level values even if $\frac{1-\vartheta}{(\vartheta-\vartheta^{Z+1})} - \frac{1+\vartheta-2\vartheta^{Z+1}}{2(\vartheta-\vartheta^{Z+1})(2Z+1)} > \mu n w$.

The levels of $\omega\gamma$ and γ that induce socially optimal investment given local and Federal control respectively are both falling with $\mu n w$.

When $\mu n w = 0$, then the optimal value of $\omega\gamma$ falls with ϑ.


The Optimal Match as a function of μnw
Optimal Local Share
0,5
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
0
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
Value of μnw
Local Control
National Control

The Benign View of Federal Funding

- Transportation is a dance between non-local funding and the Law of 1/N (that induces overprovision) and NIMBYism that induces underprovision.
- As the level of local nuisance and NIMBYism rises, the share that needs to be funded at the national level also rises.
- In a sense, the Federal Highway Aid Act of 1973, which authorizes urban transit spending, can be seen as an appropriate response to rising NIMBYism during the 1960s.
- Yet Federal funding also creates such overspending in other areas (such as mitigation) that is it hard to believe that this benign view is accurate.
- A less benign view is that the Federal government funds – for its own reasons– and because of the power of NIMBYism, the Federally funded projects are the only ones that get built.

Master Builder Robert Moses to Master Organizer Jane Jacobs: Overbuilding-> Underbuilding (?)

The Age of Expensive Mitigation

The Mega-Projects (Altshuler and Luberoff) version of US Infrastructure History

- Post WWII had large scale projects (think Robert Moses) that occasionally ran roughshod over poorer local communities. Many of these were Federally funded – creating strong incentives for communities to build.
- In the 1960s, there was a substantial backlash (think Jane Jacobs) that shut down projects (like Lomex) that would have harmed neighborhoods– although possibly creating wider benefits.
- By the 1970s, there was vastly more attention paid to mitigation occasionally with extremely expensive results (think the Big Dig).
- So the result has been a move from to many (perhaps) projects to too few and far more investment in mitigation.
- I tend to think of the changing variable as either (1) local knowledge about projects (created by human capital), (2) or political organization, or (3) cost of nuisance rising with income.

Allowing Big Dig type effects in the model

- We investing to reduce nuisance at a cost $c(\mu_k, s_k)$, and hence the total social cost of nuisance is $c(\mu_k, s_k) + \mu_k w_k s_k n_k$ (fixed s_k)
- Nuisance is highly observable– the costs of mitigation are much less so– and hence there is often overspending on nuisance reduction.
- We focus on local control for simplicity.
- Proposition 7: If $\gamma = 1$, then spending to reduce the nuisance is optimal.
- If $\gamma < 1$, then spending will be higher than optimal if and only if $\sum_j (\theta_0 - \theta_{ij}) w_j n_j > 0$.

The Law of 1/N applied to mitigation

- If spending to reduce the nuisance is only observed by the residents of the area impacted by the nuisance, then the ratio of the socially optimal marginal cost of nuisance spending to the equilibrium marginal cost of nuisance spending is $\frac{w_k n_k}{\sum_j w_j n_j}$.
- This equals 1/(2Z+1) if communities are homogenous.
- The ratio of marginal costs equals the ratio of spending on mitigation to a power of c(.,.) is a power function.
- High observability of mitigation at the local level combined with low observability elsewhere suggests large scope for overmitigation.
- In principle, this suggests that mitigation should be locally funded while the transportation projects themselves should be more nationally funded, but separating the two is often difficult.

The City and the Suburb

- We assume that there are only two areas – the suburbs and the city– and consider the construction of a transport system in the city that benefits both the suburbs and the city.
- Suburban welfare: $w_S(1 - tax_S - \delta\tau_S g(q_C)t(s_C))$
  - Ignore trips in the suburbs themselves
- Urban welfare: $w_C(1 - tax_C - s_C\mu_C - \delta\tau_C g(q_C)t(s_C)$
- Budget constraint: $tax_S w_S n_S + tax_C w_C n_C = \gamma(s_C + c(\mu_k, s_k))$
- $c(\mu_k, s_k) = c_0(\mu_k)^{-\alpha} s_k$

Proposition 8: The level of s_C and total spending are both falling with γ.

The level of μ_C is rising with γ and the ratio $\frac{\theta_S}{\theta_C}$.

The level of s_C is rising with the ratio $\frac{\theta_S}{\theta_C}$ if and only if $\frac{\gamma(1+c(\mu_C))}{\mu_C(n_C w_C+n_S w_S)+\gamma(1+c(\mu_C))} < \frac{\tau_S}{\tau_C}$.

If $\tau_C = \tau_S = \tau$, $t(s_C) = (s_C)^{-\alpha}$ and $c(\mu_C) = (\mu_C)^{-\varepsilon}$, then an increase in the ratio $\frac{\theta_S}{\theta_C}$ will raise total spending if $\delta g(q_C)\tau$ is high but not if $\delta g(q_C)\tau$ is low.

Proposition 9: If $\theta_S > \theta_C$, then if $\gamma = \frac{1+\frac{n_S w_S}{n_C w_C}}{\frac{\theta_S}{\theta_C}+\frac{n_S w_S}{n_C w_C}}$, the level of mitigation will be socially optimal, but at that level of γ, the investment in transportation will be too high.

If $\theta_S < \theta_C$, there will always be overinvestment in mitigation.

When $\frac{\theta_S}{\theta_C}$ is less than but sufficiently close to one, then there exists a value of γ between zero and one that ensures efficient investment in transportation (conditional upon mitigation) if and only if

$$1 + \frac{(n_C w_C + n_S w_S)\mu_C(1)}{1+c(\mu_C(1))} > \frac{\tau_C}{\tau_S} > \frac{n_S w_S \mu_C(0)}{1+c(\mu_C(0))} - \frac{\theta_S}{\theta_C}\left(\frac{n_S w_S \mu_C(0)}{1+c(\mu_C(0))} + \frac{n_S w_S}{n_C w_C}\right).$$

This condition holds—for example—if $\frac{\theta_S}{\theta_C}$ is close to one and if $\frac{\tau_C}{\tau_S}$ is less than or equal to one.

Buses vs. Trains

- Well– this could be about the relatively observability of one versus the other.
- Alternatively, it could reflect just the coolness of the train.
- Or the greater opportunities for corruption on trains.
- I’m not really sure
- So on to the failure to anticipate behavioral responses which gives us too little support for congestion pricing and too much support for new highways.

Do Voters Anticipate Behavioral Responses to Congestion Pricing and New Roads?

- Survey Question: “Congestion pricing would be good for the economy because traffic congestion costs New Yorkers billions of wasted dollars every year.”
- 42 percent agreed to this question in a 2007 poll of New Yorkers; 49 percent disagreed.
  - It is not obvious if the disagreement is with the impact of fees on congestion or some other factor that might hurt the economy.
- Share of Stockholm residents in 2005 who opposed congestion pricing was 55 percent. This dropped to 41 percent after the trail of the cordon-based pricing scheme.
  - This seems likely to reflect changing views of the impact of the fee.
- “Just as building new schools does not “cause” more students or studying, building roads does not “cause” more drivers or traffic.” American Road and transportation builders association.

Dal Bo, Dal Bo and Eyster (“The demand for bad policy when voters underappreciate equilibrium effects”): Choose which Game to Play

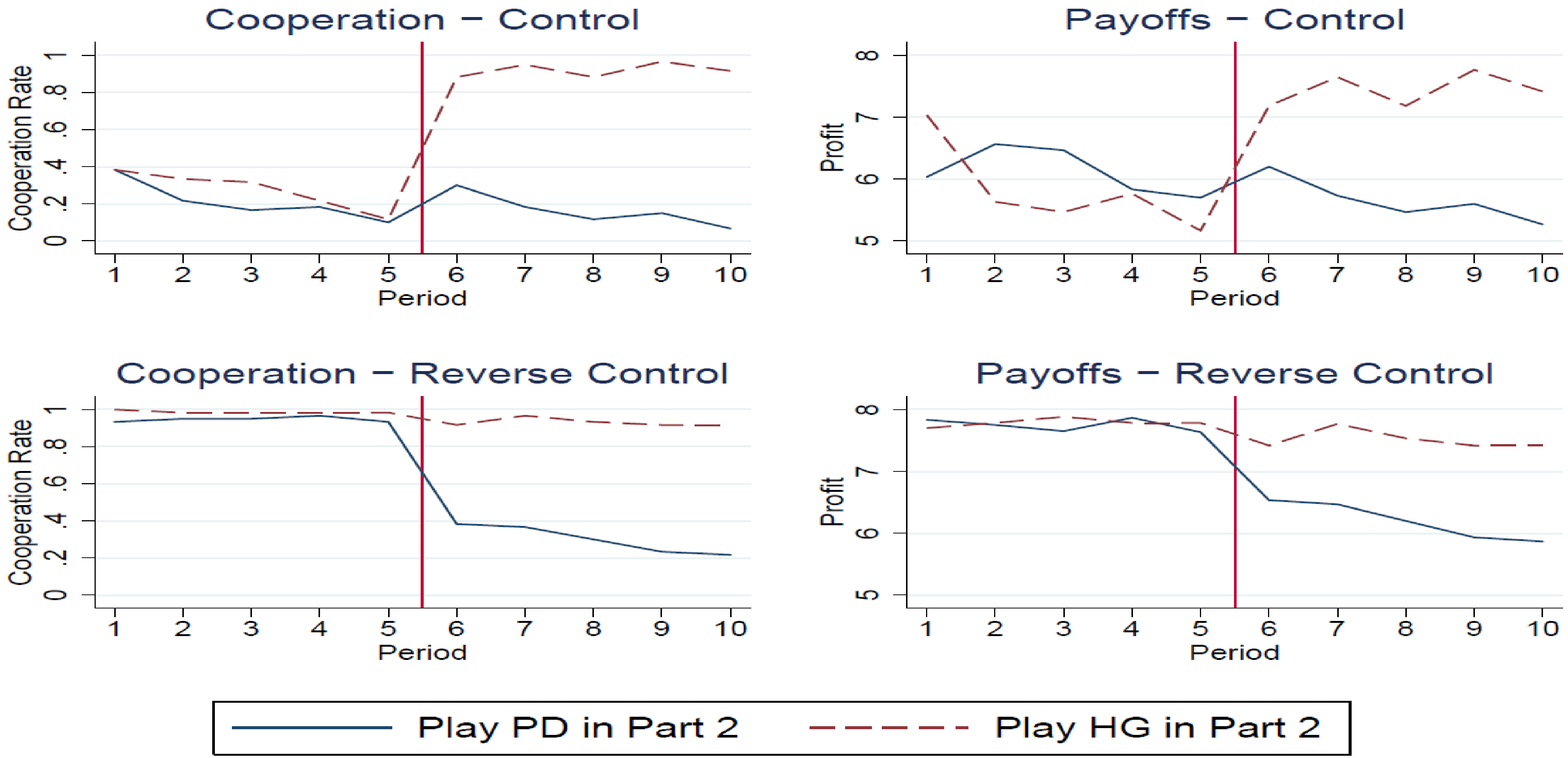
Prisoner’s Dilemma

	Cooperate	Defect
Cooperate	9,9	3,11
Defect	11,3	5,5

Harmony Game

	Cooperate	Defect
Cooperate	8,8	2,7
Defect	7,2	1,1

A Majority of Voters Choose Prisoner's Dilemma, but they do better in Harmony



The Oslo Example: Projected Traffic

- **“Motorists trying to drive in and through Norway’s capital face months, if not years, of what’s expected to be the worst traffic chaos ever. Ten of the city’s tunnels have been ordered to undergo rehabilitation, at a time when major construction projects are also forcing constant changes in traffic patterns.” 4/2/15 http://www.newsinenglish.no/2015/04/22/traffic-nightmare-hangs-over-oslo/**
- The nightmare fails to materialize apparently because motorists actually responded to the projected traffic and changed their commuting patterns.

The Failure to Predict the Behavioral Change of Others

- Related to the Winner’s Curse Paradox (can’t figure out what winning implies about the beliefs of others)– hence Cursed Equilibria (Eyster/Rabin).
- Related to the Cognitive Hierarchy models of Camerer and Ho. Nathanson and I use this in the context of housing bubbles– failure to properly connect past housing prices with past beliefs.
- Dal Bo, Dal Bo and Eyster think about it as a failure to determine equilibrium, but it may be easier to understand it as a failure to predict behavioral responses.
- Even tied to Kahnemans “Why You See is All There Is” bias of not thinking through the impact of others’ actions of a policy change.
- Tied closely to the Fundamental Attribution Error – we attribute other people’s attractions to intrinsic characteristics not external factors.
    - This is essentially assuming that other people’s behavior does not respond fully.

The Cursed Voter Model: General Form

- Voter i's preferred policy maximizes $W\left(A_i, \tilde{A}_{j\neq i}, q\right)$, where A_i is the individuals own action (or vector of actions), $\tilde{A}_{j\neq i}$ is the vector (or matrix) of actions of others and q represents the policy (or vector of policies).
  - Alternative formulation is $W\left(A_i, P\left(\tilde{A}_j\right), q\right)$ where $P\left(\tilde{A}_j\right)$ represents market quantities
  - Function is concave in q
- The correct first order condition is $\frac{\partial W}{\partial q} + \sum_{j\neq i} \frac{\partial W}{\partial A_j}\frac{\partial A_j}{\partial P} = 0.$
- The Cursed Voter believes that $\frac{\partial A_i}{\partial q} = \theta \frac{\partial A_i}{\partial q}$, where $\theta < 1.$
  - At present, the perceived under-reaction is assumed; later it will be derived.
- The level of q is rising with θ if and only if $\sum_{j\neq i} \frac{\partial W}{\partial A_j}\frac{\partial A_j}{\partial q} > 0.$
  - Hence there is overprovision when $\frac{\partial W}{\partial A_j}\frac{\partial A_j}{\partial q} < 0$, and underprovision when $\frac{\partial W}{\partial A_j}\frac{\partial A_j}{\partial q} > 0$

Possible Examples of Underprovision $\frac{\partial W}{\partial A_j}\frac{\partial A_j}{\partial q} > 0$

- Congestion pricing: $\frac{\partial W}{\partial A_j} < 0$ – the driving externality is negative and $\frac{\partial W}{\partial A_j} < 0$ – a higher tax (or public transportation) reduces congestion.
  - This is a general point of Pigouvian taxes, like carbon taxes (Dal Bo, Dal Bo, Eyster)
- Too little funding for disabled riders on public relative to imposing an unfunded mandate: $\frac{\partial W}{\partial A_j} > 0$ – transit users benefit from having better service and $\frac{\partial A_j}{\partial q} > 0$ – alleviating the ADA unfunded mandate presumably increases service availability.
  - The MBTA in Mass. spends $110 million on two million rides for the disabled.
- Underprovision of permits for new housing (from a renter's perspective):

$\frac{\partial W}{\partial A_j} > 0$ renters benefit from new building that pushes down prices, $\frac{\partial A_j}{\partial q} > 0$ more permits allow more building.

Examples of Overprovision: $\frac{\partial W}{\partial A_j}\frac{\partial A_j}{\partial q} < 0$

- Highways and free-parking building: $\frac{\partial W}{\partial A_j} < 0$ – the driving externality is still negative but $\frac{\partial A_j}{\partial q} > 0$
  - More roadbuilding and free parking w increase driving (Duranton and Turner, 2011).
- Rabin's example—too much desire by the healthy to eliminate handicapped parking because of the supply response of other parkers:
  - $\frac{\partial W}{\partial A_j} < 0$—more people competing for spots makes you worse off. $\frac{\partial A_j}{\partial q} > 0$: more people looking for parking spots because more are available.
- Peltzman's example—too many seatbelts: $\frac{\partial W}{\partial A_j} < 0$—more people driving unsafely makes you worse off. $\frac{\partial A_j}{\partial q} > 0$: more people drive unsafely with seatbelts (according to Sam).
- Labor market restrictions (lump of labor fallacy): $\frac{\partial W}{\partial A_j} > 0$—more new jobs being created makes you better off. $\frac{\partial A_j}{\partial q} < 0$: fewer new jobs being created because they have to be spread among more workers.

Congestion Pricing and Infrastructure

- Individuals choose N to maximize $V(N) - NC\left(\frac{\widehat{N}}{I}\right)$ where I is per capita infrastructure spending, N represents the individuals trips, $\widehat{N}$ is the community average, and $C\left(\frac{\widehat{N}}{I}\right)$ is the time cost of each trip which is increasing and weakly convex.
- Politically they choose I to maximize $V(N) - NC\left(\frac{\widehat{N}}{I}\right) - I$
- They underestimate the reaction of $\widehat{N}$ to all changes by a factor θ
- The first order condition for I is $\left(\frac{\widehat{N}}{I} - \theta\ \frac{\partial \widehat{N}}{\partial I}\right)\frac{N}{I}C'\left(\frac{\widehat{N}}{I}\right)$=1

Overinvestment and Cursed Voting

- The level of I is always falling with θ so there is overinvestment.
- The marginal benefit is overstated by a fraction $\frac{(1-\theta)\frac{I}{\hat{N}}\frac{\partial \hat{N}}{\partial I}}{1-\frac{I}{\hat{N}}\frac{\partial \hat{N}}{\partial I}}$
- If $\frac{I}{\hat{N}}\frac{\partial \hat{N}}{\partial I}$ is close to one, then this overestimate of the benefits could potentially have enormous effects on perceived benefits even if θat is relatively close to one.
- If Duranton and Turner (2011) are right, then this implies a huge potential for mistaken population support for highway building based on underestimating the behavioral response of others.

Congestion Pricing and Cursed Equilibrium

- Hold I constant and choose t– a tax per trip – with $\delta t\widehat{N}$ returned to voters, with $\delta<1$ to reflect administrative costs, waste, etc.
- Without this cost, the behavioral response is irrelevant – just set price equal to marginal cost – with this cost, a reduction in behavioral response matters.
- Voters choose t to maximize $V(N) - N\left(t + C\left(\frac{\widehat{N}}{I}\right)\right) + \delta t\widehat{N}$
- Condition for t is $N - \delta\widehat{N} = \theta\ \frac{\partial\widehat{N}}{\partial t}\left(\delta t - \frac{N}{I}C'\left(\frac{\widehat{N}}{I}\right)\right)$
- If $N = \widehat{N}$, then $t = \frac{\widehat{N}}{\delta I}C'\left(\frac{\widehat{N}}{I}\right) - \frac{1-\delta}{\delta\theta\left(-\frac{t}{\widehat{N}}\frac{\partial\widehat{N}}{\partial t}\right)}$

Congestion Pricing with Heterogeneity

- Individuals make a one zero choice of whether to drive. Distribution of benefits of driving "V".
- Equilibrium is $V^* = t + C(1 - F(V^*))$
- In reality there is a uniform distribution of V on [0, 1].
- Cursed voters beliefs that this even distribution holds only for a fraction θ and out of the rest, a fixed share "m" always drive (V=1).
- Hence Perceived Number of Drivers or N=$(1-\theta)m + \theta(1 - V^*)$
- "Cursed Social Optimum" maximizes expected welfare and gets:

$$t = \frac{NC'(N)}{\delta} - \frac{\big(1 + \theta C'(N)\big)(1-\delta)N}{\delta\theta}$$

Heterogeneity of preferences for congestion pricing

- Non-marginal non-drivers always benefit from higher values of the tax and don't care about the behavioral response much.
- Non-marginal drivers benefit from the tax if and only if

$\big(1-\delta(1-F(V^*))\big)t + C(1-F(V^*))$ falls with t.

- If the median voter is an infra-marginal drivers then

$$\mathrm{t} = \frac{C'(N)}{\delta} - \frac{\big(1+\theta C'(N)\big)(1-\delta N)}{\delta\theta}$$

- Supports any tax if and only if $\theta > \frac{(1-\delta N)}{\delta N C'(N)}$

Conjectural Variations

- Consider a simpler distribution $V_i \in \{v, 1\}$ and the true share of drivers with V_i=1 is m.
- Individuals know the binary distribution but err about m.
- C(1)<v so everyone drives without a fee.
- Consider the imposition of an effective tax so that $1 \geq t + C(m) \geq v$
  - If there is waste, then the optimal tax is $\mathrm{v} - C(m)$
- Welfare rises if $m + (1-m)v - C(1) < m - mC(m) - (1-\delta)(\mathrm{v} - C(m))m$
- Welfare ex post for low v-types is δtm and for high v-types is $1 - C(m) - t + \delta tm$
- Error # 1: FAE means that both types over-state m– the group with fixed behavior.
- Error # 2: Over-representativeness means that both types over-state the size of their own group.

The Fixed Behavior Error

- The welfare increasing condition holds if and only if OR $\delta m C(m) + (1 - \delta m)v < C(1)$ which does not hold when m=0 or m=1, so for high enough values of perceived m– congestion pricing will not be optimal.
- If people believe that m equals a larger value m', then the low-v types will not expect to drive. The high-v types will expect a mixed equilibrium if t>1-C(m') or that they will drive if t<1-C(m').
- In the mixed strategy equilibrium, with fraction m^* (defined so that $t = 1 - C(m^*)$ driving, then both types will perceive that their welfare after the tax equal to $\delta t m^*$.
- Higher perceived values of m make congestion pricing more attractive to low-v types since revenues go up. The low-v types always perceive a benefit from higher m' since revenues are higher.
- In the pure strategy equilibrium, where all high v-types drive, then the expected welfare after the tax for the low v-types is $\delta t m'$ and for high-v types is $1 - \mathrm{C}(\mathrm{m}') - \mathrm{t} + \delta t m'$
- This goes to $1 - \mathrm{C}(1) - (1 - \delta)t$ as m'→ 1, so when FAE is strong enough, drivers always oppose the congestion charge.

The Representativeness Error

- Just as before, but now the low v-types believe that there are more types like themselves.   This will reduce the revenue benefits from the tax and make the tax seem less attractive.
- The high-v types believe that there are more high v-types. As in the previous case, this will ensure that they oppose congestion pricing as long as m' is close enough to one.
- Mistakenly assuming less of a behavioral response increases support for taxes among people who benefit primarily from the revenues, but decreases support among people who will benefit from less congestion.
- If we target revenues to the impacted drivers, this can actually eliminate the only base of support for congestion pricing.
- Mistakenly assuming that people are like yourself can reduce support among both groups because those who want revenue assume that that the tax will raise less revenue and those who want less congestion assume that the tax do less to reduce congestion.

What Should We Learn from Political Economy Models?

- What interventions are more or less likely to succeed politically
- What alliances are most likely to be effective in different ways
- What can we say that will be more likely to be effective in moving public debate