MIND THE EXTERNALITY GAP*:*

COMPARING RAIL TRANSIT CAPITAL AND OPERATING COSTS TO CONSUMER BENEFITS

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COSTS AND BENEFITS OF RAIL TRANSIT:
HIGHLY CONTENTIOUS

Policy Analysis
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Defining Success
The Case against Rail Transit

by Randal O'Toole

Executive Summary

Over the past four decades, American cities have spent close to $100 billion constructing rail transit systems, and many billions more operating those systems. The agencies that spend taxpayer dollars building these lines almost invariably call them successful even when they go an average of 40 percent over budget and, in many cases, carry an insignificant number of riders. The people who rarely or never ride these lines but still have to pay for them should ask, "How do you define success?"

This Policy Analysis uses the latest government data on scores of rail transit systems to evaluate the systems' value and usefulness to the public using six different tests:

- Profitability: Do rail fares cover operating costs?
- Ridership: Do new rail lines significantly increase transit ridership?
- Cost-Effectiveness: Are new rail lines less expensive to operate than buses providing service at similar frequencies and speeds?
- The "Cable Car" Test: Do rail lines perform as well as or better than cable cars, the oldest and most expensive form of mechanized land-based transportation?
- The Economic Development Test: Do new rail lines truly stimulate economic development?
- The Transportation Network Test: Do rail lines add to or place stresses upon existing transportation networks?

No system passes all of these tests, and in fact few of them pass any of the tests at all.

Randal O'Toole is a senior fellow with the Cato Institute and author of Gridlock: Why We're Stuck in Traffic and What to Do about It.

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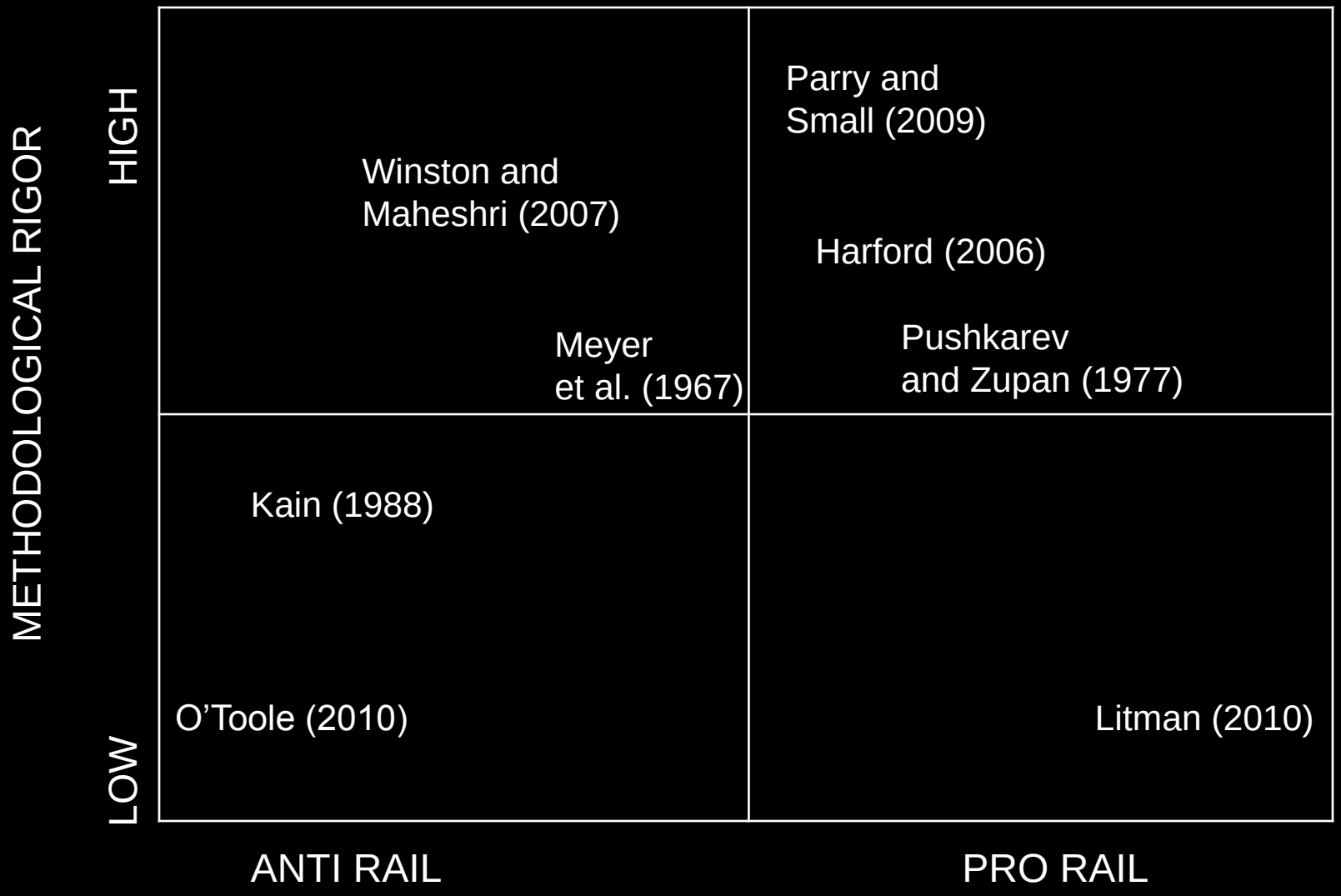
Raise My Taxes, Please!
Evaluating Household Savings From High Quality Public Transit Service

26 February 2010

Todd Litman
Victoria Transport Policy Institute

Summary
High quality public transit consists of service sufficiently convenient and comfortable to attract travel that would otherwise be by automobile. This report uses data from U.S. cities to investigate the incremental costs and benefits of high quality transit service. It indicates that high quality public transit typically requires about $268 in additional subsidies and $104 in additional fares annually per capita, but provides vehicle, parking and road cost savings averaging $1,040 per capita, plus other benefits including congestion reductions, increased traffic safety, pollution reductions, improved mobility for non-drivers, improved fitness and health. This indicates that residents should rationally support tax increases if needed to create high quality public transit systems in their communities. Current planning practices tend to overlook or undervalue many of these savings and benefits and so result in underinvestment in transit quality improvements.

LITERATURE MAP



If consumer benefits alone do not justify the high cost of rail transit, what would the external value of a passenger mile have to be to do so?

RB = UB + FR – CC – OC + EB

Where
RB = Rail Net Annual Benefits
FR = Fare Revenues
CC = Annualized Capital Costs
OC = Operating Costs
EB = Net External Benefits

Set RB to 0 and solve for EB.

“The Externality Gap” = CC + OC – FR – UB

FARE REVENUES	+
(OPERATING COSTS)	–
OPERATING LOSS	
(CAPITAL COSTS)	–
TOTAL NET COSTS	
CONSUMER BENEFITS	+
EXTERNALITY GAP	?
NET ECONOMIC BENEFITS	0

SYSTEMS IN STUDY

	City	Agency
1.	Atlanta	Metropolitan Atlanta Rapid Transit Authority
2.	Baltimore	Maryland Transit Administration
3.	Boston	Massachusetts Bay Transportation Authority
4.	Buffalo	Niagara Frontier Transportation Authority
5.	Charlotte	Charlotte Area Transit System
6.	Chicago	Chicago Transit Authority
7.	Dallas	Dallas Area Rapid Transit
8.	Denver	Denver Regional Transportation District
9.	Los Angeles	Los Angeles County Metropolitan Transportation Authority
10.	Miami	Miami-Dade Transit
11.	Minneapolis	Metro Transit
12.	New York	MTA New York City Transit
13.	Newark/Jersey City/Trenton	New Jersey Transit Corporation
14.	Philadelphia	Southeastern Pennsylvania Transportation Authority
15.	Pittsburgh	Port Authority of Allegheny County
16.	Portland	Tri-County Metropolitan Transportation District of Oregon
17.	Sacramento	Sacramento Regional Transit District
18.	Salt Lake City	Utah Transit Authority
19.	San Diego	San Diego Metropolitan Transit System
20.	San Francisco	San Francisco Municipal Railway
21.	San Francisco	San Francisco Bay Area Rapid Transit District
22.	San Jose	Santa Clara Valley Transportation Authority
23.	San Juan	Puerto Rico Highway and Transportation Authority
24.	Washington, DC	Washington Metropolitan Area Transit Authority

SYSTEMS IN STUDY

EB = CC + OC – FR – UB

	Average System	Average per PMT	Total in Billions
FARE REVENUES	$0.18	$0.21	$3.9
(OPERATING COSTS)	(0.66)	(0.39)	($7.1)
OPERATING LOSS	($0.48)	($0.17)	($3.2)
(CAPITAL COSTS)	-	-	-
TOTAL NET COSTS	-	-	-
CONSUMER BENEFITS	-	-	-
EXTERNALITY GAP	-	-	-
NET ECONOMIC BENEFITS	-	-	-

Operating loss per PMT by Agency

	Agency	Op Loss
1.	MTA New York City Transit	.1074102
2.	San Francisco Bay Area Rapid Transit District	.1174533
3.	San Diego Metropolitan Transit System	.1199913
4.	Denver Regional Transportation District	.1472077
5.	Washington Metropolitan Area Transit Authority	.1814085
6.	Metropolitan Atlanta Rapid Transit Authority	.1841911
7.	Chicago Transit Authority	.1993877
8.	Southeastern Pennsylvania Transportation Authority	.216748
9.	Massachusetts Bay Transportation Authority	.2268611
10.	Metro Transit	.2408751
11.	Utah Transit Authority	.2472688
12.	Tri-County Metropolitan Transportation District of Oregon	.2718581
13.	Los Angeles County Metropolitan Transportation Authority	.3575824
14.	Sacramento Regional Transit District	.4404929
15.	Miami-Dade Transit	.4863477
16.	Dallas Area Rapid Transit	.4968237
17.	Charlotte Area Transit System	.6025766
18.	Maryland Transit Administration	.6059452
19.	Santa Clara Valley Transportation Authority	.8618044
20.	San Francisco Municipal Railway	.8755004
21.	New Jersey Transit Corporation	.9644889
22.	Puerto Rico Highway and Transportation Authority	1.050253
23.	Port Authority of Allegheny County	1.121352
24.	Niagara Frontier Transportation Authority	1.312702

EB = CC + OC – FR – UB

Estimating Annualized Capital Costs

Used capital cost data on 55 investments over the past 4 decades providing:

100% of costs: 9 systems
80% to 99%: 9 systems
54%: 1 system
0 to 10%: 5 systems

Costs Annualized at 2.2% Amortization Rate over 50 years.

EB = CC + OC – FR – UB

Estimating Annualized Capital Costs for the 5 Systems with Insufficient Cost Data:

Average the inflation-adjusted capital expenditures over the past 17 years (available from the NTD).

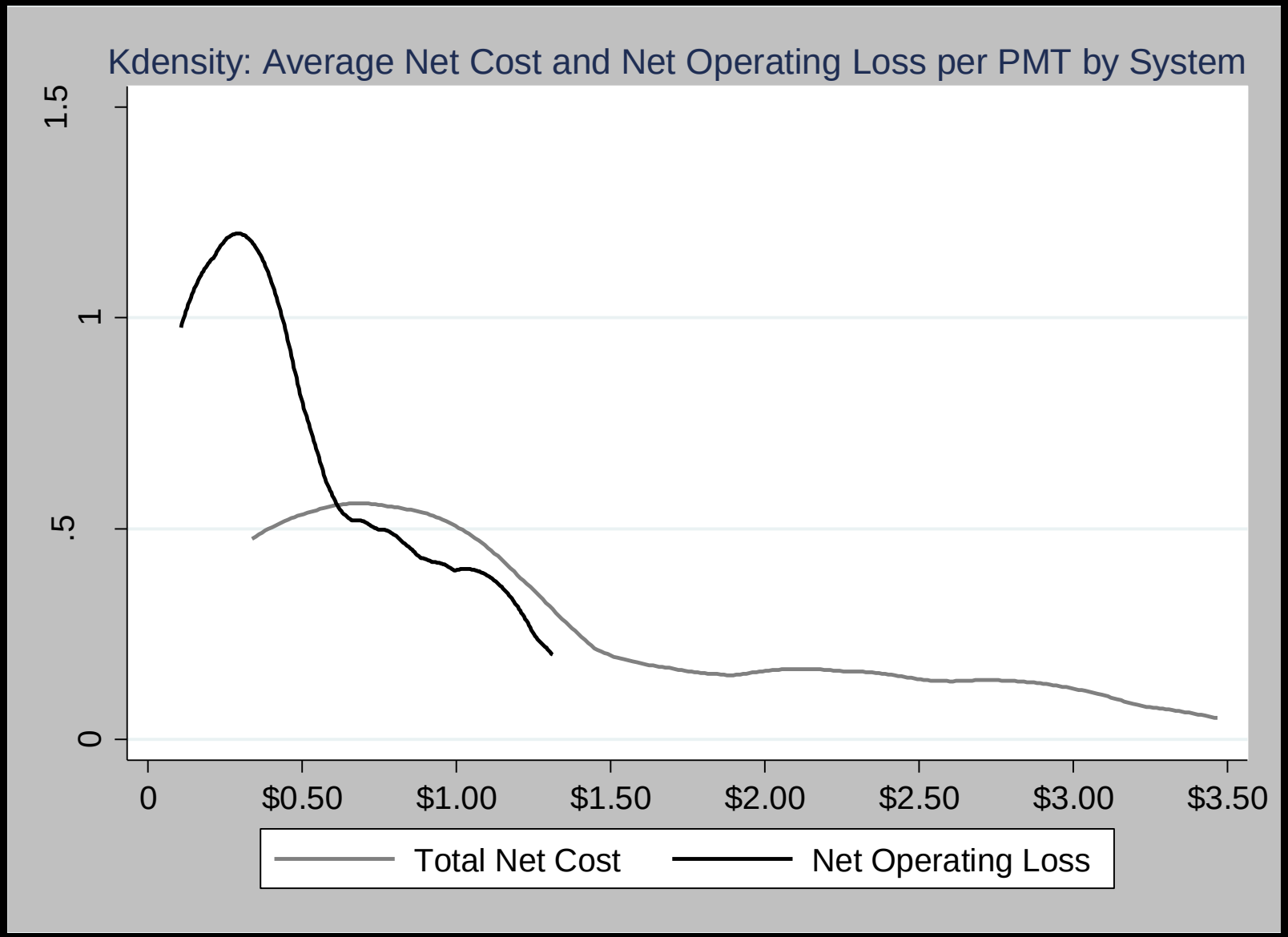
Annual Capital Cost Estimates by Method for Older Systems with Investment Data

SYSTEM	Investment Data	NTD Estimate	Difference
SF BART	$321 Million	$355 Million	9.6%
DC METRO	$694 Million	$425 Million	-38.8%

EB = CC + OC – FR – UB

	Average System	Average per PMT	Total in Billions
FARE REVENUES	$0.18	$0.21	$3.9
(OPERATING COSTS)	(0.66)	(0.39)	$7.1
OPERATING LOSS	($0.48)	($0.17)	($3.2)
(CAPITAL COSTS)	($0.71)	($0.33)	($6.1)
TOTAL NET COSTS	($1.19)	($0.51)	($9.3)
CONSUMER BENEFITS	-	-	-
EXTERNALITY GAP	-	-	-
NET ECONOMIC BENEFITS	-	-	-

SMOOTHED DISTRIBUTION OF COSTS BY SYSTEM

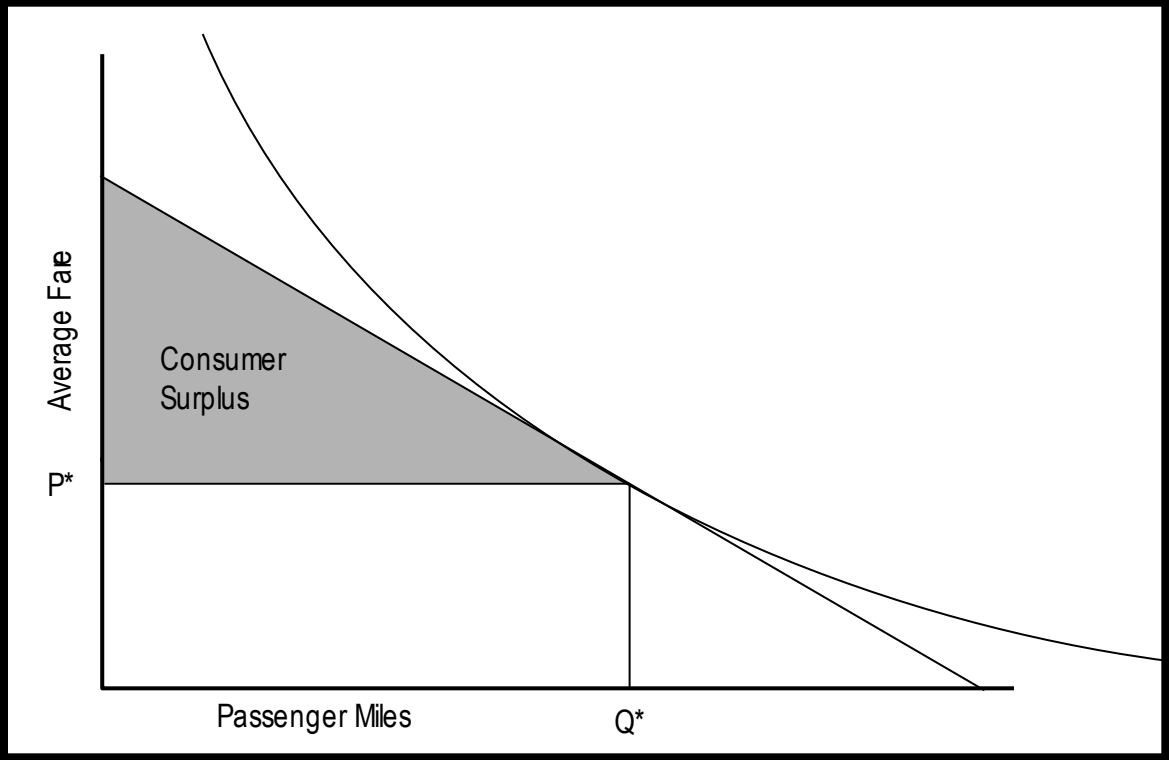


Net Rail Cost per PMT by Agency

	Agency	Net Cost
1.	San Francisco Bay Area Rapid Transit District	.3392514
2.	MTA New York City Transit	.3521312
3.	San Diego Metropolitan Transit System	.4631574
4.	Metro Transit	.4878086
5.	Denver Regional Transportation District	.5023656
6.	Chicago Transit Authority	.5657239
7.	Metropolitan Atlanta Rapid Transit Authority	.5884137
8.	Massachusetts Bay Transportation Authority	.5890374
9.	Utah Transit Authority	.5933548
10.	Washington Metropolitan Area Transit Authority	.6044832
11.	Tri-County Metropolitan Transportation District of Oregon	.6690745
12.	Southeastern Pennsylvania Transportation Authority	.7467733
13.	Sacramento Regional Transit District	.7897594
14.	Dallas Area Rapid Transit	.8901268
15.	Los Angeles County Metropolitan Transportation Authority	1.02479
16.	Miami-Dade Transit	1.064788
17.	Maryland Transit Administration	1.385065
18.	San Francisco Municipal Railway	1.63248
19.	Charlotte Area Transit System	1.690542
20.	New Jersey Transit Corporation	2.333046
21.	Santa Clara Valley Transportation Authority	2.377767
22.	Port Authority of Allegheny County	2.658739
23.	Puerto Rico Highway and Transportation Authority	2.750571
24.	Niagara Frontier Transportation Authority	3.469359

EB = CC + OC – FR – **UB**

Estimating User Benefits.
Assumptions:
Linear demand elasticity
Point elasticity at p*,Q* = -0.3, -0.6, or -1.0



Log-Log Panel Regressions of Determinants of PMT (6 Years, 23 systems)

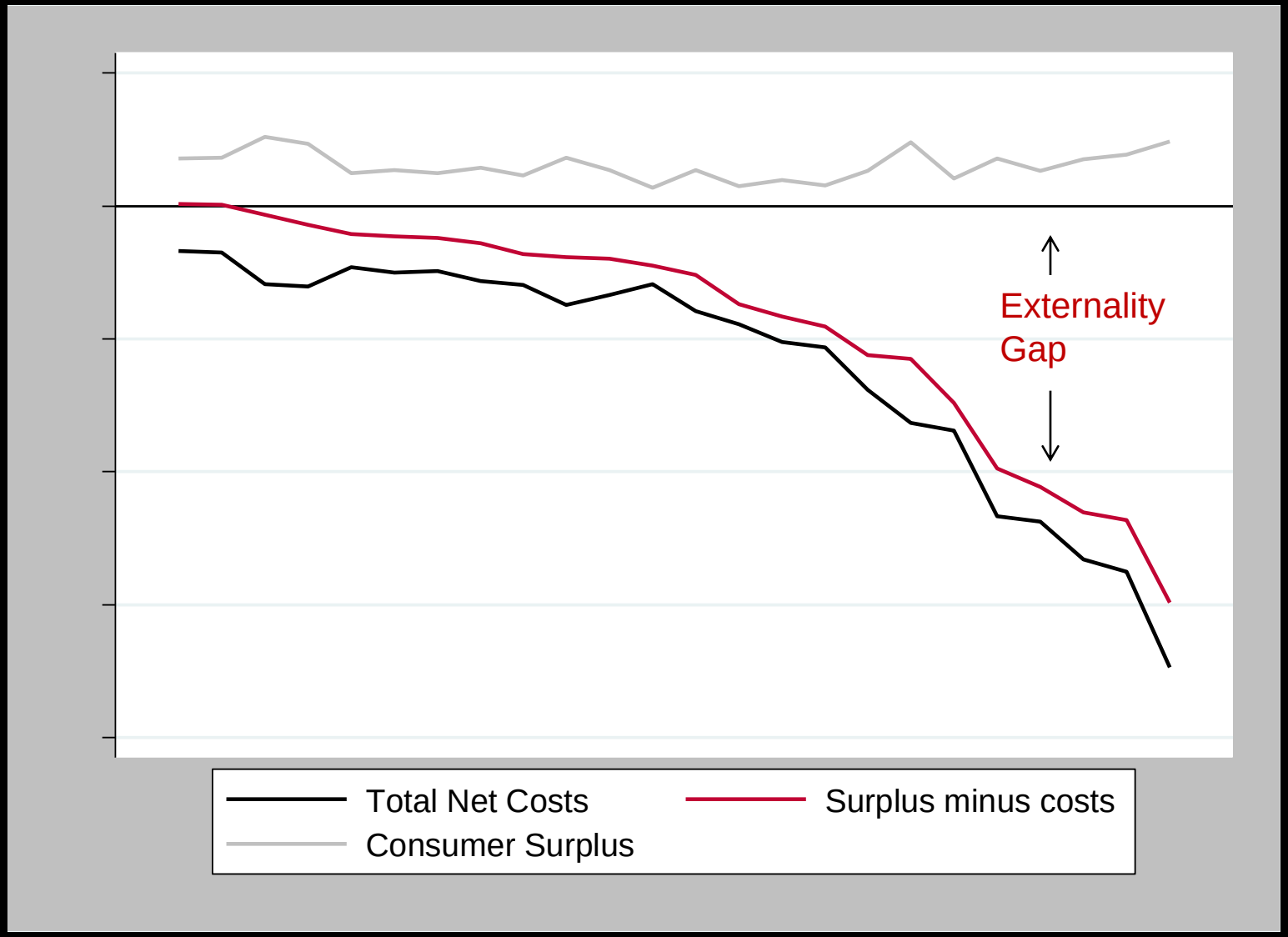
	(1) BE	(2) OLS #	(3) RE #	(4) FE #
Fare per PMT	**-0.650***	**-0.445****	**-0.327****	**-0.283***
	(0.036)	**(0.004)**	**(0.006)**	**(0.047)**
Controls				
stjobs_ln	1.095***	0.966***	0.597**	0.410*
stpop_ln	0.0790	0.245	0.367*	0.938+
park_ln	0.538**	0.297**	0.114	-1.415**
freq_ln	0.734**	0.413**	0.536***	0.507*
netpop_ln	0.477	0.462	0.204	0.198
netjobs_ln	-1.340+	-0.937*	-0.213	-0.254
mph_ln	-0.214	1.174*	1.293**	0.891+
fuel_ln	-1.525	0.185+	0.226*	0.256*
dist_ln	0.381	-0.228	-0.454*	1.708*
gdp_ln	0.515	-0.00310	-0.00957	0.00967
new_corr	0.678	-0.0555	-0.0579+	-0.0359
_cons	1.343	0.546	-0.409	-8.533
N	135	135	135	135
R-sq	0.994	0.972	0.959	0.803
rho			0.723	0.992

Models 2, 3, and 4 cluster standard errors by system.
p-values in parentheses
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

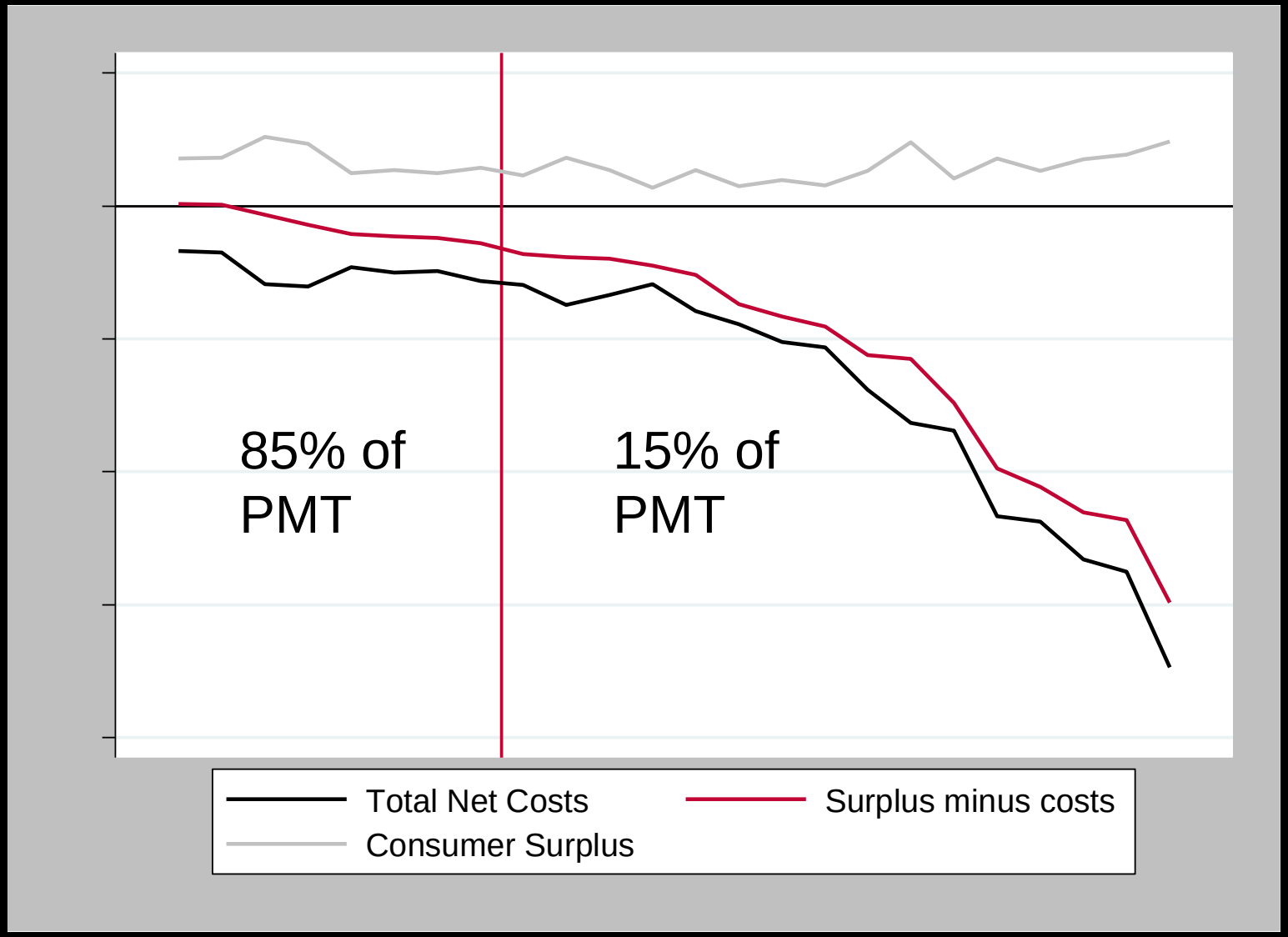
EB = CC + OC – FR – UB

	Average System	Average per PMT	Total in Billions
TOTAL NET COSTS	($1.19)	($0.51)	($9.3)
CONSUMER BENEFITS (e=-.3)	$0.31	$0.35	$6.5
CONSUMER BENEFITS (e=-1.0)	$0.09	$0.11	$1.9
EXTERNALITY GAP (LOW)	$0.88	$0.16	$2.8
EXTERNALITY GAP (HIGH)	$1.09	$0.40	$7.3
NET ECONOMIC BENEFITS	$0	$0	$0

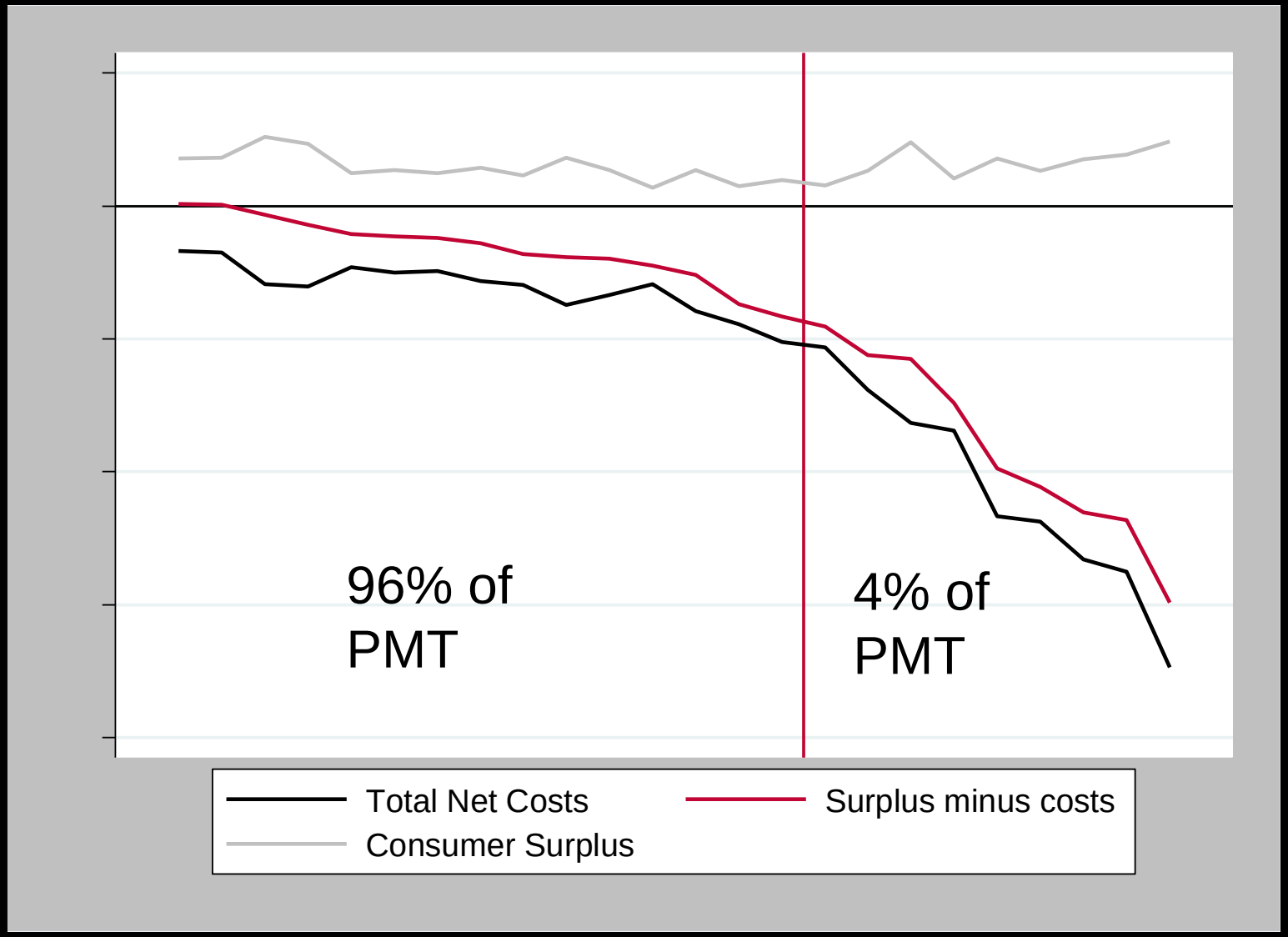
EXTERNALITY GAP BY SYSTEM (LOW ESTIMATE)



EXTERNALITY GAP BY SYSTEM (LOW ESTIMATE)



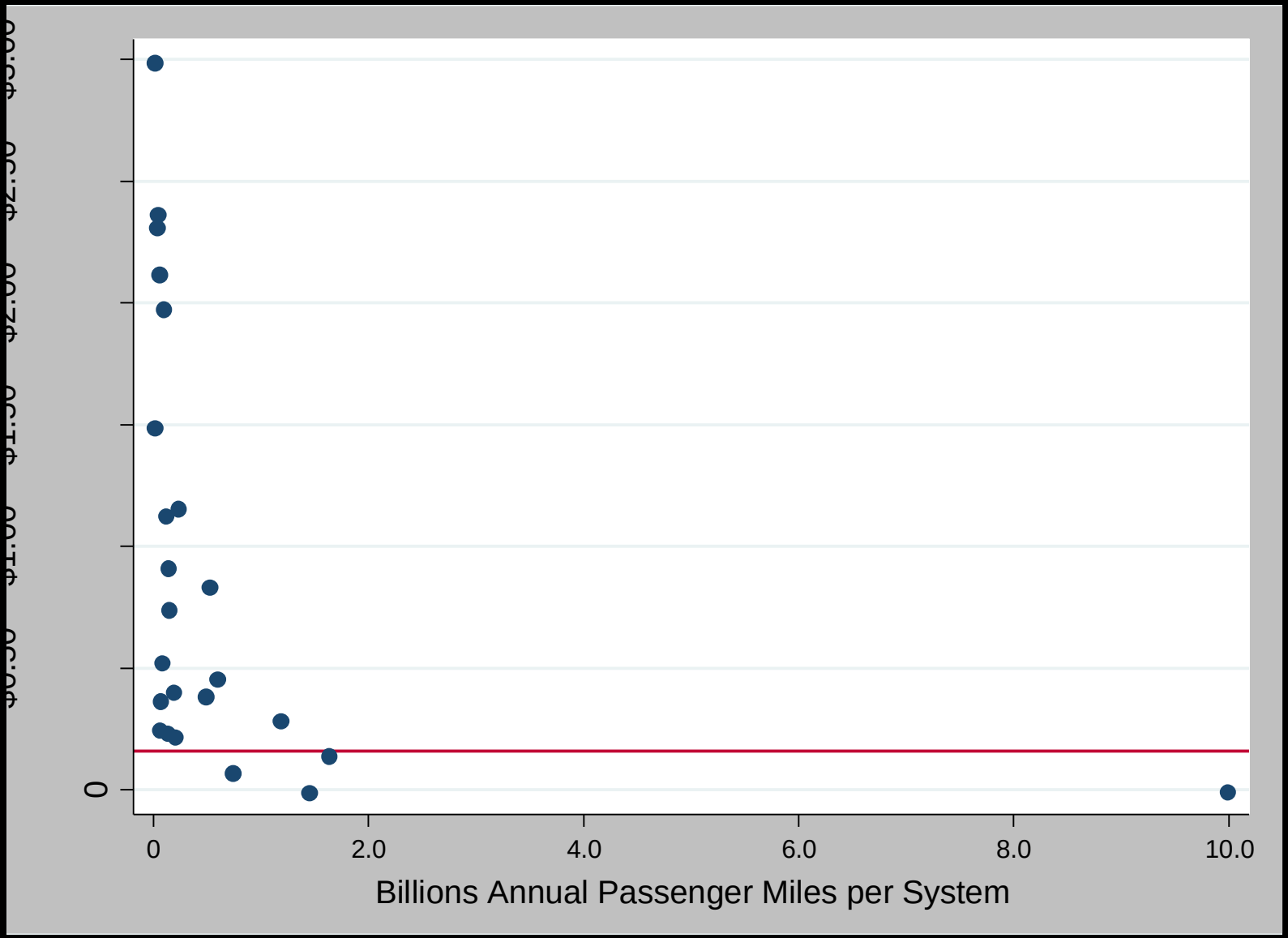
EXTERNALITY GAP BY SYSTEM (LOW ESTIMATE)



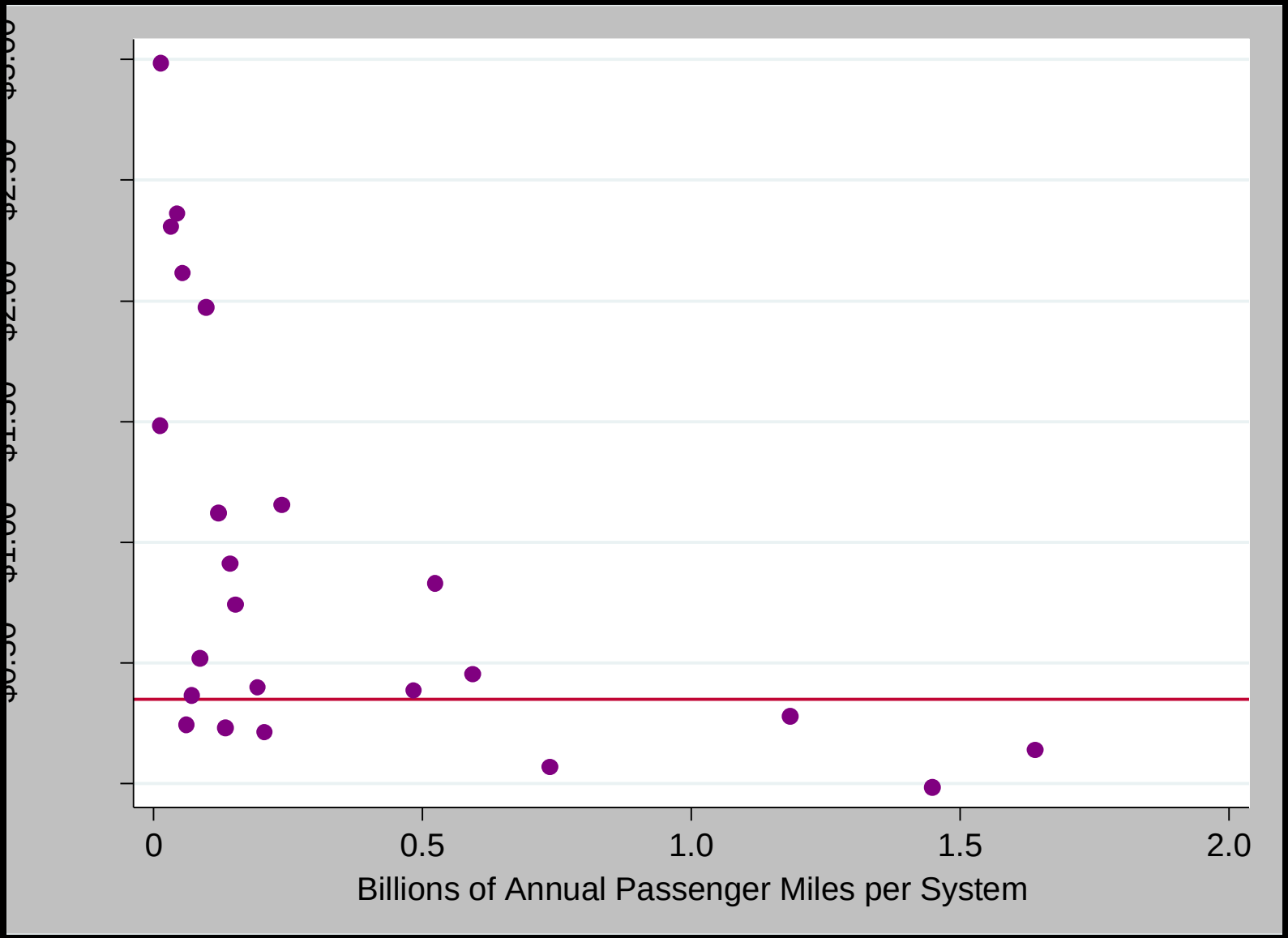
“Externality Gap” per PMT by Agency

	Agency	e = -0.3	-1.0	PMT Percent
1.	San Francisco Bay Area Rapid Transit District	-.0161117	.2326425	.0793106
2.	MTA New York City Transit	-.0106258	.2433041	.547422
3.	Massachusetts Bay Transportation Authority	.067074	.4324484	.0403492
4.	Washington Metropolitan Area Transit Authority	.1386206	.4647244	.0897738
5.	San Diego Metropolitan Transit System	.2125003	.3879603	.0113296
6.	Denver Regional Transportation District	.22948	.4205	.0073388
7.	Metro Transit	.2424222	.4141927	.0033431
8.	Chicago Transit Authority	.2788251	.4796543	.0648259
9.	Utah Transit Authority	.3637786	.5244819	.003894
10.	Southeastern Pennsylvania Transportation Authority	.3824804	.6374854	.0265544
11.	Tri-County Metropolitan Transportation District of Oregon	.3979011	.5877225	.0105987
12.	Metropolitan Atlanta Rapid Transit Authority	.4501123	.5469233	.0324912
13.	Sacramento Regional Transit District	.5172024	.7079923	.0046981
14.	Dallas Area Rapid Transit	.7383175	.844584	.008309
15.	Los Angeles County Metropolitan Transportation Authority	.8293792	.9661665	.0287349
16.	Miami-Dade Transit	.9094784	1.018195	.0077832
17.	Maryland Transit Administration	1.120712	1.305759	.0066195
18.	San Francisco Municipal Railway	1.153354	1.488743	.013089
19.	Charlotte Area Transit System	1.483523	1.628436	.0007153
20.	New Jersey Transit Corporation	1.972736	2.224953	.0053126
21.	Santa Clara Valley Transportation Authority	2.114722	2.298854	.0029826
22.	Port Authority of Allegheny County	2.305204	2.552679	.0018208
23.	Puerto Rico Highway and Transportation Authority	2.36107	2.633721	.002452
24.	Niagara Frontier Transportation Authority	2.985662	3.32425	.0008007

Externality Gap per PMT (low) = $0.16 with NYC.



Externality Gap per PMT (low) = **$0.35** without NYC.



TRANSIT EXTERNALITIES

What is a reasonable externality gap?

Dependent on the counterfactual.

What happens to the annual 18 billion passenger miles:
1)Stop Travelling
2)Take Bus
3)Drive
4)Other (taxi, walk bike, private paratransit)

Do municipalities invest in additional roadway or bus service?

TRANSIT EXTERNALITY ESTIMATES

EXTERNALITY GAP (Average PMT) $0.16 to $0.40
EXTERNALITY GAP (Average System) $0.88 to $1.09

External Cost of Car Mile
Los Angeles: $0.31; Washington DC, $0.25 (during peak).
Parry and Small (2009)
New York: $0.39; Los Angeles: $0.83; San Jose: $0.38
Harford (2006)

Bus Costs
More or less expensive?
The average net operating loss per passenger mile for bus is $0.32 higher for bus than for rail.

Non-trip Costs
Lowest value trips or transit dependent trips?

TRANSIT EXTERNALITY ESTIMATES

EXTERNALITY GAP (Average PMT) $0.16 to $0.40
EXTERNALITY GAP (Average System) $0.88 to $1.09

Distortionary Tax Effect
-8% to -15% of public expenditure

Public Health
Charlotte: $0.11, Stokes et al. (2007)

Agglomeration Economies

Equity Concerns

Land Conservation

CONCLUSIONS

The net economic benefits of rail are highly dependent on the counterfactual without rail. 18 billion annual passenger miles need to be accounted for.

Nevertheless, investigating the externality gap provides guidance about which systems are likely to generate net economic benefits and which are not.

The findings support neither the contention that no rail systems have net economic benefits nor the contention that all do.

CONCLUSIONS

The majority of passenger miles appear likely to pass a cost-benefit test, while the majority of systems do not.

Accounting for consumer surplus using a commonly applied elasticity of -0.3 and an assumed linear demand curve, two systems generate net economic benefits without accounting for any external benefits. Together, these systems provided 63% of the 24 systems' passenger miles in 2008.

One third of the systems, however, have an externality gap of over $1.00 per PMT. These systems provided 4% of passenger miles in 2008.

At an elasticity of -1.0, eight systems have an externality gap lower than $0.50 per passenger mile. Together, these systems accounted for 85% of passenger miles in 2008.

CAVEATS

Elasticity and external costs and benefits likely vary by system. This will tend to reinforce the differences between the best and worst performing systems.

Choosing a discount rate for capital costs is highly subjective. Applying a higher rate will increase the average cost per passenger mile.

The counterfactual is unknowable, but the economic benefit of public investment in transit depends entirely it.