

## **DO ECONOMISTS REACH A CONCLUSION?**

### **Do Economists Reach a Conclusion On Rail Transit?**

**TED BALAKER\* AND CECILIA JOUNG KIM\*\***

#### [Abstract](#)

**FOR MANY POLICY ISSUES THERE IS GENERAL AGREEMENT ON** policy goals. That is not the case with rail transit. Depending on who you ask, rail transit should reduce traffic congestion, improve mobility, get motorists out of their cars, clean the air, stimulate the economy, boost property values, concentrate development, fight sprawl, decrease social alienation, help make a city “world class,” and so on. Once we focus solely on economists the list of potential goals shrinks considerably, but we are still left with a bundle of goals.

Summarizing economists’ views on rail transit poses additional challenges. Even simply separating the economists from the non-economists can be quite challenging.

Many researchers from many different disciplines have weighed in on the merits of rail transit. In this case, we will examine only the opinions of economists, that is, those who have at least a Master’s degree in economics or who have taught economics at the college level. In cases of coauthorship,

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\* Reason Foundation. Los Angeles, CA 90034.

\*\*University of Southern California. Los Angeles, CA 90089.

We are very grateful to James E. Moore, II and Jiamin Chen for early research conducted on this project. We also express our thanks to Wendell Cox, Robert Dunphy, Peter Gordon, Adrian Moore, Thomas A. Rubin, Donald Shoup, and Clifford Winston for their valuable comments.

we include the reference if at least one of the authors is an economist. We exclude the judgments of many of the most prolific researchers in rail transit, notably urban planners and engineers. Indeed, the disagreements over rail often stem from the fact that different researchers from different disciplines think rail should accomplish different goals.

Another challenge comes in attempting to focus on rail transit. Since transit modes tend to operate under the same kinds of incentives, economists may analyze public transit in general (i.e. rail, bus, etc.). We focus on rail transit, but, when appropriate, take a more general view of public transit. Apart from separating rail from other modes, there is also the matter of distinguishing between heavy and light rail.<sup>1</sup> The extensive and well-established systems in places like New York City, Washington, D.C., Chicago, and San Francisco are heavy rail, while newer systems and extensions tend to be light rail.<sup>2</sup> There are important operational differences between the two types of rail which affect their performance. For example, heavy rail enjoys greater speeds<sup>3</sup> and carrying capacity in large part because it is grade-separated, typically operating underground or on elevated tracks. Light rail is generally at-grade, but not always.

Here we examine U.S. cases and consider rail's success or failure as determined by the criteria set by each individual economist. And so the big-picture question—Do economists think that rail-transit is good policy?—will be a compilation of judgments given by economists who consider different criteria.

Our general approach is to quote amply and allow readers to decide how much weight to give to the various arguments, studies, and such. However, in some cases readers may benefit from our giving analysis and perspective, so occasionally we do just that. Of course, this introduces the possibility that some of our biases will creep in and so we will make it clear where we stand. The lead author is generally skeptical about rail transit's success in most areas in the U.S. Whether the issue is highways or transit, rail or bus, he generally favors a transportation policy supported by user fees. Public transportation is often characterized by public subsidies, and here he favors cost effective policies that focus on improving conditions for the poor.

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<sup>1</sup> We do not address high-speed rail and address commuter rail only briefly.

<sup>2</sup> In some cases, heavy rail systems do have some light rail components as well.

<sup>3</sup> According to the American Public Transportation Association, average operating speeds in 2004 were 20.4 miles per hour for heavy rail and 15.5 mph for light rail. For commuter rail (not the focus of this study) average speeds were 31.5 mph.

## TRENDS IN USAGE AND FUNDING

Economists often express concern that we are spending more on public subsidies to transit, but getting less. Baum-Snow and Kahn (2005) examine the 16 major metropolitan areas that established or expanded rail transit infrastructure from 1970 to 2000. They estimate that federal, state, and local governments spent more than \$25 billion on construction.

Billions more have been invested to maintain and improve existing rail transit lines. Despite the significant infrastructure improvements associated with these improvements, transit ridership has been declining rapidly. . . . Across all metropolitan areas, the fraction of [those working outside the home] using public transit fell from 12 percent in 1970 to just 6 percent in 2000. These declines have occurred in metropolitan areas with historically high transit use and significant rail infrastructure in 1970 (old-transit cities), metropolitan areas that established significant rail transit infrastructure since 1970 (new-transit cities), and metropolitan areas without rail transit in 2000 (no-transit cities). Though in percentage terms rail transit cities saw less rapid declines in use than cities with no rail transit, transit lost more market share in cities with rail lines. (Baum-Snow and Kahn 2005 1, 4)

The authors see the benefits of rail construction and expansion as flat.

[W]e find little evidence that significant ridership gains due to new rail lines continue to accrue more than a few years after construction is completed. (Baum-Snow and Kahn 2005, 2)

A network-effects argument would expect that newly added lines would spur larger ridership gains because riders would have access to more possible destinations. And yet, “We find evidence of decreasing marginal returns to new rail investments for every city that had rail transit expansions in more than one decade except Portland and perhaps Atlanta” (Baum-Snow and Kahn 2005, 39).

Winston and Maheshri (2006) draw similar findings.

In 1980, two million Americans got to work by transit. Today, in spite of an increase in urban jobs and transit coverage, fewer than one million U.S. workers commute by rail, causing its share of work trips to drop from 5 percent to 1 percent.<sup>4</sup> Although rail transit's farebox revenues have consistently failed to cover its operating and capital costs since World War II, governmental aid to cover transit deficits has been increasingly available. Since 1980, annual operating subsidies have climbed from \$6 billion to more than \$15 billion today (APTA Transit Fact Books, figures in 2001 dollars). Capital subsidies have also increased as transit agencies struggle to maintain and provide new facilities, track, and rolling stock. (Winston and Maheshri 2006, 2)

Even in the early twentieth century world events and local policies that governed private transit monopolies were already causing financial strains. Hilton (1985) summarizes conditions in 1918.

The industry had an extremely inflexible pricing structure with a five-cent fare enforced nearly everywhere either by franchise or by municipal regulation. The effects of the draft, expansion of factory employment, and the strength of the union, the Amalgamated Association of Street Railway Employees, caused labor costs to rise by 85 to 90 percent in 1918. Many of the basic materials used by the industry rose in price by about the same amount, and the price of inputs used also for military purposes increased even more (for example, asbestos by 560 percent). The industry's output declined both absolutely and relative to population. (Hilton 1985, 38-39)

As auto travel grew, transit ridership suffered. In 1964 the federal government stepped in to attempt to rescue transit patronage. Yet, according to Charles Lave, federal subsidies brought new problems.

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<sup>4</sup> Does not include commuter rail ridership.

Consider the urban transit “problem.” In the 1960s the problem was declining transit patronage. Finances received little discussion because the industry was essentially self-supporting: operating costs were so low that passenger revenues covered costs. In the 1990s “problem” has a whole new meaning: financial deficits. Today, most transit revenue comes from governments, not passengers, and the result is continued fiscal crisis—the search for money to continue the subsidies. (Lave 1994, 21)

Subsidies were designed to save transit, but they lead to severe deficits and a large decline in productivity, that is, output per dollar of input.

Indeed, if transit productivity had merely remained constant since 1964, when federal intervention began, total operating costs would be more than 40 percent lower—enough cost reduction to erase most of the current operating deficit, without raising fares. It is uncommon to find such a rapid productivity decline in any industry. In general, productivity increases over time, and a given quantity of input produces more and more output—which is why per capita income rises. Thus the productivity change in the transit industry is notable for both its downward direction and its magnitude. (Lave 1994, 21)

The initial federal subsidy program in 1964 was confined to capital subsidies, but in 1974 the Urban Mass Transit Administration began subsidizing operating costs as well.

[T]he decline in productivity accelerated by 50 percent when capital subsidies began and accelerated by another 48 percent when operating subsidies were added as well. . . . Our attempts to solve the original problem created a new one: a serious decline in the basic productivity of the industry, with an inevitable growth in financial problems as the result. (Lave 1994, 24, 25)

## BIASED PROJECTIONS OF RIDERSHIP AND COSTS

Economists have long been critical of faulty forecasting (Gómez-Ibáñez 1985). Haynes Goddard contends that local decision-makers are unfairly critical of rail. He cites a failed attempt to persuade Cincinnati voters to support a sales tax increase that would have funded a light rail system. Goddard argues that the economic analysis overestimated costs and underestimated benefits.

Local officials decided that a genuine benefit-cost analysis of the proposed starter line should be undertaken (and the subsequent alternatives as well). A public solicitation was held, and a competent economic consultant was retained for the study. . . . The study was very conservatively done in that some benefit categories were excluded, such as development benefits around the stations. . . . On the cost side, the most extreme cost conditions were included in order to ensure against the all too common bane of public investment projects, cost underestimation. An explicit uncertainty analysis was conducted (Monte Carlo) and the probabilities of the outcomes were generated with the aid of a regional panel of economists and corporate financial executives who oversaw the entire process. (Goddard 2004a, 4)

However, Goddard appears to represent the minority view. For example, after conducting 209 interviews with public officials in Southern California and elsewhere Jonathan Richmond concludes that the evaluation process is unfairly tilted to favor rail.

[T]he evidence from the Long Beach case shows that decisions did not follow from technical analysis, but that technical analysis was used to support an already existing predisposition to rail transit. Interviews conducted for this project in San Diego, San Jose, Sacramento, and Portland, Oregon also indicated that decision makers had made up their minds prior to the conduct of technical analysis. Technical analysis, then appears to serve a ritual function: it gives an aura of respectability to decisions which have

been reached on other grounds, rather than focusing on the decisions themselves. (Richmond 2005, 147)

Inaccurate cost and ridership forecasts make others wary of rail:

In most cases, actual ridership has fallen far short of projected figures. This is important because, in many instances, local development agencies use ridership projections to convince the Urban Mass Transit Administration of the Department of Transportation that their rail projects are worthy of government assistance. (Zaretsky 1994, 10)

Economists frequently treat biased projections as an unsurprising reality: “It is very common for transit planners to underestimate construction costs and overestimate future ridership” (Baum-Snow and Kahn 2005, 21).

Winston seems to expect inaccuracies to continue:

Indeed, if experience is any guide, rail ridership will be grossly overestimated at the planning stage for new service, while capital and operating costs will be underestimated. (Winston, 1999a)

Even so, Goddard (2004a, 2004b) charges that critics of rail transit are corrupt:

It is said that when you cannot understand why people take the positions on issues they do, it is usually for at least one of three reasons: ideology, money, or sex. In the case of the various light rail transit critics around the nation, mostly associated with libertarian institutes, ideology certainly is involved, and given their general unwillingness to reveal the sources of their funding for their irrational enthusiasm for highway based transport policies, it is an easy conclusion that money quite likely is involved as well ... As Upton Sinclair once quipped, it is difficult to get a man to understand something when his income depends on his not understanding it. (Goddard March 2004, 1)

Yet Goddard's assessment of rail critics as right wing or libertarian is misleading. Many of the institutions that have produced the greatest amount of rail skeptical research—for example, the University of California system, University of Southern California, the Brookings Institution, and Harvard—can hardly be considered libertarian. Many libertarian researchers are skeptical of rail, but rail skepticism is hardly a bedrock belief of libertarian philosophy. Like economists in general, libertarians place considerable weight on cost-effectiveness and this helps shape their views about many issues, including rail transit. If and when rail proves the best, most cost-effective choice, libertarian scholars are likely to support it. Moreover, libertarian scholars tend to support the “user pays” principle which calls for reducing subsidies in all aspects of transportation policy, from transit to highways. Note, for example, their strong support of toll roads and variable pricing, policies that place the costs of driving more directly on the shoulders of motorists themselves.<sup>5</sup> Lindsey (2006) shows that such views are typical of economists who write on highway management.

Speculation about motivations can be applied to any side of any policy issue and such conjecture offers little illumination. Scholarship should be judged, first and foremost, on its merits. But Goddard charges that much scholarship that is critical of rail is not well done. He views rail critics as not just corrupt, but incompetent as well.

In the absence of a clearly articulated and explicit model for predicting transportation choices, the critics can make cheap and superficial but plausible sounding arguments. But in fact, most of their writing reflects either an intellectual incapacity to formulate and reason from explicit analytical models, or in some cases where the training of the authors (some with Ph.Ds) ought to permit this, the writing borders on intellectual dishonesty. Tellingly, these critics don't publish in the peer reviewed literature, with few exceptions, because most of what they write would be shredded by professional reviewers. Their

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<sup>5</sup> For example, Robert W. Poole, Jr., the founder of the libertarian Reason Foundation is well known as a pioneer of toll roads and variable pricing. He developed the High Occupancy/Toll (HOT) lane concept in 1987 and the term first appeared in a 1993 Reason Foundation study.

writing certainly would be awarded a failing grade in virtually any economics class. (Goddard 2004a, 3)

Goddard's assessment of rail skeptic's academic credentials is wildly off the mark. He overlooks the many rail-skeptical economists who frequently publish their findings in peer reviewed journals, write books published by academic presses, and hold positions at major universities. (The references cited in this article provide a sample of this, including articles published in top-tier journals such as the *Journal of the American Planning Association* and the *Journal of Urban Economics*.) Indeed, one of the most prolific critics of rail transit, the late John F. Kain, was chairman of the economics department at Harvard. Most would consider such a man eminently qualified to conduct economic analysis.

One of the earlier systematic critiques of rail transit was written by Donald Pickrell of the U.S. Department of Transportation. Pickrell (1990) examines ten rail projects and discovers that only in Washington, D.C. was ridership more than half of what was forecasted. "The consistent over-estimation of future ridership on recent rail transit projects suggests that, with few exceptions, the levels of travel and related benefits they currently provide are far below those originally anticipated by the local decision-makers who selected these projects" (x). Pickrell found a similar pattern for cost estimates. "[C]apital outlays for Pittsburgh's South Hills light rail reconstruction project were actually 11 percent below their forecast value, while cost overruns on other projects ranged from 13 percent for Sacramento's recently completed light rail line to 106 percent for Miami's downtown 'Metromover' project" (xii). Sacramento's operating expenses were lower than expected, but elsewhere "actual expenses range from 12 percent to more than 200 percent above their projected levels" (xiii). In the *Journal of the American Planning Association*, Pickrell (1992) reviewed the finding in an article titled, "A Desire Named Streetcar: Fantasy and Fact in Rail Transit Planning."

Richmond (2001) recalls the controversy that followed Pickrell's report:

The transit industry responded angrily. . . . The [American Public Transit Association] was particularly concerned that "The report used projection data made during the very early project planning stages, rather than in the revised and more accurate submitted with the Final Environmental Impact Statement or the Full Funding Agreements."

Pickrell had made clear, however, that since subsequent (and generally less optimistic) forecasts made after the decision to proceed were by definition irrelevant to the choice of rail, 'this study focuses upon the accuracy of projections that were available to local decision-makers *at the time the choice among alternative transit improvement projects was actually made*' (p.3 emphasis in the original). (Richmond 2001,149)

Richmond defends the Pickrell report, calling it "a model of clarity." The conclusions in Richmond's 2001 analysis of rail in twelve U.S. metropolitan areas are very similar to those reached by Pickrell.

Optimistic claims that new urban rail systems would increase transit ridership, reduce congestion and improve the environment while at the same time improving the financial performance of transit systems have proved incorrect in most instances examined here. The evidence shows that the capital funds spent have generated few benefits. While rail's contribution to increasing transit ridership on the systems under review has been mostly minimal, changes in bus operating practices designed to accommodate rail have generally had a negative effect on the financial productivity of the transit systems concerned. (Richmond 2001, 172)

Kain analyzes forecasting problems in locations such as Los Angeles (1988), Dallas (1990), and Houston (1992). Lave (1991) suggests introducing self-correcting discipline in the forecasting business, in which consultants would have to bond their forecasts. In cases of significant errors, Lave argues that consultants should be forced to give back their fees or build and operate the rail system at the cost they initially projected.

When transit patrons move from buses to service offered by a new rail line, the substitution can add an additional challenge for those who examine ridership figures. Since patrons who switch from bus to rail are not increasing overall transit ridership, modal substitution may at least partially offset rail's ridership gains.

Analyses contained in this paper also demonstrate that widespread claims that [Atlanta's] MARTA achieved large

increases in transit ridership by building rail are incorrect and result from the mistaken use of boardings rather than linked trips to measure system ridership. When MARTA implemented its rail system, it modified its bus network to feed the new rail system. This practice increased rail boardings, but more importantly dramatically increased system transfer rates. Many trips that previously had been made as a direct bus trip with one boarding required two or three boardings after the bus feeder-rail network was implemented—a bus-rail, rail-bus, or in some instances a bus-rail-bus trip for the same journey. Use of boardings thus greatly overstated the increases in ridership that actually occurred during the period of rail operation. (Kain 1996, 23)

Reviewing the earlier decades of rail, George Hilton (1976) concluded: “In general only about 8 to 12 percent of the riders on a rapid transit line are former drivers of automobiles. Typically, more than 80 percent are former passengers on bus lines or pre-existing electric railways.” Lave (1998) puts the figure at 70 to 75 percent and Richmond (2001) reports that the percentage of rail riders who were former bus riders ranged from about a quarter to three-quarters. Baum-Snow and Kahn (2005) find that most rail riders are former bus riders, yet while commenting on that research, Voith suggests that widespread mode-switching is not necessarily a shortcoming of rail.

[I]t is not clear that in the absence of the rail investment bus riders would have remained transit users over time. The authors argue that the differences-in-differences approach effectively controls for trends pre- and post-rail investments, and therefore controls for trends in bus ridership. However, the populations in neighborhoods evolve over time, and there is little reason to expect that the people living in neighborhoods ten years ago are the same individuals (and certainly not in the same point in their life cycle) as those in the neighborhood ten years in the future. It seems highly unlikely that the demographic characteristics of ridership on the Washington Metro would be the same as the characteristics of those riding the

bus in the city if the metro had not been built. (Voith 2005, 56-57)

Kain and Liu (1995) argue that rail can compromise ridership gains attained via service increases and fare reductions.

Regrettably, in all three cases [Portland, Los Angeles, and Atlanta], regional transit authorities abandoned their highly successful policies of increasing service levels and reducing real fares for policies that entailed using growing shares of available subsidy dollars to build and subsidize the operations of costly and ineffectual rail systems. Frequently, the introduction of rail services was accompanied by increases in real transit fares. (Kain and Liu 1995, 623)

## MOBILITY AND CONGESTION RELIEF POTENTIAL

A key issue that many economists examine is whether rail transit is cost-effective in reducing traffic congestion. One way economists judge this is whether rail can lure commuters out of their cars. On this count, Baum-Snow and Kahn (2005, 51) point to rail systems in Boston and Washington as “standouts” compared to others that have been significantly expanded since 1970. It appears that the authors are most encouraged by Washington.

Washington in particular stands out as a city in which commuters are significantly better off as a result of having the option of using rail transit. While there are measurable welfare benefits of new rail lines in other rail transit cities, they appear to be much smaller. (Baum-Snow and Kahn 2005, 51)

Lewis and Bekka (2000)<sup>6</sup> argue that, especially in the absence of road pricing, rail transit can be a good way to deliver congestion relief. They find net benefits, for example, from rail lines in Sacramento and elsewhere. And,

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<sup>6</sup> At the time this paper was published David Lewis was President and Khalid Bekka, Vice President of HLB Decision Economics, an architectural-engineering-consulting firm.

again, Washington, D.C., is highlighted. The authors calculate the travel time index for Washington, D.C.'s I-270 corridor to be 1.72, meaning that peak-period travel times exceed off-peak by 72 percent. Without the rail line the authors estimate that peak-period travel times would exceed off-peak by 98 percent. This one branch, they argue, saved 4 million hours of delay in 1999. It also saved an estimated \$62 million in fuel, time and other driver costs, while costing taxpayers only \$25 million.

Voith (2005) also shares a favorable view of rail transit in Washington, D.C., and Nelson et al. (2006) see substantial net benefits.

[I]t seems to us that transit advocates in the Washington metropolitan area are on solid ground when they cite rail transit's effect on highway congestion. The bus system alone generates little in the way of driver time savings, both because buses and cars compete for scarce roadway space and bus users who switch to rail do not affect drivers. Of the benefits to drivers, about two-thirds are congestion-related; the rest are parking search costs.

The motorist benefits are dwarfed by the total benefits of the transit system, \$2.3 billion per year. [T]raveler benefits from the weekday bus system are \$975 million per year, or \$7.57 per bus trip in 2000 dollars. Weekday rail produces about \$833 million in traveler benefits and a per rail trip welfare benefit of \$5.16. Taking into account the regional subsidies for the two modes, these per trip net benefits drop to \$5.81 and \$4.51 for bus and rail respectively. (Nelson et al. 2006, 12-13)

Yet economists are not in agreement about rail in Washington. Winston and Maheshri (2006) estimate that costs exceeded benefits by more than \$200 million in 2000 and Downs sees little in the way of congestion relief.

There is no evidence that new fixed-rail public transit systems in the Washington and San Francisco Bay areas have diminished peak-period congestion on any expressways there. (Downs 1992, 29)

Some argue that rail has certain advantages that allow it to operate efficiently and reduce congestion.

Compared with single-occupant automobiles, public transportation, especially rail systems, is a much more efficient way to move people around a metropolitan area. (Zaretsky 1994, 1-2)

As for reducing congestion, one full 40-foot bus (about 70 passengers including standees) is the equivalent of 58 cars with an average of 1.2 passengers per car. This one bus is the equivalent of a line of autos that stretches six city blocks for traffic moving at 25 miles per hour. Comparing autos and heavy rail, where one full heavy rail car can accommodate about 180 people including standees, a train of six rail cars, holding about 1,080 passengers, is the equivalent of 900 automobiles. Thus, one full six-car heavy rail train is the same as a line of moving cars that stretches 95 city blocks for traffic operating at 25 miles per hour.

As these statistics clearly show, public transportation is energy-efficient and capable of reducing congestion. (Zaretsky 1994, 3)

However, others say that such analysis confuses carrying capacity with actual use. Rail transit has the potential to operate efficiently, they argue, but only if rail cars are filled with passengers. Nearly empty rail cars are not likely to achieve desired goals, such as reduced congestion.

During the mid-1990's rail filled roughly 18 percent of its seats with paying customers, while bus filled roughly 14 percent.<sup>7</sup> In contrast, about one-third of auto's carrying capacity is typically filled. These differences in capacity utilization have clear implications for mass transit's cost competitiveness with autos. While transit's average operating costs per seat mile are lower than auto's, this potential cost advantage is never realized in practice

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<sup>7</sup> The FTA no longer requires transit agencies to report load factor figures.

because empty seats drive its operating costs per passenger mile much higher than auto's. (Winston, 1999a)

Although it apparently does not affect his opinion of the efficiency of rail transit, Zaretsky (1994, 9, 19) acknowledges that use of rail transit often falls well below capacity: "Even in our nation's most congested areas, usage levels do not reach much beyond 50 percent of workers. . . . [E]ven light rail success stories are subject to the reality that over all usage levels are low."

Winston and Maheshri (2006) do find that rail systems offer substantial congestion cost savings, but those benefits are overshadowed by other costs. Although Garrett (2004, 9) contends that "there is little evidence that rail transit has reduced traffic congestion," he writes that evidence suggests "that light rail may have slowed the growth in roadway congestion in some cities."

Before light rail was introduced in Baltimore, the roadway congestion index increased an average of 2.8 percent a year. After light rail, however, the index increased an average of 1.5 percent a year. Average annual index growth in Sacramento before light rail was 4.5 percent and 2.2 percent after light rail . . . For St. Louis, the average annual congestion index growth before and after light rail was 0.89 percent and 0.86 percent respectively. The roadway congestion index growth in Dallas remained at an annual average of 2.3 percent before and after light rail was introduced. (Garrett 2004, 9)

Yet the increase in transit ridership in general (let alone light rail ridership in particular) relative to the increase in roadway travel tends to be too small to affect congestion. For example, since the start of light rail operation, transit has captured only 0.7 percent of new travel in the St. Louis urban area and only 0.2 percent in the Baltimore urban area. Further, it is important to consider alternate congestion relief methods, for without such context one cannot assess opportunity costs. (Below we examine other congestion reduction options.)

Balaker and Staley (2006) point out that in some rail areas it is official policy to encourage traffic congestion to bring more riders to transit. They also reference Minneapolis's Hiawatha light rail line to show how at-grade

rail lines can increase congestion in the corridors where they are implemented.

Economists are generally not encouraged by rail transit's ability to get motorists out of their cars.

This marginal attraction of drivers is so small relative either to the growth of traffic on roads or to the daily variance of vehicle counts on the freeways that it cannot be perceived. Rail transit lines built in Chicago, Cleveland, and Boston with funds of the Urban Mass Transportation Administration had uniformly shown an ability to take off the roads approximately the equivalent of six months' to a year's secular growth in vehicle counts on the parallel highway facilities. This cannot typically be observed relative to the daily variance in vehicle counts. (Hilton 1976)

Winston adds cost considerations.

Rail transit does divert some traffic off the roads, but rail systems are so expensive to build and operate and transport such a small share of travelers that they can be justified on cost-benefit grounds in only a few U.S. cities. (Winston 2005)

Giuliano and Small (1995, 203) put it bluntly: "[I]n the U.S investment in rail transit has proven to be a terribly inefficient way to divert trips from automobiles."

Rail transit's average operating speeds are typically well below automobile speeds and having to schlep oneself and effects to and fro and to make transfers typically render transit journeys even longer. Glaeser and Kahn (2003) note that, on average, transit commutes take nearly twice as long as car commutes. Garrett (2003-2004, 4) also cites trip durations: "Given the opportunity cost of time, especially during work hours, it is expected that many people choose not to ride rail transit."

Fielding (1995, 239) cites additional factors to explain why rail has difficulty attracting large numbers of motorists: "The automobile provides a faster, more convenient and comfortable alternative for most travelers." Giuliano and Small (1995, 220) contend that rail struggles against the automobile even when large investments in it are made: "Attempts to lure

people into other modes, even with grandly expensive rail transit systems, are impotent against the convenience of individualized motor vehicles.”

Lave agrees and adds that the preference for auto travel is not merely an American quirk.

Attempts to lure people out of their cars failed because they ignored the commuter’s desire for fast, safe, reliable, on-demand, door-to-door travel. And this is not just an idiosyncratic preference of Americans. As Europeans have gotten richer, they have also bought and used more cars. (Lave 1998, 10)

If rail is not adept at getting motorists out of their cars it is unlikely to provide congestion relief. “[Peak-hour] congestion did not decline for long in Portland, where the light rail system was doubled in size in the 1990s, or in Dallas, where a new such system opened, or anywhere else that light rail systems or even new subways have been promoted as antidotes to peak-hour road congestion” (Downs 2004).

Staley (2006) explains why congestion often increases, even when transit captures a considerable share of travel and auto trips decrease.

Suppose a suburban community of 7,000 people generates 2,000 automobile trips of equal distance (so we can hold vehicle miles traveled constant). The city’s population doubles to 14,000, but its boundaries stay the same, so density doubles. This would double the number of commuter trips to 4,000. If the city is well served by mass transit—everyone lives within a quarter mile of a bus, van, or rail transit stop—research suggests automobile trips might fall by as much as 30 percent, or 600 trips. The community would still generate 1,400 automobile trips even though vehicle miles traveled per person falls. If road capacity doesn’t increase, or fails to keep pace with the increase in travel demand, congestion increases. Compact and higher density development becomes congestion-inducing development. (Staley 2006, 77)

According to Small (2005, 10), congestion relief is not among the benefits produced by transit. “While many recently built transit systems

have achieved some desirable effects, none have seriously lessened traffic congestion.”

Baum-Snow and Kahn (2005, 46) find “scant evidence that rail lines have reduced . . . congestion externalities.” Richmond (2001, 160) offers a similar assessment: “In no case has new rail service been shown to have a noticeable impact upon highway congestion.”

Richardson and Gordon (2000, 11) suggest that larger demographic trends have helped tame congestion: “The moral is that it is continued metropolitan decentralization not transit investments (especially rail transit) that keeps congestion under control.”

## **DECONTROLLING ROAD-BASED TRANSIT ALTERNATIVES**

Often, improving mobility and reducing congestion are among the most important justifications given for building rail transit. With these goals in mind, many economists have insisted that mobility and congestion problems arise because the market is not allowed to function. Economists are very supportive of road pricing (for a review see Lindsey 2006) and pricing may help spur transit ridership (Fielding 1995). Additionally, many economists argue that, rather than build rail transit, government needs to decontrol entry into road-based transit, including buses, minibuses, vans, shuttles, taxis, share-ride taxis, and on-the-spot carpool systems (Roth and Shephard 1984; Klein, Moore, and Reja 1997, 94-125; Savage 1999; Winston and Shirley 1998, 89-106; Kain 1999, 388-393; Utt 2003, 9-10).<sup>8</sup> This literature is about road-based transit, but the potentialities are often discussed favorably in comparison to rail. In most states, government restrictions are very heavy, eliminating virtually all possible services except for the government planned bus services, airport shuttles, and the highly controlled taxi industry.

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<sup>8</sup> For a review of economists' views on taxi deregulation see Moore and Balaker 2006.

## OTHER JUSTIFICATIONS FOR RAIL TRANSIT

Rail transit is often justified on grounds not directly related to transportation, such as its ability to achieve various environmental goals. Zaretsky (1994) argues that rail transit's large carrying capacity allows it to save energy and clean the air. Yet, as noted above, others counter that one must separate capacity from actual use. Just as they are unlikely to reduce congestion, nearly empty rail cars are unlikely to reduce energy consumption or improve air quality.

[S]ignificant pollution reduction from light-rail transit may not be realized for several reasons. First, there is little evidence that rail transit has reduced the number of vehicles on the roadways. . . . Second, large-scale improvement on pollution, assuming no growth in traffic congestion, can only be had if light-rail passengers substitute rail transit for auto transit. (Garrett 2003-2004, 4)

Shapiro, Hassett, and Arnold move beyond theoretical considerations of capacity and, although they address public transportation in general, they find substantial environmental gains.

The facts are clear and indisputable. For every passenger mile traveled by Americans, public transportation consumes about one-half the fuel and energy of private automobiles, SUVs and light trucks. For every passenger mile traveled by Americans, public transportation produces only five percent as much carbon monoxide, less than 10 percent as much volatile organic compounds, and little more than half as much carbon dioxide and nitrogen oxides. Greater use of public transportation offers the most effective strategy available for achieving significant energy savings and environmental gains without imposing new taxes, government mandates or regulations. At current levels of use, every year public transportation saves close to one billion gallons of gasoline and reduces harmful emissions by millions of tons. Increasing Americans' use of public transit would produce even greater benefits for

our nation's economy, security, and environment.  
(Shapiro, Hassett, and Arnold 2002, 33)

Still, it seems that most economists are skeptical about rail transit's environmental benefits. Richmond asserts that new rail service has not had a "noticeable impact" on air quality (2001, 160) and Baum-Snow and Kahn (2005) also find little evidence that rail transit has cleaned the air. Glaeser and Kahn (2003) point out that air pollution has decreased significantly in recent decades. They credit the "greening of the automobile" (38), in which improved technology reduces vehicle emissions even as vehicle miles traveled increase.

Lave (1978) finds that rail systems are net users of energy,<sup>9</sup> partly because of the large amount of energy invested during construction. Winston and Maheshri (2006) also reference the high use of energy during construction.

For instance, Tri-County Metropolitan Transit Agency claims that under the best case scenario, the proposed north light-rail line in Portland, Oregon would save the equivalent of 7,875 gallons of gasoline per day. But the agency also calculates the energy cost of building the line to be 32 million gallons of gasoline. Thus, even using the most optimistic estimates and assuming no depreciation of the capital stock, it would take a minimum of 15 years to even begin to achieve energy savings—and concomitant reductions in emissions—from this rail line. (Winston and Maheshri 2006, 16)

Lave (1978) calculates that San Francisco's new BART system would generate energy savings only after 535 years of operation and only under a scenario that has not materialized: that auto fuel efficiency would remain at 14 miles per gallon and that the average commuter trip length on BART would not be greater than the car trips it replaced.

Winston and Maheshri (2006) further reference rail's low load factors, high consumption of electricity (whose generation creates pollution), and the fact that a large share of patrons keep older, high emission cars to drive to suburban rail stations instead of driving newer, cleaner cars to work. They

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<sup>9</sup> The 2006 Transportation Energy Data Book list energy intensities (Btu per passenger mile) by mode: bus transit 4,160; car 3,549; rail transit (light & heavy) 3,228; vanpool 1,401.

assert that “a greater share of rail ridership has, at best, an ambiguous effect on the environment” (Winston and Maheshri 2006, 16).

Lave (1998, 9) argues that “in terms of energy policy, the money spent trying to boost rail and bus ridership was not just wasted, it was actually counterproductive.” Instead he advocates “The Law of Large Proportions,” which holds that, when trying to reduce energy consumption, it is best to focus on the large components of energy use.

[O]nly 3 percent of passenger trips are made on public transportation; cars carry most of the people and use most of the energy. It makes little sense to spend much effort on increasing the modal share of transit, but even a tiny improvement in the energy efficiency of cars will be consequential. An increase of only 0.2 mpg, for the average mid-1970’s car would have more impact than doubling transit patronage. The Law of Large Proportions says the effects of transit policies would have been insignificant even if they had been able to lure people out of their cars. (Lave 1998, 11-12)

Often researchers and public officials justify rail projects, at least in part, on grounds that they spur economic development. In their analysis of 16 cities over a 30 year time span, Baum-Snow and Kahn (2005) discover that mean real household income in new rail transit-accessible areas was below that of other areas. Moreover, except for Atlanta and Miami, the income gap widened after new rail lines opened. The authors suggest that this supports previous conjectures that public transit is a “poverty magnet” (Baum-Snow and Kahn 2005, 25).

Garrett (2004) considers light rail’s effect on St. Louis property values and examines whether the benefits of greater accessibility outweigh the negative nuisance effect (e.g. noise, increased traffic congestion, safety concerns). He finds that within 1,460 feet of a MetroLink station, home values increase the closer they are to a station. But beyond 1,460 feet home prices rise with distance to station:

However, the increase from being farther from the station is less than the increase from being closer to the station. This suggests that for the entire sample, a house will show a premium the closer it is to a MetroLink station ... This positive accessibility effect outweighs the negative nuisance

effect; so, the net effect of MetroLink on property values is generally positive. (Garrett 2004, 21, 23)

Weinstein and Clower (2002) study areas located outside the Dallas central business district and within one-quarter mile radius of a light rail station. In general, the Dallas area experienced a strong property market during the study period.

Nonetheless, *proximity to a current or future DART LRT station appears to have had an additional positive impact on median valuations for most classes of property* (emphasis in original). (Weinstein and Clower 2002, 6)

Weinstein and Clower report that residential properties near DART stations increased 32.1 percent versus 19.5 percent for the control group areas.

Voith (1991) finds a small positive relationship between median home values and proximity to commuter rail stations. Bowes and Ihlanfeldt (2001) reveal that an intermediate distance from rail stations (one to three miles) is where property values tend to be higher, compared to properties within a quarter-mile of a station and those more than three miles away. Yet others suspect that the positive effects of light rail “will diminish rapidly beyond the quarter-mile radius” (Weinstein and Clower 2002, 2).

In their meta-analysis, Cockerill and Stanley (2002) report that light rail enhanced residential property values 2 to 18 percent in Portland, Sacramento, San Diego, and Santa Clara. But again, it was determined that properties located too close to a station (less than a quarter-mile) may suffer nuisance effects and lower property values.

As expected, the capitalization premiums appear to be higher with the establishment of heavy and commuter rail systems. Turning to the light-rail systems, Portland and Dallas have smallest scale operations as regards the distance and stations included. But the land market changes in Portland have been more extensive than those in cities with larger systems (such as Miami). A strong Smart Growth planning initiative in Portland and attempts to install a culture of reducing congestion have enhanced ridership and the premium residential owners place on being located near public transit. Authors of studies in

both Miami and Dallas, where the effects of residential properties were actually negative, suggest that the “car culture” of these cities has limited public enthusiasm for light rail and thus dampened property value impacts. The studies of various systems in California indicate smaller, and highly varied, land market effects of public transit. (Cockerill and Stanley 2002, 10)

Garrett (2003-2004, 3) writes, “Research generally finds that rail transit has a positive impact on residential property values, although the impact is relatively small.”

Cockerill and Stanley (2002) note that there have been fewer studies on rail’s effects on commercial property, but they report premiums of 4 to 30 percent in Santa Clara, Dallas, Atlanta, San Francisco, and Washington, D.C.

In cities where both the residential and commercial markets have been analyzed (such as Washington, D.C. and Atlanta), higher premiums occur in the later. Yet the California studies of both light and heavy rail seem to represent some exceptions. In San Diego the commercial benefits appear to be concentrated only in the central business district rather than any suburban office zones. And in San Francisco and Los Angeles few capitalizations have appeared for commercial properties located nearer transit stations. (Cockerill and Stanley 2002, 10)

Lewis and Bekka (2000) examine 2,830 commercial properties located in Washington D.C. and find that, all else equal, the shorter the distance between a commercial property and a metro station, the higher the value of the property. In their study of the Dallas area, Weinstein and Clower report that the value of office properties within a quarter-mile of light rail stations increased 24.7 percent versus 11.5 percent in the control group areas. The positive effect did not seem to extend to industrial properties and “retail properties show no meaningful difference in the change in median values between outlets located near the rail stations and those in the control group” (Weinstein and Clower 2002, 5). The authors note that their results “suggest that DART rail is an amenity-enhancing service most keenly affecting the market values of properties where people live and where there

are comparatively high concentrations of non-industrial jobs—i.e. office buildings.”

In many communities public officials have partnered with developers and business leaders to pursue “Transit-Oriented Development” (TOD). The idea is to encourage economic development, alter travel patterns, and reduce congestion, often by building high-density, mixed-used developments that encourage walking and transit use and discourage driving. Boarnet and Crane (2001) conducted a literature review on TOD.

Surprisingly, there is little credible knowledge about how urban form influences travel patterns. . . . Given the enormous support for using land use and urban design to address traffic problems, it was somewhat surprising...to find the empirical support for these transportation benefits to be inconclusive and their behavioral foundations obscure. Prior evidence on the link between design and travel is difficult to interpret and tells us relatively little about the behavioral nature of the problem and thus provides a weak foundation for policy advice. (Boarnet and Crane 2001, 172)

Giuliano and Small (1995) cite changing demographics to explain why hoped-for land-use effects may not occur.

There is also reason to doubt that the hoped for land-use changes will take place as result of investment in rail transit investment. High-density compact cities developed before the automobile. In North America they were the result of industrialization and the earlier state of transportation technology. The technology of production required agglomeration. Access to the intercity rail network was critical, and streetcar systems shaped residential patterns for workers. None of these conditions exist today, and the continued shift to service and information-based industry suggests that economic activity will be even less ‘place dependent’ in the future. (Giuliano and Small 1995, 204)

Measuring rail transit’s impact on economic growth can be especially difficult because researchers must control for many factors, from market forces to public policies on issues as varied as crime rates, regulatory

climate, and the quality of public schools. Of course the benefits must also be weighed against the cost of public subsidies: “The increase in property values and economic development are subsidized benefits and may not be greater than the subsidy costs” (Garrett 2003-2004, 5).

Garrett suggests that policymakers first consider why economic development is not taking place in a certain area.

The general consensus from the academic literature and the findings presented in this report is that light rail is not a catalyst for economic development, but rather light rail can help guide economic development. Rather than relying solely on light rail to create economic development, city planners and officials should first address a key question: Why is economic development not occurring in a given area in the first place? Possible reasons include relatively high cost to business start-ups, unattractive locations (crime, poor infrastructure) and unnecessary zoning and regulations. Unless these barriers are lowered or removed, the long-run economic development objectives, with or without light rail, will not be fully met. (Garrett 2004, 25)

If rail improves mobility for the transit-dependent, it may be justified on social equity grounds. Baum-Snow and Kahn (2005) confirm that most rail riders are former bus riders, and, as noted previously, some economists regard this as a shortcoming of rail. Yet here the authors view it as the chief benefit of rail transit.

In contrast to the pollution and congestion reductions touted by many rail transit proponents, we argue that the primary social benefit associated with new rail lines is that they may significantly reduce trip times. Given that the majority of rail transit riders are former bus users, mode switching to rail has the potential to represent large aggregate time savings. (Baum-Snow and Kahn 2005, 51)

Such time savings could be achieved when a transit user switches from bus travel, which is typically just as vulnerable to traffic congestion as private automobiles, to grade-separated rail travel, which avoids such congestion. (Since the critical issue seems to be not bus versus rail, but grade-separation, one wonders whether such time savings could be

achieved with exclusive busways.) If such mode-switching benefits poorer bus riders, then rail can be seen as progressive. However, Baum-Snow and Kahn are apparently undecided on the matter.

Our empirical work suggests that there are distributional consequences from expanding rail transit infrastructure. Suburban workers who commute by car are likely to gain little from improved transit, while bus commuters who work in the CBD enjoy large time savings in many cities. Since bus riders tend to be poorer people, this suggests that rail transit expansions are progressive. This is a contentious point that merits future research. Transportation scholars have argued that an unintended consequence of rail transit expansion is bus coverage deterioration due to budget reallocations to pay for the new transit lines. If this is true and if the poor are more likely to take the bus than rail transit, then transit expansion could be a regressive public policy. (Baum-Snow and Kahn 2005, 50)

Winston and Maheshri are clearly skeptical of rail's equity benefits.

[S]upporters of these systems claim that they are attractive on distributional grounds because they contribute to the mobility of low-income residents. But the median income of rail transit users exceeds the median income in the general population. In addition, rail transit systems have difficulty keeping up with and responding to changes in job growth; thus, they are unable to provide the poorest residents access to employment opportunities in outlying suburbs. (Winston and Maheshri 2006, 17)

A fairly common argument is that transit agencies build rail transit systems in hopes of luring comparatively well-off motorists out of their cars and, in the process, neglect bus service which serves a poorer demographic. Gordon and Richardson (2001) criticize inefficient targeting in which "many highly subsidized rail systems, such as that of Washington, D.C., serve large numbers of the middle and upper-middle class" (14).

In their favorable assessment of the system, Nelson et al. (2006, 21) agree that: "The benefits of the D.C. transit system accrue disproportionately to

wealthy travelers, both in terms of economic welfare measures and raw minutes saved while traveling.”

Winston and Shirley remark on additional dimensions of the matter.

Rail systems are clearly responsive to the interests of upper middle-income riders because fares fall and route coverage and frequency increase as their share of ridership increases. In contrast, fares increase and service frequency deteriorates as the share of (lower) middle-income riders increases, and route coverage contracts as the share of lower-income riders increases. (Winston and Shirley 1998, 81)

Castelazo and Garrett (2004) offer a different way to serve the transit dependent.

While providing public transit to the poor does produce tangible economic benefits, the following example suggests that light rail is not an efficient means of providing transportation to the poor. Specifically . . . the money spent on MetroLink in St. Louis can be used to much better effect.

Based solely on dollar cost, the annual light-rail subsidies could instead be used to buy an environmentally friendly hybrid Toyota Prius every five years for each poor rider and even to pay annual maintenance costs of \$6,000. Increases in pollution would be minimal with the hybrid vehicle, and 7,700 new vehicles on the roadway would result in only a 0.5 percent increase in traffic congestion. And there would still be funds left over—about \$49 million per year. These funds could be given to all other MetroLink riders (amounting to roughly \$1,045 per person per year) and be used for cab fare, bus fare, etc. (Castelazo and Garrett 2004, 12-13)

Like many economists, Castelazo and Garrett regard bus service as another preferable alternative to rail.

Instead of building light-rail systems to provide transportation for the poor, communities could expand

bus service, offer more express bus routes or expand on-demand services; these would still realize the benefits of providing public transportation to the poor. Although these other forms of public transportation are also cost-inefficient compared to the automobile, fewer inefficient public transportation systems would be less costly to society. (Castelazo and Garrett 2004, 13)

The preference for bus is not just on equity grounds. In what was probably the first comprehensive estimate of the comparative costs of urban transit modes, Meyer, Kain, and Wohl (1965) found bus transit to be generally more cost effective than heavy rail. Giuliano and Small (1995, 204) agree that “rail transit is far more costly to build and operate than bus transit.” Pardue (1976) touts the cost-effectiveness of bus transit and Downs (1992, 45) argues in favor of expanding bus service: “Needless to say, expanding existing public transit systems—especially bus systems—is much less costly than building new fixed-rail systems.”

Kain holds that bus service generally offers lower costs and higher performance.

With few exceptions, academic studies of the cost-effectiveness of alternative modes have found that some form of express bus system, operating on either an exclusive right-of-way or a shared facility, would have lower costs and higher performance than either light or heavy rail systems in nearly all, if not all U.S. cities. (Kain 1999, 384)

Vincent and Roth (2005) comment specifically on a rail proposal for the Northern Virginia region.

Our conclusion suggests that building rail as planned would be a significant misallocation of resources. It fails to maximize the number of new transit trips that can be generated, because too much is being spent to attract each new transit rider. It also takes resources away from other potential transit projects that could better serve the region. For example, for the same budget as rail, our analysis suggests that a high quality bus transit system could be built in the Dulles corridor *and* in several other corridors in

Northern Virginia. This would attract many more people to transit, serve many more communities, and do more to relieve Northern Virginia's notorious traffic congestion.

Moreover, even though our options are more cost-effective, they can provide better service than rail, including more seats for passengers, more frequent service, and more convenient service that skips stops and reduces travel time (emphasis in original). (Vincent and Roth 2005, 23)

Certain economists challenge the popular notion that rail is an inherently more appealing mode than bus. McFadden (1974) finds that, if the cost and time of the trips were the same, rail patrons have no preference between bus and rail. Richmond (2005) maintains that fares, schedule reliability, and travel time are the factors most important to travelers. He explains that decision makers frequently overlook the time passengers spend walking to and waiting at transit stops, and that travelers actually place extra weight on time spent engaged in such activities. "With a rail system there will be more transferring, waiting, and walking on average than with a bus system. The same bus can provide both local and line-haul service and—lacking attachment to a fixed track—can serve a wider range of destinations than can be reached by train" (Richmond 2005, 48).

Morgner (1976) and others tout other forms of rubber-tire transit.

Rail rapid transit is probably the worst step Los Angeles could take to improve transportation. There do exist a variety of other, smaller steps that can easily be accomplished with strong and positive results. The most promising alternatives appear to be "para-transit" operations of several types that promise substantially larger benefits at a fraction of the costs of the proposed rail system. (Gordon and Eckert 1976)

Still, not all economists are enthusiastic about bus transit: "bus service actually increases congestion to motorists, especially when it operates on exclusive bus lanes that would otherwise be available to all vehicles" (Winston 2005).

## BROAD JUDGMENTS

Determining whether building rail transit is a wise investment can be complicated when success is assessed in comparative terms. An economist may view one system as better than most, but that does not necessarily mean that economists favor rail in general. Consider Kain's highly critical assessment of Atlanta's rail system.

In spite of the serious questions the analyses presented in this paper raise about MARTA's decision to build a costly rail system, it should be understood that Atlanta's system is almost certainly one of the most successful rail systems implemented in the United States since the end of World War II. Most of the other light and heavy rail systems built in the United States since the end of World War II would fare much worse in analyses of the kind presented in this paper. (Kain 1996, 23)

Economists find that rail transit delivers benefits in a variety of metropolitan areas, but most regard larger social trends as at odds with rail. As noted above, economists tend to regard other options as preferable, such as decontrolling transportation markets, introducing pricing, or improving bus service. We have also examined how they are also critical of forecasts that frequently understate costs and overstate ridership. Economists seem to be skeptical that rail's benefits outweigh costs. For example, Richmond reports that optimistic claims "have proved incorrect in most instances" (Richmond 2001, 172); Baum-Snow and Kahn provide "pessimistic evidence" about the success of new rail lines (Baum-Snow and Kahn 2005, 49); Garrett (2003-2004, 5) and others make similar assessments: "Given the size of costs relative to the benefits, the creation of light-rail transit systems or the expansion of existing systems in American cities may be difficult to justify."

Utt (2005) sees few places where rail transit can succeed. "The truth is that for almost all cities and communities, the economics of rail-based transit just don't make sense."

In their analysis of 25 light and heavy rail systems in operation between 1993 and 2000, Winston and Maheshri (2006) estimated the contribution of urban rail operation to social welfare based on the demand for and cost of its service.

We find that with the single exception of BART in the San Francisco Bay area, *every* U.S. transit system actually reduces social welfare. Worse, we cannot identify an optimal pricing policy or physical restructuring of the rail network that would enhance any system's social desirability without effectively eliminating its service (emphasis in original). (Winston and Maheshri, 2006, 2)

Welfare performance of the largest systems deteriorated over time, and during the last year of their sample researchers found negative net benefits for every system. Rail systems in New York City and Chicago may be able to become socially desirable, but only if they were privatized, which Winston and Maheshri regard as highly unlikely. They add: "Because no policy option exists that would enhance the social desirability of most urban rail systems, policymakers only can be advised to limit the social costs of rail systems by curtailing their expansion" (Winston and Maheshri 2006, 20).

Although Richard Voith is somewhat supportive of rail transit, he acknowledges that most economists are skeptical of its benefits. "The dominant view of economists has been that rail investments generally have been ineffective and expensive, and the benefits do not justify the costs" (Voith 2005, 52).

### RAIL TRANSIT IN A CHANGING WORLD

Economists seem to agree on the demographic features that make rail more likely to succeed—high population density, high concentration of employment in the central business district, and strong commute flows to and from the CBD. If you need to get from point A to point B and you have a choice between train and bus, you probably prefer the train, but if you need to get to a point three miles from B, namely, point C, and only a bus will take you from A to C, then that beats taking the train to B. Economists point out that, compared to rail infrastructure, buses and other road-based modes are far more flexible in route differentiation and alteration over time (Kain 1988; Giuliano and Small 1995, 204, 211-215; Richardson and Gordon 2000; Zaretsky 1994, 3; Vincent and Roth 2005).

The CBD-type features that favor rail appear in a diminishing share of the American landscape and today less than 10 percent of our nation's

metropolitan employment is located in traditional central business districts (Winston and Maheshri 2006). Economists often cite related demographic trends like decentralization, the suburbanization of employment and housing, and increasing wealth to explain why it is difficult for rail to succeed in modern society. “Suburbanization of employment and residences has made it less likely for transit to be a feasible commuting alternative” (Baum-Snow and Kahn 2005, 31).

Gordon expands on the same theme:

[Transit] worked best in a world with high concentrations of origins and destinations (where employment and population densities are high) and with large numbers of people too poor to own and operate an automobile. Both conditions have been declining in the United States and in many other developed and developing nations, explaining the decline of conventional transit both here and abroad.

Population and employment densities are falling in most places, and most people and jobs are choosing not to locate near transit stations because collective transportation is inconvenient and expensive in terms of what really counts, people’s precious time.

In low-density settings where origins and destinations are dispersed, transit that best serves high-volume corridors competes poorly. High-capacity rail systems are, thus, inevitably underutilized, ever more expensive and ever more difficult to provide more of. (Gordon 1999)

Kain challenges perceptions that CBDs have been growing in influence.

Central business district employment levels are especially critical to transit ridership, particularly on the new rail transit systems that were designed specifically to serve large projected increases in central city employment. Although data are fragmentary and difficult to interpret, they, nonetheless, indicate that few central business districts experienced significant employment growth after World War II. This conclusion will surprise many

individuals who have equated the construction of new office space within central business districts of large cities with employment growth. Overly optimistic forecasts of central city employment are important contributors to the excessively optimistic forecasts of transit ridership of proposed rail systems. (Kain 1999, 366)

Goddard stands out as one who sees demographic trends, especially lower densities, as actually supportive of rail transit.

Upon a little reflection, we can see that the density argument is 19<sup>th</sup> century in nature and therefore antiquated. When most people in the urban areas didn't own a horse and carriage and therefore walked to their destinations or to the street car stop, the density argument was valid and important. But in today's world, in the U.S. at least, most people own vehicles, so population density has lost its force. The rising interest in light rail today is caused by highway congestion, and since park and ride facilities are typically part of light rail transit investments, the *population* density argument is no longer important—what is important is *vehicle* density on the roadways, which is high and growing higher. This is another way of referring to congestion, and reduction in congestion is the major source of light rail transit benefits. . . . [O]ne can make the interesting hypothesis that light rail transit benefits will always be higher the *lower* the suburban population density, as that implies more sprawl, higher vehicle ownership and use and consequent higher road congestion. (Goddard March 2004, 3, 5)

Still most economists agree that today's housing and travel patterns do not fit well with rail transit. Zaretsky contends that it is increasingly difficult to construct effective public transportation systems.

Designing an effective public transportation system is more difficult than it used to be, as urban and suburban development has altered commuting patterns. Today, most commuting patterns are not from the suburbs or urban residential areas to a central business district, but are

instead between points in the suburbs, as businesses have followed their workforces from downtowns to the suburbs. Although this change does not affect bus service much, as routes can be altered to match commuting patterns, rail service can be rendered obsolete because fixed routes cannot be altered quickly or cheaply ... If the corridors chosen for rail construction do not match either the commuting patterns of workers or the areas amenable to future industry expansion, cities will end up with little more than expensive tourist movers paid for with government dollars. (Zaretsky 1994, 3)

Some trends may temporarily boost transit, but they are still not strong enough to reverse transit's declining influence.

Although a few trends, such as increased immigration, have led to temporary increases in ridership in some communities, the complex industrial, demographic, and land use changes affecting U.S. society continue to erode ridership, even among the most dedicated groups of transit users. Soon, the losses will outweigh the gains. (Rosenbloom and Fielding 1998, 2)

Gómez-Ibáñez considers the financial strain that changing demographics puts on transit systems.

The basic problem is how to maintain or increase public transport ridership without widening the gap between transit costs and passenger revenues; this gap, which we call the transit deficit, is usually financed by the taxpayer. In the last several decades most metropolitan areas have been promoting public transportation as a way to reduce traffic congestion, control air pollution by automobiles, and preserve the mobility of citizens who do not have ready access to automobiles. At the same time, however, the underlying economics of mass transit have been deteriorating, as real incomes rise and jobs and residences move to the suburbs. Rising real incomes make labor-intensive services such as transit more costly, and suburbanization produces a dispersed pattern of travel that

is difficult for transit to serve. The result has been rapidly increasing transit deficits with disappointingly small ridership gains (Altshuler 1979; Meyer and Gómez-Ibáñez 1981; Wachs 1989). The debate over transit seldom faces up to these realities. The public has little grasp of the difficulties the local transit agency faces in trying to hold on to ridership despite rising incomes and suburbanization. Transit's growing deficits are often blamed instead on management or labor inefficiencies, accusations that are only partly true. Thus the public is misled into believing it is possible to have it all: better service and ridership without continually rising deficits. (Gómez-Ibáñez 1996, 30)

It is often assumed that the shift to automobile travel occurred during the post-World War II years and in conjunction with the development of the interstate highway system, which was initiated in 1956. Yet the shift had begun much earlier. Hilton (1985) notes that patronage of demand-responsive private jitneys peaked around 1915, but the trend was soon squelched.

Municipal governments proved to be unanimously hostile to this development. They were directly dependent on the street railways for tax revenues and they achieved some implicit benefits from the monopolistic status of the street railways. . . . More basically, the electric streetcar had produced an urban pattern that most municipal governments liked. (Hilton 1985, 37)

“By 1915 the jitneys had given every impression of being a viable industry,” but they were “eradicated in most cities” before America entered World War I in 1917 (Hilton 1985, 37, 38). Freewheeling private transit struggled under unfriendly policies, yet in the years leading up to World War II private automobile travel was already widespread.

The ubiquity of the automobile was producing changes in the urban pattern to which public transit, as it was organized, could not respond effectively. The old pattern of strip shopping streets leading to a centralized business district of office employment, an amusement-restaurant

complex, and a specialized shopping area was slowly being replaced with one of free placing economic activity, based on expectations that most people would arrive by automobile and goods would arrive and depart by truck. (Hilton 1985, 43, 44)

As wealth increased, more Americans chose to drive. “For the majority of society . . . the tendency to turn away from public transit with increases in income was dominant” (Hilton 1985, 44).

During World War II transit ridership was buoyed by policies that restricted automobile production and rationed gasoline. But after the war, increased wealth meant that private automobile travel would continue to overshadow transit. In their analysis of the 1970 to 2000 period, Baum-Snow and Kahn (2005, 31) note that cost of owning an automobile fell. Moreover, “wages have been growing, increasing people’s value of commuting time, thereby making them less likely to commute by bus or rail lines that are slower than driving.”

Hilton expands on that theme:

The automobile has a strongly positive income elasticity of demand, which is to say that as people’s incomes increase, they want more of the services of automobiles. Indeed, they want additional services of automobiles more than proportionally to their increases in income. In contrast, the income elasticity of demand for transit is positive only in relatively low income brackets, below \$4,000 per year. In higher income brackets, income elasticity is negative; as people’s incomes increase they turn away from transits to the automobile. The cross elasticity of demand between the two, which is to say the responsiveness of consumers of one service to a change in the price of the other, is so low as closely as to approach zero. Typically it cannot be picked up by ordinary econometric techniques. (Hilton 1976)

### WHY DOES RAIL TRANSIT REMAIN POLITICALLY POPULAR?

Despite criticism from economists, rail transit remains politically popular. Since the early 1980s roughly two dozen American metro areas have built or expanded rail transit systems. Many more angle for federal dollars to break ground on more lines. Some economists, such as Hilton (1973) underestimated the power of politics. "By 1980, at the latest, the present rapid transit movement will be looked upon as unsuccessful, misguided, and purely wasteful."

Supporters often point to rail's political popularity as evidence that rail transit is good public policy. Why is there such a disconnect between the economic evidence and political reality? Many economists have confronted this question.

Despite the pessimistic evidence we have presented about the likely success of new rail lines, they are being built at historically high rates. Why is this? An important reason is that most of the cost is covered by the federal government. The nature of federal funding is such that they fund capital intensive transit projects like fixed rail over other types of projects that might actually draw more new riders. (Baum-Snow and Kahn, 49)

Among other factors, Winston and Maheshri (2006) cite increased federal earmarks and federal legislation that sets aside for transit 20 percent of revenues from gasoline tax increases. Yet Voith (2005) notes that locals may be willing to shoulder much of the cost themselves.

[M]any regions have adopted specific local taxes to support the development of rail transit systems. Dallas, Salt Lake City, and St. Louis are examples of regions that have adopted local taxes to fund significant shares of rail transit investment. Thus in some metropolitan areas the investment is not simply local areas opting for rail because it has a low tax price. (54)

Castelazo and Garrett (2004) suggest that rail is politically popular because the benefits are “highly concentrated, while the costs are widely dispersed.”

The direct benefits of a light-rail project can be quite large for a relatively small group of people, such as elected officials, environmental groups, labor organizations, engineering and architectural firms, developers and regional businesses, which often campaign vigorously for the passage of light-rail funding. These groups would benefit from light rail, not from the subsidization of cars and money to all potential riders of light rail. (Castelazo and Garrett 2004, 13)

Winston and Maheshri continue the theme of concentrated benefits and dispersed costs.

Why do existing systems continue to expand and new systems get built despite rail’s negative contribution to social welfare? Rail transit enjoys strong support from urban planners who wish to discourage auto use, from suppliers of transit capital and labor, who receive economic rents, from civic boosters, who perceive that a rail system adds prestige to their city, and from city officials, who support investments in a transit system that serves the downtown core because it may help the downtown remain vibrant or keep it from decaying. Until recently, the public has rarely rebelled against the actual costs of new systems or system extensions. In fact, opinion polls suggest that a majority of residents in a city tend to support rail transit regardless of whether they actually use it on a regular basis. We speculate that the public may support rail transit because it overstates rail’s ability to mitigate automobile externalities and because it is “rationally ignorant”—that is, the costs of transit subsidies (relative to other subsidies in the U.S. economy) are too small to merit the attention of most residents in a metropolitan area. Facing little resistance from the public, transit advocates aggressively explore alternative avenues

to fund a new system or extend an existing one. (Winston and Maheshri 2006, 19)

Downs highlights the influence of downtown business interests:

[O]ne way to strengthen the market for office and other space within a business center is to build more off-road transit facilities to serve it. That is undoubtedly why downtown business interests so strongly support construction of new fixed-rail transit systems—especially if they can obtain federal subsidies to cover much of the costs. (Downs 1992, 89)

Winston takes a broader view:

[The] simplest answer to why government repeatedly pursues inefficient transportation policies is that policymakers—appropriately—respond more to political forces than to market forces. Transportation policy has thus become a giant grab bag whose benefits are available to various vested interests—some just get more than others—at the expense of a more efficient transportation system that could save the public at large billions of dollars. (Winston, Summer 1999, 45)

After conducting more than 200 interviews with transportation decision makers, Richmond (2005) concludes that most succumb to the power of myth and delusion and enter the evaluation process already devoted to building rail. They frequently romanticize rail travel, and go through an evaluation process that serves little more than a “ritual function,” one that “gives an aura of respectability to decisions which have been reached on other grounds” (147). Officials focus on forecasting findings that support rail and dismiss those that do not. Just as others speculate that the public overestimates rail’s positive effects (Winston and Maheshri 2006), Richmond (2005, 252) observes a similar phenomenon among public officials.<sup>10</sup> He contends that officials hold beliefs based on incomplete assessments, which causes them to, for example, assume rail

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<sup>10</sup> Lave (1998) notes that observer bias prompts transit riders to assume that load factors are higher than they really are. After all, few people use transit when loads are light.

travel is faster than it really is: “[M]any of those interviewed for this project focused on the rail component of a trip. Other necessary elements of any journey—getting to and from the train stations—were given little or no attention.”

Economists like Hamer (1976) and Kain go further and bring up the possibility of deception. “The tendency of policymakers to ignore the abundant evidence on the superiority of high-performance bus systems is explained by a prior commitment to rail and a willingness to ‘cook the numbers’ until they yield a desired result” (Kain 1999, 384). Kain suggests the use of straw men may be “the most serious flaw of all.”

Nearly all, if not all, assessments of rail transit systems have used costly and poorly designed all-bus alternatives to make the proposed rail systems appear better than they are. In some cases, the use of badly designed alternatives is intentional, while in others a lack of interest in developing better bus systems may account for the inadequacies of the all-bus alternatives. (Kain 1992, 487)

Commenting on a rail proposal in Hawaii, Hamer (1978) offers a similar critique. He charges that consultants recommended rail without first determining whether some kind of express bus network might be a better choice.

Daniel Klein (2005, 19) suggests that rail-transit projects illustrate “the people’s romance,” wherein citizens warm to the idea of a collective effort, endeavor, and experience. In the people’s romance, people imagine that everyone in the community enters into a common sentiment, satisfying a basic yearning for the encompassing coordination of sentiment. Large, visible government projects have this aspect, and we observe that rail promoters often argue that the rail project will help to make the city prominent or “world class.” For economists, however, romantic appeals do not seem to cut much ice, as they almost never count such factors among the benefits of a rail project. Garrett (2004) is somewhat of an exception.

The overall cost of light rail, and the cost of providing rail transit to the poor, can certainly be justified if society obtains some intangible benefit (e.g. pride, generosity, compassion) from knowing that light rail exists in a community. This is similar to the community pride argument made in favor of using tax dollars to finance the

construction of professional sports stadiums. Measuring these intangible benefits that society may receive, however, is difficult. So, although providing light-rail transportation is very costly, each community must weigh the cost with the tangible and intangible benefits it receives from light rail. If these benefits are high enough, then the dollar cost can certainly be justified. (Garrett 2004, 13)

However, counting such intangible factors would open the door to hairy questions about cultural benefits and costs—Klein, for example, argues that the people’s romance is something humankind should not gratify but rather learn to subdue, like the penchant for sweets.

### EXAMINING THE EXCEPTIONS

In some cases, it is easy to identify enthusiastic supporters of rail transit. Haynes Goddard, Khalid Bekka, and David Lewis seem to be clear-cut examples of economists who see hearty benefits from rail transit. Lewis contends that light rail investments often yield benefits that exceed costs.

No economic analysis can claim to quantify every conceivable category of the benefit and cost arising from transit investments. Yet, when the major effects are taken into account, light rail investments can be seen to generate economic benefits that exceed the costs of their construction and operation. . . . This is not to say that every light rail proposal is an economic winner; each project proposal must be examined on its merits. (Lewis 2006, 3)<sup>11</sup>

Shapiro, Hassett, and Frank (2002) do not distinguish among modes, but they see great benefits from public transit in general.

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<sup>11</sup> At the time this paper was published David Lewis was President of HLB Decision Economics, an architectural-engineering-consulting firm.

Greater reliance on more fuel-efficient means of travel, especially use of public transportation is the key to the United States achieving greater energy independence and environmental progress. . . . Both pragmatism and patriotism can become catalysts for much greater use of public transportation. As a practical matter, increasing transit may be one of the most feasible—and desirable—strategies for sharply reducing our dependence on foreign oil and making historic strides in environmental quality. As an act of civic commitment, many Americans may view riding public transit, even on a limited basis, as a small but important contribution to our country's well being. (Shapiro, Hassett, and Frank 2002, 33)

However, in many cases it is rather difficult to discern the degree to which the “exceptions” are exceptional. As was discussed above, Zaretsky (2004, 1-2) writes that “compared with single-occupant automobiles, public transportation, especially rail systems, is a much more efficient way to move people around a metropolitan area.” He speaks favorably of rail transit's ability to reduce energy use, pollution, and traffic congestion. Yet Zaretsky also brings up concerns that are common to other economists, such as the relatively low use of rail transit and how the rise of suburbanization makes it more difficult for rail transit to succeed.

Zaretsky also worries about rail's recovery ratio. “One problem light rail faces is that passenger revenue is never sufficient to cover operating costs. . . . [A]pproximately two-thirds of a light rail's operating expense must be either raised through local taxes or subsidized by the government.” Zaretsky wonders about the feasibility of rail but then seems to reassert its value.

As economic theory tells us, a firm should generally not continue to operate if it cannot generate enough revenue to cover its operating costs. In some sense, then, government is operating a system that should shut down. Of course, one response to this argument is that the rail system's direct operating costs are not adjusted for the indirect savings from lower energy consumption and the lessening of pollution and congestion. In addition, public transit contributes a positive byproduct by providing affordable transportation for those who cannot afford

other means of transport, like owning a car or taking a taxi. Although these adjustments to operating expenses are not directly measurable, they can play an important role in determining the viability of a system. (Zaretsky 1994, 8).

Zaretsky cites Washington, D.C.'s rail system, which he notes "is considered relatively successful." Likewise, Voith (2005) also views that system in a favorable light.

Baum-Snow and Kahn cite the fact that new rail transit systems tend to provide service to fewer people than existing systems because the density of the areas served are lower. They argue that this is evidence for the declining marginal productivity of additional rail transit lines. The Washington experience, however, suggests that there are positive network effects associated with extensive development of quality rail facilities. In the Washington area, rail investments have seen extensive development in areas served by the system, increasing both ridership and density. (Voith 2005, 55)

Voith further highlights San Francisco and Boston as areas where rail has made transit relatively successful. As noted above, Voith also sees small positive land use effects of rail transit and he does not view the large proportion of bus-to-rail substitutions as a negative outcome. Perhaps, he argues, bus riders would not have remained transit users if not for investments in rail. Again, given his relative supportiveness of rail transit, it is probably significant that Voith writes that economists' "dominant view" is that "rail transit investments generally have been ineffective and expensive, and the benefits do not justify the costs" (Voith 2005, 52). He continues:

While I share the view that some rail transit investments have not had large, positive impacts on their communities, measuring the success or failure of rail transit investments is an endeavor fraught with many challenges, from the definition of the counterfactual, to controlling for other local policy choices affecting the outcome of the investment. In general, I believe that the focus of these analyses should not be based on a particular mode, but

rather on the characteristics of the service as perceived by the transportation consumer. Finally, I would conjecture that evaluating the impact of very large transit investments like the Washington Metro by using marginal analysis is nearly impossible. The high levels of use have resulted in a city that otherwise could not evolve in a similar manner. (Voith 2005, 58)

Nelson et al. also highlight the Washington experience. They find that D.C.'s rail (and bus) system offer substantial net benefits, but advise against using this example to make general conclusions.

An obvious limitation of this study is that results reflect specific features of the Washington metropolitan area, including the geography of income distribution, relative importance of public transit, level of carpooling, degree of utilization of HOV lanes, and the fixed central economic activity of the federal government. As Baum-Snow and Kahn (2000) argue, the D.C. region is one of the most promising settings for a major transit system in the country. The large benefits found here should not be taken as evidence in support of transit investment in dissimilar locations. (Nelson et al. 2006, 2)

And since “most of the costs are sunk, and there is little prospect that the system will be disassembled,” Nelson et al. consider estimating the total benefits of the existing transit system to be “an interesting academic and political question,” but “something of a moot point practically.” What they find more significant is “whether the current scale of service is near optimum” (18). The researchers do not advocate large-scale expansions.

[A]lthough the current level of investment in transit in the Washington area is not optimal, it is reasonably close. Furthermore, although the value of the transit system as a whole is unquestionable, the net gains from moving the baseline to the optimum (assuming no other concurrent instruments, like road pricing) are trivial compared with the net benefits of the system. Similarly, moving from the optimum to a point of lower provision results in trivial losses. (Nelson et al. 2006, 21)

## CONCLUSION

The public debate often strays from some simple considerations that are fundamental to economic analysis. It is not enough to show that rail (or any other public policy) provides benefits. Benefits must outweigh costs. And if it is to be viewed as the best choice, policymakers must be able to determine that it is more effective than all other options at achieving a particular goal. Yet most of the public debate, indeed much research, gives short shrift to considerations of opportunity cost.

The debate is further complicated by the general lack of agreement regarding which goals rail transit should even attempt to achieve. We have aimed to explore most of the core issues that are important to economists, but we have not examined all justifications for rail transit. Policymakers might consider whether it is reasonable to expect rail transit to make good on a wide array of goals and whether insisting on certain goals (e.g., getting comparatively well-off motorists out of their cars) could make it more difficult to achieve other goals (e.g., serving the transit dependent). Further, the success of rail transit will, to a large degree, be determined by trends, demographics, policies, and other factors that vary greatly from one community to another. If a community exhibits the right mix of features, rail can indeed be successful.

Economists also note the importance of the nature of public management in the provision of transportation services. Rail is affected by (mostly) the same incentives that affect other transit modes and it can be difficult to determine the degree to which rail's performance is the result of public management or the features inherent to the mode. A liberalized transportation regime (especially one that embraced pricing) would likely look much different than what we have now, and economists are often enthusiastic about what kinds of services might emerge and how transit might expand market share.

What conclusions can we draw from economists' view of rail transit? Economists demonstrate a range of views regardless of the particular justification examined. Still some justifications receive more support than others. Although the matter is filled with disagreement and caveats, economists appear to be the most optimistic about rail transit's impact on economic development, especially its impact on residential housing values. Economists seem to be less optimistic about rail's ability to achieve environmental improvement and serve the transit dependent poor. Economists seem quite pessimistic about rail's ability to achieve key transportation-related goals, like

reducing congestion, and they tend to see other modes, primarily bus, as more functional and worthwhile. Economists often attribute rail's political success to their belief that decision-makers are motivated by rent-seeking and romantic factors. Of those economists who offer a big-picture view, there appears to be wide, though not unanimous, agreement that rail's costs exceed its benefits. And it seems that almost all economists who write about rail agree that various demographic features, such as suburbanization, the declining influence of central business districts, and increasing wealth will make it increasingly difficult to design successful rail systems.

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### ABOUT THE AUTHORS



**Ted Balaker** is the Jacobs Fellow at Reason Foundation. His research and writings focus on urban policy, globalization, and workplace issues. Previously, Balaker worked at ABC Network News, producing segments and documentaries on government reform, regulation, the environment, transportation policy, and other issues. Balaker graduated Phi Beta Kappa from the University of California, Irvine with bachelor's degrees in Political Science and English. He is co-author (with Sam Staley) of *The Road More Traveled: Why the Congestion Crisis Matters More Than You Think, and What We Can Do About It* (Rowman & Littlefield, 2006). Email: [ted.balaker@reason.org](mailto:ted.balaker@reason.org).



**Cecilia Joung Kim** is originally from Daejeon, Korea but spent her childhood in York County, Virginia. She subsequently moved back to Korea to learn her native language and culture. She received a Bachelor and Master of Urban Engineering from Hong Ik University in Seoul and recently a Master of Planning at the University of Southern California. Her concentration is in urban design, though her interests cover all areas of planning from transportation to economic development. Email: [joungkim@usc.edu](mailto:joungkim@usc.edu).