



ENERGY INSTITUTE BLOG

Five Arguments for Making Subways Free

Lowering subway fares would save energy and make cities greener.

Subway ridership has fallen sharply around the world due to COVID-19. For most of the 170+ subway systems worldwide it is going to be a long time before ridership gets back to pre-COVID levels. The sharp drop in revenue is squeezing transportation budgets, making now an opportune time to think more broadly about [how to fund](#)

[\(https://energyathaas.wordpress.com/2020/04/27/will-we-still-be-riding-on-the-same-bus-post-corona/\)](https://energyathaas.wordpress.com/2020/04/27/will-we-still-be-riding-on-the-same-bus-post-corona/) urban rail.

For today's blog, I want to imagine a world where you don't have to wait in line to buy a subway ticket, or help your kids through

the turnstiles. I want to imagine a world where subways are free.

In a new Energy Institute working paper ([here](https://haas.berkeley.edu/wp-content/uploads/WP307.pdf) (<https://haas.berkeley.edu/wp-content/uploads/WP307.pdf>)), I estimate the price elasticity of demand for subways using evidence from Mexico City, Guadalajara, and Monterrey. One of the natural experiments I examine in the paper is a fare “holiday” that was successful in attracting new riders and has made me wonder whether we should be doing this all the time and everywhere.

I’m not sure what the right answer is, and I’m sure readers will chime in with other considerations, but in my view there are five economic arguments for making subways free.



People waiting in line to buy a ticket for the subway in Bangkok. Particularly now with COVID19, wouldn't it be nice to get rid of these queues? Image licensed under creative commons, shorturl.at/lqOX2.

#1. Low Marginal Cost

It is expensive to build subways. Recent expansions to the New York City subway, for example, cost more than [\\$2 billion per mile](https://www.nytimes.com/2017/12/28/nyregion/new-york-subway-construction-costs.html) (<https://www.nytimes.com/2017/12/28/nyregion/new-york-subway-construction-costs.html>). But subway construction is a fixed cost — not a marginal cost. Once the subway has been built, those capital costs are sunk and do not change if you add more trips.

It does take more energy to move a full train than an empty train, but the marginal energy consumption per additional passenger trip is very small. For example, I find that an additional passenger trip in the Mexico City subway increases total system electricity consumption by less than one-third of a kilowatt hour. Electricity is [expensive in Mexico](https://www.nera.com/publications/archive/2020/mexican-wholesale-electricity-market-report-2019.html) (<https://www.nera.com/publications/archive/2020/mexican-wholesale-electricity-market-report-2019.html>), but this still implies a marginal cost of only about 4 cents per passenger trip.

It is well known that rail travel is highly-fuel efficient compared to private vehicles, using [less than 1/10th](https://www.iea.org/reports/the-future-of-rail) (<https://www.iea.org/reports/the-future-of-rail>) as much energy per passenger mile. Steel-on-steel wheels have 85% less rolling friction losses compared to tires on a road, and make far fewer stops than private vehicles in urban driving.

Off-peak most subway systems can accommodate significant increases in trips without crowding. On-peak, however, crowding is the more significant marginal cost, particularly [now due to COVID](https://www.nytimes.com/2020/03/03/nyregion/mta-subways-covid-19-virus.html) (<https://www.nytimes.com/2020/03/03/nyregion/mta-subways-covid-19-virus.html>). Subway operators try to address crowding by [adding trains](https://thesource.metro.net/2019/09/12/metro-to-add-some-expo-line-trains-during-peak-hours-to-address-crowding/) (<https://thesource.metro.net/2019/09/12/metro-to-add-some-expo-line-trains-during-peak-hours-to-address-crowding/>) — which has both costs and benefits as I discuss later.

#2. Low Externalities

The marginal *external* cost of subways is low too. When you use less energy, you create less negative energy-related externalities. In addition, [two-thirds](https://www.iea.org/reports/the-future-of-rail) (<https://www.iea.org/reports/the-future-of-rail>) of urban rail systems worldwide are electrified, so are becoming cleaner as electricity becomes [less carbon-intensive](#)

[\(https://energyathaas.wordpress.com/2018/12/10/u-s-power-plant-emissions-down-45-since-2010/\)](https://energyathaas.wordpress.com/2018/12/10/u-s-power-plant-emissions-down-45-since-2010/).

In contrast, the alternatives to subways use more energy and impose additional costs. Private vehicles, ride sharing, and even bus transit all create local pollution, traffic congestion, and accidents.

When economists account for the costs of the alternatives, they've concluded that the optimal price for urban rail transit is often negative. The benefits of getting vehicles off the roads are that large. See, in particular, work by Ian Parry and coauthors

[here \(https://www.aeaweb.org/articles?id=10.1257/aer.99.3.700\)](https://www.aeaweb.org/articles?id=10.1257/aer.99.3.700) and [here](#)

[3\). \(https://www.sciencedirect.com/science/article/abs/pii/S0094119010000203\)](https://www.sciencedirect.com/science/article/abs/pii/S0094119010000203). Of course, it would not actually make sense to use negative prices because you would invite professional “riders”. But how about zero? Zero has a nice ring to it.



We go to great lengths to stop people from riding subways without paying, like these gated rotating turnstiles. This equipment is expensive, creates time delays, and is confusing to infrequent riders. If subways were free all this would go away.

#3. Operational Efficiencies

I may be overly fixated on these operational efficiencies, but I love the idea that you'd never again need to wait in line to buy a ticket. No annoying turnstiles. No enforcement. It would be particularly nice for visiting other cities. No need to figure out

the pricing system, or buy a new card. Just walk in and get on a train.

There would also be significant cost savings for subway operators. I don't know how much electronic ticket kiosks cost, but they can't be cheap, and in addition to the capital costs I'm sure they require frequent maintenance and replacement. There would be labor savings too, with fewer employees needed at subway stations.



Wouldn't it be nice if San Francisco's BART didn't need to install these expensive double-decker turnstiles?

#4. Redistributive and Stimulus Benefits

It depends on the city, but in many cities it tends to be lower-income, younger people, and more vulnerable groups who ride the subway. This is certainly the case for the three subways I study in Mexico, and has been shown in [previous research](https://www.aeaweb.org/articles?id=10.1257/pol.6.4.1) (<https://www.aeaweb.org/articles?id=10.1257/pol.6.4.1>). Thus in addition to the efficiency gains, making subways free would have positive redistributive benefits.

Putting resources in peoples' pockets is particularly valuable today because it would act as economic stimulus. The U.S. unemployment rate in June 2020 is above 13%, so now is exactly

the time that Keynesian-style economic stimulus makes the most sense.

#5. Dynamic Efficiencies

Finally, as economist Herbert Mohring pointed out [50 years ago](#) (<https://www.jstor.org/stable/1806101>), public transportation is an increasing returns-to-scale technology. The more riders in the system, the more you run the trains, and the shorter the wait times for all riders. If you make subways free, you'd increase ridership significantly, initiating this virtuous cycle.

Operations at peak would be the most challenging. Depending on the city, many subways are already running at or near maximum capacity during certain hours. These peak crowded hours are also when COVID transmission risks are highest. Still, this increasing-returns-to-scale idea is compelling because it suggests that subways may be an all-or-nothing proposition.

As we emerge from COVID-19, subways are in a bad equilibrium, with low ridership and infrequent service. With ride sharing increasingly available as a [low-cost alternative](#) (<https://la.curbed.com/2019/12/12/21011353/los-angeles-metro-ridership-stats-2019>), people are not going to wait 30 minutes for the next subway train. Making subways free could help flip the switch back to a better, more sustainable, equilibrium.



Particularly during off-peak hours, the economic cost of additional passengers on the London underground is very low. [shorturl.at/IGNX0](https://energyathaas.wordpress.com/2020/06/29/five-arguments-for-making-subways-free/)

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*For more see Lucas Davis, "[Estimating the Price Elasticity of Demand for Subways: Evidence from Mexico](https://haas.berkeley.edu/wp-content/uploads/WP307.pdf)" (<https://haas.berkeley.edu/wp-content/uploads/WP307.pdf>)" *Energy Institute Working Paper*, June 2020.*

Lucas Davis VIEW ALL

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18 thoughts on “Five Arguments for Making Subways Free”


Our local transit system, in Olympia, Washington, went fare-free at the beginning of this year.


Since then, their ridership has declined by 95%.

That is not the result that this economist anticipated.

I suspect an economist is less well equipped to explain this than a public health professional. 

How about making Footlocker, McDonald's, taxis, shopping in supermarkets gas, clothes free. I guess that's ridiculous but they all have employees. 

I had understood that the purpose of ticketing and barriers was rationing access by slowing the number of people who could enter at any time, not revenue raising. I appreciate, however, this is not a widely held view and I wonder how it works in a world where ticketing keeps getting easier, because more electronic, even as access doesn't. 

Since this is an issue for environmental econ 101 (<https://www.env-econ.net/green-subsidies.html>) or that nice and serious book written by Kolstad, the author is encouraged to take a look at basic environmental economics. 

A San Francisco bay area BART rider I know has complained that in the six month period prior to Covid-19 she had seen all bodily

functions performed on BART and she hated her commute on the system. I was surprised to discover that some people regard BART as already free to ride as they just follow a person with a ticket closely through the turn stiles. Making BART free might just turn the system into an even worse nightmare of homeless people asleep on the seats, begging for money, and not leaving the system to relieve themselves. If BART becomes more crowded it will become a vector for Covid-19 transmission. This could rapidly turn BART from a deteriorating system into one that most people try to avoid. And there is the issue that when something is given away it is not valued. There is also the issue of funding. With lower ridership systems like BART are already facing a major funding crisis. How would free ridership be funded? Most subway systems in the world do not adequately account for depreciation in their running cost. How would this be funded? In terms of environmental benefits expensive transit systems like BART already require such large subsidies that fares only cover a small fraction of cost including depreciation. This requires most of the population to take other forms of transport, mostly driving, so any environmental benefits are very limited, and may be detrimental compared to cheaper alternative transport. All these arguments must be addressed before subways are “free.” ↩

Lucas, I appreciate your positive outlook. Had I sat down to write about this topic, the tone would have come out very differently. More of a horror show of what’s going to bedevil us if we fail to make transit appealing again, or more so: pollution, inequity, urban sprawl, etc. Increasing use of transit looks like an urban imperative to me right now. ↩

How is any difference in pollution, inequity, etc going to be made with systems like new subways have to be subsidized so heavily that most people have to drive or travel some other

way to subsidize them? It appears new rail systems can never carry any significant percentage of commuters because they are too expensive. Please reply with cost data showing how such expensive systems can make any difference in percentage taking transit. ⬅

Air is 'free'; see where THAT got us.

Yes, transit could be free provided we could figure out a way to keep it for 'serious' travelers. That is, keep off people who will just use it as 'housing'. ⬅

Lucas

If you want to add to your examples/ estimates relating to demand elasticity, Luxembourg now has a national policy of free public transport. I don't know whether anyone has studied the impact. From the opposite angle, there is a rail line around North London, pictured on Tube maps and now under Transport for London control, which was known informally locally as the "free train"! However, beginning in the early 2010s, barriers have been put in place so that customers are obliged to pay in order to travel. There are likely to be estimates of the effects, although comparisons with previous experience are difficult due to the service quality improvements. ⬅

Several transit systems have gone without fares, at times. These have been studied and should be studied more. Several marginal costs should be included, such as cleaning, and maintenance. Wear on equipment is not linear, i.e. it is more costly in high use areas. ⬅

Pingback: [Five Arguments for Making Subways Free - Berkeley Haas Insights](#)

