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Differences in optimal subsidy levels across cities stem from their characteristics, including congestion level and commuters' preference for different transport modes. There is no hard and fast rule for optimal subsidies that Singapore can easily adopt, says the author. Instead, the Government will have to determine optimal levels by assessing the merits of each consideration in the Singapore context. ST PHOTO: GAVIN FOO

Ask: NUS Economists

Determining the optimal subsidy for public transport

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For The Straits Times

Q *Should governments subsidise public transport? And to what degree?*

A Public transport subsidies, though commonplace around the world, vary in magnitude. Subsidies are low in some cities and very high in other cities. In Sao Paolo, Brazil, subsidies cover only about 5 per cent of operation costs, while in Washington DC and Los Angeles, they run as high as 80 per cent of operation costs.

Singapore, too, subsidises public transport. Historically, instead of subsidising commuters directly through fares, the Government covered particular costs. For example, it provided funds through the bus service enhancement programme to increase the number of buses in operation.

However, since the implementation of the bus-contracting model and the new rail-financing framework in 2016, the Government has been subsidising operations much more directly. It receives a portion of public transport fares and is responsible for a share of operation costs, making up any financial shortfalls. Regardless of the form of the subsidy, users end up paying less than the true cost.

To determine optimal subsidies for a transport system, we need to identify the justifications for subsidising the system. A commonly invoked argument is that public transport subsidies benefit the poor since the poor are more likely than the rich to use public transport. While evidence shows that this is true, researchers have found the effects of such redistribution to be small, in part because transportation costs are only a small portion of household expenditure.

However, there are other justifications for public transport subsidies beyond the argument for equity. The main argument is that public transport services display economies of scale – the average cost of service falls as more people use the service. Public transport systems like trains and buses have extremely high fixed costs of operations; these costs are shared by more and more people as usage of the system rises. Subsidies encourage more travel, thus lowering the operation costs for each person.

Commuters also introduce a type of economies of scale on public transport operations. When there are more users, the operator is able to provide more frequent services.

These increased frequencies lower the time cost of travel for commuters, encouraging more people to use public transport. This is known as the "Mohring Effect", named after economist Herbert Mohring, who first detailed this in 1972. This effect can potentially set off a virtuous circle of improvements. With more passengers, the operator can now further increase service frequencies, once again lowering time costs to users.

POSITIVE EXTERNALITY

Another way to think of the Mohring Effect is as a positive externality – a benefit enjoyed by a party that was not directly involved in a decision. When an individual uses public transport, he makes it possible for improvements in service frequency; these improvements benefit not only himself (personal benefit) but also others (external benefit). However, when the individual decides whether to use public transport, he considers only his personal benefit relative to his cost of using public transport (measured in both time and money) and ignores the external benefit.

Thus, there are situations where the total gain to society (personal benefit plus external benefit) from an individual using public transport exceeds the cost to the individual, but the individual chooses not to use public transport because he considers only his personal benefit against his personal cost. Society stands to benefit from the individual taking public transport, but he does not have sufficient incentive to do so. Introducing a subsidy helps align the individual's decision with what is best for society because the subsidy serves, to some degree, as a substitute to the external benefit that he does not see. Thus, the subsidy helps set in motion the virtuous circle of improvements.

Economists Ian Parry of the International Monetary Fund and Kenneth Small of the University of California, Irvine, find that these economies of scale generate the bulk of the justification for subsidies of transport systems in London, Washington and Los Angeles. In particular, subsidies are most warranted during off-peak periods when ridership is low. Making off-peak travel cheaper increases ridership in these times, lowering both operation costs and user time costs, thus making the commuter better off.

Public transport subsidies also encourage people to leave their cars behind, which can be a good thing since car travel is often associated with negative externalities – costs borne by a party not directly involved in a decision. Drivers do not consider the congestion, pollution and potential accident costs they impose on others when they drive. Associate Professor Michael Anderson of the University of California, Berkeley, finds that public transport in Los Angeles greatly decreases road congestion.

Only 2 per cent of the Los Angeles population commute to work by public transport. Even so, when a strike by public transport workers shut down the entire public transport system, travel delays on the road rose by 30 per cent to over 100 per cent. The study conservatively values annual losses due to additional time delay at US$1.2 billion (S$1.64 billion). Similarly, a study of Brussels and London, by Professor Stef Proost of KU Leuven and Dr Kurt Van Dender of the OECD, finds that congestion externalities are quantitatively more important than economies of scale in justifying subsidies.

SINGAPORE CASE

The effect of subsidies on congestion in Singapore is likely smaller than the effects documented in Los Angeles, Brussels and London since Singapore already implements congestion taxes through the Electronic Road Pricing system. Associate Professor Leonardo Basso of Universidad De Chile and Assistant Professor Hugo Silva of Pontificia Universidad Catolica de Chile find that once congestion pricing is in place, the added benefit of public transport subsidies on congestion relief becomes much smaller. Nevertheless, the benefit of subsidies on reduced congestion on Singapore's roads is likely to be a non-negligible amount.

Economists have also studied the effect of public transport on air pollution since cars typically emit higher pollutants per person than public transport vehicles. One study finds that on average, globally, the opening of a new subway network decreases particulate concentrations by about 5 per cent in the 10km disk around the city centre.

That said, there are also arguments against public transport subsidies. One major detraction is that subsidies raise crowding. As public transport usage rises, so does crowding, leading to higher passenger discomfort and longer travel times due to lengthier boarding and alighting times. Crowding is particularly true for buses. My data on Singapore's buses shows that when fewer than 20 people board a bus, boarding time is on average 18.2 seconds. Between 20 and 40 people, this rises to an average of 53.9 seconds. Such slowdowns can increase time costs quite significantly, particularly for passengers using buses for long journeys.

In light of this, economists argue that bus subsidies should not be entirely commensurate with distance travelled. Subsidies should be net of the cost of boarding delays that passengers inflict on others. Since all commuters impose roughly the same boarding delays on other commuters, regardless of whether they travel long or short distances, the same amount should be subtracted from all commuters' subsidies, leaving commuters travelling short distances with a smaller fraction of their fares subsidised.

OPPORTUNITY COST

Another detraction from the justifications for public transport subsidies is the opportunity cost of public funds. These funds could be used for other purposes, such as education, healthcare or welfare.

Prof Proost and Dr Van Dender find that for Brussels, taking into consideration the opportunity cost of public funds wipes out any benefits of subsidies from demand-side economies of scale.

Combined, these reasons determine the optimal subsidy for public transport operations. Dr Parry and Professor Small find optimal subsidies to be very large in Washington, London and Los Angeles – in most cases beyond 90 per cent of operation costs. This is on the back of large economies of scale benefits and a strong Mohring Effect in these cities. Prof Proost and Dr Van Dender find the optimal subsidy for Brussels during peak periods should be close to zero. This is in part of the opportunity costs of public funds. Prof Basso and Prof Silva find optimal subsidies in Santiago, Chile, to be about 55 per cent of operation costs. Unsurprisingly, the differences in optimal subsidy levels across cities stem from the cities' characteristics, including congestion levels, commuters' preferences for different transport modes, and commuter valuation of travel time.

There is no hard and fast rule for optimal subsidies that Singapore can easily adopt. Instead, the Government will have to determine optimal levels by assessing the merits of each consideration in the Singapore context.