

Example 7.4

Pricing Traffic Congestion in Singapore and London

Traffic congestion is a serious problem in most of the world's major cities. To give one example, a 1989 study estimated the costs of traffic congestion in urban areas in the U.S. to be \$26 billion (in 2006 dollars), and congestion has undoubtedly worsened since 1989. The increase in travel time constitutes the overwhelming majority of these costs.¹

Economists advise that the best way to reduce congestion is to charge motorists a price to enter a congested roadway. They favor a pricing strategy to combat congestion for the same reason that they favor pricing strategies to combat any external diseconomy: Pricing cars off congested roadways achieves a given reduction in congestion at the lowest possible cost.

In 1975, Singapore (a city-state) became the first major urban area to take the economists' advice. It demonstrated to the world that pricing to reduce congestion was both feasible and effective. In 2003, London introduced a similar pricing scheme to reduce congestion, and with much the same result. Thanks in part to the experiences of Singapore and London, pricing to reduce traffic congestion is now recognized as an essential component of any plan to move people effectively through urban areas. Simply providing more public transportation, whether bus or rail transit, is not enough. The problem is that the people who change from their cars to public transportation when public transportation is expanded are invariably soon replaced by the same number of new people driving into the city, if the use of vehicles is not simultaneously subject to a congestion price.

¹ Increases in air pollution and gasoline consumption are other components of the congestion costs, but they are relatively minor.

That Singapore was the first city to make a concerted effort to reduce traffic congestion is hardly surprising. It was already densely populated in 1975, with three million people living within a land area of 633 km². Also, the average income was quite high and the demand for cars was income elastic – people were buying new cars to the point that the roadways were becoming clogged with traffic. Building enough roadways to accommodate the increased traffic was not possible given the limited land area, so the government had little choice but to consider policies to reduce the demand for automobile travel.

One of its first policies was the Area Licensing Scheme (ALS), which was instituted in March of 1975. The ALS set a price for cars and taxis to enter the most congested part of the city during the morning rush hour from 7.30am to 9.30am, when traffic density was at its peak. This area was called the Restricted Zone. Anyone wishing to enter the Restricted Zone during those times had to purchase a supplementary license in the form of a sticker to be placed on the windshield of the car. The licenses were sold on a daily or monthly basis, at a cost of US\$4.87 per day or US\$99.68 per month (2006 prices). There were 22 points of entry to the Restricted Zone, where officials checked cars for the stickers. Cars with four or more occupants were exempt from purchasing the license. The government also doubled the average fees for parking in the public garages within the Restricted Zone.

There is always a distributional issue that arises when adopting a pricing scheme to reduce traffic congestion. The prices have to be fairly high to achieve a significant reduction in traffic volume, as they were in Singapore – so high that only higher-income people can comfortably afford them.² Consequently, the government has to ensure that adequate public transportation alternatives are available to those with moderate and low incomes. Singapore responded to this concern by increasing the public bus service within the Restricted Zone. It also established 10,000 new parking spaces in the ring area around the Restricted Zone, with bus services from the ring parking lots to a number of destinations within the Restricted Zone.³

The effects of the ALS were immediate and dramatic, far exceeding expectations. The government had hoped to reduce the morning traffic flows in the Restricted Zone by 25–30%. By September and October of 1975, traffic flows had fallen by 44%, with the

² Norway also instituted congestion pricing in a number of its cities. But it has achieved only small reductions in congestion (less than 5%) because the prices are relatively low compared with Norwegian incomes.

³ There have been four notable changes in the ALS since its inception. Immediately after instituting the ALS, a second traffic peak was generated after 9.30am, so the morning time when a license was required was extended to 10.15am. In 1989 the ALS was expanded to cover the evening rush hour. In 1994, it was expanded again to cover the entire day. Finally, in 1998 the government switched to electronic monitoring of traffic throughout the Restricted Zone, which gives it much more flexibility to adjust traffic flows during the day.

number of car trips into the Restricted Zone in the morning rush hour down from 43,000 to 11,000 (taxi use fell by 35%).

One of the great advantages of using prices to reduce congestion is flexibility – people have a number of different options for responding to the prices and can choose the one that is best for them. That is why pricing is a least-cost strategy for reducing congestion. Flexible responses to the ALS were clearly in evidence. Some people chose to car-pool: the number of cars with four or more occupants increased by 60%. Other people chose a different mode of transportation. For people who commuted into the Restricted Zone to work and who owned cars, the percentage who chose to ride the public buses rose from 33% to 46%. Still other commuters chose to enter the Restricted Zone before 7.30am. The percentage of car trips before 7.30am rose from 27% to 40% for drivers, and from 17% to 28% for passengers.

The government of Singapore has used the pricing strategy to reduce traffic congestion far beyond simply trying to reduce rush hour traffic in the Restricted Zone. It has also aggressively attempted to discourage the purchase of new cars through a set of stiff prices and fees, including: a road tax; an 8% import duty on purchases of new cars; and registration fees that include an Additional Registration Fee equal to 150% of the price of a new car. By 1990 the government decided that even all these fees were insufficient to control the growth in car ownership, which it hoped to keep at 3% per year. The problem was that the income elasticity of demand for new cars was far greater than the price elasticity of demand, and the Singapore economy was booming. People continued to buy new cars at a rapid pace. Therefore, in May of 1990 the government decided to institute a quota for new cars and other vehicles. A monthly quota was established for each of four categories of cars by size of engine and the quota licenses to purchase a car, called Certificates of Entitlement (COE), were put up for auction, with the highest bidders receiving the COEs. For example, suppose there are 2,000 quota licenses available in the month of June for cars with the largest engines. Everyone who wants to buy such a car must submit a bid for a COE. The people who submit the 2,000 highest bids are given a COE, at a price equal to the lowest of the 2,000 highest bids. Once a COE is obtained to buy a new car, it applies for ten years. After a car is ten years old, a new COE has to be obtained through the auction to keep it on the road. Sales of used cars less than ten years old did not require a COE.⁴ Because the quotas are auctioned, they constitute a pricing strategy to limit car sales that is analogous to marketable permits to limit pollution. The only difference is that the COEs are not transferable, because a car can be purchased only once as a new car.

⁴ In May of 1991, the government introduced a Weekend Car Scheme (WEC), another monthly auction of quota licenses for new cars that people agreed to drive only between the hours of 9.00pm and 7.00am on weekdays, after 3.00pm on Saturdays, and any time on Sundays and public holidays. In addition to having much lower auction prices than the COEs, a WEC car received a 95% discount on the road tax and steep reductions on some of the other fees as well.

COEs have generally been in excess demand, with the result that the price of a COE can exceed the price of the car that it is used to purchase. Indeed, the combination of the COEs and all the other fees raises the price of a new car to two or three times the manufacturer's selling price. For example, a Honda Civic purchased in July, 1992 cost US\$46,100 (in 1992 dollars), broken down as follows:

Manufacturer's selling price	\$7,488
Import duty	3,328
Additional Registration Fees	11,232
Certificate of Entitlement	10,400
Road tax	1,248
Other (including regular registration fees)	7,904
Total	\$41,600

As one can well imagine, price incentives this strong have significantly reduced the number of cars demanded. Car ownership per person is much lower in Singapore than in any other developed country. For example, the number of people per car in Singapore is approximately four times that in the U.S.

Singapore has clearly demonstrated the efficacy of price incentives to reduce traffic congestion. However, it is questionable whether other countries would be willing – or would even need – to push as hard as Singapore did on fees and quotas to reduce the demand for automobile travel.

LONDON

In 2003, London decided to follow the example of Singapore's ALS in an effort to reduce traffic congestion in central London. The streets were so choked with traffic that it took the same amount of time to traverse central London in 2003 as it did in 1900 before the arrival of the automobile. There was one main difference between London in 2003 and Singapore in 1975: central London had no recognizable morning and evening peak. Traffic was essentially uniformly congested throughout the day. Therefore, beginning on February 17, 2003, the government made a large area of central London into a 'congestion charge zone': anyone who wanted to drive an automobile or taxi within this zone between 7.00am and 6.30pm had to purchase a pass. A pass cost UK£5 per day – this was increased to £8 per day in 2005, and again to L10 effective from 4 January 2011.⁵ Passes must be purchased in advance, either daily, weekly, or annually. The

⁵ Residents of central London can purchase passes at a 90% discount, and owe nothing on days that they choose not to drive their cars. Also, motorcycles and bicycles are exempt. There are a number of other

purchases are recorded electronically; there is no sticker placed on the vehicle. Instead, the system is enforced by cameras placed at entry points into the congestion charge zone and on mobile units throughout the city that record license plates, which are then matched with the purchased passes. The fine for driving in the congestion charge zone during the restricted hours without a pass is £100 (reduced to £50 if paid within two weeks.) On average, the cameras detect about 85%–90% of the vehicles that have passes. Most of the net revenue from the system is dedicated to improving bus services within central London.

The results so far have been remarkably similar to the Singapore experience. The government expected 20% fewer car trips into London. By mid-2003, car trips to central London had fallen by 33%, a decline of 65,000–75,000 trips each day. Before the pricing scheme, cars represented about half the trips within the congestion charge zone. After the scheme they fell to one-third of the trips, with the slack taken up by taxis (up 22%), buses (up 21%, twice the expected increase), and bicycles (up 8%). (There was, surprisingly, little change in rail transit use.) The average speed of cars traveling through the congestion zone increased by 17%.

The only disappointment has been that the net revenues from the pricing scheme were much less than anticipated. On the revenue side, the unexpectedly large decrease in car trips led to revenues that were only about half of their projected value. On the cost side, noncompliance was higher than expected, as was the cost of pursuing the offenders. Noncompliance was the main reason why costs were twice the expected costs. Estimates of the social net benefits by economists have also been a bit disappointing. The net benefits were positive but not as high as expected; the social costs were about two-thirds of the social benefits.

Overall, though, the London pricing scheme is viewed as a success in reducing traffic congestion in central London. Moreover, Londoners seem to like it, contrary to the prevailing view in 2003 that congestion pricing is unpopular.⁶ Whether the London pricing scheme's success and/or popularity can be duplicated by other major cities in Europe and the U.S. is unclear, however, as the London scheme had a number of factors working in its favor. One is that the congestion charge zone is a geographic area bounded by ring roads with a limited number of entry points. Other cities may not have such clearly delineated regions that can be easily monitored. Another is that London already had an extensive public transportation system in place to serve those who were either unwilling or unable to purchase the passes. Yet another is that Londoners were comfortable with camera surveillance because it was already in use to prevent criminal

changes that took effect from 4 January 2011. The details can be found at www.tfl.gov.uk/roadsters/congestioncharging/17094.aspx#AutoPay

⁶ The success of the scheme was such that the congestion charge zone was roughly doubled in size effective from February 19, 2007, by extending it to the west. On that same date, the hours of operation were reduced by 30 minutes, from 7.00am to 6.00pm (rather than 6.30pm). The extension to the west was removed, however, as part of the changes that took effect from 4 January 2011.

and terrorist activity. Residents in other cities may not be so accepting of the cameras – the U.S. comes to mind as one possible example. If cameras cannot be used, then a different type of electronic identification system would have to be adopted, such as devices placed in all cars that might travel to the restricted area of a city. But this tends to be much more expensive than monitoring by cameras, reducing the potential net benefits even further. These caveats notwithstanding, the London experience offers further support for the use of pricing strategies to reduce traffic congestion in major urban areas.

Sources

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