Congestion Pricing: How?

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Abstract

Over the past two decades, China has experienced a dramatic increase in auto ownership and uses, with the number of private-owned vehicles increasing more than 70 folds in twenty years, from 0.82 million in 1990 to 59.39 million in 2010. Urban roads in major Chinese cities thus have become much more congested. Congestion pricing helps to internalize traffic externality and reduce congestion. Practically, it has been implemented in a number of countries. This paper first presents the economic theory of congestion pricing. It then demonstrates the implementation of congestion pricing on the State Route 91 in southern California. Finally, it discusses implications to China. This paper focuses on implementation issues, including project financing, fee structures, benefit-cost analysis, and public acceptability.

Keywords: China, Urban, Transportation, Taxes, Public Policy

About the Author

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1. Introduction

Over the past two decades, China has experienced a dramatic increase in auto ownership and uses, with the number of private-owned vehicles increasing from 0.82 million in 1990 to 59.39 million in 2010 (China Statistical Yearbook, 1991 and 2011), a 72.43-fold increase in two decades. Wang (2011) estimated that China has 85.50 million private vehicles in 2012. With the rapid increase in automobiles, urban roads in major Chinese cities are becoming more congested than ever, causing much longer commuting time, consuming much more gasoline, worsening air pollution, and increasing traffic accidents. Traffic congestion is one of the major complaints of residents in Chinese cities.

For a long time, China has mainly relied on supply-side policies to deal with urban congestion, such as building more roads. Previous studies, however, have demonstrated that expanding road capacity is often ineffective and sometimes counter-effective, as building more roads induces more hidden or potential demand (Arnott and Small, 1994; Down, 1994; Duranton and Turner, 2011; Ding and Song, 2012). For example, Duranton and Turner (2011) found that vehicle-kilometers traveled in US cities increases proportionally to roadway lane kilometers for interstate highways, although this proportion becomes smaller for major urban roads, suggesting that increased provision of interstate highway and major urban roads is unlikely to relieve congestion of these roads.

A number of Chinese cities also have implemented various instruments to control travel demand. For example, Beijing requires all private cars stay off one day every week, on a rotation basis. Beijing and Shanghai set daily maximum numbers of new licenses, through lottery or auction, respectively. Starting August 27, following the steps of Beijing and Shanghai, Guangzhou began to issue new licenses through both lottery and auction. On April 12, 2010, Beijing started its staggering schedule for all municipality agencies that affects more than 800 thousand public employees, and on April 1, 2011, Beijing significantly raised parking fees, especially within the third ring.

All above-mentioned instruments have a relative weak link to commuting behavior because they do not have a direct control over where, when, and how long commuting occurs. A more effective solution could be congestion pricing, which is to internalize negative externality that commuters impose on others. Thus, it helps to correct the market failure and improve efficiency. A recent article published in America Economic Review concludes “These findings suggest that both road capacity expansions and extensions to public transit are not appropriate policies with which to combat traffic congestion. This leaves congestion pricing as the main candidate tool to curb traffic congestion” (Duranton and Turner, 2011, page 2646).

Congestion pricing has been extensively studied (e.g., Giuliano, 1992; Small, 1992; Small and Jia, 2001; King et al., 2007; Benko and Smith, 2008). It also has been implemented in a number of countries around the world, including Singapore (Waston and Holland, 1976; Keong, 2002;

Hang and Toh, 2004), UK (Santos and Shaffer, 2004; Leape, 2007; Nash, 2007), Sweden (Eliasson and Mattsson, 2006; Eliasson, 2008; Karlstrom and Franklin, 2009), and USA (Decorla-Souza, Patrick, 2006; FHA, 2006).

This research focuses on a number of issues related to implementation of congestion pricing. Using the case of the State Route 91 (SR-91) in southern California, this research examines project financing, fee structures, benefit-cost analysis, and public acceptability. Based on empirical findings, implications to China will be proposed. Section 2 presents the theory of congestion pricing. Section 3 demonstrates the implementation of congestion pricing on the SR-91 in southern California. Section 4 gives conclusions and discusses implications to China.

2. Economics of Congestion Pricing

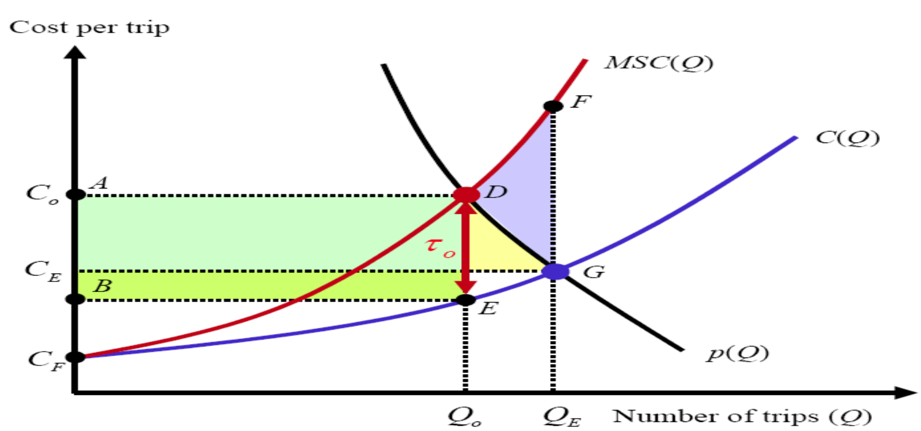
This section presents the economic theory of congestion. Travel is a derived demand. People travel because they need to go to work, shop, or do other things. In making travel choices of route, time, or modals, travelers compare their own costs and benefits. Put it differently, they will travel as long as the benefit is greater than the cost. However, they ignore how much delay they cause on other travelers but only pay attention to how much it costs them to get to their destinations. Therefore, the equilibrium numbers of commuters for routes and modals are reached when the private benefit equals to the private cost, which is not socially optimal, as shown below.

For a given road/route, denote Q to be the traffic level and C the average commuting cost. The marginal social cost (MSC) is derived by ,

$$MSC = \frac{d(CQ)}{dQ} = C + Q\frac{dC}{dQ} = C + EC$$

where EC is the externality cost. Graphically,

Figure 1. Economics of Congestion Pricing



To reach the social optimization, externality should be internalized. In the case of congested urban roads, this suggests a toll, $\tau_o = Q\frac{dC}{dQ} = EC$, be charged on commuters, so that the

marginal benefit equals to the marginal cost at the optimal traffic level Q_o. Because $Q\frac{dC}{dQ}$ depends on traffic volume and the relationship between travel time (speed) and traffic volume, the toll should be higher for more congested roads or periods than the ones for less congested roads or periods. The optimal toll revenue equals to $Q^2\frac{dC}{dQ}$ and it is determined by the area of *ABED* in Figure 1.

Several comments on congestion pricing are worth mentioning. First, the purpose of congestion pricing is not to collect toll revenue per se. It is to correct the market failure caused by negative externality and thus reduce traffic level. Second, congestion pricing generates efficiency gain, because it helps to save time, reduce pollution, and improve safety. Graphically, the efficiency gain is measured by the area of *DFG* in Figure 1, where the marginal cost exceeds the marginal benefit if the equilibrium traffic level Q_E prevails. Third, congestion pricing does not eliminate congestion. It is to reduce traffic. As long as the marginal social cost does not exceed the marginal social benefit, certain level of traffic is desirable. Fourth, the toll internalizes traffic externality. It varies with the level of congestion (the demand curve), higher during the peak hours and lower or none during other periods of the day. Last, because some commuters will be priced off the road or forced to pay the toll, they may be hurt by congestion pricing with lower consumer surplus. Congestion pricing had been regarded as an "economists' dream but politicians' nightmare". Distribution of toll revenue becomes important to redistribute welfare among commuters and gain public support. Often, it is believed that most toll revenue should be used to improve public transit and transportation network (Giuliano, 1992; Small, 1992).

3. Congestion Pricing on State Route 91 in Southern California, USA

Congestion pricing has been implemented in a number of cities in different countries, including Singapore, Europe, and the USA (see Song, 2011 for a detailed review). In the USA, according FHA (2006), since 1998, single-occupant vehicles pay a per-trip fee each time they use the I-15 HOT lanes in San Diego, California. Tolls vary dynamically with the level of traffic demand on the lanes, in 25-cent increments as often as every six minutes to help maintain free-flow traffic conditions on the HOV lanes. The project generates $2 million in revenue annually, about one-half of which is used to support transit service in the corridor. Variable pricing began August 3, 1998, on the Midpoint and Cape Coral toll bridges in Lee County, Florida. Bridge travelers were offered a 50 percent discount on their toll if they traveled during specific discount periods and paid their toll electronically. The discount periods are 6:30 to 7 am, 9 to 11 am, 2 to 4 pm, and 6:30 to 7 pm. This toll structure was developed to encourage drivers to shift from peak periods to off-peak/discount periods. The State of Oregon is studying an approach that would allow area-wide pricing with smaller expenditures on roadside infrastructure. The study is focusing on mileage-based fees and peak-period driving charges designed to reduce traffic during the most congested periods while at the same time raising revenue to replace existing fuel-based fees. GPS-based technology is being tested (FHA, 2006).

The following discussion focuses on the State Route (SR) 91 Express Lanes in Southern California. It discusses issues related to project financing, fee structure, revenue and cost, technology, and public acceptance.

Figure 2. Pylons Separate Priced Lanes from Free Lanes on the SR-91 (FHA, 2006)

The SR-91 express project is a 10-mile, four-lane toll area added to the median of an existing eight-lane between State Route 55 in Orange County and the Riverside County line. It connects rapidly growing residential areas in Riverside and San Bernardino counties with major employment centers in Orange and Los Angeles counties. As the world's first high-occupancy toll (HOT) or express toll lanes, started in December 1995, the project allows vehicles with a single passenger to pay the full toll amount and those with multiple passengers to pay a lower toll, while still maintaining free lanes for those who choose to not pay a toll.

Financing and Ownership

The SR-91 HOT lanes were financed privately with $134 million in partnership with Caltrans and California Private Transportation Company (CPTC, an entity formed by subsidiaries of Level 3 Communications, Inc., Compagnie Financiere et Industrielle des Autoroutes (Cofiroute), the world's largest private toll road operator, and Granite Construction Inc). Once the facility was constructed, CPTC formally transferred ownership of the facility to the State of California. Caltrans then leased the improvements back to CPTC for a 35-year operating period. In September 2002 the Orange County Transportation Authority (OCTA) purchased the facility for $207.5 million (Boarnet and Dimento, 2004).

Fee Structure

Following the economic principle of congestion pricing, toll amounts vary during the day with traffic volumes, to keep free flow (between 60 mph and 65 mph). According to the toll schedule, effective on April 1, 2012, the highest toll is charged for eastbound traffic at 4 pm on Thursday, $8.95. Lowest toll rates are late at night/early morning at $1.30. Since May 19, 2003, "Three Ride Free" policy has been implemented to encourage carpooling by allowing a group of three or more commuters per vehicle to travel for free during most hours, except when traveling Eastbound, Monday through Friday between the hours of 4:00 p.m. and 6:00 p.m. At these times, carpools of three or more can still save money by earning a 50% discount on the posted toll.

Figure 3. Toll Schedule Effective April 1, 2012

91 Express Lanes — **Toll Schedule** — Effective April 1, 2012 — **Eastbound** — SR-55 to Riverside Co. Line

	Sun	M	Tu	W	Th	F	Sat
Midnight	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
1:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
2:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
3:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
4:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
5:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
6:00 am	$1.30	$2.10	$2.10	$2.10	$2.10	$2.10	$1.30
7:00 am	$1.30	$2.10	$2.10	$2.10	$2.10	$2.10	$1.30
8:00 am	$1.65	$2.10	$2.10	$2.10	$2.10	$2.10	$2.10
9:00 am	$1.65	$2.10	$2.10	$2.10	$2.10	$2.10	$2.10
10:00 am	$2.55	$2.10	$2.10	$2.10	$2.10	$2.10	$2.55
11:00 am	$2.55	$2.10	$2.10	$2.10	$2.10	$2.10	$2.55
Noon	$3.05	$2.10	$2.10	$2.10	$2.10	$3.15	$3.05
1:00 pm	$3.05	$2.90	$2.90	$2.90	$3.15	$4.95	$3.05
2:00 pm	$3.05	$4.15	$4.15	$4.15	$4.25	$3.10	$3.05
3:00 pm	$2.55	$4.45	$3.70	$3.95	$4.95	$9.75	$3.05
4:00 pm	$2.55	$4.55	$6.30	$6.80	$8.95	$8.85	$3.05
5:00 pm	$2.55	$4.85	$5.75	$7.00	$8.30	$6.50	$3.05
6:00 pm	$2.55	$4.45	$3.60	$3.60	$4.40	$5.35	$2.55
7:00 pm	$2.55	$3.15	$3.15	$3.15	$4.55	$5.00	$2.10
8:00 pm	$2.55	$2.10	$2.10	$2.10	$2.90	$4.55	$2.10
9:00 pm	$2.10	$2.10	$2.10	$2.10	$2.10	$2.90	$2.10
10:00 pm	$1.30	$1.30	$1.30	$1.30	$1.30	$2.10	$1.30
11:00 pm	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30

91 Express Lanes — **Toll Schedule** — Effective April 1, 2012 — **Westbound** — Riverside Co. Line to SR-55

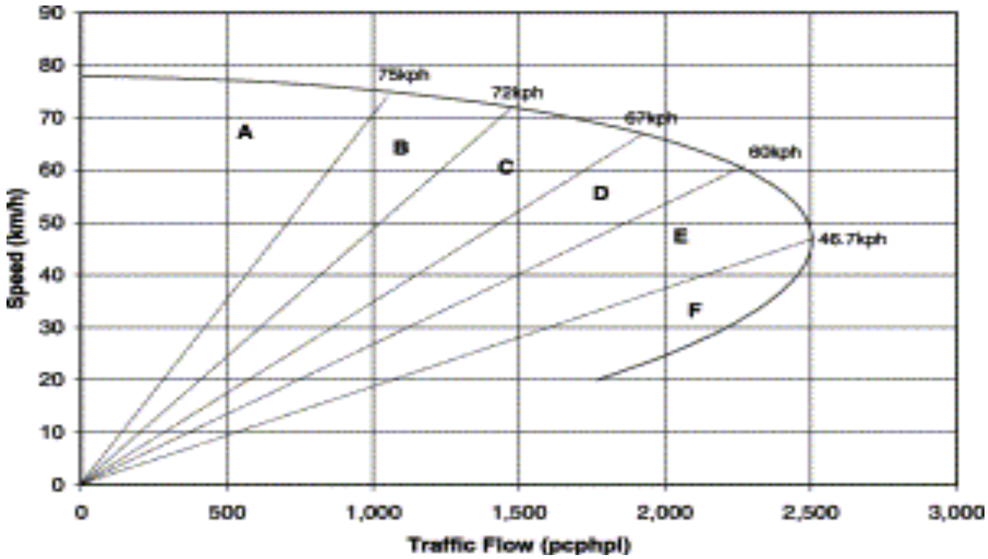
	Sun	M	Tu	W	Th	F	Sat
Midnight	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
1:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
2:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
3:00 am	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
4:00 am	$1.30	$2.45	$2.45	$2.45	$2.45	$2.45	$1.30
5:00 am	$1.30	$4.00	$4.00	$4.00	$4.00	$3.85	$1.30
6:00 am	$1.30	$4.15	$4.15	$4.15	$4.15	$4.00	$1.30
7:00 am	$1.30	$4.60	$4.60	$4.60	$4.60	$4.45	$1.75
8:00 am	$1.75	$4.15	$4.15	$4.15	$4.15	$4.00	$2.10
9:00 am	$1.75	$3.30	$3.30	$3.30	$3.30	$3.30	$2.55
10:00 am	$2.55	$2.10	$2.10	$2.10	$2.10	$2.10	$2.55
11:00 am	$2.55	$2.10	$2.10	$2.10	$2.10	$2.10	$2.95
Noon	$2.55	$2.10	$2.10	$2.10	$2.10	$2.10	$2.95
1:00 pm	$2.95	$2.10	$2.10	$2.10	$2.10	$2.10	$2.95
2:00 pm	$2.95	$2.10	$2.10	$2.10	$2.10	$2.10	$2.95
3:00 pm	$2.95	$2.10	$2.10	$2.10	$2.10	$2.55	$2.95
4:00 pm	$3.10	$2.10	$2.10	$2.10	$2.10	$2.55	$3.10
5:00 pm	$3.10	$2.10	$2.10	$2.10	$2.10	$2.55	$3.10
6:00 pm	$3.10	$2.10	$2.10	$2.10	$2.10	$3.05	$2.55
7:00 pm	$2.55	$1.30	$1.30	$1.30	$1.30	$2.10	$2.10
8:00 pm	$2.55	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
9:00 pm	$2.55	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
10:00 pm	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30
11:00 pm	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30	$1.30

Source: http://www.91expresslanes.com

Benefit-Cost Analysis

A number of studies have conducted benefit-cost analysis for the SR-91 express lanes. For example, Sullivan and Burris (2006) found a benefit-cost ratio of 1.51 over 1995–2005. FHA (2006) showed that congestion pricing during peak hours also improves road efficiency, with the vehicle throughput on the express lanes doubling the one on the free lanes, respectively, 1,600 vehicles per lane per hour and 800 vehicles per lane per hour. This result is because once freeway traffic exceeds a certain threshold level, both vehicle speed and vehicle throughput drop precipitously (Figure 4).

Figure 4. The Speed-Flow Curve



In its Fiscal Year 2010–2011 Annual Report, the Orange County Transportation Authority estimates that with about 30 minutes saved per trip and 100 million trips per year, the express lanes have saved commuters about 50 million hours and 50 million gallons of gas. Based on the recommended hourly values of travel time savings by US Department of Transportation (2011), the 50 million saved hours had $625 economic values, if single-occupancy is assumed. With multiple-occupancy, the saved economic value became greater. Using data from the US EPA, the 50 million gallons of saved gas reduced CO_2 emission by 950 million pounds. Table 1 presents annual operating revenue and cost, with revenue including user fees and charges and costs including depreciation and amortization, contracted services, administrative services, professional services, and insurance claims and premiums (OCTA, various years). As the last column shows, the revenue-cost ratio is close to 2.0, suggesting that the SR-91 express lanes are quite cost effective. The net revenue tells that the SR-91 express lanes could generate a significant income each year for the local transport authority, and that in turn, could help to maintain and improve the local transportation network.

Table 1. Annual Operating Revenue and Cost ($)

Fiscal Year	Revenue	Cost	Net Revenue	Revenue/Cost
2006	44,231,308	23,653,109	20,578,199	1.87
2007	49,838,090	23,768,662	26,069,428	2.10

2008	46,236,247	23,396,655	22,839,592	1.98
2009	43,704,888	24,958,428	18,746,460	1.75
2010	43,008,572	22,402,576	20,605,996	1.92
2011	41,245,590	22,381,682	18,863,908	1.84

Technology

Tolls are collected when vehicles with a FastTrak transponder pass beneath the toll zone gantry at highway speeds. The Violation Enforcement System uses video camera and Optical Character Recognition to capture images of violators and process violations. It allows for the collection of tolls and fines associated with violations.

Public Acceptance

Public acceptance of congestion pricing largely depends on how the general public perceive that privacy and equity are addressed. In the SR-91 case, traveler's personal information collected by the system includes traveler's name, address, billing address, email address, credit card number and expiration date, tracking information for checks or money orders, license plate numbers, photographs of license plates, and travel data. Certain instances of permitted disclosure of personal information are stated in the Privacy Policy, as a part of user account agreement (http://www.91expresslanes.com).

Regarding the equity concern that congestion pricing may price the poor off the road, Scheweitzer and Taylor (2008) found that about one third of the SR-91 users with income below $40,000. They also showed that the toll is less regressive than a sales tax. A customer satisfaction survey by True North Research (2011) shows only 8.9% of users with income below $50,000.

Specifically, based on a sample of 1000 travelers on the SR-91, conducted online or telephone between September 19 and September 26, 2011, True North Research (2011) reveals the following major findings about customer satisfaction. First, there was an average 1.81 one-way trips per week during rush hour periods on the express lanes, 2.17 one-way trips per week for weekdays (M–F) on the SR-91 Express Lanes, and 2.71 one-way trips per week on the SR-91 Freeway. Second, the most commonly reported purposes for trips were not for work commute. The survey showed that, with multiple responses allowed, 69% were for visiting friends and family, 67% for shopping or recreation trips (67%), and 46% for work commute. Third, the average perceived time savings was 27.58 minutes during morning rush hours and 34.24 minutes during the afternoon rush hours. This finding is consistent with the time savings estimated by OCTA (2011). Fourth, 90% of customers generally satisfied with Express Lanes, of which, 51% very satisfied; 9% dissatisfied; 1% unsure. Fifth, areas of satisfaction (multiple responses were allowed) include felt lanes saved time (97%), fast way to travel (96%), accurate billing statements (95%), lanes well maintained (94%), the tolls help improve the SR-91 freeways (81%), easy to get in touch with customer services (80%), and the convenience received is worth the cost (79%). Sixth, areas for improvement include desired reduced fees (34%), extending Express Lanes (16%), decreasing wait times for customer service (8%), and prevention of illegal lane changes (5%). Seventh, 56% support setting the toll charge high enough to keep traffic free flowing, 28% opposed this policy and 17% were unsure. Eighth, 54% would change travel schedule if the toll charge were reduced just before and after rush hour periods, 37% indicated that they would not alter their travel behavior and 10% were unsure. Lastly, 54% support the proposed direct connection between the SR-91 Express Land and the SR-241 toll road, 8% opposed the project, whereas 35% do not have an opinion.

4. Conclusions and Implications to China

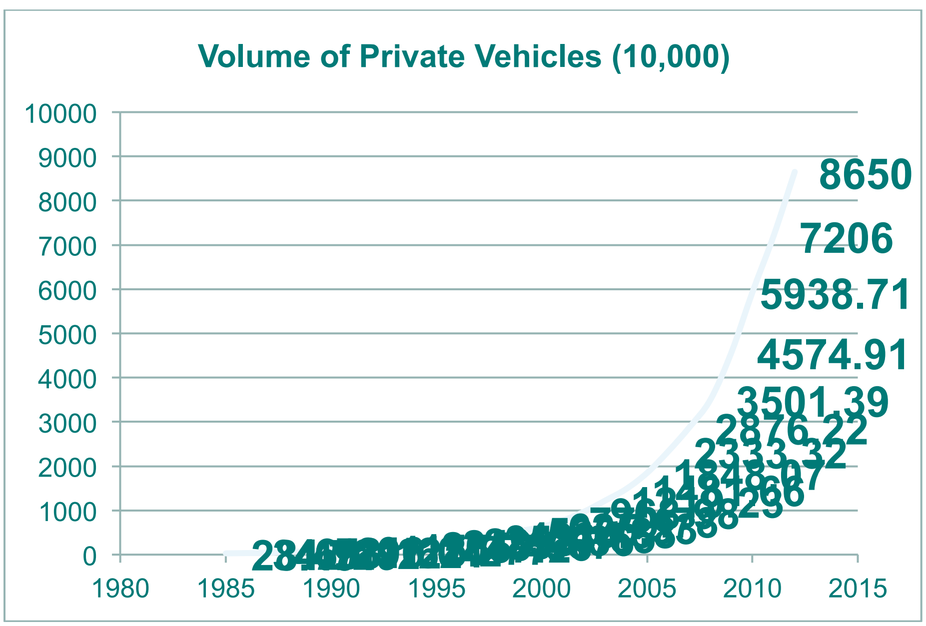
Unlike many demand-side policies, such as raising parking fees, auctioning licenses, staggering work schedule, and rotating vehicles off the road, congestion pricing links directly to commuting behavior (when, where, and how long) and helps to internalize traffic externality and correct market failure caused by externality. The US experience suggests that congestion pricing could be quite successful in reducing traffic levels, saving travel time, improving air quality, generating net revenues, enhance road efficiency, and even increasing public acceptability.

Specifically, we can draw the following conclusions regarding congestion pricing on SR-91 in southern California. First, with lack of initial public investment, the construction of toll roads could be financed with private-public partnership or fully private investment. Later, the facility could be transferred to local governments. Second, as suggested by the theory, charges of congestion pricing should vary with travel levels, with a higher rate during rush hours than those in other time periods. The daily toll schedule also needs to reflect the traffic dynamics. In the SR-91 case, it is adjusted every three months. Third, congestion pricing could generate significant net revenue for local governments. Roughly, the gross revenue is about twice as the operating costs. Fourth, congestion pricing helps to save travel time, improve air quality, and enhance road efficiency. The SR-91 experience shows an average perceived time savings of about 30 minutes, a reduction of annual CO_2 emission of 950 million pounds, and doubling the number of vehicles throughput on HOT lanes per lane per hour, comparing those on free lanes. Fifth, as shown in Scheweitzer and Taylor (2008), congestion pricing is less regressive than sales tax, the most prevailing tax in the USA. True North Research (2011) also found that many low-income travelers use the priced lanes on the SR-91. Sixth, the vast majority of users are satisfied with priced lanes and most users love to see that congestion pricing could be implemented in a larger area to other freeways. All these suggest that congestion price is well accepted by consumers using SR-91 in southern California. Last, technology could be least concerned. Tolls could be collected when a vehicle with a transponder passes beneath the toll zone gantry at highway speeds. Video cameras can capture images of violators and process violations.

Put the above differently, FHA (2006) concludes “congestion pricing benefits drivers and businesses by reducing delays and stress, by increasing the predictability of trip times, and by allowing for more deliveries per hour. It benefits mass transit by improving transit speeds and the reliability of transit service, increasing transit ridership, and lowering costs for transit providers. It benefits State and local governments by improving the quality of transportation services without tax increases or large capital expenditures, by providing additional revenues for funding transportation, by retaining businesses and expanding the tax base, and by shortening incident response times for emergency personnel and thus saving lives. By preventing the loss of vehicle throughput that results from a breakdown of traffic flow, pricing maximizes return on the public's investment in highway facilities. And it benefits society as a whole by reducing fuel consumption and vehicle emissions, by allowing more efficient land use decisions, by reducing housing market distortions, and by expanding opportunities for civic participation."

Should China implement congestion pricing in major cities? Yes, certainly. As shown in Figure 5, China experienced a dramatic growth of private vehicles in the past two decades, with the number of private-owned vehicles increasing from 0.82 million in 1990 to 59.39 million in 2010 (China Statistical Yearbook, 1991 and 2011), 72.06 million in 2011 and 86.50 million in 2012 (Wang, November 2011). Yet, only about 15% of urban families own cars, with top three of Beijing 60%, Zhejiang 26.43%, and Tianjin 25.3% (http://gongyi.ce.cn/gongyikantai/xuejiegongyi/20120319530.html). Quite certainly, China will see a faster growth in the number of private vehicles. Hence, it is important to make travelers recognize and pay their full cost of driving. Congestion pricing internalizes traffic externality and makes travelers pay their social costs instead of their private costs only, thus discouraging vehicle ownership and uses.

Figure 5. Trend of China's Private Vehicle Ownership



Could China implement congestion pricing in major cities? Yes, probably after some pilot projects. Public perception about congestion pricing could be more favorable in China than in other countries. First, privacy is not as concerned by most Chinese commuters as those in Western countries. Second, car travelers in China include only middle or higher income people. Hence, congestion pricing tends to be much less regressive in China. Third, freeways in China are mostly not free. A fee is collected from every vehicle traveling in the freeway. Hence, charging a fee for using transportation facility is not a new concept, especially for those that are newly constructed. Last, most of Chinese urban workers still commute via public transit. According to Yang et al. (2011), 34% of Beijing resident commute via private vehicles in 2009 and this number becomes 12.2% for those who live in the city core that includes Dongcheng and Xicheng Districts. With congestion pricing, toll will be collected from those who are relatively richer and revenue will be used to improve transportation facility such as adding more buses and expanding subways. Therefore, the majority of Chinese urban residents would see direct benefits from congestion pricing.

China also could have a better political feasibility of implementing congestion pricing. First, with the rapid increase in private vehicles, local officials feel urgent to find effective solutions to mitigating the worsening urban congestion. Expanding facilities has been proved an unsustainable solution. They have to seek some other instruments that could better influence commuting behavior and reduce traffic levels. International successful experiences of congestion pricing would encourage Chinese policy-makers to implement similar programs. Second, unlike cities in the US where a metropolitan area have many political cities and these cities have to cooperate to make decisions on regional policies, transportation or economic cities are basically the same as political cities in China. Hence, there are many fewer institutional or political barriers to overcome in transportation planning and implementations. Third, as mentioned above, most of Chinese urban workers still commute via public transit. With congestion pricing, a significant portion of toll revenue would be used to improve public transportation, benefiting the majority of Chinese urban residents. In turn, it enhances political support. Fourth, the Chinese government seems to have more financial means for public project investment. It also enjoys more control over resources such as urban land.

Some may argue against any implementation of congestion pricing in Chinese cities because the vast number of public-owned vehicles are not be subjected to toll charges or do not care about paying tolls. However, the number of public vehicles is relatively much static than the number of private vehicles. With time, the latter will dominate the vehicles running on urban roads. Unfortunately, no official statistics are available on the number of public vehicles in China. Probably, the only semi-official statistics is from China Economic Weekly that shows China had about 2 million public vehicles in 2010 (http://paper.people.com.cn/zgjjzk/html/2010-12/27/node_1422.htm, December 27, 2010). China Economic Weekly is published and administrated by People's Daily and thus it is regarded as a government publication. Comparing the total number of private vehicles in 2010, 59.39 million, public vehicles accounted for a small proportion, 3.4%, and this proportion will become smaller with the rapid growth of private vehicles in China. Beijing had 62,026 public vehicles and 3,715,100 private vehicles in 2010, showing the former is 1.7% of the latter.

Some may also argue against any implementation of congestion pricing in Chinese cities because public transit in Chinese major cities is already over-crowded. If congestion pricing is implemented, public transit will become even more over-crowded, hurting all people who use public transit. However, the question is not if public transit is over-crowded, but if public transit is lagged behind the demand. Put it differently, the question is not if public transit can generate positive profits, as many policy-makers want, but if public transit is provided to maximize social welfare or not. Given the scale of economies in public transit, it is a theoretical prediction that public transit earns a negative profit. Congestion pricing, with its toll revenue, would help local government to finance public transit. Because most commuters travel via public transit, a better public transit system is particularly important to Chinese urban residents.

Others may argue against any implementation of congestion pricing in Chinese cities because vehicles priced off the toll roads will make other roads more congested, causing the roads more congested overall. The spillover effect, however, is subjected to future test. The London experience shows that the traffic spillover proved to be minimal. A key lesson is that traffic has not overflowed onto neighboring roads. After a short adjustment period, free rings have traffic levels comparable to 2002 levels, the year prior to the congestion pricing implemented (http://www.edf.org/page.cfm?tagID=6241).

Technology should not be an issue for congestion pricing implementation. However, initial capital investment could be a challenge and a barrier for some local cities and governments. One possible option is a government-private partnership in financing the initial capital investment, like the case of the SR-91 in Southern California. Another option could be municipality bonds (which could be an area for China's future reform).

With the sound economic theory and successful international practices, congestion pricing in China could become a reality. In fact, China could have a better feasibility of implementing congestion pricing in major cities due to less regressive congestion charges and fewer institutional barriers. Congestion pricing, which used to be a Western economists' dream but politician's nightmare, could be a dream of both Chinese economists and policy makers.

Still, to remedy urban congestion in major Chinese cities, the "one-hundred-cut principle" needs to be emphasized. Like cutting down a huge tree with a small axe, one swing may only have a dent on the tree. That means various remedies must be combined to effect a cure. Congestion pricing, therefore, should be only considered as one solution, not the solution.

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