Managing Private Vehicles in Asian Cities

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I. Introduction

Asia’s rapid urbanization and growing incomes have resulted in a corresponding booming market in motor vehicle sales. In 2013, an estimated 18 million new passenger cars were sold in China. Motor vehicle users generate congestion, pollution, accidents, noise and road damage. Yet, in most cities motor vehicle users often do not pay the full social costs and are therefore implicitly subsidized by non-users. According to the Tom Tom Traffic Index,¹ which is based on GPS data, motorists in the worst congested cities in developed countries spend up to 40% more time for peak hour commutes. This level of delay is relatively benign when compared to the congestion problems in many developing country cities where traffic jams of the ‘monster’ variety have on occasion stretched on for over 100 km and lasted for several days. Congestion and pollution are examples of instances of market failure which justify government intervention. That these problems persist and have grown in magnitude reflect government failure to adequately implement policies to address these issues.

The reasons for inadequate government response are varied and can be due to ignorance, inertia, bad policies, implementation failures, capture by vested interests, and ideological or political constraints. It is certainly not for lack of policy instruments. Numerous instruments exist that have been implemented to manage the motor vehicle problem. These measures can be classified as measures that

¹ Tom Tom Traffic Index at http://www.tomtom.com/en_gb/trafficindex/
reduce motor vehicle ownership and those that reduce usage. The top left hand corner in Table 1 represents the traditional fiscal measures that are present in almost all countries. Policy innovations such as congestion pricing, travel restrictions and quotas have developed in recent decades to meet the challenges of managing motor vehicles. City governments can consider the wide range of instruments available and choose the combinations that can be adapted to the local context. Table 1 also indicates the cities that have become associated with particular motor vehicle management policies. Singapore was the first city to implement congestion pricing in 1975 and a motor vehicle quota scheme in 1990. Vehicle travel restrictions are common in Latin American cities while there are over 200 Low Emission Zones in the EU.

### Table 1  Classification of Vehicle Management Policies

<table>
<thead>
<tr>
<th>Policy</th>
<th>Reduce Ownership</th>
<th>Reduce Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through price</td>
<td>- Custom duties</td>
<td>- Congestion pricing:</td>
</tr>
<tr>
<td></td>
<td>- Registration fees</td>
<td>Singapore, Bergen, London,</td>
</tr>
<tr>
<td></td>
<td>- Annual road tax</td>
<td>Stockholm, Milan, Gothenburg....</td>
</tr>
<tr>
<td></td>
<td>- Location based parking permit charges</td>
<td>- Road tolls and distance based pricing:</td>
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<tr>
<td></td>
<td></td>
<td>Spain, France, Germany, Switzerland, Austria, Slovakia,...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- High occupancy and toll lanes: US</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fuel taxes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Parking charges</td>
</tr>
<tr>
<td>Through quotas and restrictions</td>
<td>- Auctions: Singapore, Shanghai</td>
<td>- Low emission zones:</td>
</tr>
<tr>
<td></td>
<td>- Lottery:</td>
<td>226 cities in the EU</td>
</tr>
<tr>
<td></td>
<td>Beijing, Guiyang</td>
<td>- License plate number travel restrictions:</td>
</tr>
<tr>
<td></td>
<td>- Hybrid auction + lottery:</td>
<td>Mexico City, Beijing, Manila, Paris</td>
</tr>
<tr>
<td></td>
<td>Guangzhou</td>
<td>- HOV lanes</td>
</tr>
<tr>
<td></td>
<td>- Parking:</td>
<td>- Parking restrictions</td>
</tr>
<tr>
<td></td>
<td>Japan, Hong Kong</td>
<td>- No car zones / Pedestrian zones</td>
</tr>
</tbody>
</table>

Source: This is an adaptation of Figure 2 in Zeng (2013).

I shall elaborate on congestion and road pricing in Section II of this paper and travel restrictions in Section III. Section IV describes quantity restriction schemes for motor vehicle ownership and Section
V briefly discusses parking policies. The final section focuses on the special challenges that Asian cities face in managing the rapid growth of the motorcycle population.

II. Congestion and road pricing

The economic theory of the welfare gains from charging for road use was already well established by the 1960s. Yet no city was willing or able to implement congestion charging until Singapore made the first move in 1975. Singapore is a high income city-state with a population of 5.3 million. With only 716 km² of land and a population density that is higher than Hong Kong’s, the government has, from the 1970s, proactively managed the ownership and usage of private motor vehicles.

In 1975 the Singapore government implemented an Area Licensing Scheme for the downtown area. To enter the Restricted Zone when the scheme was in operation, motorist had to purchase a paper license to stick on their windscreen. Enforcement was performed by sharp-eye police officers stationed at visible gantry points. An initial charge of S$3 for private cars led to an immediate post implementation reduction in traffic by an estimated 76% (LTA, 2005, p.79).

Road pricing went electronic in 1998 when revenue collection and enforcement was automated. The technology adopted was DSRC or Dedicated Short Range Communication (Phang and Toh, 2004). Under the Electronic Road Pricing (ERP) system, each vehicle is installed with an in-vehicle unit and payment is made either through pre-paid stored value cards or through a credit card arrangement. Singapore’s experience with road pricing demonstrated that demand for motor vehicle usage is price elastic. Relatively small charges of less than US$3 are sufficient to have significant impacts on traffic volumes and speed.

The Singapore variant is just one of many ways to implement congestion pricing. Other existing toll collection schemes can easily be modified to variable pricing schemes to manage congestion. The technologies available for e-toll collection have developed rapidly in the past decade to include
Automatic Number Plate Recognition as well as the use of Global Navigation Satellite System (GNSS). Truck tolling in Germany uses the GNSS system. GNSS trials are currently ongoing in Singapore for future adoption in place of ERP. Singapore’s experience has shown that congestion pricing can work well to keep traffic moving. It is efficient as the user pays thus internalizing the costs of congestion and pollution. The revenue generated can be used for road and other public transport improvements.

It was only in the past decade that congestion pricing has been adopted by other cities. After Mayor Ken Livingstone’s successful implementation of congestion charging in London in 2003, many other cities began to seriously consider plans for congestion charging. Stockholm began with a trial period of pricing in 2006 and residents later voted in a referendum to adopt the scheme permanently. Notably absent from the list of cities which have since adopted congestion pricing are cities in Asia. This is expected to change in the near future as plans for congestion pricing have been announced for Jakarta and Beijing. The experiences of London and Stockholm have reaffirmed findings in Singapore that congestion prices do not need to be extremely high to effect a reduction in traffic.

However, adoption of congestion pricing is not inevitable. When put to a vote, cities that have rejected plans for congestion pricing include Hong Kong, Edinburgh, New York City, the West Midlands and Greater Manchester. Perceptions that the congestion charging is unfair remain the primary obstacle to its adoption. Social and political acceptability issues thus have to be handled carefully before such schemes can be successfully implemented. In recent months, there have been protests against eco-taxes in France and electronic tolls in South Africa.

III. Travel restrictions

It is not surprisingly that many cities have found it less contentious to rely on travel restrictions to reduce traffic flows. Travel restrictions based on the last digit of a vehicle’s license plate number have been implemented in several Latin American cities. For Beijing, hosting the 2008 Olympics provided a good reason to introduce this form of travel restriction. Car owners were prohibited from
driving one day each week based on the last digit of their license plate number. The scheme was permanently adopted after the Games and other cities in China have begun introducing similar restrictions.

European cities have also used travel restrictions in many specific locations with the objective of reducing pollution. Low emission zones (LEZs) are demarcated roads or areas where the most polluting vehicles are restricted from entering. Germany has close to 50 LEZs and there are over 200 LEZs in the EU.²

Pedestrian streets impose a total ban on motor vehicle use. They can be considered a tool of urban rejuvenation to create usable, pleasant urban spaces. These amenity benefits tend to be underestimated in Asian cities in the headlong rush to urbanize. A recent exception is to be found in Seoul. In 2003, under the leadership of then Mayor Lee Myung-bak, the Seoul government removed an entire 8 km highway, restored a stream that had been covered up, and created an accessible public recreation space in the middle of the city. This project has attracted worldwide attention and transformed the city of Seoul in more ways than one.

IV. **Motor Vehicle Quotas**

The use of quotas as a motor vehicle ownership management measure was pioneered by Singapore in 1990. Prior to the quota, there already exist high registration fees for motor vehicles. The ALS has also been in operation for 15 years. There were a number of reasons for the government to complement the then existing measures with a quota. Growth in car ownership had been rapid. Studies had shown demand for car ownership to be price inelastic and income elastic. Moreover demand uncertainty and policy lags in adjustment of registration fee rates meant that the ownership tax rate could often be far from the theoretical optimal. Expectations of an impending increase in tax rates

² For the list and details of vehicle restrictions, see the EU LEZ website at [http://www.lowemissionzones.eu/](http://www.lowemissionzones.eu/).
would lead to a rush to purchase new vehicles. To compound the problem, the then incentive scheme to scrap 10 year old vehicles had resulted in car owners paying a low effective cost for ownership (Phang et al, 1996).

The quota scheme that was implemented in 1990 has been tweaked and fine-tuned over the years. In its current form, those who are interested to register a new motor vehicle bid for a 10 year Certificate of Entitlement (COE). There are 5 COE categories including a motorcycle category. COE Open Bidding exercises are held twice a month, starting on the 1st & 3rd Monday of each month at 12 noon. The auctions last for 3 working days, ending on Wednesday in the same week at 4pm. Bid submission and revisions are via online bidding on the internet.

COE prices for March 2014 were in the range of S$78,000 to S$84,000. Together with registration fees and excise duties, a mid-range Japanese sedan (Toyota Corolla Altis) sells for S$136,000, multiple times its import price of around S$15,000. COE prices fluctuate with economic conditions and sentiments. From the revenue angle, Singapore’s motor vehicle policies yield substantial revenue for the Singapore government, certainly more than sufficient to finance transport infrastructure investment and public transport subsidies.

The Shanghai government made the decision almost two decades ago in 1994 to also introduce a quota for motor vehicle licenses. Beijing, Guiyang and Guangzhou have implemented quotas only in the last few years. Shanghai’s quota has been very effective in curbing car ownership when compared with other Chinese cities (Hao et al, 2011). The quota allocation is via bidding in Shanghai while Beijing chose a lottery mechanism. Shanghai distributes 10,000 licenses each month through 90 minute online auctions. The average bid in March 2013 was 92,000 RMB. The auction revenue collected in 2012 totaled 6.7b RMB (Li, 2014).

From January 2011, Beijing began distributing 20,000 licenses each month through lotteries, with the odds of winning decreasing from 1:10 in Jan 2011 to 1:84 in Aug 2013. For 2012 and relative to
a uniform price auction, Li (2014) estimates consumer surplus losses of 43b RMB due to misallocation from the lottery system and revenue foregone of 21b RMB. The reduction in total external costs was estimated at 7b RMB although Li suggest that the optimal level of quota is less than the existing level of 20,000 per month.

Interestingly, in a comparative study of policies in Singapore, US and China, Chen and Cui (2014) have described Singapore as more market-oriented than the US in its use of market-based mechanisms in allocating public resources and regulatory permits and more socialist than China in its orientation towards public property protection.

V. Parking policy

One often overlooked motor vehicle management instrument is parking policy. UCLA Professor Donald Shoup, a long-time advocate of market-oriented parking policy, has described parking as the unstudied link between transportation and land use. Shoup suggests that properly pricing on street parking and eliminating minimum parking requirements will greatly improve urban transportation, land use and life. His proposal is to set parking rates high enough so that 15% of parking spaces stay vacant at any time, which represents something like a market-clearing price (Shoup, 1997). A strong supporter of Shoup’s proposals, Professor Edward Glaeser of Harvard University, finds it ‘somewhat bizarre that New York provides a luxury good -- parking in Manhattan -- to public-housing residents at almost no cost’ (Glaeser, 2012).

Japanese parking policies have inadvertently resulted in market-based outcomes. Proof-of-parking is required before vehicle registration in Japan. This ensures motorists have no excuse to park illegally overnight on the streets and has led to local markets in overnight parking. In addition, in Tokyo, minimum parking requirements are set very low for buildings (see Figure 1 below) and there is limited on-street parking (Barter, 2011). In Hong Kong, a thriving parking real estate market exists. Car owners can spend more than HK$1 million to purchase a 2.5 m by 5 m parking lot for their cars. High parking
costs and a public transport system that has been ranked number one in a recent global study on urban mobility have contributed to keep car ownership rates low (see Figure 1).

**Figure 1** Parking requirements at commercial buildings versus approximate car ownership

![Parking requirements graph]

Source: Barter, 2011.

VI. Motorcycles

In estimating its urban mobility index, the study mentioned in the previous paragraph (Arthur D. Little, 2014) placed cars and motorcycles in a common ‘private motorized vehicles’ category. Yet, the challenges posed by motorcycles are quite distinct from cars. Asian countries have high rates of motorcycle ownership rates and motorcycles comprise more than 60 percent of total motor vehicles registered in several Asian countries including China, India, Indonesia, Thailand, Taiwan and Vietnam (Posada et al, 2011). In addition to car strategies, every Asian city needs to have in place clear long term policies on how motorcycles are to be managed.

There are several reasons for the popularity of the motorcycle. It is convenient, weaves in and out of traffic jams, reduces travel time, provides door-to-door service, and is easy to park. In addition,
motorcycle taxis provide a source of income where unemployment rates are high; motorcycles are also useful goods and passenger transport vehicles (Kumar, 2011). Motorcycles however generate congestion, noise and air pollution; accident and fatality rates are multiple times that for cars and their use has often been associated with urban crime.

Asia is urbanizing at a rapid pace in a context where motorcycles have become less expensive over time, are available on easy credit and often unregulated or under regulated. Where public transport systems are inadequate or absent, the motorcycle has become the dominant mode choice. The statistics for the Indian city of Pune typifies the pattern of motorcycle ownership and usage in cities of developing Asia, Africa and Latin America: in Pune, motorized 2 wheelers (M2W) represent 77% of registered vehicles and 55% of overall transport mode share (EMBARQ India, 2014).

There is clearly a need for M2W to be recognized as a separate mode with policies crafted to manage the negative externalities generated. In Singapore, motorcycles are subjected to similar measures as cars. Motorcycles come under the motor vehicle quota scheme and motorcyclists pay half the congestion charge that cars pay. Some Asian countries ban M2Ws in entire cities or zones, or on freeways, expressways and major arterial roads. Such bans exist in China, Japan, Korea and Taiwan. It is interesting to contrast the motorbike policies adopted in China and Taiwan.

Motorcycle ownership and usage grew rapidly in Guangzhou in the 1980s. The Guangzhou city government decided from 1991 to impose travel restrictions on motorcycles from outside Guangzhou. Within the city itself no new registration was allowed from 1995. From 2002, the government required older motorcycles to be scrapped. This was followed by travel time restrictions. Motorcycles were banned on Dongfeng Road from 2006 and completely banned in Guangzhou urban areas from 2007. Guangzhou’s experience with progressive restrictions on motorcycles has since been followed by other Chinese urban areas. The Guangzhou city government paid compensation for scrapping with the amount calculated according to age and cost of the motorcycle. Employment support measures were also
provided for displaced motorcycle drivers. Arising from the ban, noise and emissions were reduced, criminal cases declined by 15.3% between Jan and Aug 2007, and snatch theft cases declined by 44.3% over the same period (Zhu, 2011). After the ban, however, traffic speeds on several major arterials rapidly deteriorated as nearly one fifth of motorcycle riders shifted to car use.

In contrast to the bans in Chinese cities, Taiwan policymakers decided to introduce safety and other traffic measures. The motorcycle has been a popular transport mode in Taiwan from the 1970s. Contrary to expectations, its popularity did not decline with income growth. In 2013, there were more than 15 million motorcycles in Taiwan or 68 bikes for every 100 people. Motorcycles are a major safety issue in Taiwan as they account for 88% of traffic accidents involving injuries and fatalities in 2011 (Wang, 2013). This is despite safety measures introduced over the years. A nationwide Mandatory Helmet Law came into effect in 1997. Taiwan also introduced motorcycle bans on expressways and freeways as well as motorcycle specific traffic management policies. From 1984 motorcyclists were required to make left turns in two stages at major intersections in Taipei. Left turning motorcycles needed to proceed straight across the intersection to a painted two-stage left turn motorcycle box and wait there for the other traffic signal to turn green.

A motorcycle waiting zone in front of cars at major intersections was introduced in 1997 and exclusive motorcycle lanes were introduced on major roads from 1999. Traffic studies indicate that a segregated motorcycle lane may be called for if there are more than 1000 motorbikes per hour and the traffic composition is greater than 10% and less than 60% motorcycles (ITDP, 2009).

Taipei began enforcement of no parking on sidewalks from 1999 and progressive parking fee implementation on a zone-by-zone basis from 2003. Yet these measures may not be sufficient to reflect the total costs of motorcycle usage. One estimate places the private costs paid by the Taiwan motorcyclist at 35% of the total costs (Chang, 2013).
Policymakers in Asia’s cities are faced by a policy dilemma on the M2W. The motorbike is an extremely useful and low private cost transport mode. However, its use in dense urban areas also creates numerous negative externalities with high accident and fatality rates a cause for major concern. Policy delays with regard to the motor vehicle management are especially problematic when motorcycle ownership and usage can increase very rapidly within a short period with urbanization and income growth. Delays in infrastructure investment, inadequacies in public transport provision and underdeveloped or non-existent insurance regulations and markets further exacerbate the problem.

Should the motorcycle be banned as is the case in major Chinese cities, or managed as is the case in Taiwan? What if motorcycles continue to be underpriced or under-regulated? A ban on a very popular and useful mode of transport may not be justifiable in most cities. The banning of this major mode in Guangzhou was supported by the community as it was perceived to be a crime reduction measure (Zhu, 2011). Congestion in urban areas is also likely to worsen if motorcycle riders shift to cars. Mobility and employment for low and middle income groups can be seriously impacted. Measures to discourage the motorcycle therefore need to be complemented with public transport improvement. It is not surprising that the motorcycle ownership rate in Taiwan is lowest in Taipei City as it has the most comprehensive public transport system.

Containing the negative costs of motorcycles in Asia’s cities will require policy action on many fronts that will need to be suited to the local context. If left unregulated or under regulated, and if public transport provision continues to lag urbanization and income growth, the motorcycle will become entrenched as the massive mode of transport in Asian cities. As time passes, altering the status quo will become harder, not easier. The motorcycle will then, because of government failure to organize and regulate the market, become the future of urban transport in rapidly growing Asian cities. That is the scenario which policymakers must take immediate steps to avoid.
References


