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## Allocation flexibility and price efficiency within Singapore's Vehicle Quota System

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### ABSTRACT

Permit or license plate quotas are highly effective albeit controversial policy tools for managing growth in the vehicle population and thereby, adverse traffic congestion. A judicious distribution of the scarce permits that targets the dual objectives of price efficiency and social diversity in vehicle ownership can however mitigate the controversy. This paper scrutinizes the attainment levels of these two objectives within Singapore's multi-categorical Vehicle Quota System in two time periods (1991–1998 and 2002–2011) which differ in the number of permit allocation categories, the auction format used (sealed versus open bids) and in the frequency of distribution (monthly versus semimonthly). The lessons derived are contrasted to the other two jurisdictions which have also implemented quotas on their vehicle registrations namely, Shanghai and Beijing.

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## 1. Introduction

South-east Asian city-state Singapore and Chinese metropolises, Shanghai and Beijing, currently use the frontline tool of permit quotas to manage vehicle ownership and thereby, the adverse effects of traffic congestion within their jurisdictions. Beijing, which joined this select club in January 2011, was pertinently ranked among the three most stressed cities in the IBM's Global Commuter Pain Index constructed from surveys carried out in 2010 and 2011 (IBM, 2010).

### 1.1. Singapore

Singapore implemented the world's first Vehicle Quota System (VQS) in May 1990 after systematic raises of vehicle and gasoline taxes since the 1970s were deemed insufficient towards curbing vehicle ownership aspirations – see for example, Phang (1993). Another complementary innovation implemented in 1998 was Electronic Road Pricing (ERP) which replaced the manual cordon-style Area Licensing Scheme (ALS), introduced in 1975 to charge for entry in the Central Business District, and the Road Pricing Scheme started in 1995 for expressways utilization (Chin (2002) and Olszewski and Xie (2005)). The ALS is recognized as the first ever successful implementation of congestion-pricing worldwide.

The VQS is deployed to the public via regular uniform-price auctions of quotas of Certificates of Entitlement (COE). These are permits required in the registration process as they entitle vehicles to run on the local roads for up to 10 years. COEs are offered in distinct categories catering to cars and taxis, commercial vehicles and motorcycles as well as in an unrestricted or “open” category whose objective is to avail flexibility in the mix of vehicles.

Car categories are demarcated by engine capacity to promote social equity and progressivity in car ownership. The original four car categories (1000 cc or less, 1001–1600 cc, 1601–2000 cc and above 2000 cc) have been merged into two since

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May 1999 with the cut-off set at 1601 cc. A COE obtained in the “open” category is transferable and it can be used to register any vehicle. COEs in the other categories are non-transferable except for those within the commercial vehicles category. The evolution of the COE scheme is traced in several articles, e.g. [Chin and Smith, 1997](#); [Barter, 2005](#), etc. Recently, [Chu \(2011\)](#) contrasted the COE premiums in the “open” category following the auction format change from sealed to open bids in July 2001 and inferred an average price reduction of about 16% *ceteris paribus* as well as a more pronounced manifestation of demand and supply forces.

### 1.2. Shanghai

Beijing and Shanghai have opted for simpler methods for allocating their quotas of vehicle permits (or license plates, as they are more commonly known there). Shanghai has used an auction system since 1986 ([Song and Zhou, 2010](#)). The latest reform pertaining to private cars took place in January 2008 with a shift in format from sealed to open bidding ([Press Conference of the Shanghai Municipal Government, 2008](#)). The 2-rounds auction, accessible over both Internet and telephone channels, takes place monthly on a designated Saturday.

The first round of the auction typically takes place between 10 and 11 am. Its objectives are to register the initial bid from each participant and thereby, to determine a minimum bidding price for the second round. During the latter's 30 min duration, each participant is allowed up to two bid revisions which are constrained to be within  $\pm$ RMB300<sup>1</sup> of the evolving price. If the current clearing price is say RMB30,000, a revised bid can then only be between RMB29,700 and RMB30,300. Successful bidders pay the final amount they bid. Interestingly, the winner's curse effect is mitigated as the range constraint on the revised bids positions the auction closer to the uniform price. In June 2012, the auction attracted 24,774 bidders for the 9500 license plates on offer. The minimum and mean successful bids were respectively RMB55,800 and RMB58,227<sup>2</sup> ([Bloomberg News, 16 June 2012](#)). In a rare published analysis of the Shanghai auction data, [Song and Zhou \(2010\)](#) infer that the auction format change from sealed to open bids in January 2008 has led to an average price reduction of RMB3020 and higher price efficiency, as inferred through higher prediction errors.

As a result of the ownership restraint, there were only about 1.03 million private cars registered in Shanghai at the end of 2010 ([Shanghai Daily, 5 April 2011](#)). This is a remarkable feat as Shanghai is widely regarded as China's iconic business hub and its population size of 23 million inhabitants is comparable to the capital city Beijing. The latter is discussed next.

### 1.3. Beijing

Beijing issued some 700,000 license plates during 2010 and ended the year with a park of about 4.8 million vehicles. Compared to its vehicle population of some 1 million in 1997, this implies an average yearly growth of about 13% since then. To counter this unsustainable growth rate, Beijing introduced in January 2011 a monthly quota of 20,000 new license plates catering to individuals (17,600), business (400) and government bodies (2000). Allocation is effected via an egalitarian ballot or lottery system (see e.g. [The New York Times, 2 January 2011](#)). A possible rationale for the adoption of balloting in the Chinese capital city is the questionable legality of the auction system in Shanghai as it ran counter to national policies pertaining to road usage and the development of an automotive industry ([Song and Zhou, 2010](#)).

The very first computerized ballot draw carried out on live TV attracted 187,420 eligible candidates for the 17,600 private vehicle license plates in January 2011. By March 2012, the number of participants had swollen to 990,806 (amounting to a chance of success of about 1 in 50) due to the automatic re-eligibility of the unlucky ones from previous draws. This number however dropped by about 120,000 in April 2012 when long-time unlucky applicants were asked to renew their applications ([China Daily USA, 10 April 2012](#)). The competition for a license plate remains way above that observed in the auctions held in Singapore and Shanghai. It highlights the inefficiency of a lucky dip allocation system which tends to attract an inflated demand coming from those who either have no immediate need for a vehicle or who are just helping out friends or relatives.

### 1.4. Research agenda: allocation flexibility and price efficiency

Economists define efficiency as the allocation of resources to their highest valued use. A pragmatic way to achieve this goal is through auctions where scarce resources like license plates are allocated to those who value them the most (e.g. [Vickrey, 1961](#); [Klemperer, 1999](#), etc.). In comparison, lotteries (or queuing) engender “... inefficiency ... in the fact that those who draw the goods ... may not be the ones who value the goods the highest ...” ([Boyce, 1994](#)). This appears to be the case with the allocation of license plates via the lottery system in Beijing, as reported in the previous sub-section.

Singapore and Shanghai demarcate from Beijing in their adoption of the auction mechanism to allocate license plates. Whereas Shanghai auctions off license plates in a single category, Singapore uses several categories as well as an unrestricted “open” category for flexibility purposes. Singapore's multi-category strategy aims to promote ownership diversity compared to Shanghai where potentially the richest could dominate the single category license plate auctions and thereby aspire to vehicle ownership.

<sup>1</sup> US\$ ~ 6.36 RMB in June 2012.

<sup>2</sup> <http://www.alltobid.com/guopai/>.

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