Enforcing or Permitting Urban Parking

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Extended abstract

Objectives and motivation

Central business districts (CBDs) are major destinations for goods pickup and delivery in many urban centers. One of the most expensive components of urban freight is the cost of “last mile” delays in CBD where truckers navigate through congested metropolitan areas looking for appropriate parking. When parking is scarce, unavailable, or even far from the final delivery point, truckers frequently park illegally and consider the potential ticket as “the cost of doing business”. As a result, parking tickets have been increasing. In Toronto, issued parking fines increased by 70% from 2006 to 2009, thus encouraging city planners to revise urban truck parking management policies (Haider, 2009).

Policies such as time restrictions, pricing, space management, enforcement, and off-peak delivery have been imposed in different cities to manage urban truck parking (Nourinejad et al., 2014). Among these policies, parking enforcement is imperative for two main reasons. First, a ratio of the generated revenue from parking citations is allocated to the city. This ratio is roughly 75% in Toronto and the remaining 25% is dedicated to financing the cost of parking enforcement. Second, parking enforcement when accompanied with lower parking violations leads to enhanced flow of traffic which is equivalent to increased social welfare. As an example, hindrance of double parking through enforcement keeps the lanes clear of obstructions for smoother flow of vehicles. For these two reasons parking enforcement is imposed with the objective of maximizing either or both social welfare and generated revenue. Nevertheless, enforcement alone is not efficient when truck drivers are insensitive to receiving parking citations. In Toronto, from the ticket citations that were issued to delivery trucks in 2009, a total of $1.5 Million worth of fines were receded in court (Haider, 2009). The cancelled tickets cause a negative externality in the system since the enforcement authorities are unable to claim the citation penalty and the delivery agencies have to pay for the cancellation expenses. In light of this negative externality, some cities offer fixed-price parking permits to delivery agencies, thus allowing them to park in parking restricted zones for free. The permits, if proliferated, allow enforcement agencies to alleviate parking inspection since the truck drivers have already paid for parking via the permit. The delivery agencies would benefit as well if the permits are affordable.

Although parking permits are now issued in many cities such as Vancouver, Washington D.C., and Houston, there is vast discrepancy in how the policy is implemented in each city. For instance, Vancouver charges only $40/year per truck for a maximum of 30 minutes parking in loading zones, passenger zones, or any other meter stall except during rush hour, whereas Houston charges $1,285/year per truck for a maximum of two hours for parking in a loading zone or a metered stall. We hypothesize that each city develops its parking permit policy based on factors such as the cost of enforcement, parking demand, traffic conditions, impact of illegal parking on through-traffic, and available parking supply. The objective of this paper is study the impact of these factors on both social welfare and generated revenue and profit. The methodology is described below.

General description

Urban parking behaviour, for both passenger vehicles and trucks, is understood to form as a reaction of drivers to policies. For instance, increasing both parking enforcement and parking fines prompts drivers to find legal parking to avoid the high penalty of citation. The less acknowledged aspect of parking, however, is the reaction of parking policy-makers to parking behaviour. For instance, increasing parking enforcement as a policy is not suitable if the majority of the tickets end up getting cancelled at court. Hence, any policy analysis should simultaneously consider the policy-maker and the drivers. The problem has distinct similarities with the non-cooperative inspection game where an inspector verifies whether another party, called the inspetee, adheres to legal rules (Avenhaus, 2004). Inspection games have many applications including fraud detection, arm control and disarmament verification, and barrier-free bus fare control. As an example, the barrier-free bus fare control game involves (i) passengers that decide whether to pay the fare or risk getting caught by the transit agency (i.e. the inspector) and (ii) the transit agency that randomly conducts inspections for the valid proof of payment and collects fines from violator (Sasaki, 2014). In the parking context, drivers without a parking permit, decide whether to park legally or illegally depending on the enforcement intensity and the citation penalty. The enforcement agency, on other hand, decides the cost of the fixed-cost of the parking permit, the citation penalty, and the level of enforcement. Each player of the game has its own response function. Truck drivers minimize their expected cost of parking with respect to the implemented parking policies and enforcement agencies maximized their expected profit and/or social welfare with respect to parking behaviour.
Results and conclusions

The inspection game and its underlying equilibrium conditions are studied. We model the number of issued tickets as a function, denoted by $f$, of both enforcement intensity and the number of violators. Intuitively, more tickets are issued with more violators and more vigorous enforcement. Pareto-optimality of the two objective functions, i.e. social welfare and demand, is studied and shown to be dependent on the features of the function $f$. The conditions that promote implementation of parking permits are identified.

References


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