Dynamic Parking Pricing: Implementation in North America

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1.Introduction

Dynamic parking prices, which adjust in response to changes in demand, can be a useful tool for managing parking availability and encouraging turnover. However, there are some limitations to this approach. First, it can be difficult to implement and administer, requiring complex pricing algorithms and systems to collect and process data in real-time. Additionally, dynamic pricing may not be well-received by drivers, who may perceive it as unfair or unpredictable. Parking as it stands is a relatively 'dumb' system, and introducing any smartness into the system will include a number of added complications that can limit the uptake and the success of the system. This paper will look into the parking problem overall, introduce dynamic parking as a potential solution, and then delve into the example of SF Park. Finally further considerations and alternate solutions will be considered in the context of dynamic parking pricing to provide context and consider further research.

2.The Parking Problem

There are three aspects of the parking problem that are essential to understand before exploring possible solutions, the issue of space, of pricing, and of cruising. It must be noted that because most trips in most North American cities start and end with a parked car, that parking is one of the most important intermediary goods in the market; however, since cars spend about 95% of their time parked it can be safely assumed that market lacks in efficiency (Inci, 2015) (Shoup, 2005). Cars take up large amounts of space relative to the

number of passengers they transport even when moving, but considering they are parked most of the time the efficiency of the method is reduced even further. Not only do parked cars take up a lot of space, but they also require a parking spot at every place they travel, be it workplaces, shopping centres, or at home; in the US there are an estimated ten parking spaces for every car, and on a typical day space equal to the state of Massachusetts is taken up by parked cars (Fabusuyi & Hampshire, 2018). While there is so much space devoted to parking, many drivers will insist that there isn't enough parking available; however, as Donald Shoup observed in his seminal book The High Cost of Free Parking, this is almost universally untrue, and rather drivers are saying there is a limited amount of free parking not parking overall. Herein lies another problem with parking: it is rarely priced correctly (according to the cost of its provision) and often the cost of parking is not directly levied on the parker (Shoup, 2005). This means that parkers are shielded from the true cost of parking and feel entitled to free or near free parking wherever they go, leading to drivers cruising through cities to find parking once they have already reached their destination. In cities across the US it is observed that between 50-30% of downtown traffic is caused directly from cruising (Chen et al., 2015). Drivers are not cruising looking for parking, rather they are looking for free parking, often on street parking provided at substantially lower rates than the true cost of parking charged by private parking garages (Shoup, 2005).

3.A Dynamic Solution

To tackle this parking problem, municipalities have considered changing parking fares dynamically on streets and in lots based on demand. It has been observed through many studies that the ideal occupancy for parking spaces in urban environments is between 60% and 80%, because at this level there is limited need cruising (as 20% of spots should be free) but still most of the spots are being used so the use of space is more efficient (Maternini et al., 2017).

Parking price can be a strong driver of behaviour for drivers who, as Shoup observed, tend to value the money spent at the parking meter as of much higher value than the time-cost of cruising around in their car (Shoup, 2005). So, in the case of dynamic parking, municipalities can price the spots located in high demand locations at a higher price than low demand locations, incentivising the most cost-sensitive drivers to park in the less popular places, reducing demand for parking in the busier areas and increasing it in the less busy areas. This is only the first layer of dynamic parking pricing, and in order to take into account changing driver habits, and other trends in a city's transportation space, cities can also make the pricing of these spots dynamic, so has demand for spots in a certain location goes up cities can adjust the price higher, thus ensuring a similar level of demand for parking spots across the city and maintaining that ideal window of 60-80% occupancy overtime.

Of course, parking demand changes not only over the weeks but also throughout the day: downtown parking near job centres will likely be higher when people are at work, and then parking demand might be higher near retail centres later in day, etc, thus cities can also dynamically change the price of a parking space throughout the day, having an even finer layer of control over demand. The speed and sensitivity of price fluctuations relative to demand can be tailored to a municipalities' needs along with a program's scope will have a major impact on the effect of the intervention.

4.SF Park: A Case Study

4.1 Overview

SF Park was launched as a pilot program in April 2011 and initially covered 7000 on- street spots and 12,250 off street spots (SFMTA). The program allows for meters to be priced differently depending on the time of day, pricing zones are from 9am to 12pm, 12pm to 3pm, and 3pm to 6pm; between 6pm and 9am the meters were off,

so parking is free. Every six weeks the hourly rate would either increase or decrease depending on occupancy. If occupancy was over 80% then the rate went up by 25 cents and if it was below 60% the rate would decrease by 50cents. The aim of the program was to keep occupancy between the ideal levels of 60-80% and ran in several districts throughout the city.

4.2 Results

The program was seen as a success by the city, and in subsequent reviews the results have been carefully analysed. The price increased in 32% of the zones, decreased in 31% of the zones, and didn't change in 37% of the zones (Pierce & Shoup, 2013). This result is quite interesting, because while it shows that the parking demand was certainly elastic relative to the price, it also indicates that the average price of parking throughout the city didn't change. From this it can be inferred that there are enough spots in the city, despite popular conception. It is unclear whether people shifted to other modalities during this time, if they parked in different zones, or if they carpooled. The results also showed that demand for parking is less elastic in the morning, than around midday and in the afternoon. Also, that demand is less elastic in residential areas than commercial areas (Pierce & Shoup, 2013). This isn't necessarily surprising, as it follows logically that when people need to go home, and park in residential areas, they do not have a lot of leeway in where they park, they are simply going to park as close to their home as possible. Also, the same follows for the morning demand, many people need to be at work at the same time every morning, and work in the same place, so they also will need to park wherever they can in the morning that is closest to their work. Finally, it is important to look at the changes to occupancy rates following the implementation of the program. For blocks that had an initial occupancy rate of <30%, it was found that 67% of them increased occupancy, and for those at above 90% occupancy, it was found that 68% reduced occupancy

(Pierce & Shoup, 2013). From these initial results it seems as though the plan was a success, but it remains important to look at the bigger picture and note potential confounding factors.

Figure 1: Parking prices on a weekday at Fisherman's Wharf in May 2012. (Pierce & Shoup, 2013)

4.3 Takeaways

Park SF was not the only parking reform that took place during this period in San Francisco, and thus there might have been some confounding factors when measuring the success of the program. It was noted that workplaces may have begun offering parking at work considering the changes, and since the pilot program didn't cover these spots, it is unclear whether workers just started parking at work instead (Fabusuyi & Hampshire, 2018). Also, since the program did not apply to every single spot within each zone, nor did it study or apply to spots outside the zones, demand could simply have just shifted between and from these un-studied spots, a more holistic study would have needed to consider these additional spots, particularly those at the edges of the zones (Fabusuyi & Hampshire, 2018). Two other changes in parking rules took place at the same time as the pilot was launched; an easier payment system was introduced and the duration which people were allowed to park for was relaxed (Fabusuyi & Hampshire, 2018). Unfortunately, it is impossible to separate the effect of these rule changes on parking demand from the SF Park program which makes it hard to identify which reform had the most effect. Further studies have noted some improvements to the program that SF Park could have undertaken; firstly, that the time periods could have been refined. Since the parking meters turned off at 6pm, people who came to the spot at 5pm could park overnight and only must pay for one hour of parking, it certainly would have been interesting to study the effects on overnight parking in the different districts and how the changing rates shifted the overnight parking trends (Pierce & Shoup, 2013). Finally, it was suggested that SF Park could have done more to predict the occupancy of different zones to pre-emptively change the rates, rather than just responding after each six-week period (Pierce & Shoup, 2013). While this certainly would have helped each zone reach the optimal price and therefore occupancy faster, it may have come under more public scrutiny; one of the strengths of the

plan in terms of public opinion was that the price changes were based on real time occupancy which seems 'fairer' than predicted occupancy.

5.Other Considerations

5.1 Pricing Change

The major limitation or risk of an intervention like dynamic parking pricing is that there needs to be a balance between the speed at which the prices are changing to the speed at which drivers can observe and act upon the different prices. Some argue that: "these existing programs nevertheless share a common feature: the parking prices are updated once per several weeks or even several months, which is not sensitive enough to deal with the highly dynamic parking demand in realistic daily operations" (Lei & Ouyang, 2017). However, the faster the prices are updated, the more frequently drivers will need to be checking the pricing landscape. Since the point of dynamic parking pricing programs is to shift demand away from popular areas at popular times, drivers need to have a general idea of the cost of parking where and when they are looking to park. A program like SF park, updated the cost of parking every six weeks, allowing drivers plenty of time to be aware of and change their behaviour in accordance to the current price (Fabusuyi & Hampshire, 2018). Perhaps a three-week cycle would have been more effective in allowing spots to reach their optimal price faster while still allowing drivers plenty of time to be made aware of the changes; however, this leads to a discussion of the 'smartness' of the system, and the method by which drivers can check the prices and find spots.

5.2 Parking Reservations

A method that had been considered for reducing cruising in downtown areas is allowing drivers to make reservations on specific spots either on the street or in lots, which would allow them to drive directly to an open spot without the worry that it might be taken. While extremely promising, a program like this would also have some limitations, two being the way in which spots are reserved, and the number of spots which are allocated for reservation only (Chen et al., 2015). While a reservation system would reduce bottlenecks in high demand parking areas due to a reduction in cruising, visitors or tourists who are unaware of the system might find an extremely limited number of non-reservation spots, which could in turn lead to increase cruising for some, eliminating the benefits of decreased cruising for others. If too many spots are allocated for reservations, people might get quite frustrated cruising around looking at all the empty spots. Therefore, a reservation system would need to be easy to access, and unreserved spots should be able to be reserved on the spot by those who weren't aware they had to book ahead of time.

5.3 "Smartness of System"

Dynamic parking pricing, parking reservations, and other parking interventions often increase the 'smartness' of the parking system, and for faster response times and a higher ability to make reservations there will be a clear reliance on smartphone apps or even smart systems within cars. While trends towards 'smarter' systems are accelerating in almost all sectors it is important to note that not everyone is able to use these 'smarter' systems, and thus the benefits of these programs could be distributed unequally throughout the population. Another consideration is the safety of these systems. While it might see a good idea to allow drivers to reserve a spot with their phone, or even check out the block by block pricing with their phone, an increase in phone usage while driving either on the freeway into a downtown area, or while driving

around downtown would be dangerous (Qian & Rajagopal, 2014). Decreasing cruising and optimizing parking need not come at the expense of driver and pedestrian safety which is another major problem in downtown systems. There needs to be a balance between the smartness of a system and its accessibility to allow usage without being on one's phone constantly.

6. Conclusion

As can be seen, dynamic parking pricing is an exciting method by which cities can manage the problems associated with downtown parking, and while the SF park program was successful in several measures, there are improvements and further considerations that should be taken into account when expanding the program or if it is taken up in other cities. Other cities such as Los Angeles have explored the possibility of dynamic parking pricing and as more cities do so, more data will be made available for study allowing for the constant improvement and expansion of these programs. It is important to bear in mind the end goal of these programs and make sure they are aligned with that of the city. While reducing cruising by smoothing out parking demand is essential, a reduction in car dependency in American cities should of course be the end goal, and whether these programs have achieved that is still unclear. An extremely interesting finding from both SF Park and the program in LA, is that overall parking prices did not increase, showing that the number of parking spots in these cities is sufficient to meet demand, but also that the cost of parking is still lower than the cost of provision (Qian & Rajagopal, 2014). A holistic increase in parking prices city wide could be a major step in reducing car dependency, however this seems unlikely due to a lack of political will, so perhaps these limited market/demand solutions remain the best option for now.

7. References

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