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Parking
Learning from Japan

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Parking – Learning from Japan

K.W. Axhausen, M. Chikaraishi and H. Seya

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Abstract

The discussion of reforming parking pricing in Europe and the US suffers from a lack of imagination, as it is hard to envision a city with spatially and temporally strong variance in parking prices within short ranges of distance given the Western historical precedent. This paper is intended to help spark the imagination by presenting the case of downtown Hiroshima, where such a regulatory framework has already been in place for decades. It will map and describe the outcomes for the core of this metropolitan area of just over one million inhabitants. This description is supported by an explanation of the regulatory framework and a chronicle of the development of the number of parking spaces across the country.

Parking prices vary by a factor of 25 during daytime hours on weekdays within this 8-km² area. The highest rates shift location by 1.25 km from daytime to nighttime. Rates fall to zero where there is no demand.

Keywords

Parking, price, parking reform, Shoup, Asia, Japan

Preferred citation style

1 What is it like in a city with market-priced parking?

Having to park a car is the flip side of the accessibility and speed which the car brings to its buyer and user. Given that the reported national averages of car use around the world are 80 to 90 minutes per day, the average car is parked for about 95% of its existence. The conflict about who should pay when and how much of the costs for parking provision became virulent when the number of cars increased beyond what on-street parking could accommodate, first in the US in the 1920s and then elsewhere.

The association of the car with speed and freedom of movement and the early general expectation that car ownership would become an option across the whole income spectrum gave rise to the appropriation of street space for ‘free’ parking, even when that space was still primarily occupied by wealthier residents and commuters. The European and American understanding that on-street parking is a legitimate use of common street space to be regulated in terms of duration of stay, but not charged a market-clearing price, is still the rule today.

As the demand for parking in downtown areas grew and as competition between drivers forced increasing numbers to walk distances longer than they deemed acceptable or forced them to wait or search for a vacant spot near their target, the policy discussion shifted. The rise of suburban shopping venues and offices increased the urgency of the need to treat the problem. The solution found in the 1920s and 1930s was threefold: (1) off-street garages, in many cases built by local governments to provide additional capacity, but priced only to recover building and management costs; (2) metered on-street parking to increase parking turnover and thus the chances of finding a spot, but charging only an administrative fee; and (3) building regulations which required the provision of a stipulated number of parking spaces on lots with new construction or substantial refurbishment.\(^1\)

This solution seemed reasonable in a planning discussion largely free of a deeper economic analysis and in an era of low car-ownership numbers. Nobody could envision the post-war explosion of car ownership, and nobody thought through the implications of these regulations for a world with 600 or 700 cars per 1,000 adults.

The regulations stipulating on-site parking spaces initially did not require parking fees, and in-town property owners in most cases did not dare to charge any, as they were up against the unregulated and unpriced or regulated but only nominally charged on-street parking and

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\(^1\) Enabling regulations were adopted in Germany at the national level in 1939 following discussions that began in the 1920s: “Verordnung über Garagen und Einstellräume” (“Ordinance on Garages and Parking Spaces”, also known as the Reichsgaragenordnung - RGaO -) of 17 February 1939.
cheap suburban land of the out-of-town competition. This situation allowed car users to form the expectation that parking is free at the point of use.

The number of parking spaces required was a contentious issue from the start. The justification for the number of spaces was to internalise the demand for parking of visitors/employees of the lot on the lot. However, the regulations rarely explicitly defined ‘demand’: it could be that of the average workday, the average weekly peak, the annual peak, or some other measure. To be on the safe side, the requirements were set high, and retailers in particular were happy if they were high enough to provide for the annual peak, which in Europe and the North America are the last four or five Saturdays before Christmas.

The regularity with which regulations were copied from one local authority to the next in conjunction with the lack of fees and a desire to be ‘safe’ led to growing requirements. The over-provision of parking according to peak-load-oriented requirements made any future pricing impossible, as days with visible scarcity were rare or non-existent by design.

The economic, social and aesthetic costs became clear with the boom of the post-war years and became a target of reform after the oil shock of the 1970s and a general orientation away from prioritizing the car in planning and policy discussions. In the absence of market-clearing prices for parking, car drivers continued to search for parking in city centres, slowing each other down and polluting everyone in the process. Without market-clearing prices for on-street parking, off-street garages could generally not be operated at prices high enough to recover costs, and their owners were forced to cross-subsidise them from other revenue streams, for instance administrative on-street parking charges available to municipal garage owners. Cross subsidies from non-car users to car users through the inclusion of the cost of parking into the price of goods and services were generally ignored.

In the presence of administrative fees for on-street parking and municipally owned off-street parking, and in the presence of commercially motivated prices set by some parking providers, the remaining prices set by the rest of the providers might be profit-maximising, but they did nothing to reduce or eliminate the externalities of the parking search.

The discussion of how to move away from the 1920s model to a new solution matching the needs of today is still ongoing in Europe and the US. The European discussion is focused on reducing parking minima in areas with better than average public transport provision and on introducing parking maxima to limit the off-site externalities of traffic attracted to the sites. The American discussion is focused on setting parking requirements (see in particular Willson, 2013), reflecting a richer database of demand estimates, even if only for the inflated demand in situations without pricing (e.g., ITE, 2004).
The biggest intellectual challenge to the status quo has been issued by the work of Shoup (2005) and recent experiments based on his proposals, e.g., SFPark (Millard-Ball, Weinberger and Hampshire, 2014; ibid, 2013; Pierce and Shoup, 2013; Chatman and Manville, 2013; see also Barter, 2010 for a cautious note). Shoup’s suggestion is to adjust the pricing for parking on each block and for each hour of the day until there is always at least one free space available for an arriving driver. If prices were thus set, there would be no more parking searches and less cause for motorists to slow down on their way to a destination.

This approach would match supply and demand and remove the externalities of the search. It would provide an incentive for more off-street supply, as developers could observe drivers’ willingness to pay. It would also demonstrate to current providers of free point-of-use parking the revenue they forgo by not charging for parking. Tax authorities would be able to fairly assess the value of employer-provided parking for the purpose of taxing in-kind benefits.

This approach is not limited to commercial areas, but could be extended to residential areas in lieu of residential parking permits, which tend to monopolise the supply for residents at less than market rates. Cities generally grant more permits than the available night-time capacity can accommodate and therefore only reduce, but do not remove, competition for parking. For a discussion, see for example Moylan, Schabas and Deakin (2014).

It is clear that Shoup’s approach disturbs the current familiar, if unloved, status quo between different stakeholders in the urban planning discourse on road space, mode use and urban form. For the sake of further discussion, it will be crucial to obtain an idea or a glimpse of how a city might look if we were to start pricing parking correctly and allow the land-use system and modal competition to adapt to it.

We can simulate such a world (e.g., Waraich, Dobler, Weis and Axhausen, 2013, who showed that prices would increase or decrease locally, but that overall the city of Zürich could earn a higher income by adopting Shoup’s policy). We can look at the outcome of the San Francisco experiment on a selected number of block faces (see Figure 1), but in the absence of the land-use response and due to the limited number of block faces affected, it is difficult to generalise. Actually seeing this policy in operation across whole cities would be far more compelling. We want to argue in this paper that Japanese cities are a very good approximation of such a world.

2 The exact measurement of this target need not concern us here: There could be 85% occupancy across the day or one free parking space per block face at any point in time, etc.
Figure 1  Weekday morning hourly rates of the SFPark experiment in spring 2015

Data sources: www.sfpark.org, and GIS layers courtesy of Adam Millard-Park

Our paper will demonstrate this by first describing the Japanese regulatory framework and then its outcome, looking in particular at downtown Hiroshima, the centre of a region with around 1.2 million inhabitants in the west of Honshu, Japan’s main island. We will show the price range of car parks and their dynamics over the course of the week. We will show how much land is taken up with parking in a system where land usage is easily converted. We will conclude with lessons learnt for the further discussion in the North America and Europe.
2 Parking in Japan

In Japan, parking regulation responds to the characteristics of the road network, tries to ensure a certain number of parking spaces, but does not attempt to control the total number of spaces or to regulate their prices and conditions of use. Figure 2 shows the extreme skewness of street width distribution in Hiroshima, which is typical for all of urban Japan. The narrow roads are an inheritance from pre-Meiji urban design and show the inability of the planning system to have them widened since 1870, or even since the Second World War (Sorensen, 2002). As a first result, on-street parking is virtually non-existent in Japan (see Figure 4). As a second result, car owners must demonstrate their ownership or lease of a parking space before they may acquire a car, as regulated in the Motor Vehicle Storage Act. This creates a ready market for off-street parking spaces, as not all residences can provide a parking space on the lot, especially in older parts of urban areas.

In this section we will discuss further parking regulations and the official statistics on the number of parking spaces, as far as these have been captured by the official regulations. In addition, we will discuss why the market for small off-street car parks has been growing in Japan.

Figure 2 Distribution of street widths in the downtown Hiroshima observation area

Data source: ESRI road network data (2012)
### 2.1 Land use and planning law basics

The types of parking provision and the associated laws in Japan are summarised in Figure 3, and the reported number of spaces since 1958 is shown in Figure 4. Parking can be broadly divided into two categories: storage spaces and parking lots. ‘Storage spaces’ refers to those parking spaces that must be owned or leased by car owners before the acquisition of a car. The Motor Vehicle Storage Act of 1962 obliges each car owner to obtain an off-street parking space so that each car has its own parking space within 2 km of home or the workplace, if a commercial owner.

#### Figure 3  Classification of parking provision

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage space</td>
<td>'Motor Vehicle Storage Act (車庫法)'</td>
</tr>
<tr>
<td>Parking spot</td>
<td>On-street parking Spot</td>
</tr>
<tr>
<td></td>
<td>Parking Law (駐車場法), Road Act (道路法)</td>
</tr>
<tr>
<td></td>
<td>Parking meter (including ticket machine)</td>
</tr>
<tr>
<td></td>
<td>Road Traffic Act (道路交通法)</td>
</tr>
<tr>
<td>Off-street parking</td>
<td>Obligatory parking spot</td>
</tr>
<tr>
<td></td>
<td>'Parking Law (駐車場法)'</td>
</tr>
<tr>
<td></td>
<td>Registered paid parking spot (&gt; 500m²)</td>
</tr>
<tr>
<td></td>
<td>'Parking Law (駐車場法)'</td>
</tr>
<tr>
<td></td>
<td>Non-registered parking spot (&lt; 500m²)</td>
</tr>
<tr>
<td></td>
<td>For public use</td>
</tr>
<tr>
<td></td>
<td>Parking space prescribed by city planning</td>
</tr>
<tr>
<td></td>
<td>Parking Law (駐車場法)</td>
</tr>
<tr>
<td></td>
<td>City Planning Act (都市計画法)</td>
</tr>
<tr>
<td></td>
<td>Parking space prepared by the road management authority</td>
</tr>
<tr>
<td></td>
<td>Road Act (道路法)</td>
</tr>
</tbody>
</table>

Source: IATSS (2012)

The second category, ‘parking lots’, includes all other parking spaces at destinations. This can be either on-street or off-street parking, but on-street parking is in principle considered to be an interim solution that should ultimately be replaced by off-street parking (MLIT, 2014). Due to this policy, no more than 800 on-street parking spaces exist in all of Japan. Note that this does not include metered parking spaces, where generally only 60 minutes or less of parking is allowed. While on-street parking spaces are established by local governments to meet...
the parking demand which cannot be fulfilled by off-street parking, metered parking spaces are established by public safety commissions to provide short-term parking spaces, mainly in central business district (CBD) areas. In terms of price setting, while fees for metered parking are set based on operational and maintenance costs, fees for on-street parking spaces are generally determined based on the market price by commissioning their operation (including price setting) to a private company.

Off-street parking can either be for a specific use or for public use. In both categories, obligatory parking takes the dominant share. Obligatory parking spaces must be provided by those who build, renovate or enlarge large-scale buildings for certain land uses if the local government has established the necessary ordinance under the Article 20 of the Parking Law of 1957. By March 2013, 198 out of 1,718 local governments had established the necessary ordinance, and a total of 2,997,363 parking spaces had been built for this purpose. Generally, these requirements are comparatively low (ADB, 2011). The second-largest type of parking is the registered commercial car park. Under Article 12 of the Parking Law of 1957, owners of commercial car parks with over 500 m² of space for parked vehicles must furnish information to their local government, including the location, size, any structure (where relevant) and other relevant data. In March 2013, there were 1,661,432 reported parking spaces in registered commercial car parks.

A certain amount of parking can also be required by city planning under Article 8 of the City Planning Act of 1968 and Article 3 of the Parking Law. Parking development zones may be established where necessary within designated city planning areas. As of March 2013, 130 local governments had established 170 parking development zones in their urban plans, and 118,477 parking spaces had been built.

The annual reports of the Japanese Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) show long-term trends in the number of parking spaces. Although this allows us to trace the main trends, the official statistics do not include metered spaces, private parking spaces (including monthly contract car parks), non-registered car parks, i.e., those under 500 m², or parking spaces operated by the road management authorities. Therefore, for the years 2007 onwards we added metered spaces and non-registered car park statistics obtained from the Japan Parking Business Association (2012) and the Japan Research Center for Transport Policy (2014) (the original statistics were adapted from the Japan Parking System Manufacturers Association Incorporated).

The results (Figure 4) show the predominance of off-street parking, which has a greater share by a factor of 200. The share of paid off-street parking is at least 30%, as it is not known how
much of the obligatory parking due to city planning requirements is priced. Most of the parking spaces are off-street, and the share of on-street parking has been consistently small over the past 50 years. More than 60% of the officially recognised car parks are obligatory. Whilst the increase in car parks and parking spaces highly correlates with the increase in car ownership, the recent increase in obligatory car parks is partially due to the growth of large-scale shopping facilities. The share of non-registered car parks (Table 1) has reached around 35% of the total number of car parks, though the share of spaces in these non-registered car parks is less than 10% of the total.

In comparison to elsewhere, the continuous fall in the number of on-street spaces, whether paid or unpaid, is striking. The needs of moving traffic are given priority in Japan.

### Table 1 Estimated number of off-street car parks (2007–2011)

<table>
<thead>
<tr>
<th>Number of off-street car parks</th>
<th>2007</th>
<th>2009</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-registered paid car parks (&lt;500 m²)</td>
<td>32,000</td>
<td>35,700</td>
<td>40,000</td>
</tr>
<tr>
<td>Registered paid car parks (≥500 m²)</td>
<td>7,487</td>
<td>8,013</td>
<td>8,391</td>
</tr>
<tr>
<td>Obligatory car parks (&lt;500 m²)</td>
<td>56,828</td>
<td>59,502</td>
<td>63,606</td>
</tr>
<tr>
<td>Obligatory car parks (≥500 m²)</td>
<td>1,980</td>
<td>2,057</td>
<td>2,140</td>
</tr>
<tr>
<td>Car parks prescribed by city planning (&lt;500 m²)</td>
<td>41</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>Car parks prescribed by city planning (≥500 m²)</td>
<td>418</td>
<td>419</td>
<td>416</td>
</tr>
<tr>
<td>Total (off-street car parks)</td>
<td>98,754</td>
<td>105,734</td>
<td>114,597</td>
</tr>
</tbody>
</table>

Non-registered car parks here only include coin-operated and unattended ones, and the figures were estimated by the Japan Parking Business Association (2012) based on interviews with major companies dealing with coin-operated car parks and parking equipment manufacturers.

Source: MLIT (2014); Japan Parking Business Association (2012)
Finally, land-use regulations related to parking are generally permissive. In only two of twelve permitted land-use categories are stand-alone car parks prohibited: category 1) the low-rise exclusive residential zone, type 1; and category 2) the low-rise exclusive residential zone, type 2. Small car parks and parking facilities (facilities of less than 300 m² floor space/size and with a maximum of two storeys) are permitted in six further categories: category 3) the medium- to high-rise exclusive residential zone, type 1; category 4) the medium- to high-rise exclusive residential zone, type 2; category 5) the residential zone, type 1; and category 6) the residential zone, type 2. For the remaining six categories and therefore for all central city areas there are no restrictions, and no limitations are placed on the construction and operation of small-scale car parks. This includes category 7) the quasi-residential zone; category 8) the neighbourhood commercial zone; category 9) the commercial zone; category 10) the quasi-industrial zone; category 11) the industrial zone; and category 12) the exclusively industrial zone. Thus in Japan small-scale, non-registered car parks are always an option for owners of urban lots. They can decide at any given point in time whether parking is the opti-
mal use for their property. Since Japanese housing and commercial buildings have a relatively high rate of turnover, this question arises regularly. Note that property owners must pay the fixed property tax (usually 1.4% of the appraised land value) and the city planning tax (usually 0.3% of the appraised land value). These taxes are lowered when land is used for housing (there is a 5/6 tax reduction for the first 200 m² and a 2/3 tax reduction for the rest of the lot), but such reductions do not apply to parking spaces. Still, converting land into car parks is the current trend in most Japanese cities.

Of the different types of car parks, both registered and non-registered paid car parks are usually established in response to market demand, and most of them are operated by private companies. In 2011 the biggest parking management company in Japan was Time24 Co., Ltd., operating 39% of all spaces, followed by Mitsui Fudosan Realty Co., Ltd. with a 12% share. The number of car parks operated by private companies is growing: There was a 7.2% increase from 2008 to 2011 (Japan Parking Business Association, 2012; see Table 1). This is partially because it has become popular among property owners to commission the operation of car parks to private companies.

There are several reasons why the parking business is growing. First, since the Road Traffic Act of 1960 was revised in 2006, there has been a crackdown on illegal parking. This has boosted the demand for car parks. Second, the cost of equipment (such as ticket machines) has decreased year by year, allowing property owners and parking management companies to operate more small-scale car parks at a profit. Car parks with two to five spaces are nothing unusual in Japan (see Figure 5). Third, a number of previously exclusive parking spaces provided by restaurants, banks, hospitals and shops for their clientele have been converted to coin-operated car parks which now may also be used by the general public. Fourth, increases in idle lands due to the severe economic depression since 2008 have resulted in an increasing temporary use of such property as car parks.
Figure 5  Example of a small car park in Higashi-Hiroshima

Photo: Chikaraishi, November 2015

Figure 6 shows a typical sign announcing the fee structure to drivers. The pricing of these car parks varies by time of day and day of the week. Normally, operators use two time periods during the day. The boundary between them shifts depending on the strength of the evening demand. Weekend rates differ from weekday ones. The rates are set by the operators. The charging unit varies among car parks from 12 to 60 minutes, allowing operators to increase turnover and users to avoid paying for unused time. Finally, some but not all car parks have maximum rates after a certain number of hours. The time-of-day division, charging units, rates and maximum rates give operators the leeway to tailor their prices to local demand. It can be expected that paying via smartphones, which is becoming increasingly common in Europe, will also become more widely adopted in Japan.
2.2 Has Japan achieved ideal market pricing?

The Japanese market for parking is mainly market driven, as both the provision and withdrawal of parking spaces is easy for property owners. Local governments generally do not provide parking, and when they do, they ask commercial firms to run it for them. Many businesses such as shops and restaurants also provide subsidised parking to their customers, which distorts the parking market at the local micro scale.

Fee schedules are set by the owners at their discretion, but limitations on the size of their signs simplify the schedules so that ideal ones are not possible. Still, the available variables offer a certain amount of flexibility.
There are no statistics on parking search times in Japan, but informal discussions with drivers suggest that the parking search is not an issue at this time. In fact, some cities have discussed whether regulations on mandatory parking spaces should be relaxed, since the parking supply already meets the demand (or in some cases even exceeds it), partially due to the increase in business-oriented car parks. In this sense, the market-driven parking supply seems to be working well in Japan.

The lack of control of the total number of car parks and parking spaces has raised concerns regarding the functioning of downtown areas and related environmental externalities. Recently, planning tools for controlling and regulating parking in CBD areas have become available in Japan through the Act on Special Measures Concerning Urban Reconstruction (April 2012) and the Low Carbon City Act (December 2012). In particular, obligatory car parks still need to be provided on the same parcels as under the current Parking Law, but exceptions can be made under the new acts. For example, local governments can ask property owners/developers to build parking spaces on the fringe of the CBD instead of providing them on their own parcels. This is not really a policy discussion about the demand for / supply of parking spaces, but rather a policy discussion about the design issue of where to place car parks on a city scale.

Yes, the current Japanese policy regime comes close to Shoup’s (2006) prescription. In the next section of this paper, we will look at its operation in a large Japanese city to give a real-life example of how this plays out for the city and its users.

3 Downtown Hiroshima

3.1 A bit of history and the city’s current role

Hiroshima was a castle town which was established around 400 years ago to serve the local ruler. The castle is located in a northern part of Naka Ward, which has long been the centre of Hiroshima City. The current downtown area is located just south of Hiroshima Castle in the same ward. According to the National Population Census, the ratio of the daytime to nighttime population in Naka Ward was 176% in 2010, which is the highest in the Chugoku region of Western Honshu. Hiroshima City’s administrative offices, a number of private companies’ main offices and commercial buildings are also located in the same district. Thus, Hiroshima currently plays a central role in terms of providing governmental and commercial functions, including nightlife, to its environs.
According to the one-day travel diary survey conducted by Hiroshima City in 2008, the modal share of car use to the central area on weekdays is around 20%, while that of public transport (including trains, trams and buses) is around 30% and non-motorised transport (including walking and bicycling) is around 40%. Therefore, there is a fairly well developed public transport system, and many residents live close to the central area. However, though the share of car use is only around 20%, it generates a non-negligible amount of parking demand since the numbers are large.

### 3.2 The data collected

To obtain an overview, we collected the necessary information from field observations and operator websites. Our observers walked all the streets in downtown Hiroshima, as not all operators have a web presence, and took photographs of the fee schedules, which were then transcribed for further analysis. The area includes the central shopping, office and entertainment districts of Hiroshima as well as surrounding residential areas. The main train station and two further commuter stations are at the border of the observation area. In total, we identified 950 car parks open to the public on around 8 km², of which we have complete data for 940. The total road length of the survey area is around 180 km. We were unable to count the number of spaces due to budget constraints and due to the lack of access to some facilities for ourselves and our other observers.

### 3.3 Prices by time of day and day of the week

The key observation is the large range in pricing by space and time, with some areas switching their role from being the cheapest during the day to being the most expensive at night (see Figure 7 and Figure 8). The range of hourly rates, rates per unit, charging units and finally maximum rates is substantial (see Table 2). This reflects localised differences in demand and in the willingness of operators to exploit them, where feasible.
Table 2  Parking fees at off-street car parks in downtown Hiroshima and its environs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Weekdays</th>
<th>Nighttime</th>
<th>Weekends</th>
<th>Nighttime</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime</td>
<td></td>
<td>Daytime</td>
<td></td>
</tr>
<tr>
<td>Charging unit [min.]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>10–100</td>
<td>10–180</td>
<td>15–90</td>
<td>20–180</td>
</tr>
<tr>
<td>Median</td>
<td>30</td>
<td>60</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Mean</td>
<td>34</td>
<td>58</td>
<td>34</td>
<td>59</td>
</tr>
<tr>
<td>Price per unit [¥]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>50–600</td>
<td>50–400</td>
<td>0–1,000</td>
<td>0–300</td>
</tr>
<tr>
<td>Median</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>147</td>
<td>115</td>
<td>147</td>
<td>110</td>
</tr>
<tr>
<td>Hourly rate [¥/h]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>60–1,600</td>
<td>33–1,600</td>
<td>67–2,000</td>
<td>0–800</td>
</tr>
<tr>
<td>Median</td>
<td>300</td>
<td>100</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>288</td>
<td>145</td>
<td>295</td>
<td>135</td>
</tr>
<tr>
<td>Maximum rate [¥]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>300–38,400</td>
<td>0–6,300</td>
<td>0–3,000</td>
<td>0–2,000</td>
</tr>
<tr>
<td>Median</td>
<td>1,200</td>
<td>500</td>
<td>1,000</td>
<td>500</td>
</tr>
<tr>
<td>Mean</td>
<td>2,390</td>
<td>766</td>
<td>996</td>
<td>566</td>
</tr>
</tbody>
</table>

The maximum rate was calculated as either the highest rate in the charging period (daytime, nighttime), or as the additional 24h or 12h maxima which some providers employ. The latter applies to parking stays during the whole charging period.

The size of the car parks was not considered in the calculations.
Figure 9  Comparison of weekday rates for 3h-parking during the daytime and nighttime in the observation area in Hiroshima

Figure 9 shows the distributions of the parking fees for a 3h-stay during the daytime and nighttime. It is clear that the demand reduction during the night causes prices to be lower, even forcing some operators to stop charging at all. Still, there remain hotspots with substantial parking fees during the night.

Figure 7  Weekday daytime hourly rates
Figure 8  Weekday nighttime hourly rates
Figure 9  Comparison of weekday rates for 3h-parking during the daytime and nighttime in the observation area in Hiroshima

<table>
<thead>
<tr>
<th>Daytime</th>
<th>Nighttime</th>
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The calculation of the rates considered any available maximum rates.

A fuller analysis of the spatial price patterns accounting for land prices and local competition and demand patterns is given in Seya, Axhausen and Chikaraishi, 2015.

4 Discussion: Could Japan be an example?

The example of Hiroshima shows that the construction of a demand-responsive market for off-street parking is possible. The ease of entry into and exit out of the parking business and the low costs of automated administration allow property owners to adapt unused land to parking easily. This allows them to cover the property tax in part or in full, and in a best-case scenario to earn income until buildings can be built, where suitable.

The market works as we would expect: There were no local reports of parking searches or waiting for parking at off-street parking facilities. Given the ubiquity of car parks, there are presumably few additional miles driven to find parking – though the presence of special discounts might lead to some extra traffic. Fees vary by location, including no charges during periods of very low demand.

The exit of local authorities from the parking market has moved the risks to private operators, which is welcome relief for local taxpayers.

The traffic-related externalities of parking are drastically reduced in Japan in comparison with the typical North American or European city. On the other hand, the loose Japanese parking
regulations have increased some externalities on the urban environment. The city and its planners have lost control over the urban form. In the typical visual chaos of the Japanese city-scape, this might not be too worrisome, although recent legislation shows some awareness of the issue.

The question for European or North American cities and suburban activity centres is whether there is any desire or ability to transition to such a market. Their current markets show some differentiation, but uniform pricing for large amounts of on-street parking and for government-owned parking distorts the remaining prices. The historical development of these metropolitan areas or cities has left them with a substantial oversupply of parking in their suburban areas, where shopping in particular builds for just four or five annual peak demand days. Under such conditions, the market price is zero for the rest of the year unless the car parks can be subdivided into zones of different walking distances to the stores, which might produce a willingness to pay accordingly. Consider the current price schedules of low-cost airlines, which have already identified a similar willingness to pay for the small comforts of a flight: an aisle seat, an extra suitcase, etc.

The situation is obviously different in urban cores, where a) large fleets of vehicles are owned by residents who compete with their neighbours and visitors for parking, and b) spatially undifferentiated and low fees do not clear the market. Linking market-clearing on-street parking fees to the construction of additional residential parking might be a political possibility, as shown by Shoup (2005). However, the likely aesthetic requirements and the need to minimise the resulting traffic externalities would make this an expensive way forward. The equity concern of potentially pricing some households out of car ownership would also require care during policy debates and later during a potential implementation phase. Still, the willingness of many cities around the world to allow new construction of (affordable) housing with few or even no parking spaces shows a willingness to engage with this issue. In commercial cores, an SFPark-like approach to incrementally identifying the right prices in time and space could help to allay the anxieties of commercial stakeholders, as prices would fluctuate both up and down (see Waraich et al, 2013 for a simulation of the Zürich case and the results cited above). We would still expect the composition of the types of trips to change. Shorter visits would be priced higher – no more “first 30 minutes free” deals – but walking distances would be shorter and motorists would no longer face search times. Vehicles parked for longer stays would be displaced by those requiring shorter stays and moved towards the margins until their drivers’ willingness to walk was exhausted.

Cities would still maintain aesthetic control, as current practice in the cities concerned shows. Nevertheless, the costs and externality trade-offs of car parks and related structures (including
aesthetic, social and environmental impacts) would need to be negotiated in detail: an exciting or horrifying prospect, depending on your position.

Clearly, this kind of parking pricing is no substitute for road pricing as such. The theoretical literature has shown that parking pricing is a second-best approach, but one which is generally easier to implement politically than road pricing proper. (See Van Nieuwkoop, 2014 for an analysis of road pricing and search-time-dependent parking pricing, including a detailed analysis of a Zürich case study; see also Calthrop, Proost and van Dender, 2000). Using parking pricing as an incentive for mode shifting was never the objective of Shoup’s or any other parking pricing approach, but it might have that impact on those less willing to trade off more walking against lower fees. Nevertheless, a direct policy intervention such as rebated season tickets or increased public transport frequencies would have greater leverage and could be funded by the reformed parking pricing system if it increased the total revenue from city-owned parking spaces, which is not a foregone result (see Waraich et al., 2013 for a simulation in which the overall revenue did not increase).

5 Conclusions and outlook

This paper has shown that the Japanese model gives us an idea of how a city with market-based fees can provide and price parking. While the Japanese path of development cannot be replicated elsewhere, the basic lesson is that differentially pricing parking could remove parking-related traffic externalities anywhere that there are enough actors in the market to account for small distortions due to rebates and discounts.

The Japanese example also shows that other road traffic externalities cannot be addressed by the parking market. There is still a need for regulatory intervention and public investment when local authorities perceive problems and have the statutory instruments to deal with them.

The SFPark example reinvigorated the discussion about parking pricing worldwide. We hope that our paper has moved the discourse out of the extraordinary experimental realm and into the streets and daily practice of Hiroshima and other cities around Japan.

A more detailed spatial analysis of Japanese parking pricing and drivers with regard to their differences is of further academic interest, but the key message is clear: Spatially differentiated pricing works!
6 Acknowledgements

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7 Literature


