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# **TITLE:** Park & ride – Exploring the demand effects of parking charges

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## **Abstract**

Parking charges can be introduced to control who uses park & ride (P&R) facilities. However, the effect of charges on parking demand is unclear. This paper presents results from a before- and after analysis of fifteen rail based P&Rs in Norway where parking charges were either introduced or increased in 2018. Results show that, in most cases, the demand for parking decreased after the change in pricing, making more parking spaces available for people arriving later than the early morning. However, there is no significant change in the median distance travelled by car to reach the P&Rs.

## **Keywords**

Parking; Park & ride; parking regulation

## **ARTICLE**

### **1. Research questions and hypotheses**

Park & ride (P&R) as a measure to encourage more use of sustainable transport modes is debated (see for example Duncan, 2019; Parkhurst & Meek, 2014; Tennøy, Hanssen, & Øksenholt, 2020). The main purpose of P&R is to reduce the total vehicle kilometers travelled by private car. To achieve this, P&R should be offered to those who live far away from a public transport (PT) stop or for other reasons have trouble getting to the stop without a car. This allows commuters to use the car on only a small part of the commute journey, as opposed to car use all the way to the workplace. At the same time though, P&R can make it easier to choose the car over other means of transport such as walking, cycling or PT. In this case, P&R will have the opposite effect, increasing the use of car. Additionally, P&Rs take up valuable space close to PT hubs that could be used for other purposes.

To ensure that P&R is offered to the right target group – i.e. those who cannot travel to the station in other ways – various measures can be considered, such as increasing the number of parking spaces or introducing pricing or other forms of regulation (Christiansen et al., 2017). Where there is a high demand for P&R facilities, spaces fill up in the morning, making it more difficult to use the offer for people who arrive later in the day. Parents, needing to take their children to kindergarten on the way to the PT station, can then lose the opportunity to use the P&R and the associated PT service. The same goes for those who live far from the P&R, who are unable to walk or cycle to the train station. Regulations, such as parking charges can have a dismissive effect among those who can travel without a car, i.e. those who live outside of walking or cycling distance to the station, freeing up parking spaces for

those with a greater need for parking. Based on these hypotheses, the following research questions are formulated:

- What effect does parking charges have on P&R demand?
- What effect does parking charges have on who uses the P&Rs, and how far old and new users live from the P&Rs?

## 2. Methods and data

We registered license plate numbers from cars parked on fifteen rail based P&Rs in Norway between 2017 and 2019. Two registrations were conducted on each P&R, once before and once after the change in pricing, which was introduced in 2018. Figure 1 shows the location of all train stations with associated P&Rs. Four stations are in the Stavanger region, and eleven are in the Oslo region.

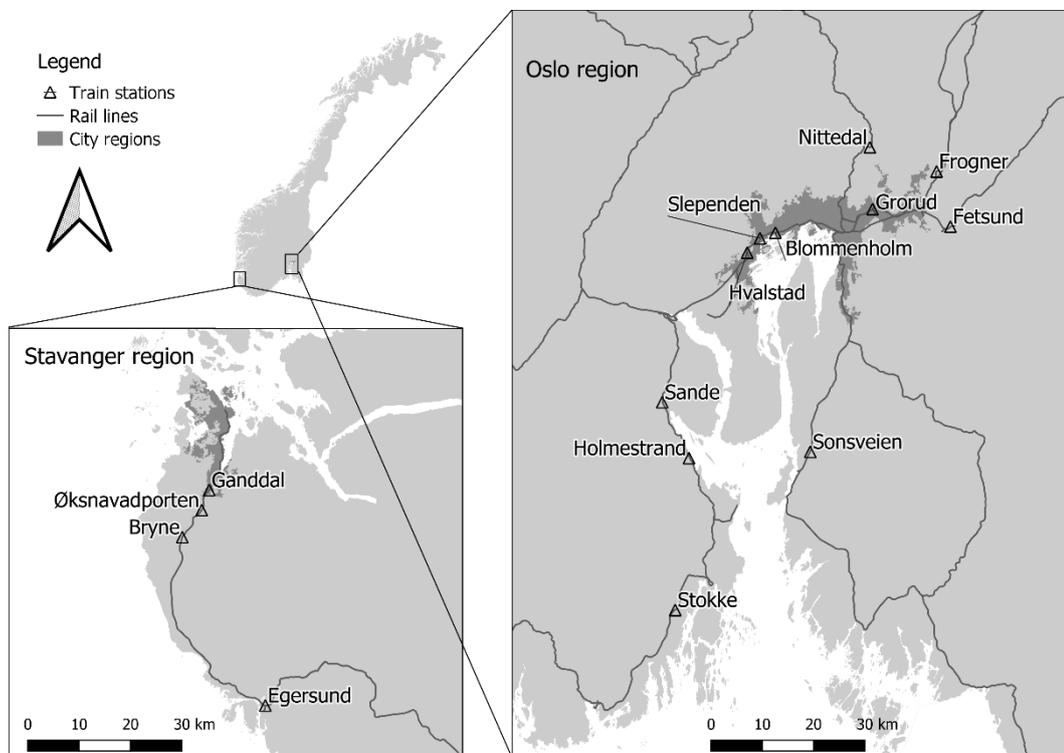


Figure 1. Location of the studied train stations and P&Rs

We retrieved the residential address of all car owners, from a publicly available registry of license plates, maintained by the Norwegian Public Roads Administration. The total number of cars on each registration date is used to measure how the total parking demand has changed after the change in charging. The residential address of users was used to measure the distances travelled by car to the P&Rs. On four P&Rs, prices were increased, while eleven P&Rs went from free parking to a parking fee (see table 1).

Table 1. List of P&R spaces with number of parking spaces and fee level (per month/per week)\*

Train station	Region	Capacity (number of cars)	Fee on first registration	Fee on second registration
Blommenholm*	Oslo region	83	NOK 100/35	NOK 250/85
Fetsund	Oslo region	201	No fee	NOK 100/35
Frogner	Oslo region	189	No fee	NOK 100/35
Grorud*	Oslo region	80	NOK 100/35	NOK 250/85
Holmestrand	Oslo region	220	No fee	NOK 100/35
Hvalstad*	Oslo region	33	NOK 100/35	NOK 250/85
Nittedal	Oslo region	150	No fee	NOK 100/35
Sande	Oslo region	200	No fee	NOK 100/35
Slependen*	Oslo region	80	NOK 100/35	NOK 250/85
Sonsveien	Oslo region	261	No fee	NOK 100/35
Stokke	Oslo region	67	No fee	NOK 100/35
Bryne	Stavanger region	142	No fee	NOK 100/35
Egersund	Stavanger region	160	No fee	NOK 100/35
Ganddal	Stavanger region	30	No fee	NOK 100/35
Øksnavadporten	Stavanger region	42	No fee	NOK 100/35

### 3. Findings

The first research question is answered by investigating how the capacity utilization changes between the first and second registration, as shown in Figure 2.



Figure 2. Capacity utilization before and after changes in the charging scheme\*. Utilization over 100 percent indicates that the officially registered capacity (in table 1) is inaccurate.

On average, the changes in pricing has led to a significant reduction in demand. On the first registration, 100 percent of the total P&R capacity was utilized. This had decreased to 76 percent on the second registration.

The changes vary, however, among the different P&Rs. As Figure 2 shows, on several of the P&Rs there was over one hundred percent utilization on the first registration, indicating an inaccurately registered capacity. Still, on the second registration the utilization as decreased to around or below 100 percent on all P&Rs except one (Øksnavadporten). On some P&Rs, the demand is unchanged or even increased. This indicates that the willingness to pay for parking varies geographically. However, there is no clear effect on demand of how central, or close to the city center the P&Rs are located, which is slightly in contrast with previous research (Carlson & Owen, 2019; Mingardo, 2013). Further, we find no difference between the P&Rs where charging was introduced, and those where an existing fare was increased, though the sample size is too small to make this point exactly.

Moving on to the second research question, Figure 3 shows the median distance travelled from users' residential location to the P&Rs.



Figure 3. Median distance travelled (in kilometers) from residence to P&R, among users before and after changes in the charging scheme\*

The distance users travel from their home to the P&R varies quite substantially among the different stations. Median distance varies from one to almost eight kilometers. However, the implementation and increase of parking charges does not seem to affect the distances travelled. In total, the mean distance travelled is four kilometers, and this remains unchanged. Only two of the P&R experience a visible increase (Blommenholm and Stokke).

In the same way as Figure 2, changes in the distance travelled (Figure 3) does not appear to be related to whether charging was implemented or increased, or to the P&Rs' distance to the city center.

To sum up, the results show that charges has a clear effect on P&R demand, making it easier to find parking spaces later in the day. The effect on driving distances and more sustainable transport is, however, more uncertain: We cannot be sure that people previously driving to the P&Rs have shifted to more sustainable travel modes, or if they still drive similar or longer distances. However, the P&R fees are lower than toll fares and more central parking fees in Oslo and Stavanger. Thus, driving all the way to work is still a more expensive option than driving to the P&Rs. In addition, the Norwegian train operator, Vy, reported increasing numbers of passengers in these regions between 2017 and 2019<sup>1</sup>, indicating that many travel to the stations without a car.

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### Footnote

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<sup>1</sup> <https://www.vy.no/vygruppen/presse-og-nyheter/pressemeldinger/passasjerveksten-fortsetter-for-nsb?item=2257> and <https://www.vy.no/vygruppen/presse-og-nyheter/pressemeldinger/reisevekst-vy-tog-2019?item=5754>

\* On P&Rs marked with an asterisk, existing parking fees were increased. On the other P&Rs, parking fees were implemented.