Institute of Transport Economics
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Summary

Reducing car use through e-scooters: A nudging experiment

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During the 2021 season, Bolt experimented with in-app information in several European cities to "nudge" users from ride hailing to e-scooters: If a set of criteria were met, e-scooter rental would appear as the second alternative in the ride hailing part of the app. This report analyses data from these experiments. We find that nudged users are significantly more likely to choose e-scooters in virtually all experiments. The e-scooter shares among nudged users are 0.4-3 percentage points higher, constituting a 40-200 percent increase in e-scooter use compared to the control group. In Oslo, where results are strongest, at least 55 percent of the e-scooter trips caused by the nudge replaced ride hail trips.

Taken together, results demonstrate that nudging users through changing information in multimodal interfaces can be an effective way of switching users away from cars, at no cost to the user.

The app interface and the experiments

Bolt manages ride hail and e-scooter services in various cities. By downloading and signing up to an app, the user can choose from two different mode options: either searching for e-scooters nearby or scheduling a ride hailing trip by submitting a destination.[1] Since both e-scooters and ride hail trips are offered through the same platform, switching between the two is less cumbersome. Furthermore, app data on users' travel behaviour present an opportunity to study the interface between shared e-scooters and ride hailing trips.

During the summer of 2021, Bolt conducted several similar experiments among users in selected European cities: Krakow in Poland, Brno and Ostrava in the Czech Republic, Lisbon in Portugal, Madrid in Spain, Bordeaux in France, Gothenburg and Stockholm in Sweden, Oslo in Norway and Valletta in Malta.[2] The purpose of the experiments was to see whether users could be "nudged" from booking a ride hail trip into renting an e-scooter. The "nudge" consisted of giving ride hail users information about e-scooters in a more accessible part of the app, by inserting an e-scooter option in the ride hailing search menu. By scrolling down, the user still had access to the same ride hailing alternatives. The ride hailing interface for a "nudged" user is displayed in Figure S1.

Users randomized into a control group saw no difference in how the app functioned, while users in the treatment group were nudged provided that their search session met three criteria: (1) A ride hail search was initiated; (2) an e-scooter was available within 300 meters of the user; and (3) the destination for the trip was less than 2 or 3 kilometres away, depending on the experiment. These criteria were meant to identify the ride hailing trips that most conveniently could be replaced by e-scooter trips. Data from the experiments contain information from 10 different cities, consisting of 12.6 million search sessions from about 1.1 million users. 4.5 percent of these search sessions met the nudge criteria.

[1] Bolt also offers other mobility services, but not in the cities analysed here.

[2] Results from Bordeaux, Brno and Ostrava are not presented due to limited sample sizes.

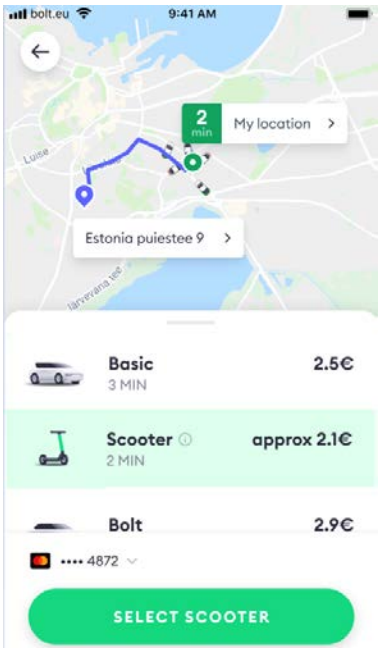

Figure S1: The ride hail interface of the Bolt app in case the user was nudged. An "e-scooter" option appears as the second alternative instead of a ride hail option.

Summary of results

We find that nudging significantly increased the number of e-scooter trips, and reduced the number of ride hailing trips. For Oslo, where results are strongest, we document that 55 percent of e-scooter trips generated by nudging replaced ride hailing. The remaining 45 percent were conducted by users that would otherwise have closed the app without booking a trip. This illustrates that in-app information is able to affect users' transport behaviour in a way that significantly reduces car trips to a larger extent that what has previously been documented in the literature. Hence, nudging can be an effective tool to influence travel behaviour without having to resort to traditional regulatory measures such as taxes or restrictions, where the associated user cost is higher. While the behavioural change is initiated by the nudge experiment, it is facilitated from the fact that the app interface is multimodal. This suggests that interfaces where several modes of transport are integrated can play an important role for mode shifts: centralising mode specific information in one app improves accessibility for the user and in turn allow nudges to influence travel behaviour.

The main findings from the report are summarized below. The first section presents the effect of nudging on e-scooter behaviour, while the next section discusses substitution between e-scooter and ride hailing.

Additional e-scooter information increases e-scooter utilization

The direct effect of being nudged is found by considering outcomes of relevant search sessions, i.e. the 4.5 percent of sessions that met the nudge criteria. By comparing the behaviour of nudged individuals to those in the control group, we can identify whether and to what extent the additional e-scooter information from the nudge directly affected travel behaviours. Figure S2 displays the share of users in the treatment group (red bars) and control group (blue bars) that chose e-scooters (left panel) and ride hailing (right panel) for each experiment.

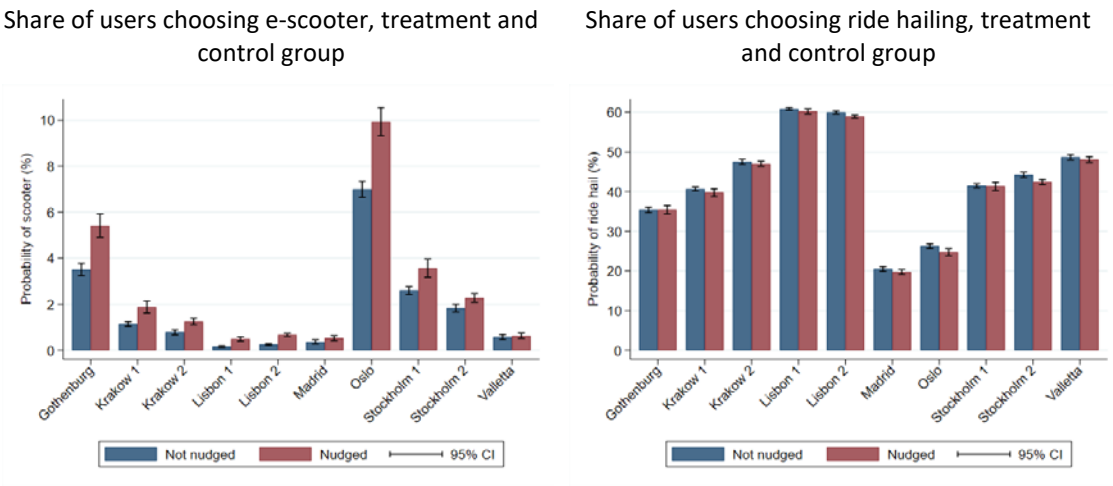

Figure S2: Outcomes of relevant search sessions, treatment and control group.

The trend is that the e-scooter share is higher and the ride hailing share lower in the treatment group compared to the control group, indicating that nudging affected travel behaviour in the intended way. The modal split is also distinctly different across experiments, not only among the treated users but also among the control group. However, it is difficult to compare the e-scooter effect to the ride hailing effect due to the difference in scale – a larger share of the relevant search sessions ended in ride hailing trips than e-scooter trips, because the nudge criteria limit relevant search sessions to users that are searching for ride hailing in the first place. To elucidate the effect of nudging, Figure S3 displays differences between those that are nudged and those that are not.

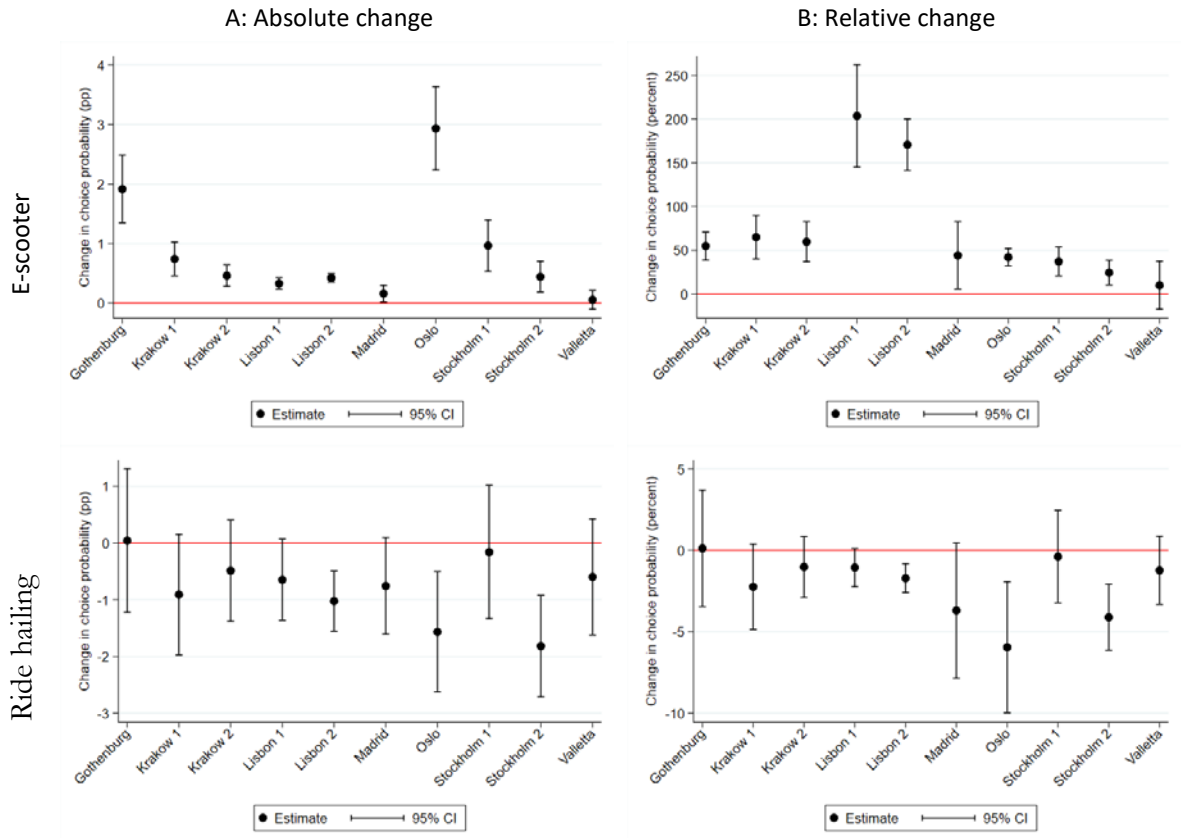

Figure S3: Effect of nudging on probability of choosing e-scooter (top) and ride hailing (bottom), including 95 percent confidence intervals. Absolute difference (left) and difference relative to share in control group (right).

Left panels display absolute differences, while the right panels display the relative size of these differences compared to outcomes for the control group. To explain the difference between the panels we use Oslo as an example, where 10 percent of nudged users and 7 percent of users in the control group chose e-scooter. An estimate of 3 percentage points in the top left panel for Oslo means that the nudging process caused an additional (10-7=) 3 percent of the relevant search sessions to result in e-scooters being chosen. The top right panel shows that this is a (3/7≈) 40 percent increase compared to the outcome for the control group.

The top row of Figure S3 shows that nudged users have a higher chance of booking an e-scooter compared to the control group, and that the treatment effect is statistically significant for all experiments except Valletta. The absolute effect is largest in Oslo (3 percentage points, corresponding to a 40 percent increase). The relative effect is largest in the Lisbon experiments, where about three times as many nudged users chose e-scooter (a 200 percent increase corresponding to 0.4 percentage points). The bottom row illustrates that the increased number of e-scooter trips are mirrored by a reduction in the number of ride hailing trips, although the estimated effects are statistically more uncertain.

For most cities (Lisbon and Valletta being the outliers) nudging increases the share of users choosing e-scooters by 40-60 percent. The fact that this pattern is fairly stable indicates that whichever (observed or unobserved) factors that are making e-scooters more popular to begin with are also increasing the effect of nudging. Further analyses indicate that one of the most important observed factors is the density of e-scooters. Both the effect of nudging as well as the share of users in the control group that chose e-scooters to begin with is higher when e-scooters are available in close proximity. This pattern holds true both

across cities and within experiments, which highlights the importance of density and visibility for e-scooters to be considered a viable option by users.

The effect of nudging in terms of e-scooter trips created is modest when only looking at the search sessions in which the nudging took place. For example, we estimate that the direct effect was 283 additional e-scooter trips in Lisbon and 273 in Oslo. This is not because the effect of nudging is small, but because only a small share of search sessions was considered to be relevant for nudging in the first place. However, users that were nudged at least once were more likely to conduct additional e-scooter searches and e-scooter trips subsequently. We find that about 3,800 additional e-scooter trips were conducted in Oslo and 1,400 in Lisbon over the duration of the experiment, as a result of nudging. This shows that people that are first presented with the additional e-scooter information are more likely to alter their behavior in the long term as a result. These predictions however are statistically more uncertain than when just considering user sessions relevant for nudging.

Additional e-scooter information reduces car use

Whether the reduction in ride hailing trips (bottom row of Figure S3) is smaller or larger than the increase in e-scooter trips varies across experiments. In the cities where e-scooters are most popular among the control group (Oslo, Gothenburg and Stockholm 1) nudging seems to increase the number of completed trips (ride hailing and e-scooter taken together). In remaining experiments, the reduction in ride hailing trips is larger than the increase in e-scooter trips. There are two likely mechanisms: First, users who would not consider e-scooters in the first place might see the additional e-scooter information as an annoyance. Second, users that are nudged might miss out on the available ride hailing options if they do not scroll down in the app.

In Oslo, where effects are largest in magnitude and most precisely estimated, nudging reduces the share of relevant search sessions resulting in ride hail trips by 1.6 percentage points. This constitutes about 55 percent of the additional e-scooter trips created. The remaining 45 percent of e-scooter trips caused by nudges were users that otherwise would have closed the app without booking a trip. Previous research on substitution patterns for rented e-scooters in Europe indicates that only 5-10 percent of e-scooter trips replace car trips. Hence, the in-app information distributed through the nudge is able to substitute car trips to e-scooter trips to a much larger extent that what has previously been documented.

In cities where nudging reduces the total number of trips, the share of deterred ride hail trips is even larger. An example is the second experiment in Lisbon, where the reduction in ride hail trips is about twice as large as the increase in e-scooter trips. Hence, for every additional e-scooter trip two relevant search sessions are deterred away from ride hailing. However, we do not know what the users did instead – they might have booked a car from a competing ride hailing service. This makes it more difficult to draw clear conclusions regarding substitution patterns for experiments in which nudging reduces the total number of trips.

Looking at the number of ride hailing trips per user over the whole duration of the experiment, differences between the treatment group and the control group are more noisily estimated. However, for Oslo where the effect is strongest, we estimate that users exposed to nudging in average are travelling 0.9 fewer kilometres by ride hailing, and 1.8 additional kilometres by e-scooter (while the e-scooter estimate is clearly significant, the ride hailing estimate is more uncertain). This indicates that 50 percent of the additional e-scooter kilometres caused by the nudge is diverted from ride hailing, which matches results from the relevant search sessions well.