Perceived accessibility and residential self-selection in the Netherlands

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EXTENDED ABSTRACT

Problem and research goals

The idea that the primary goal of the transport system is to increase accessibility rather than mobility levels is slowly gaining ground in transport policy (Akse et al., 2021; Handy, 2020). This is due to the growing realisation that prioritizing mobility (e.g. by building roads) does not improve accessibility for all and in the long term may negate initial increases in accessibility by facilitating further dispersion of activities (Farber and Páez, 2010; Ostermeijer et al., 2022).

The shift to promoting accessibility by proximity instead of mobility is accompanied by a shift from level-of-service indicators reflecting the performance of the transport system to spatial accessibility indicators that reflect the volume of opportunities that can be reached from a given location (Miller, 2018; Papa et al., 2016). Since proximity can overcome slow speeds (i.e. low level-of-service), cities generally offer, even when congested, higher levels of accessibility than rural areas (Levine et al., 2012; Mondschein and Taylor, 2017). Yet, self-reported evaluations of accessibility may not match with accessibility indicators based on spatial data (from here on *spatial accessibility*), undermining the representativeness of spatial accessibility indicators concerning how accessibility is perceived across regions (Gebel et al., 2011; Lättman et al., 2018; Pot et al., 2021).

A potential mechanism causing discrepancies between spatial indicators and self-reported evaluations is residential self-selection (Pot et al., 2021). People are likely to be unequally distributed across space based on their needs, abilities and preferences regarding accessibility. People who desire less accessibility or can cope with low levels of spatial accessibility through, for example, car-ownership may voluntarily self-select into rural areas and evaluate accessibility just as high as their urban counterparts (Van Wee and Geurs, 2011). Consequently, the translation of accessibility indicators based on spatial data into how accessibility is perceived may be biased if residential sorting mechanisms are not taken into account.

This paper aims to evaluate the role of residential self-selection effects in the spatial distribution in perceived accessibility. Specifically, using data from a self-administered survey in the Netherlands and applying the quasi-experimental method of propensity score matching, this paper estimates the differences in perceived accessibility between urban, semi-urban and rural areas if the population would be randomly distributed across space. This exercise enables examining the share of residential self-selection effects in observed differences in perceived accessibility and sheds light on which self-selection mechanisms are most relevant to take account of when evaluating accessibility based on spatial data.

Data and methods

This study uses data from a self-administered survey conducted in the Netherlands in 2020. The questionnaire covered activity and mobility patterns, accessibility preferences and satisfaction, and individual characteristics. The survey was distributed in three ways. First, 8,500 postal surveys were distributed in rural areas. A total of 1,619 questionnaires were returned, resulting in a response rate of 19%. Second, online data collection through promotion in local newspapers and social media yielded another 789 responses. Third, at the end of 2020, the survey was distributed online via the Dutch Mobility Panel (MPN) across the country, yielding 1,254 respondents (a response rate of 90%). After deducting the responses that could not be geocoded, the total sample size is 3,378.

The main outcome variable of interest is the perceived potential to interact with spatially dispersed opportunities denoted as perceived accessibility. This is measured using the 'Perceived Accessibility Scale' (PAC) developed by Lättman et al. (2018). This scale consists of four seven-point items that, considering how one travels, comprise the ease to do daily activities, the ability to live the life one wants, the ability to do all preferred activities, and satisfaction with perceived access to preferred activities (Cronbach's $\alpha = 0.90$).

Conceptually, the main problem of interpreting the observed differences in perceived accessibility across space as a pure effect of the built environment (BE) is that individuals in different development types are not identical and sorted according to factors that influence perceived accessibility in a certain environment. Of course, it is also not possible to compare an individual's perceived accessibility in two different development types at the same time. However, if almost 'identical' individuals living in different development types can be found, the difference in perceived accessibility of these two individuals can be interpreted as a pure treatment effect of the BE. Based on a cluster analysis with a gravity-based potential accessibility indicator (i.e. number of jobs within 5km weighted by distance) that serves as a proxy for the number of reachable opportunities as a clustering variable, respondents are classified into three BE-types: urban, semi-urban and rural.

Matching individuals between BE-types is based on the propensity score, the conditional probability that an individual receives treatment (e.g. living in an urban area instead of a rural area), given relevant covariates (e.g. car ownership, accessibility preferences). After matching the average treatment effect (ATE) of the built-environment on perceived accessibility is defined as the expected difference between two individuals with a similar propensity score in the treatment and control area. The difference between the observed differences between BE-types (OBE) and the ATE can be interpreted as a residential self-selection effect (SSE). That is, the reduction or the increase in the difference between perceived accessibility in two development types due to residential sorting based on needs, desires and abilities.

Main results

Differences in perceived accessibility appear to be less pronounced than differences in accessibility measured as the number of jobs that can be potentially reached. This lack of differences in perceived accessibility compared to differences in spatial accessibility may be a sign of preference-based residential sorting.

There are some significant differences across BE-types regarding sociodemographic characteristics that are presumably related to preferences regarding accessibility. The average age declines with urbanity potentially reflecting different desires concerning accessibility. Larger household sizes in semi-urban and rural areas may reflect the need for space which may be easier to find there than in urban areas. Car ownership is higher in rural and semi-urban areas than in urban areas. This may reflect both a coping mechanism to deal with lower levels of accessibility and a selection mechanism as people with access to a car can more easily live further away from urban centres. Individuals with a low level of education, who are on lower incomes or have some form of a mental or physical disability that hinders them during travel were not found to be overrepresented in a particular BE-type.

Relevant attitudes for accessibility also significantly differ across space. A latent variable based on a factor analysis reflecting the desire for many near opportunities takes on average lower values in rural areas than in semi-urban and urban areas. Compared to urban areas, attitudes to private motorized transport are more positive in urban areas, while attitudes to public transport, albeit to a lesser extent, display an opposite picture. Accordingly, the preference to live near a PT stop is most prominent in urban areas.

From the ATE estimations, it appears that the OBE in perceived accessibility between BE-types is smaller than the ATE for all comparisons. This can be interpreted as evidence for residential sorting mitigating the negative effect of lower accessibility levels on perceived accessibility when compared to areas with higher levels of accessibility. The ATE is largest for urban areas compared to rural areas and smallest when compared to semi-urban areas. This is partly a result of actual differences between spatial accessibility. diminishing marginal utility from spatial accessibility. Overall, the results show that differences in accessibility between areas found employing indicators of accessibility based on data on the BE only may not reflect the spatial distribution of perceived accessibility. Considering residential sorting effects may lead to a better understanding of how accessibility is perceived and better design of responsive policies.

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