Living life in the fast lane: a urban car and bike speed comparison analysis

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Short summary

The aim of the study is to compare with empirical tracking data the speed of bikes and cars in the same urban setting, which is the city of Bari. We aim to answer to three research questions:

1) Who is faster between car drivers and bike riders in a heavy-car trafficked urban setting like the city of Bari?;
2) How does this comparison exercise change based on the time of the day, on the distance and on the sociodemographics of the bike riders?;
3) What is Value of Travel Time Savings (VTTS) deriving by taking the fastest mode?

Keywords: Car use, Traffic congestion, Travel time, Urban cycling, Value of Travel Time Savings (VTTS).

1 Data

For this analysis, two main datasets will be used. The following subsections will briefly discuss them.

1.1 Bike trips data

1 year data of individual bike trips Origin-Destination (OD) tracks (September 2022 to September 2023) is used in the analysis. All the individual trips have start and end timestamps, GPS distance covered and travel time. Gender and age of the correspondent user support the individual OD pair, along the information about the time of the trips. The dataset contains almost 110.000 trips, of which 81.000 are commuting trips (which are the object of the analysis).

1.2 Car network data

For the same time period, the detailed street network of Bari containing real speed segments based on historical traffic data is downloaded. The detailed network is splitted in segments and every segment has 24 speed profiles, one for every hour of the day, reflecting the average real-speed that drivers experience when taking that segment.

2 Methodology

The base idea of the methodological process is to identify and select only appropriate robust bike travel based on distances, age group and gender and, for this subset of selected trips, find the travel time of the corresponding simulated fastest car trips based on real-world speeds. This is done by:

2.1 Removing atypical bike trips base on distance, gender and age specific interquartile ranges

The first fundamental step to compare bike and corresponding simulated car trips is to preprocess bike trips and to remove unappropriate bike trips which deviate too much from the mean of the distribution. We will use the interquartile range within 0.25 and 0.75 quartiles to keep robust and appropriate bike trips to be compared to corresponding car trips. As we expect the mean and the variance of bike travel times to be significantly different based on the distance class, age class and gender, interquartile ranges will be found for all the combinations of the subcategories.

2.2 Estimating, for every bike trip travel time, the corresponding car trips travel time

For every single robust bike trip mantained, the corresponding car trip's travel time will be estimated using the street segments real speeds. Car trip geometries of the shortest paths between the correspondent bike trips ODs will be snapped onto the real-speeds street network at the hour profile of the corresponding bike trip to estimate the travel time of the car trip.

2.3 Estimating the Value of Travel Time Savings (VTTS) by comparing the travel times of the two modes

Difference in travel times between car and bikes will be used to estimate the Value of Travel Time Savings (VTTS). Italian Value of Time (VOT) for car commute will be used to give an economic reflection to the value of time saved.

3 Expected results

We expect to find travel times mean differences between the two modes per distance classes, age and gender. In this way, we will be able to proof if and for what types of trips bike is a valid substitute for car. By calculating differences in Value of Time, we can provide economic justification in terms of travel time cost to the choice of one mode over the other for specific trips.