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Change in the refueling location choice during a gasoline shortage: a GPS data based analysis

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Background

Sudden gas shortages can occur for various reasons (natural disasters, strikes, geopolitical events, etc.) and restrict mobility. It induces an isolation of individuals as well as a negative impact on the economy which authorities must address by providing gasoline to strategic areas. This study aims to enhance how people refuel during a gasoline shortage in order to help governments understand and act efficiently during these periods.

Methodology

A large GPS dataset (~1% representativity with an average of 1250 tags per person an day) from mobile phones activity in the Paris region before and during the October 2022 refineries strike has been used to conduct this study. The following methodology was applied (Fig. 1):

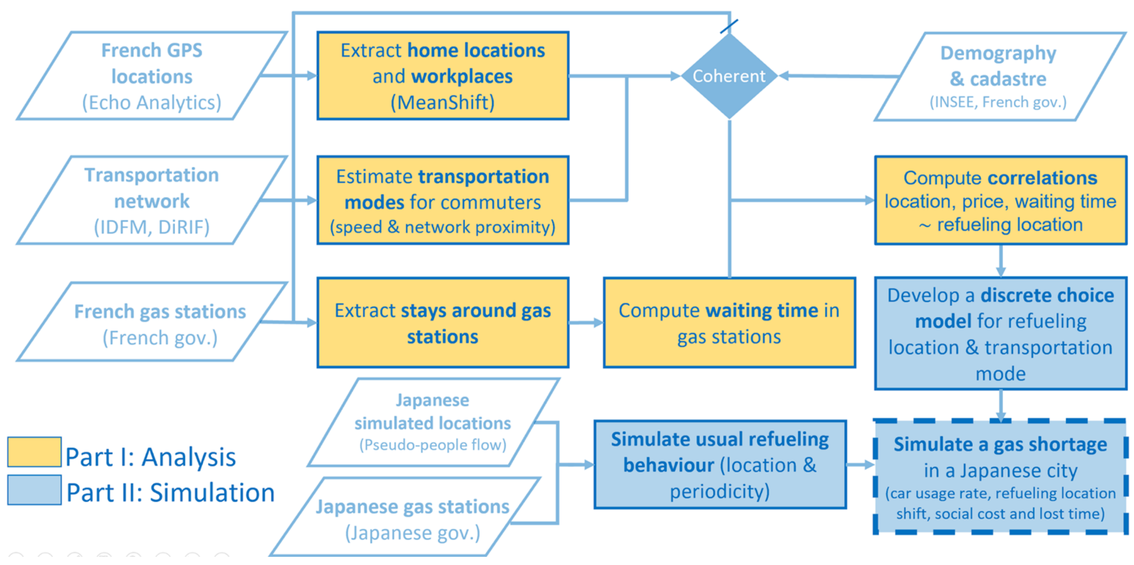

Fig. 1. Methodology flowchart of the study

The strike in refineries led to a massive gas shortage in the Paris region and a raise in fuel prices (Fig 2). The offer diminished while the demand remained still, which made queues emerge. The waiting time in these queues at gas stations (GS) can be observed on the GPS data (Fig. 3).

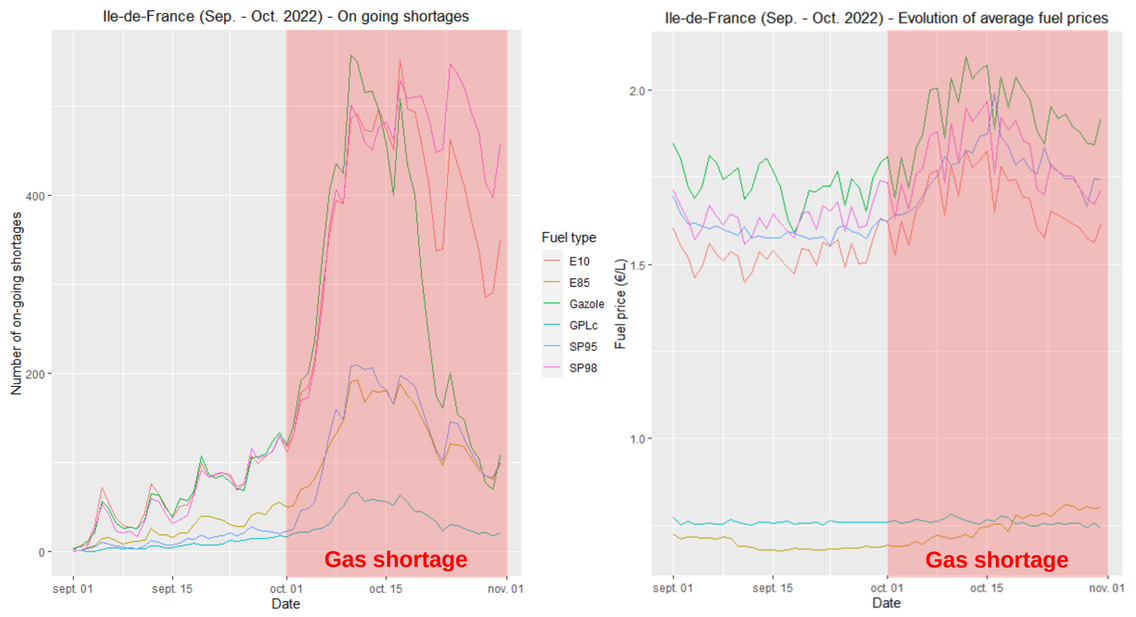

Fig. 2. Gas shortage and fuel prices in Ile-de-France by fuel

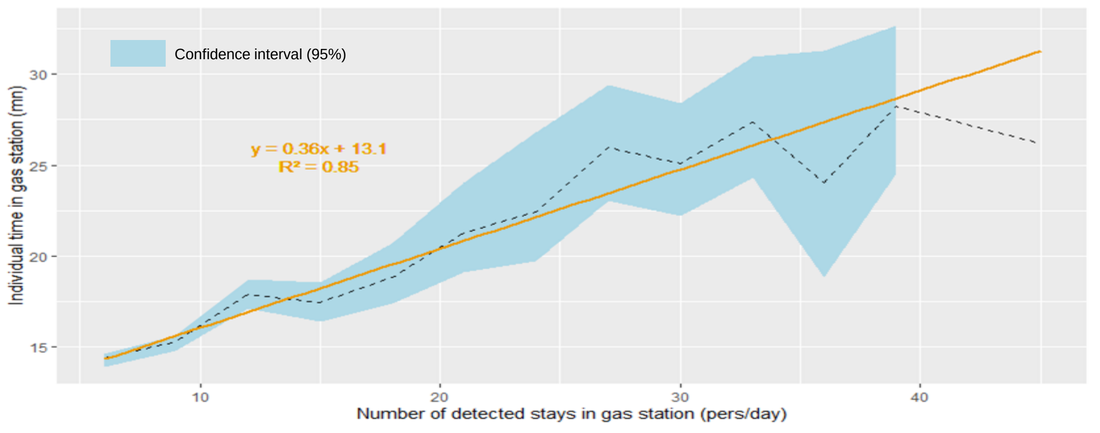

Fig. 3. Relationship between visits and waiting time in GS

Results

This new GPS approach applied in the urban units of Mantes-la-Jolie (France) and Kanazawa (Japan) corroborates previous results in the literature: drivers refuel mostly close to their house or on their commuting path close to their workplace, both places appearing as attractive during a shortage (Fig. 4). The best tested model (Fig. 5) predicts the refueling location choice with a 40% accuracy (8 times better than a random choice). Same results were observed in Ishikawa, with highly significant changes in mobility behaviour in affected areas (Fig. 6).

Fig. 4. Choice of GS on commuting path

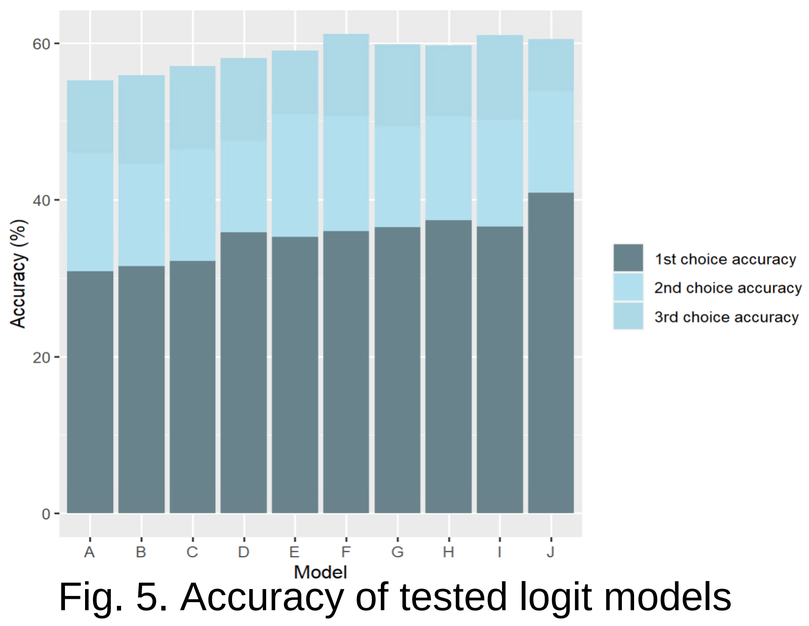

Fig. 5. Accuracy of tested logit models

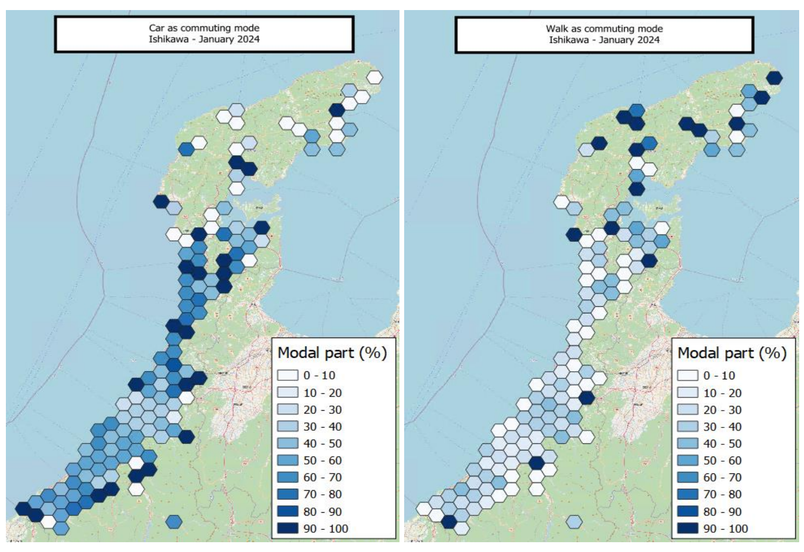

Fig. 6. Modal parts in Ishikawa (Jan. 2024)