

Enhanced Passenger Characterisation through the Fusion of Mobile Phone Records and Airport Surveys



9th SESAR Innovation Days

A case study of Madrid-Barajas Airport

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Intermodality and air transport

Previous work on this topic

Data sources

Case study: objectives and results

Conclusions & future research



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Intermodality and air transport

EU vision

- European Commission's 2011 White Paper on Transport focuses on the need for an **optimized multimodal** transport system in which **passengers** travel **from door to door in a seamless, efficient and environmentally friendly way**.
- With regards to aviation, the "Flightpath 2050 – Europe's Vision for Aviation" report envisages a **passenger-centric** air transport system **thoroughly integrated with other transport modes**, with the ultimate goal of taking travellers and their baggage **from door to door predictably and efficiently** while **enhancing passenger experience**.

Enhanced integration with ground transportation network



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Intermodality and air transport

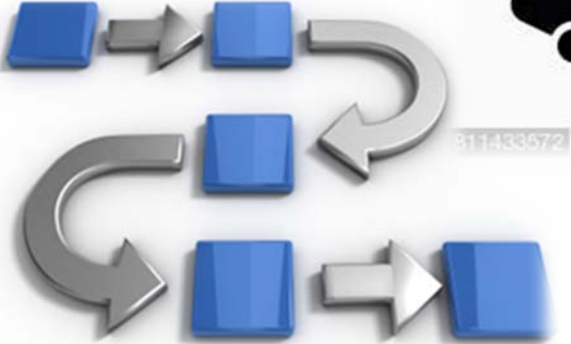
Physical infrastructure



Information systems



Operational processes



Business models



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Previous work on this topic

In recent years, different studies have explored how to improve knowledge on passenger behaviour based on innovative data sources:

Mobile phone records



Geolocated data from Apps



Public transport Smart card data



GPS registers from vehicles



Credit card transactions



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Previous work on this topic

In particular, the authors have been working with mobile phone records for several years:

- “Big Data Analytics for a Passenger-Centric Air Traffic Management System”, SESAR Innovation Days 2016
- “Understanding Door-to-Door Travel Times from Opportunistically Collected Mobile Phone Records”, SESAR Innovation Days 2017
- “Analyzing Door to Door Travel Times Through Mobile Phone Data”. 8th International Conference on Research in Air Transportation (ICRAT 2018)



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Previous work on this topic

SIDs 2019:

- Extension of the geographical scope to capture international trips
- Pilot project with AENA to complement EMMA surveys



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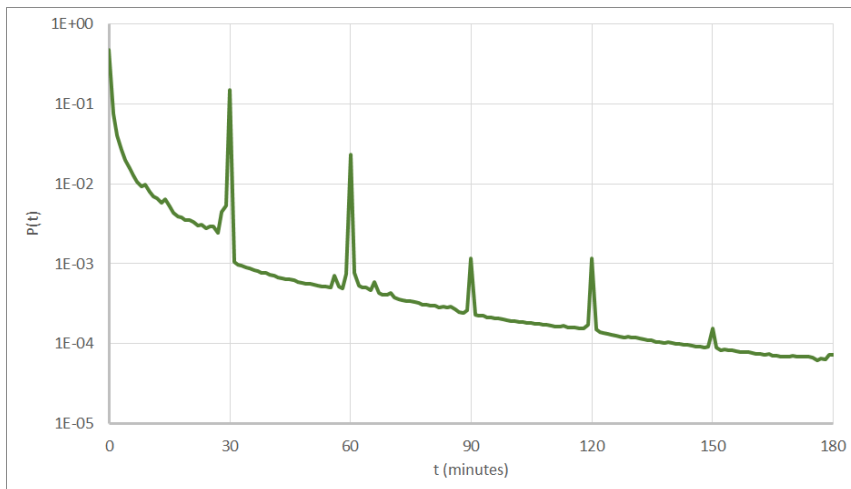
Data sources

Mobile phone records

Timestamp and cell to which the user is connected for every interaction of the phone with the network

Sociodemographic data for each user (age and gender)

Sample of around 27% of the population



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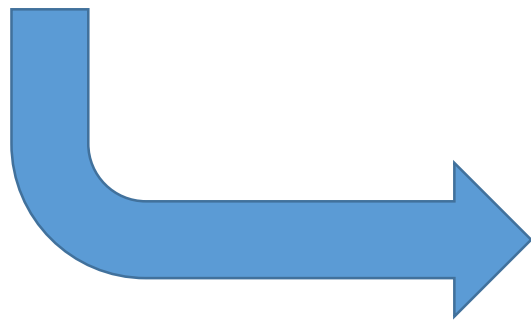


Data sources



Our data set also includes the registers generated by mobile registers abroad.

There exist some external databases (e.g. <https://opencellid.org/>) that store the location of some mobile network cells.



We can now analyse international trips!



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Case study

The objective of the case study was to explore how information extracted from mobile phone records could be used to complement the passenger characterisation surveys performed at Madrid-Barajas airport.



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Case study - Objectives

Two main objectives:

- Validate the quality of the information that can be obtained by mobile phone records
- Fill some of the gaps identified in the survey:
 - Workers & visitors
 - Real destination
 - Asymmetries
 - Others



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Case study - Scope

Two different weeks were analysed:

- 7th-13th June 2018
- 14th-20th November 2018

Different information extracted from mobile phone records:

- **Trips characterisation:** ground origin and destination, access/egress modes, times at the airport, transfer/point to point
- **Passenger tours characterisation:** go/return, duration of the stay and purpose
- **Passenger profiling:** age, gender, home location
- **Workers and short-term visitors:** volumes at different hours of the day, for different days of the week



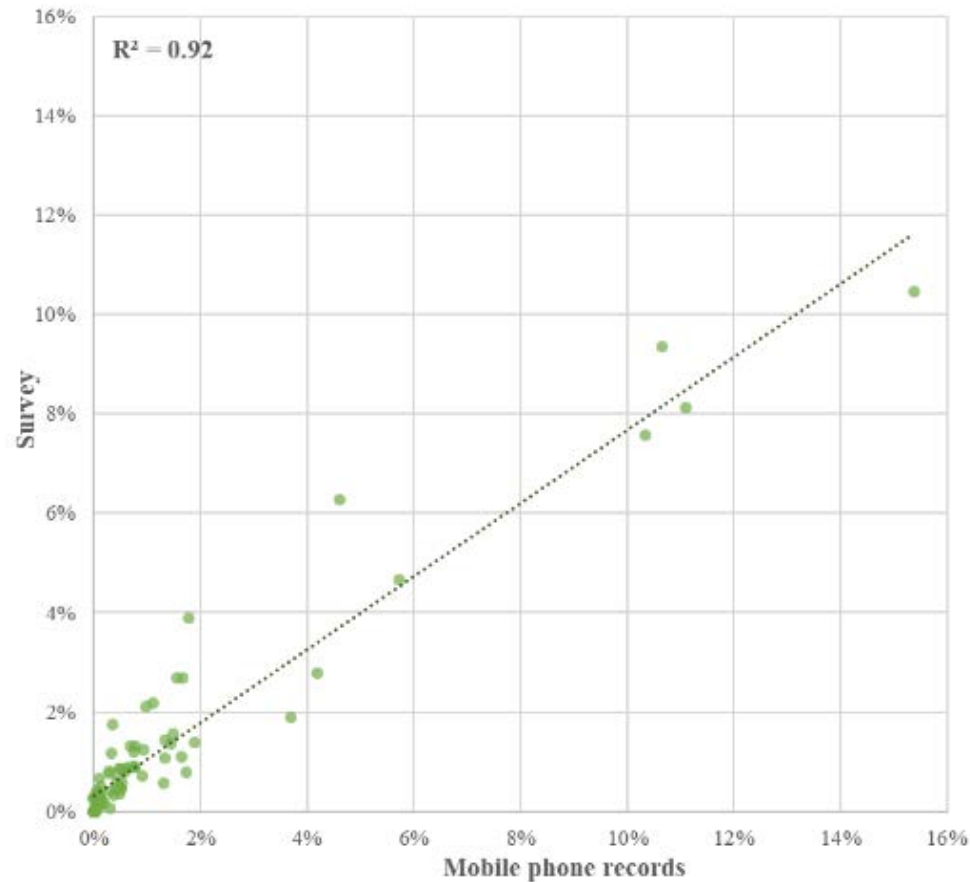
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Case study - Results

Distribution of observed abroad trips of passengers residing in Spain by destination country

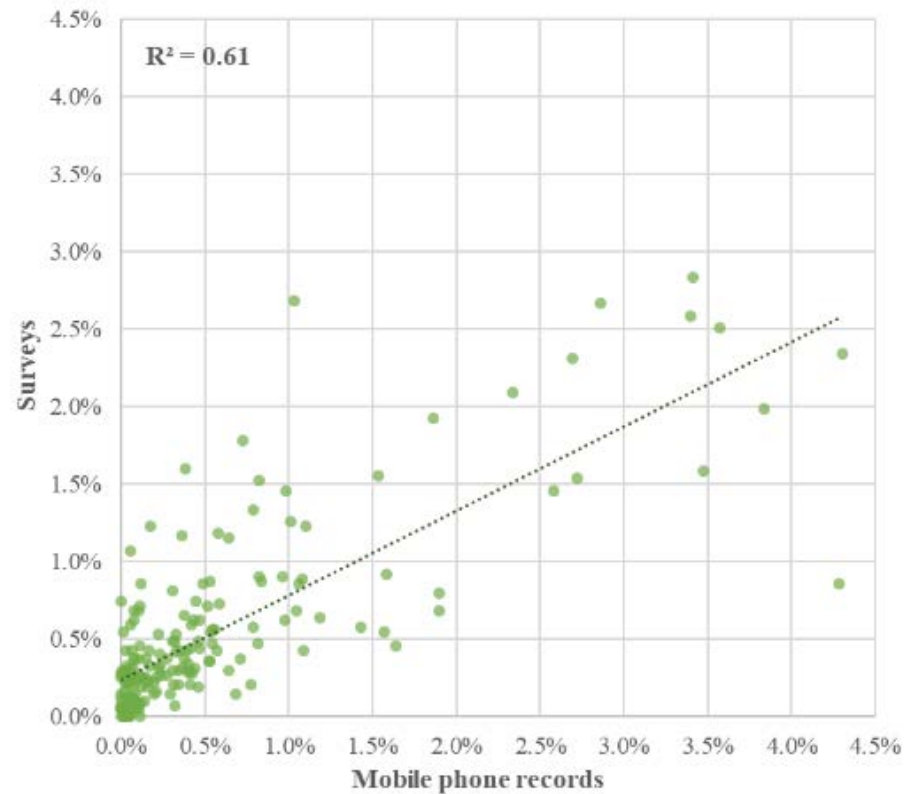


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Case study - Results

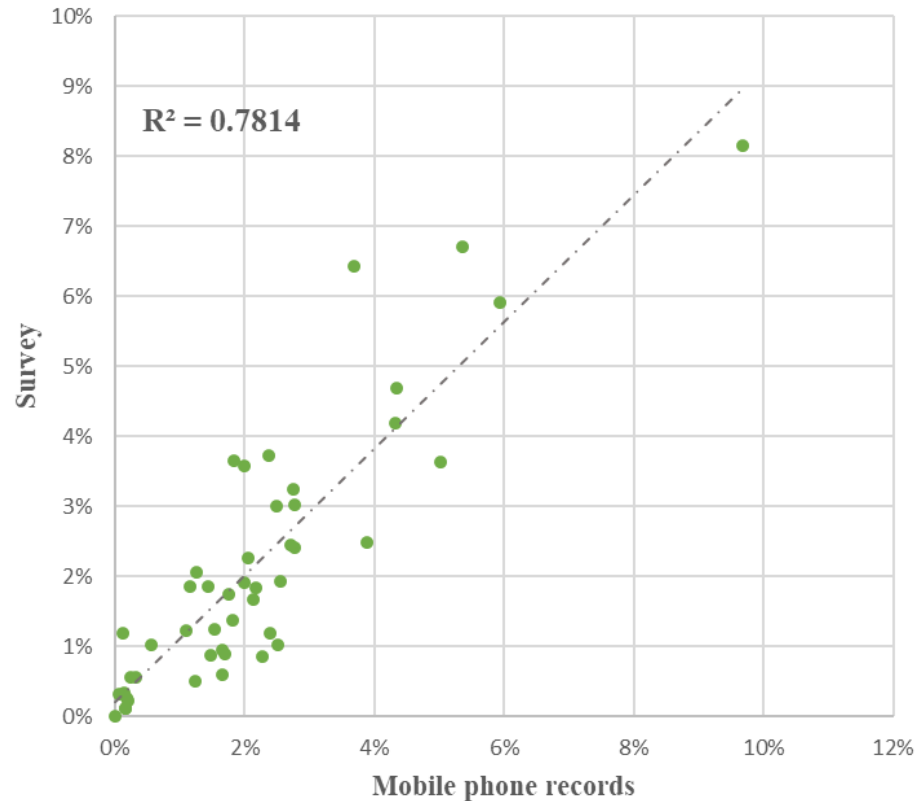
Distribution of observed abroad trips of passengers residing in Spain by destination airport





Case study - Results

Distribution of origins at NUTS-3 region for the trips that depart from Madrid Airport



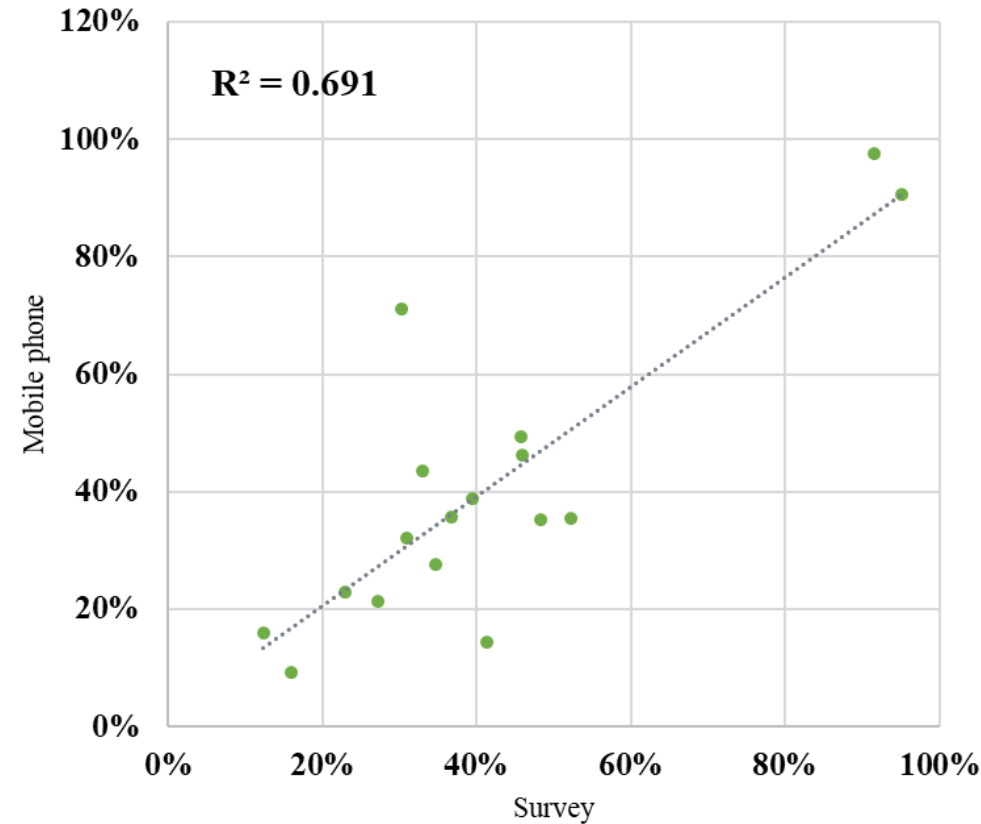
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Case study - Results

Distribution of the share of road access to the airport for trips that started in other NUTS-2 region than Madrid



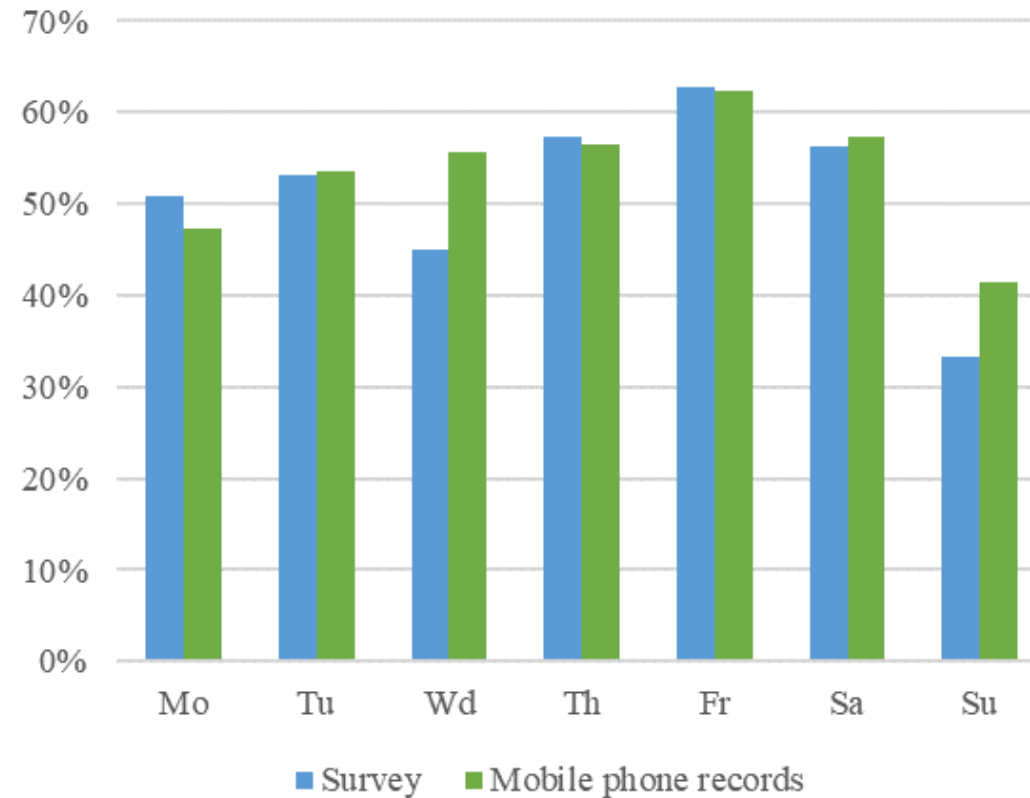
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Case study - Results

Rate of 'go' trips among domestic flights depending on the weekday

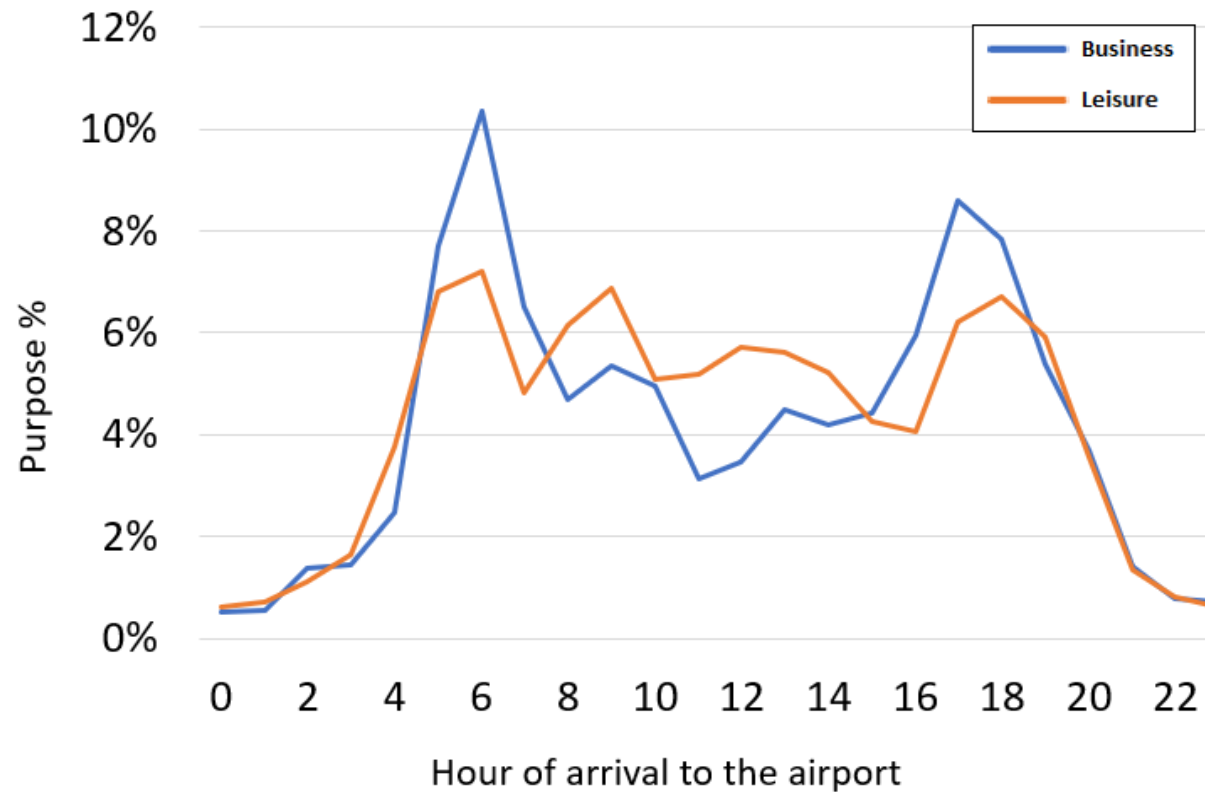


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Case study - Results

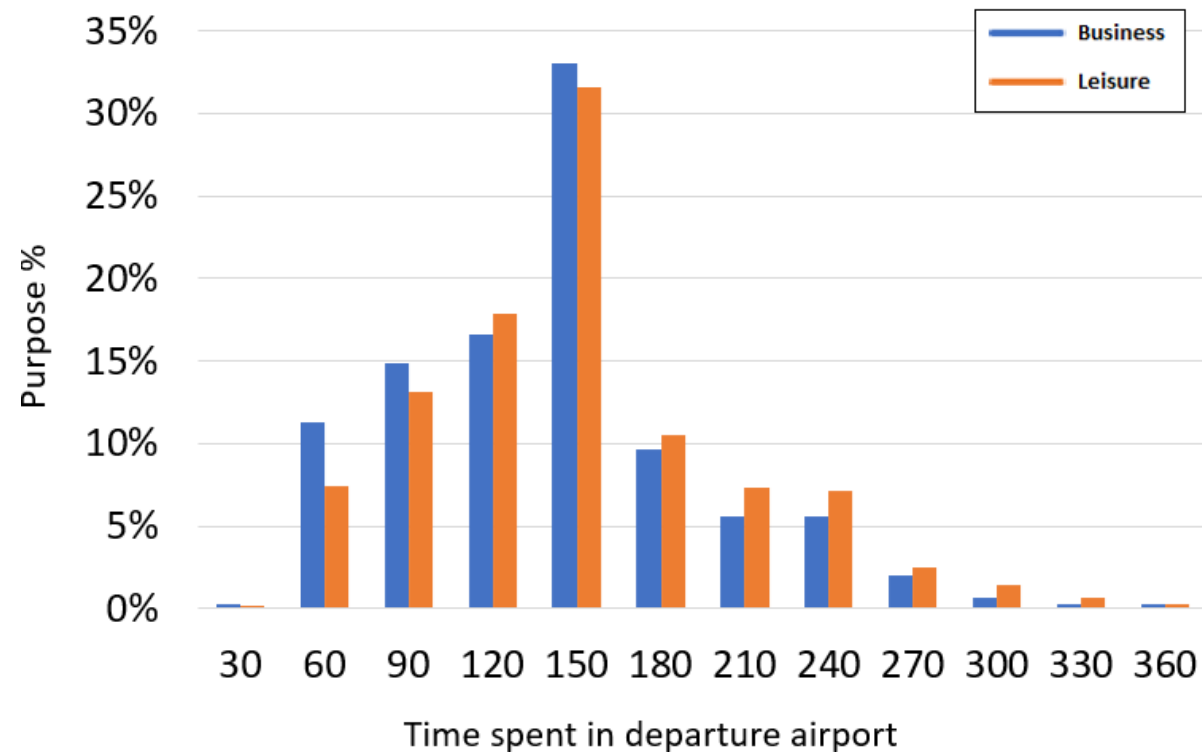
Hourly distribution of business/leisure trips





Case study - Results

Time spent at the departure airport for business/leisure trips

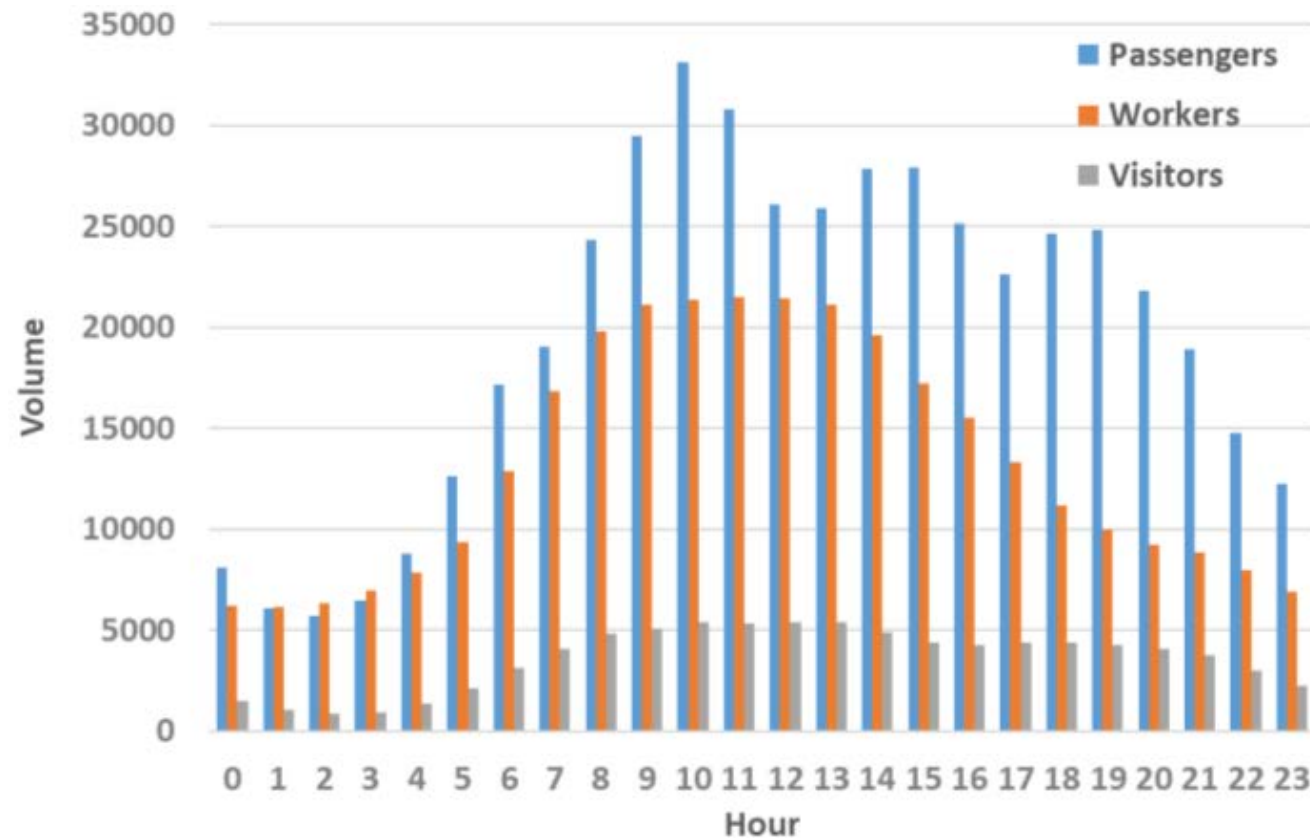


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Case study - Results

Volumes of passengers, workers and visitors for different hours of the day at the airport





Conclusions

- Mobile phone registers have proven to be a valid source of information on air transport passenger behaviour
- The geographical scope of the studies based on mobile phone data can now be extended to cover international flights
- A methodology that characterises air transport tours as business or leisure has been developed thanks to the combination of surveys and mobile phone records
- Mobile phone records have been used to provide information about those segments of population that are not covered by the survey: inbound passengers, workers, short-term visitors



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Future research

- Mobile phone registers open the possibility of analysing other airports and periods where passengers are not being characterised due to budget restrictions
- A better understanding of international destination and connection flows can be obtained through additional analysis of mobile phone registers abroad
- Combine mobile phone records with other fine-grained data sources that provide information about the access/egress legs of the trip
- The availability of huge samples of fine-grained mobility data unlocks the possibility of developing long-distance transport simulation models, enabling the evaluation of the effect of different intermodal solutions with an unprecedented level of realism



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Thank you very much for your attention!

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