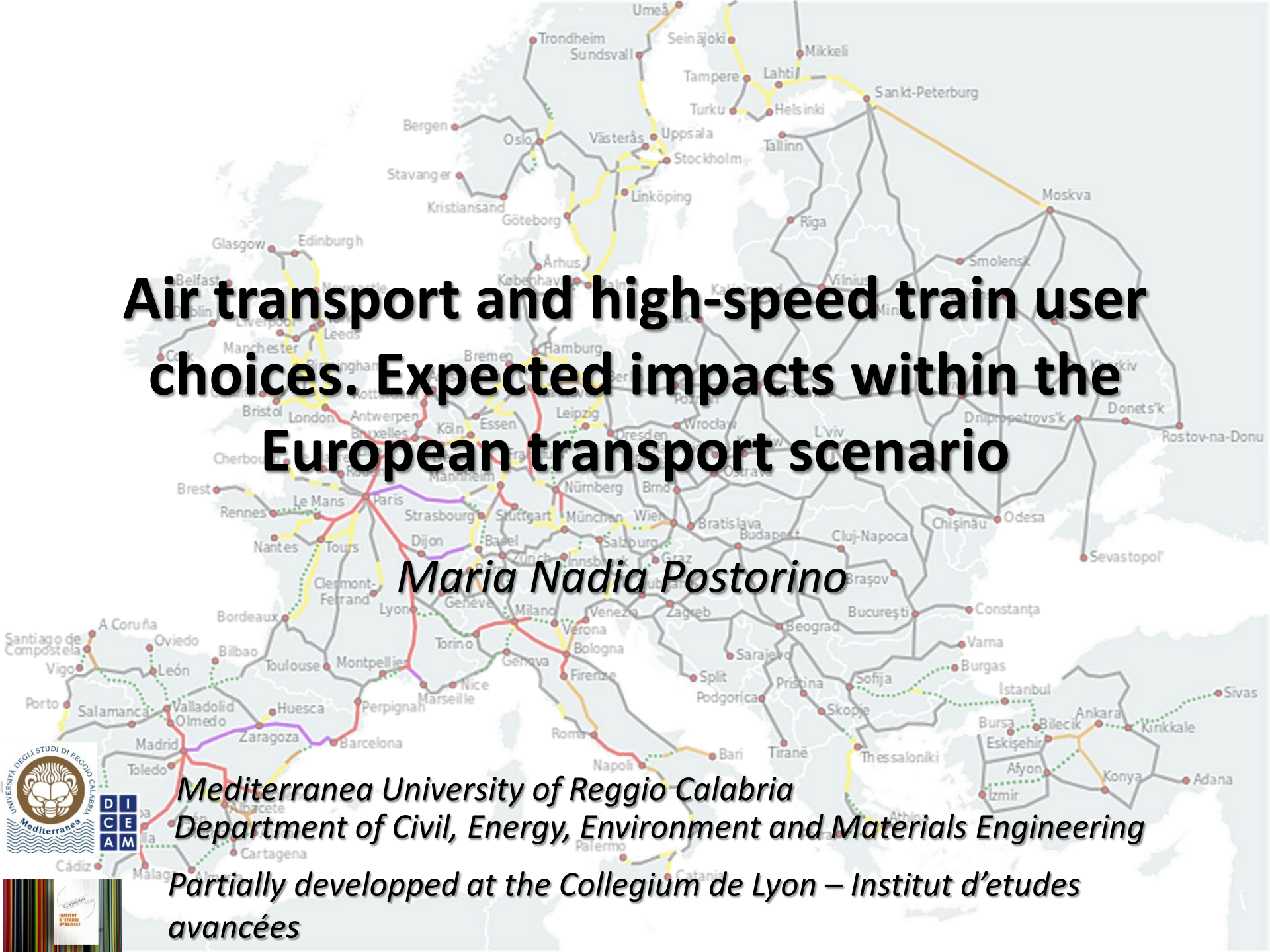

Air transport and high-speed train user choices. Expected impacts within the European transport scenario

Maria Nadia Postorino

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Department of Civil, Energy, Environment and Materials Engineering

Partially developped at the Collegium de Lyon – Institut d'etudes avancées

Framework

- Airport movements => linked to carried passengers

⇓

Main contributors to the airport carbon footprint

(*and noise levels*)

- HSR/HST vs air transport
- User choices depending on socio-economic factors => observed demand levels (HST and air passengers)
- Airport trend (pax and mov) and related airport carbon effects (*macro analysis*)

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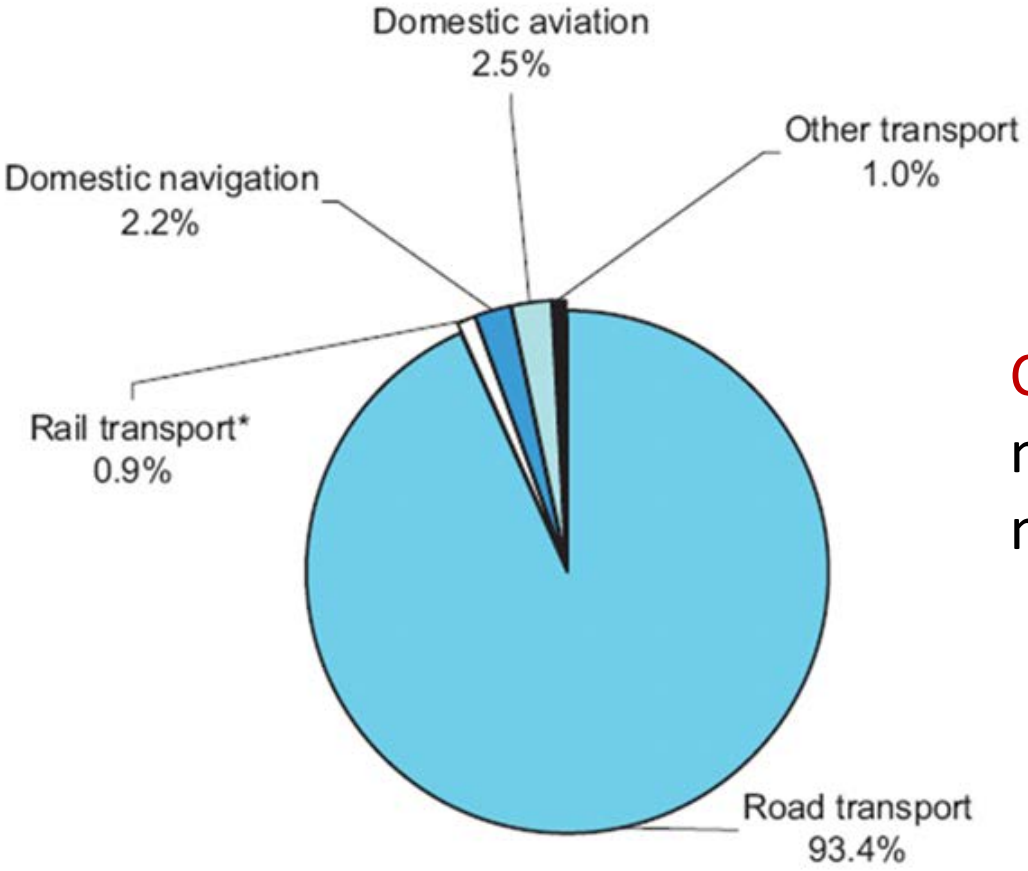
Transport carbon impacts

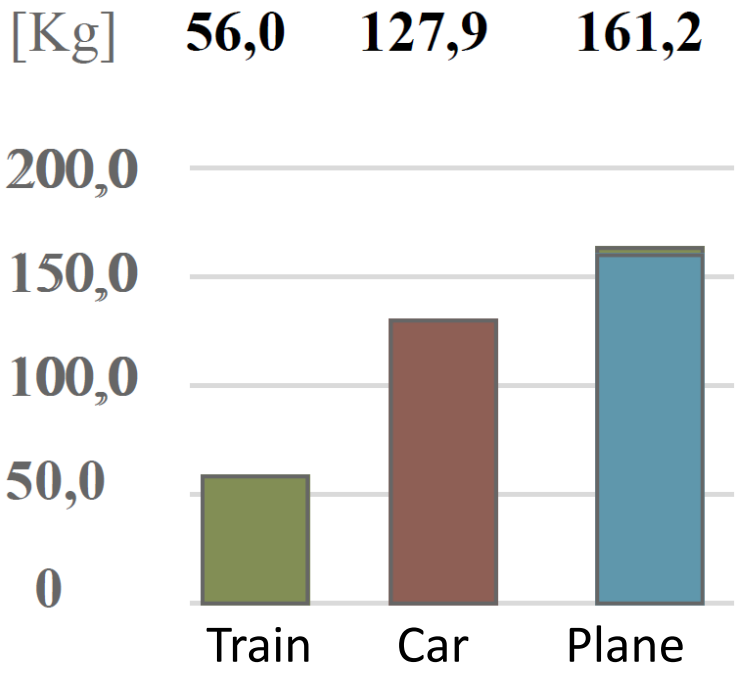


CO_2 emissions: one of the most important GHGs => many efforts to reduce them

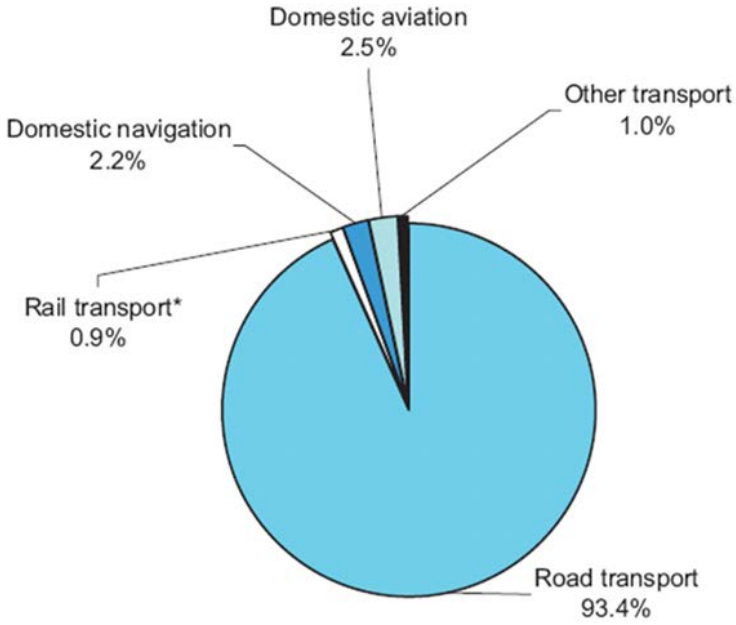
*Rail transport covers only diesel and some coal-powered trains

Greenhouse gas emissions by transport mode
(source: European Environment Agency)

Transport carbon impacts



(Source: EcoPassengers)

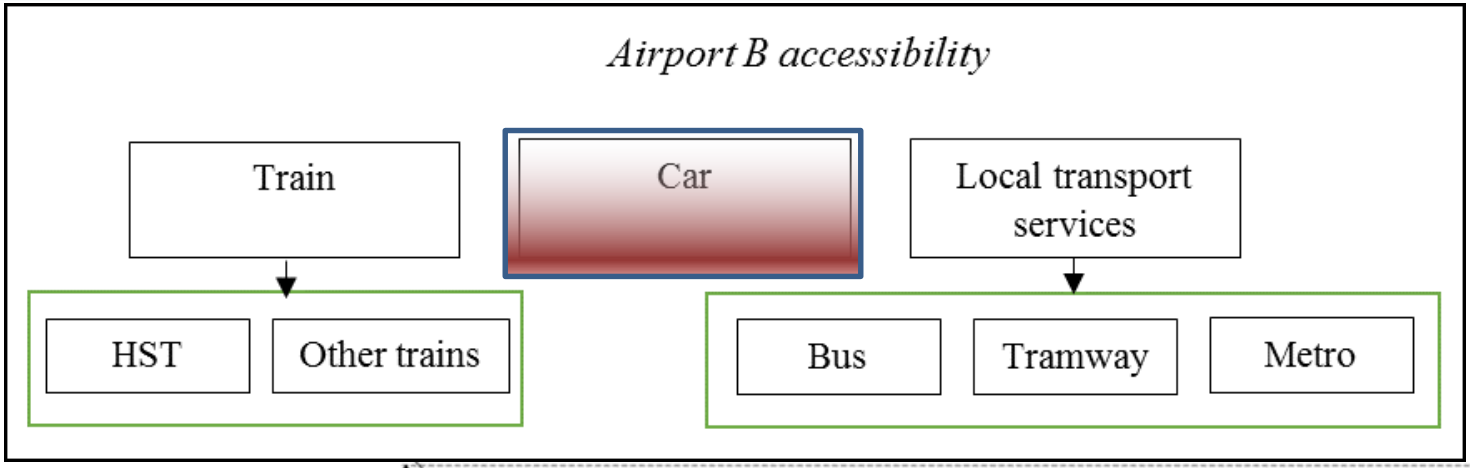


Carbon dioxide emissions

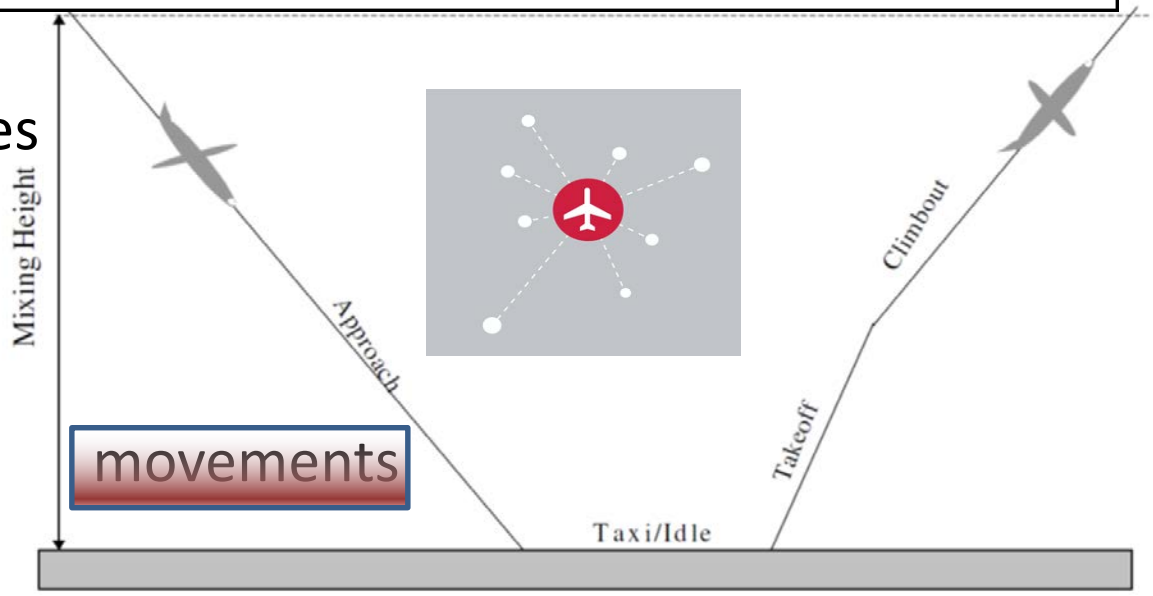
City pair: *Reggio Calabria - Milan*

Airport movements and carbon footprint

passengers

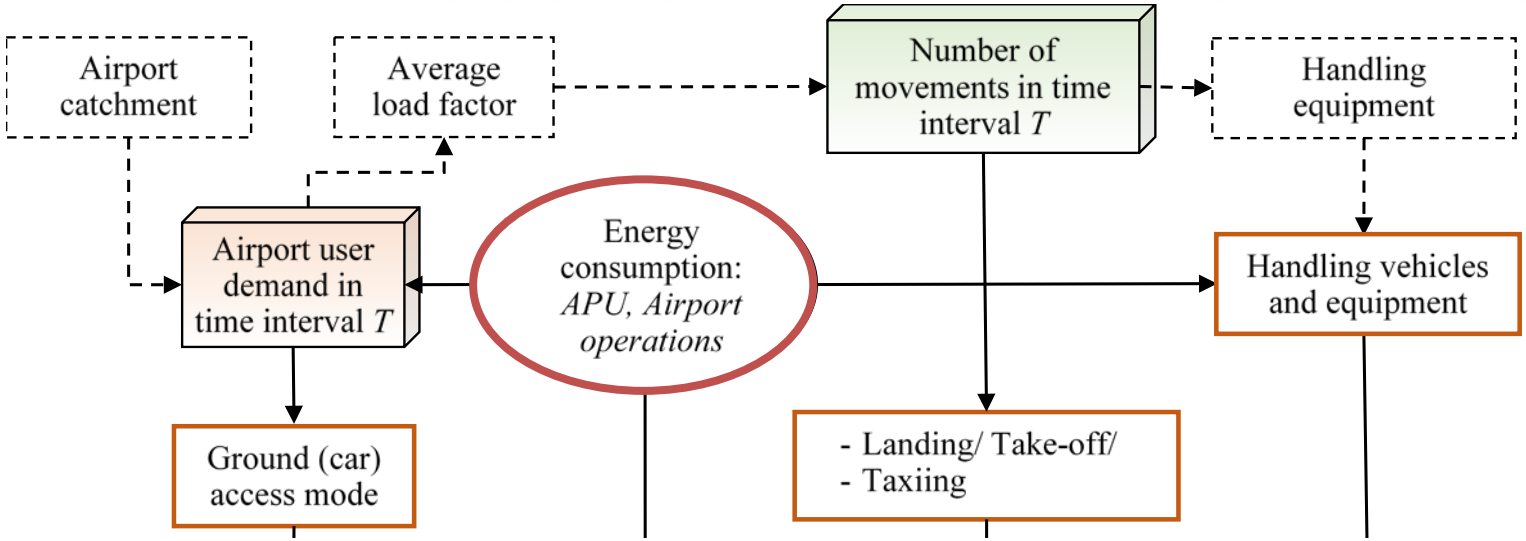


Passengers, movements:
relevant transport variables



Airport movements and carbon footprint

(*Postorino and Mantecchini, 2014*, JATM, 37C)



emission sources

$$UCF_{RV\text{-}MS} = TA_{MS} / RV$$

- RV transport relevant variable
- MS CO_2 source due to RV
- TA_{MS} CO_2 total amount due to MS

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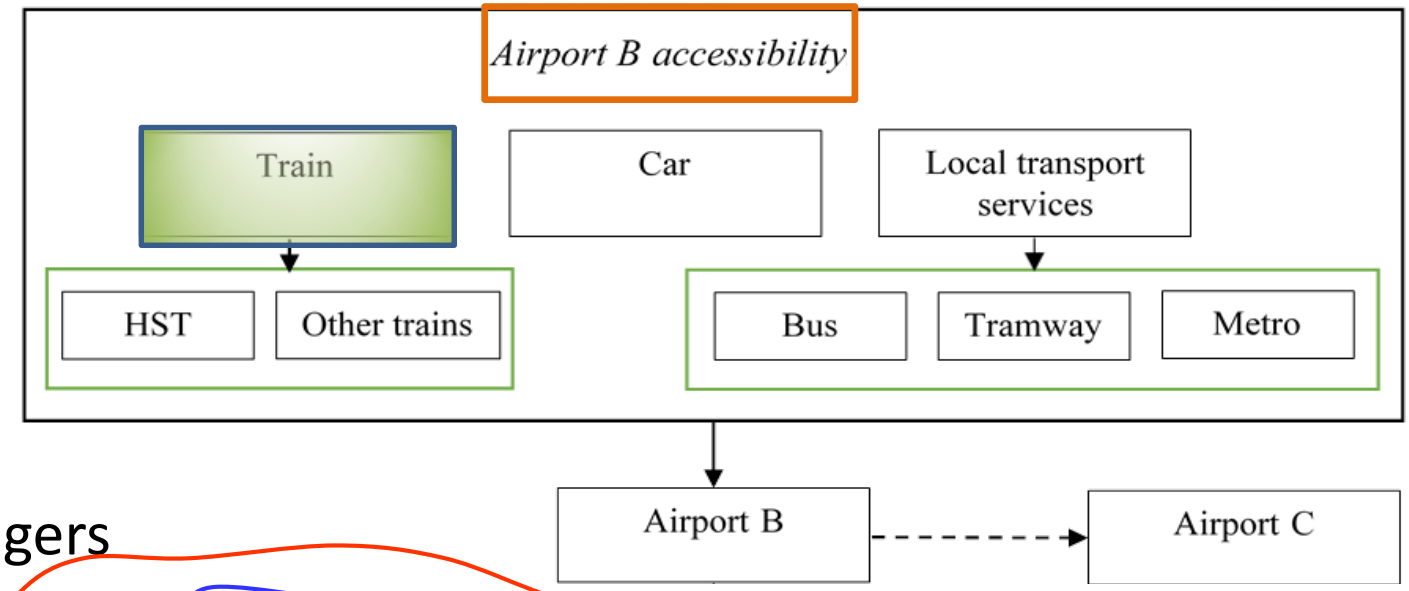
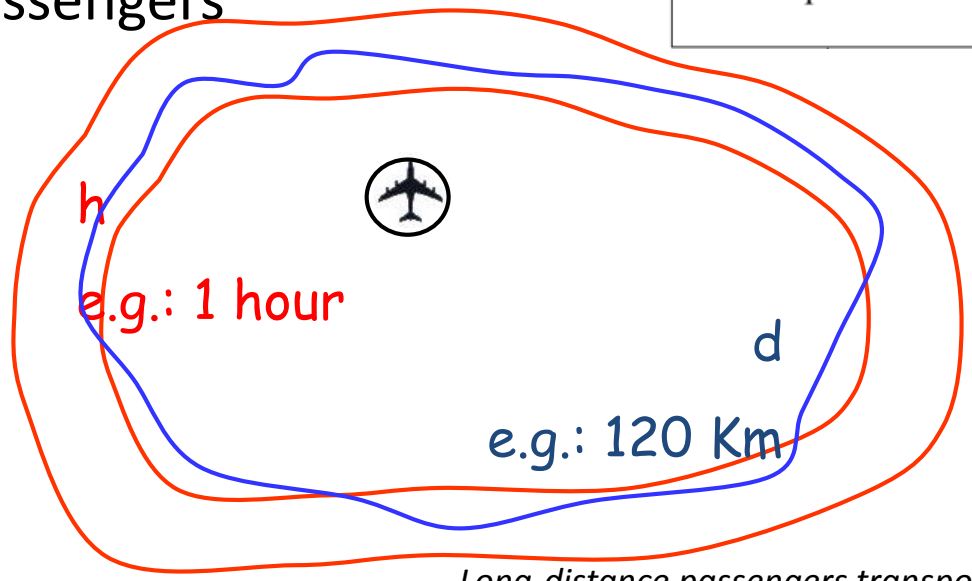
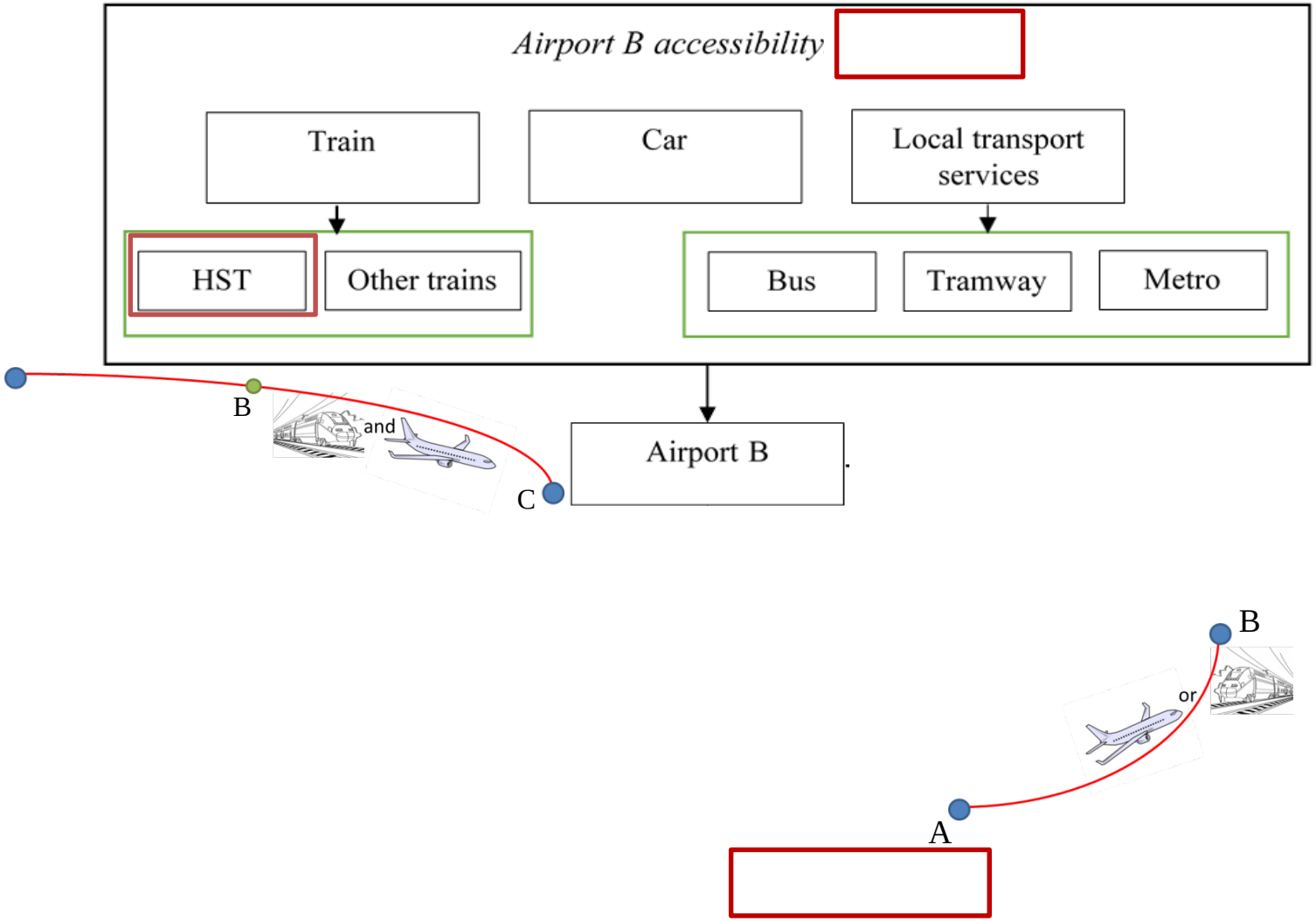
HSR/HST vs air transport



passengers



HSR/HST vs air transport



co-modality (EC, 2006): "*use of different modes on their own and in combination*" to get "*an optimal and sustainable utilisation of resources*"

HSR/HST vs air transport

Air/rail co-modality could produce benefits at:

- local level: reduction of the airport carbon impact
- global (*e.g. European*) level:
  - decrease of short-haul air trips => *more frequent* => *more environmental pollution*
  - increase of airport spare capacity => *reallocated to long-haul flights*
  - decrease of air congestion both along airways and at airports => *improve travel safety and level of service*

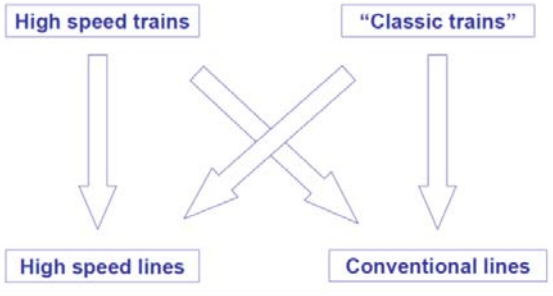
High-Speed Rail/Train system

What is « high-speed »?

- Three key elements:
  - Infrastructure (existing or dedicated allowing more than 250 Km/h; allowing 200 Km/h and reducing travel times on O/D pairs)

  - rolling stock (trains made by traction units coupled together, speeds > 250 km/h or ~ 200 Km/h with high quality services; conventional trains at 200 km/h satisfying some criteria)

  - operating conditions



"high-speed" = not associated to speed in itself *sic et simpliciter!*

Framework

- Airport movements => linked to carried passengers

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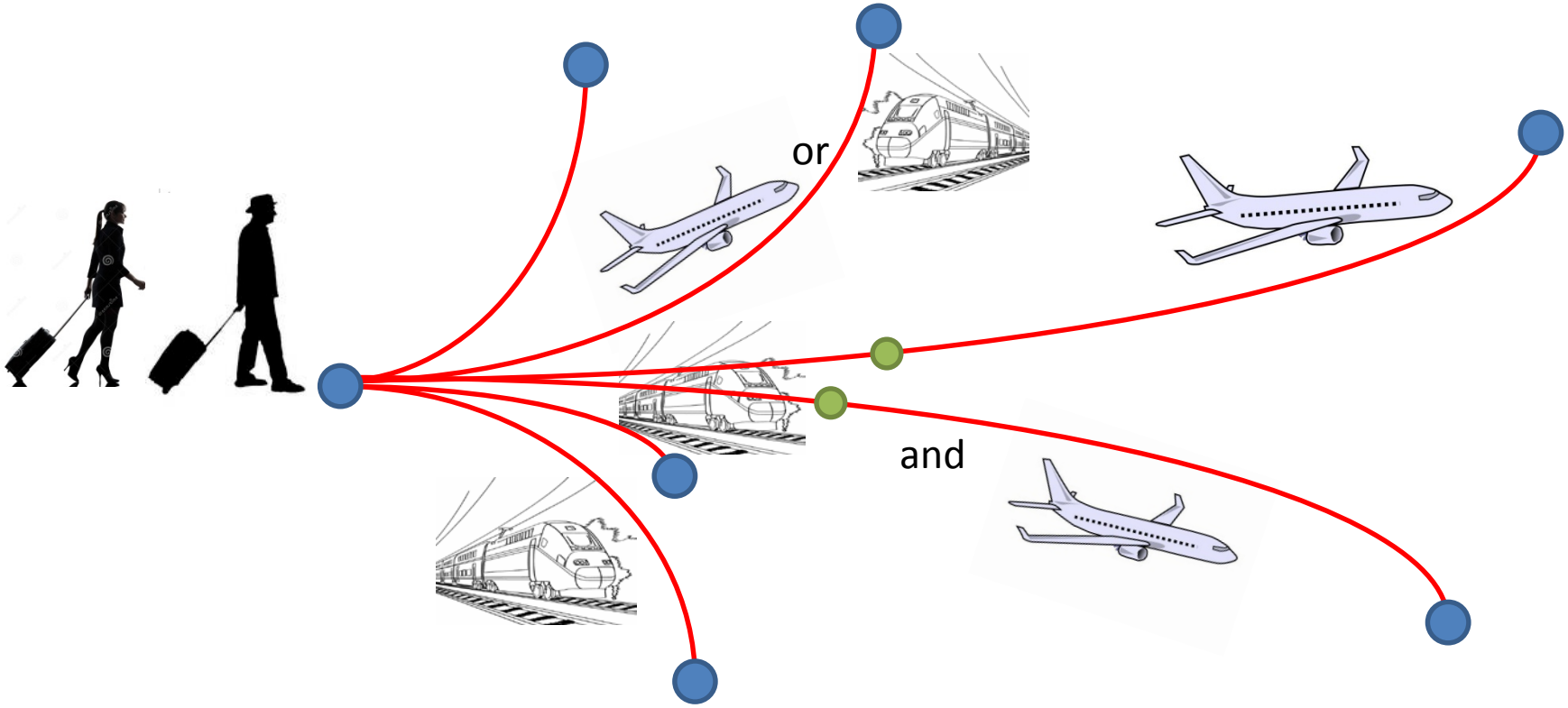
Long distance user travel choices



See for example (but not the only one) Albalate et al. / Journal of Transport Geography 42 (2015)

Long distance user travel choices

Travel choices
(Why? When? Where? How?)

Many studies!

Many hypotheses

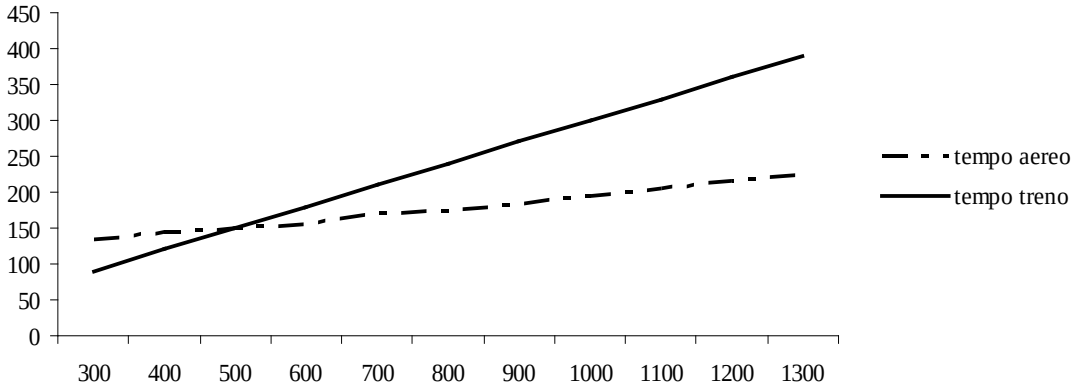
$$U_{u,j} = V_{u,j}(\mathbf{X}_{u,j}) + \varepsilon_{u,j}$$

Several functions

Attributes

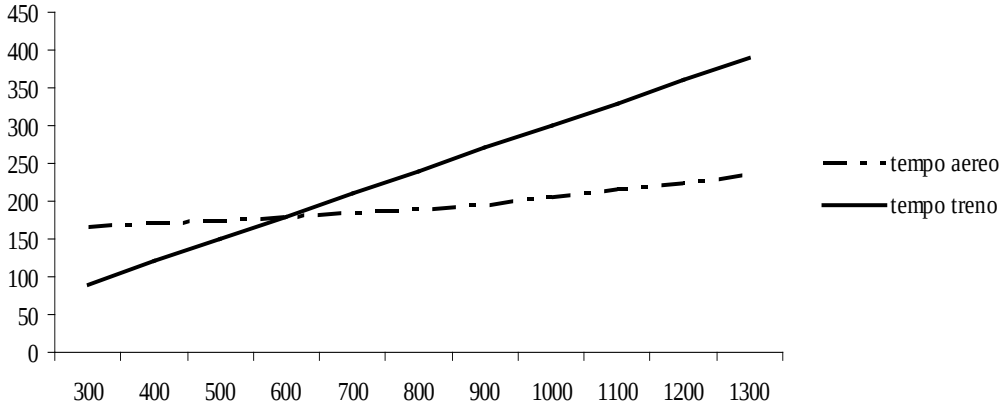
Socio economic factors	Level of service factors
Age	Access/egress time
Sex	Travel time
Income	Waiting time
Kind of employment	Transfer time
….	Fare
	Frequency
	Reliability
	Comfort

User travel choices



Train vs. air generalized costs

Level of service variables



Train vs. Air generalized costs – increased airport accessibility time

Framework

- Airport movements => linked to carried passengers

⇓

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(and noise levels)

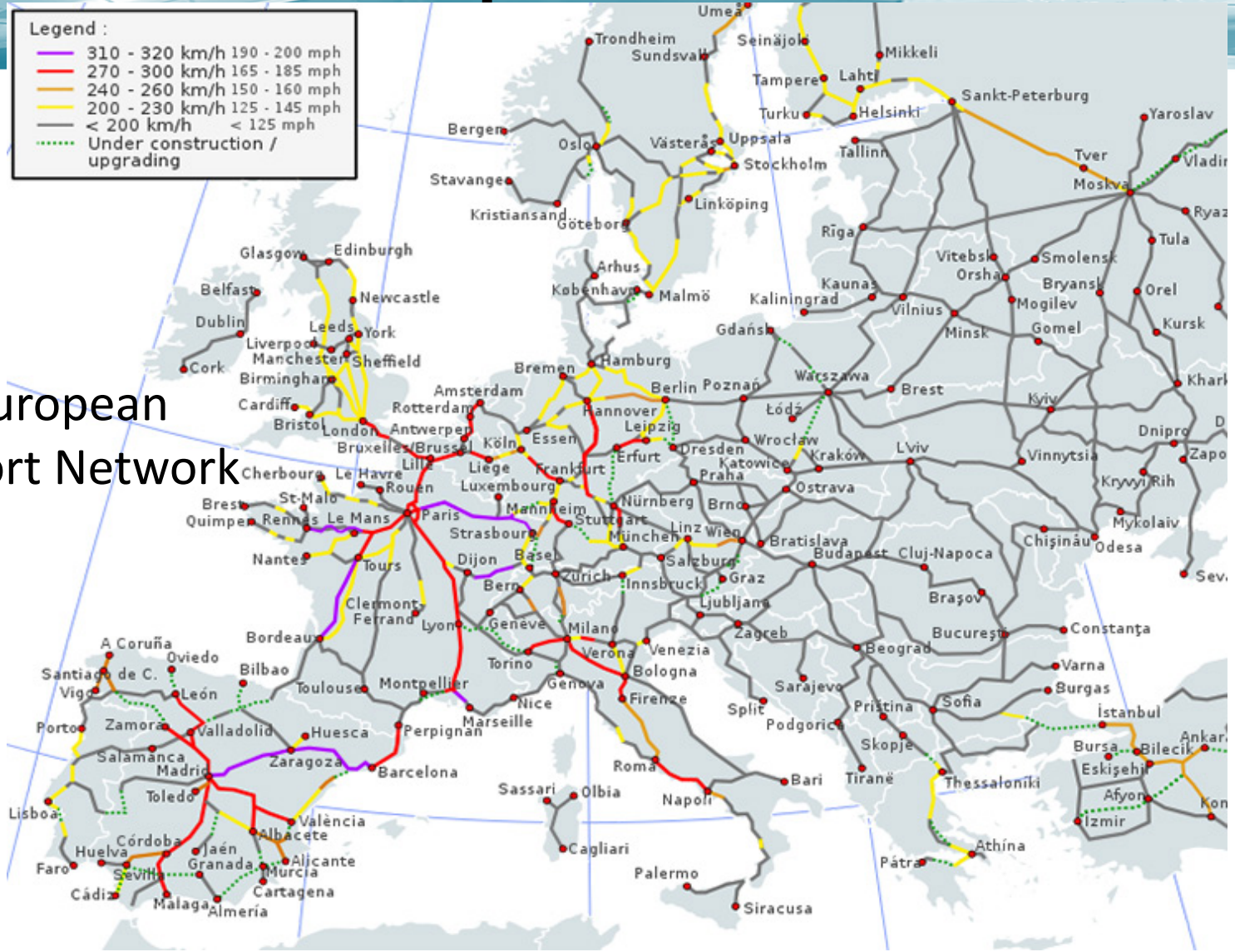
- HSR/HST vs air transport
- User choices depending on socio-economic factors => observed demand levels (HST and air passengers)
- Airport trend (pax and mov) and related airport carbon effects *(macro analysis)*

Airport carbon impacts

Methodology

- European context: aggregate pax and mov Country data (*Western EU countries where HS systems are well developed*)
- Figures
  - National/international (intra EU/extra EU): trends
  - HS vs. air passengers: modal share and average flight usage factor
- Two cases: Italy and Spain

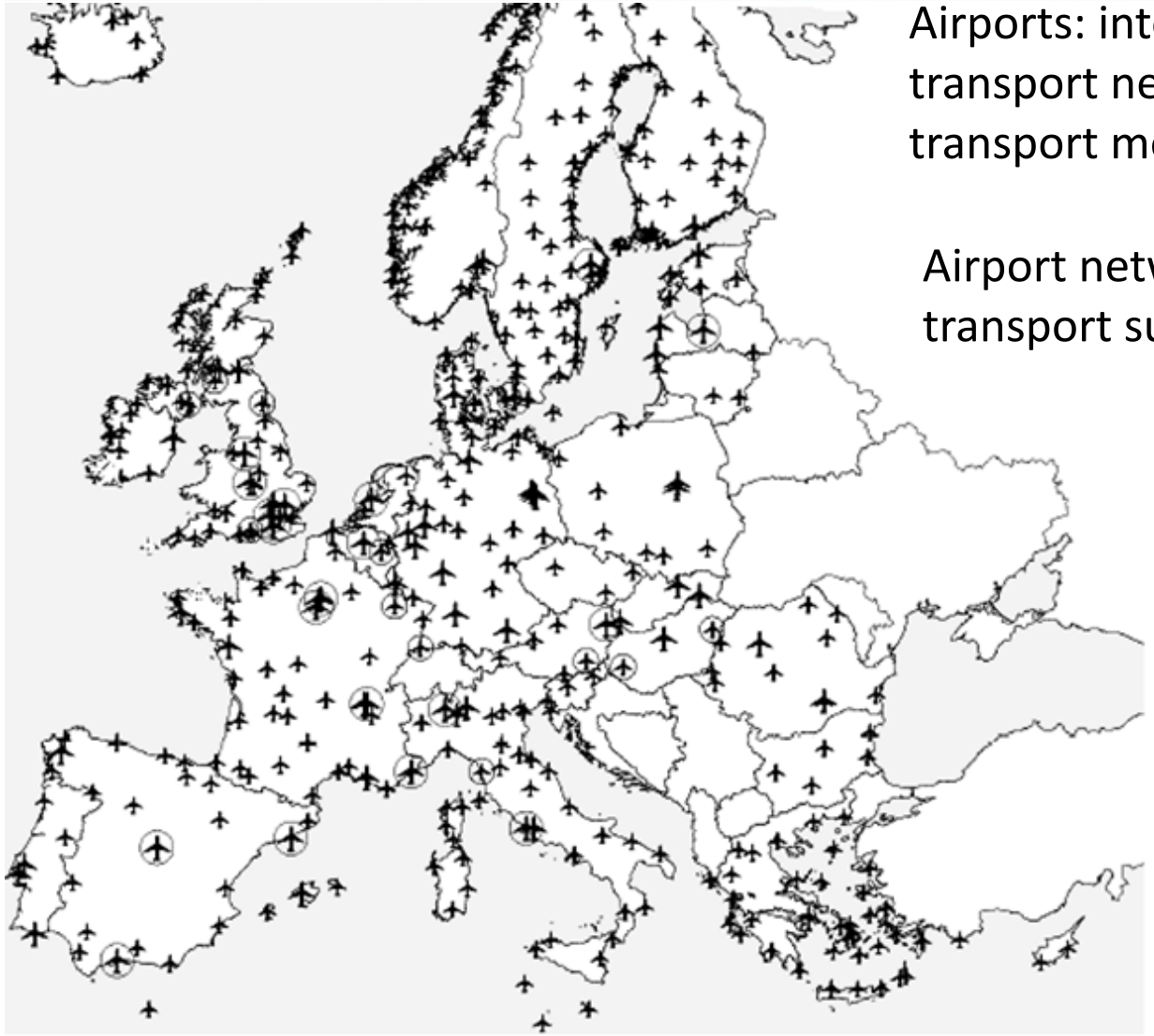
European context



Trans European Transport Network

Many HSR systems all over EU

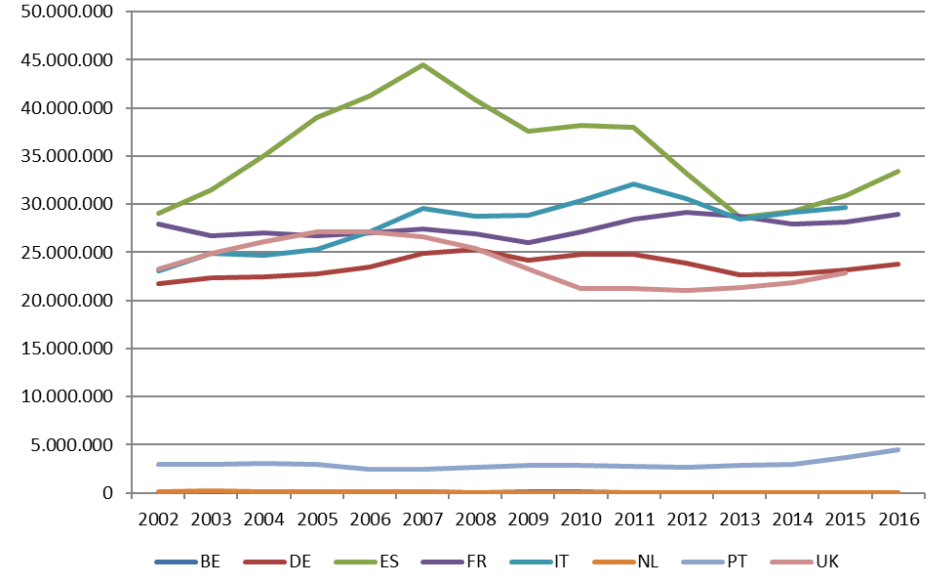
European context



Airports: intermodal nodes of a wider transport network that includes more transport modes

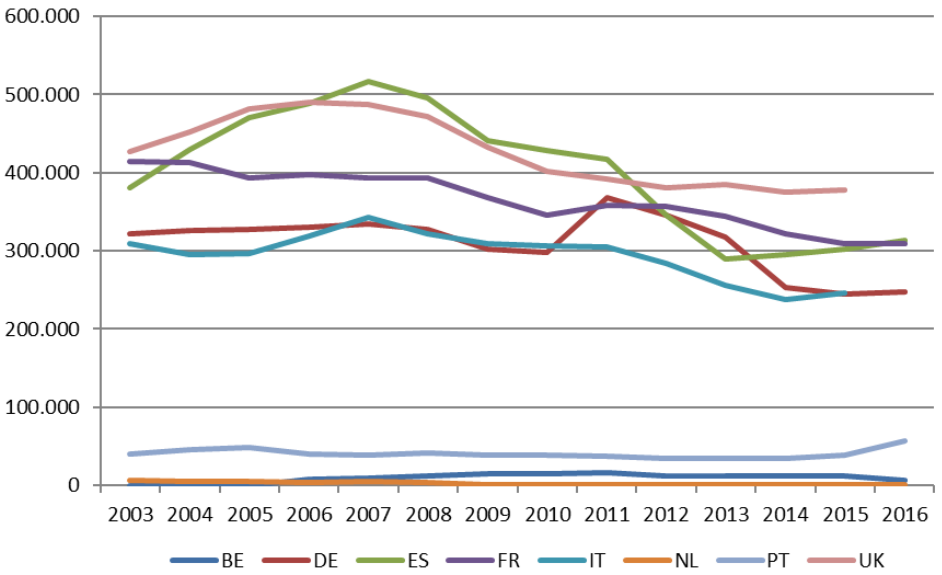
Airport network connected with the transport surface network

European context



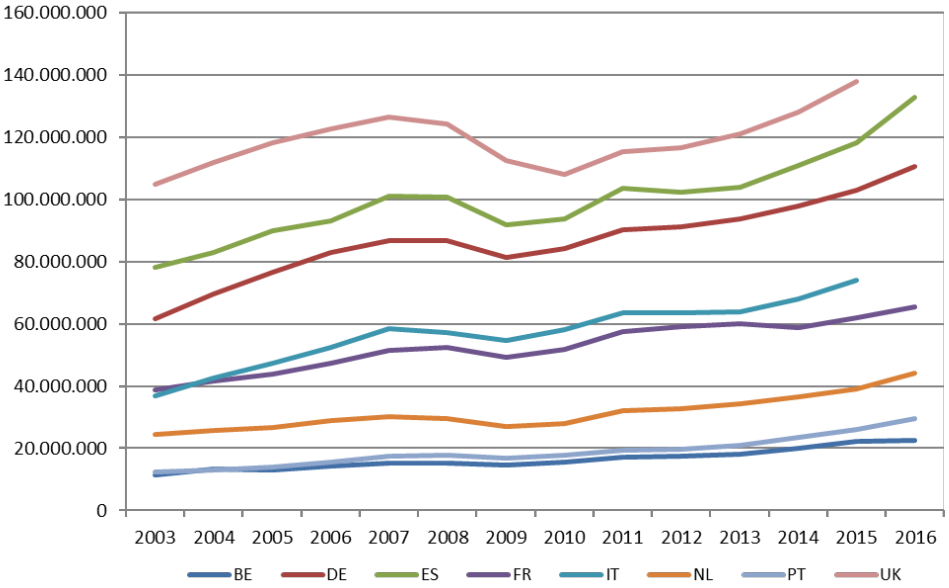
National air passenger traffic

National air movements



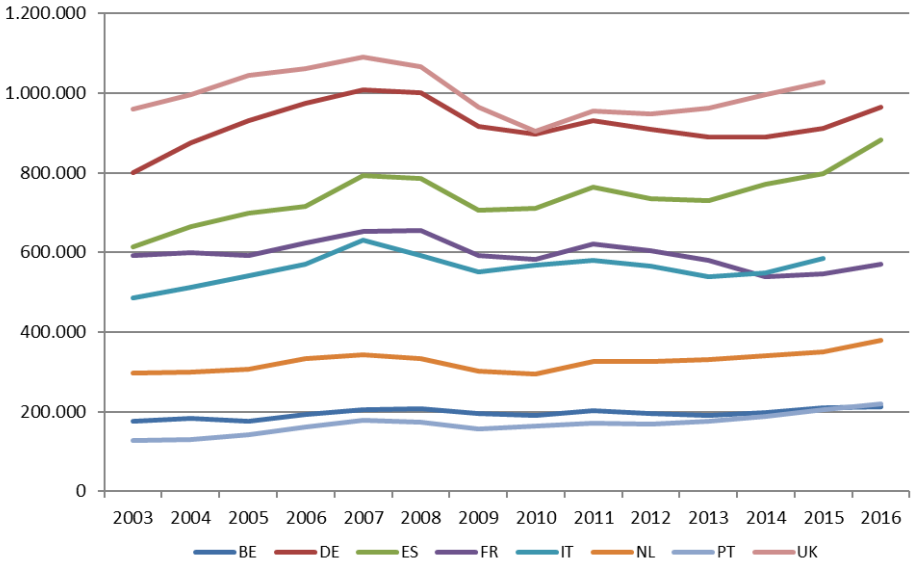
Data source: Eurostat

European context



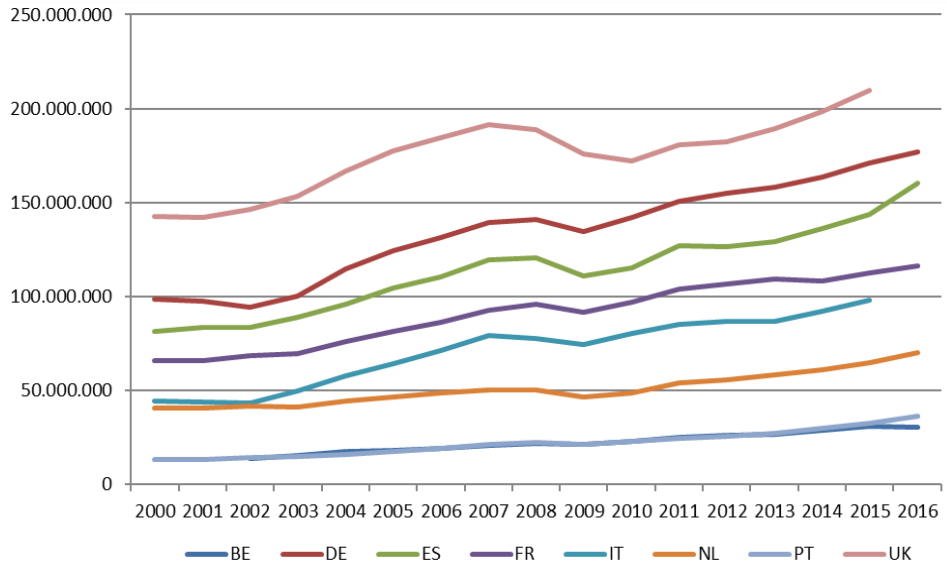
International intra EU air passenger traffic

International intra-EU air movements



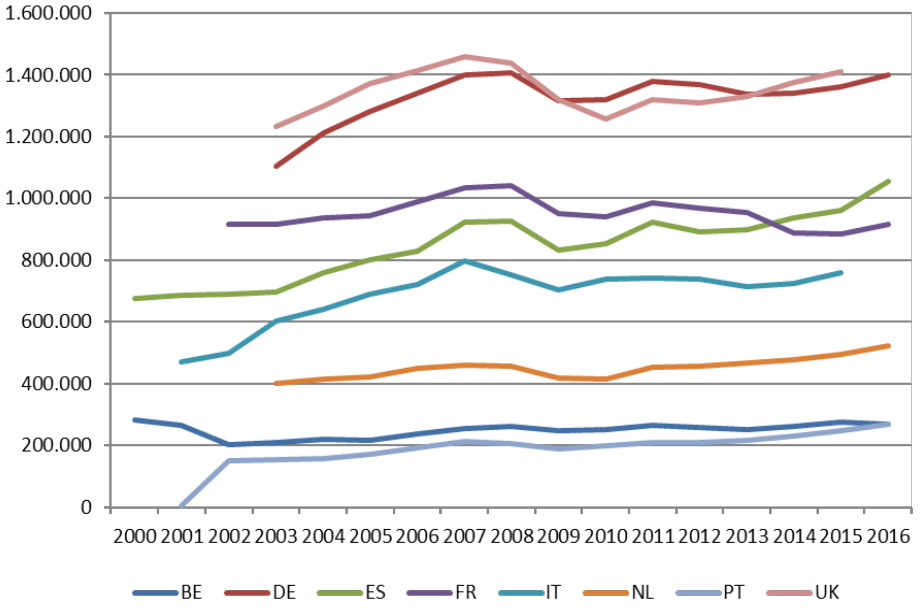
Data source: Eurostat

European context



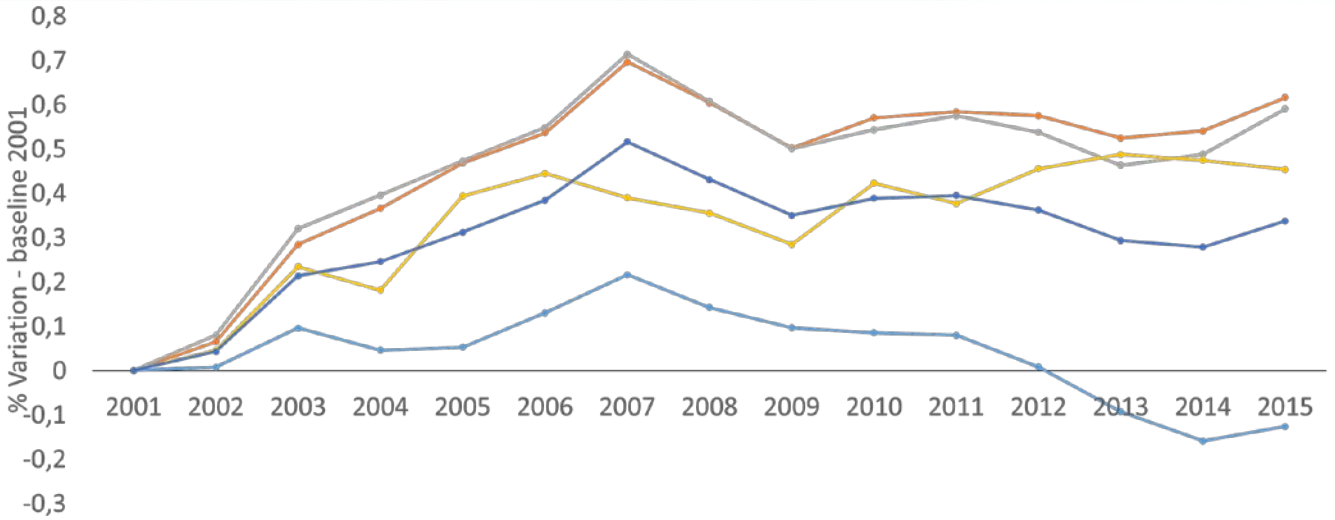
International air passenger traffic

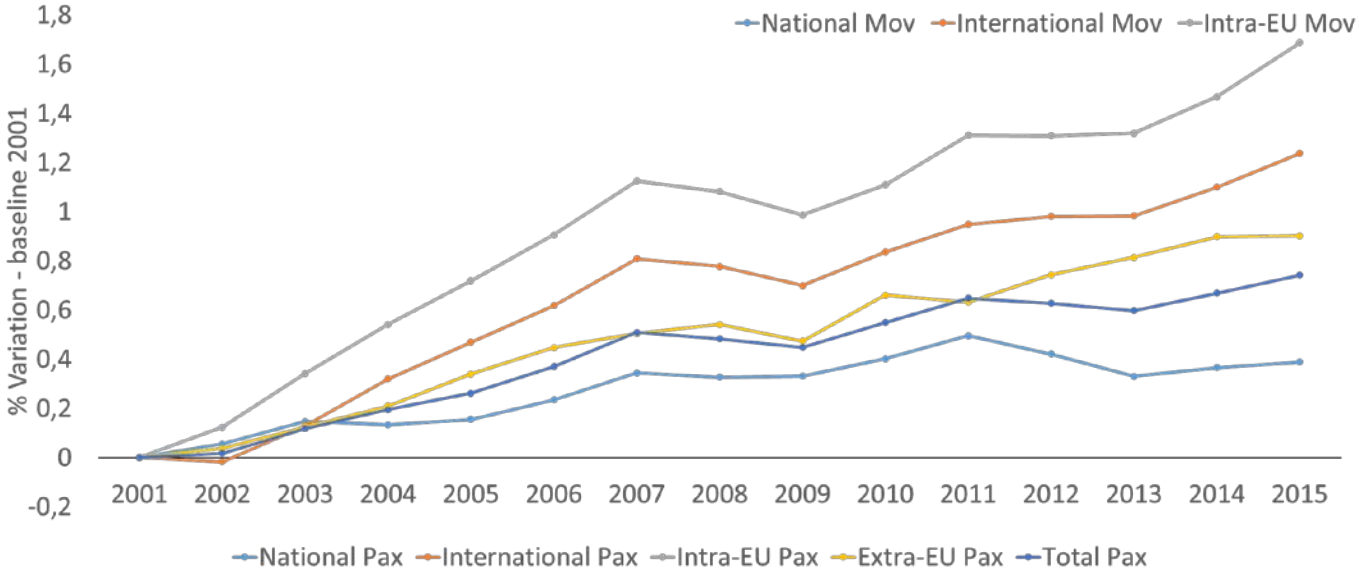
International air movements



Data source: Eurostat

Italian case: pax and mov trends





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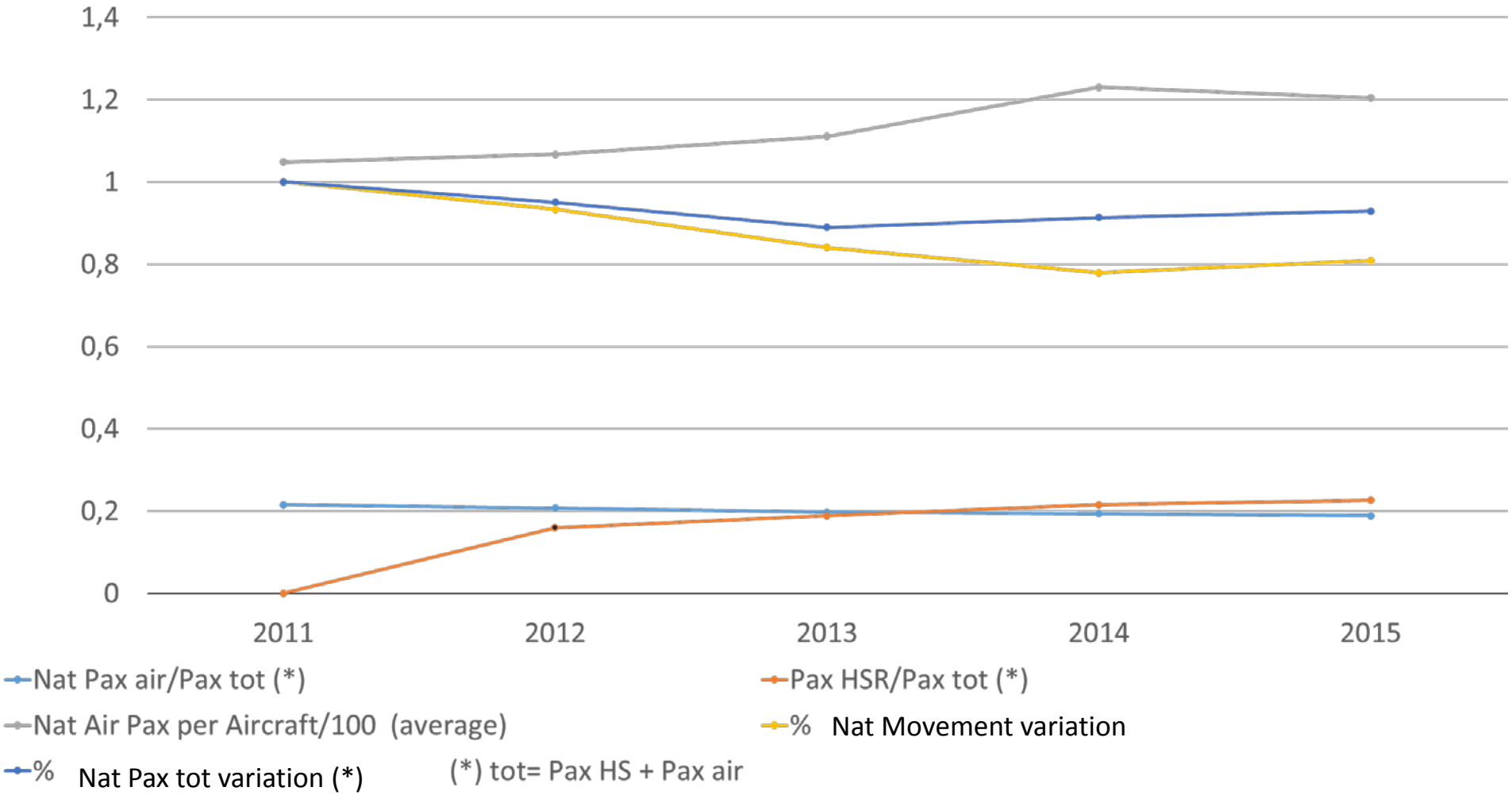

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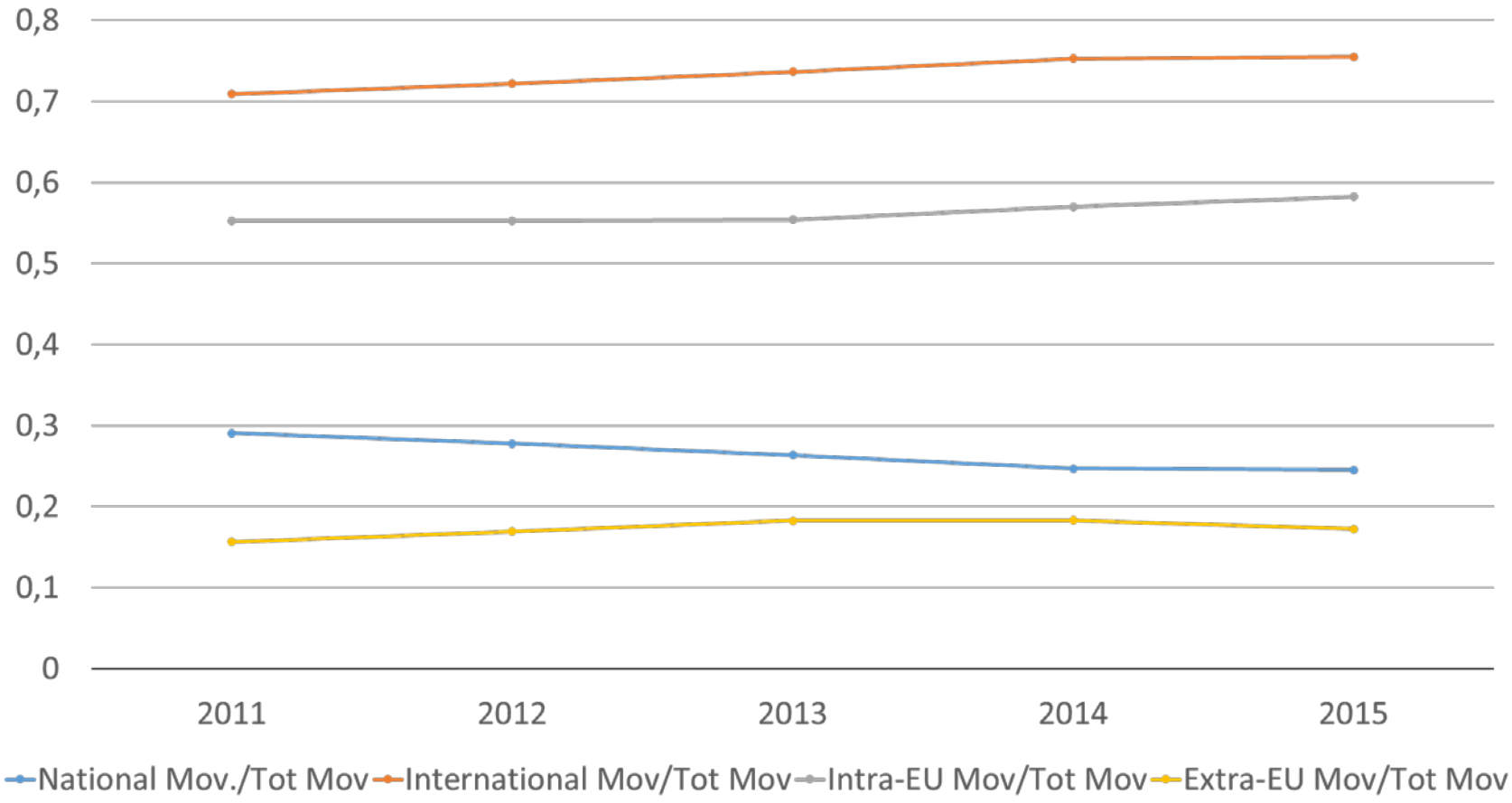
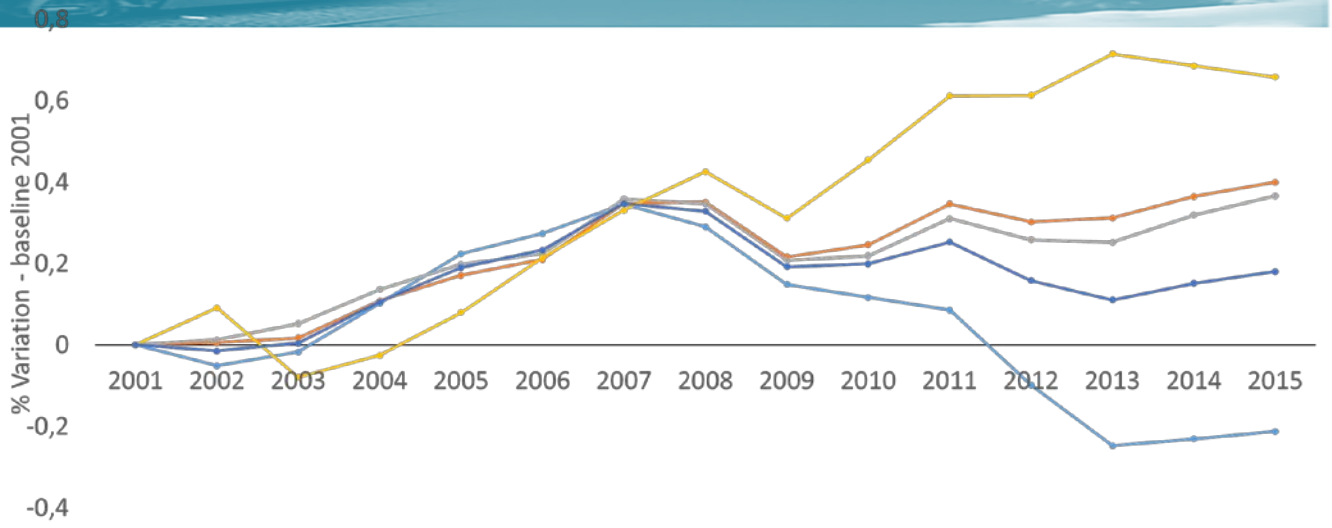
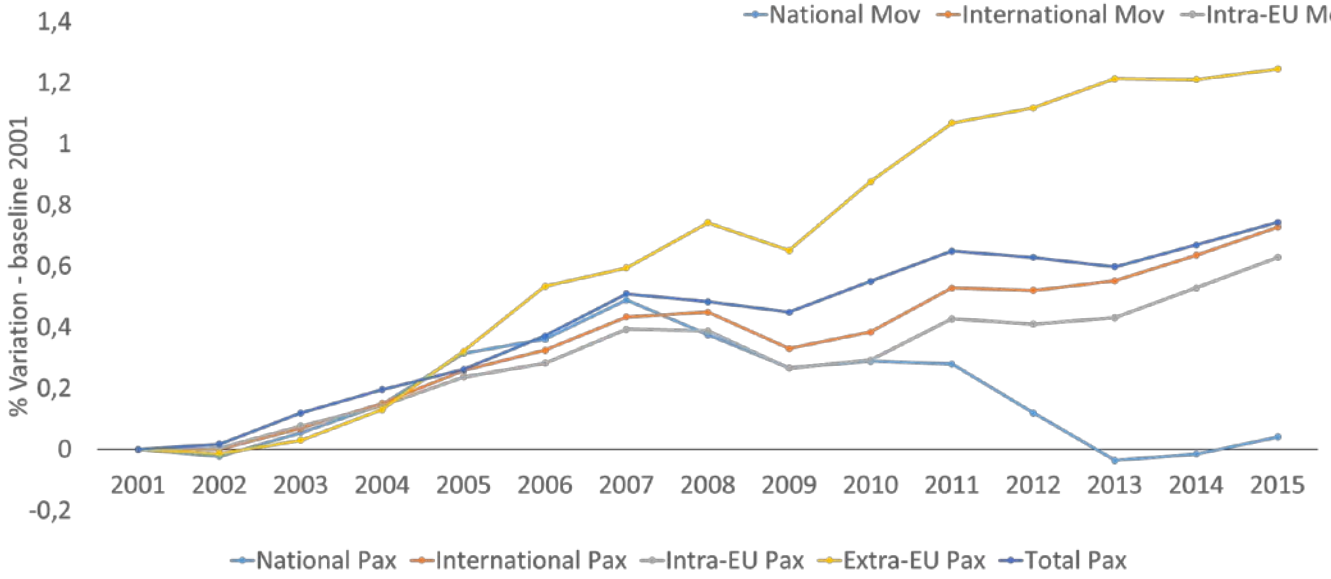


Spanish case: pax and mov trends





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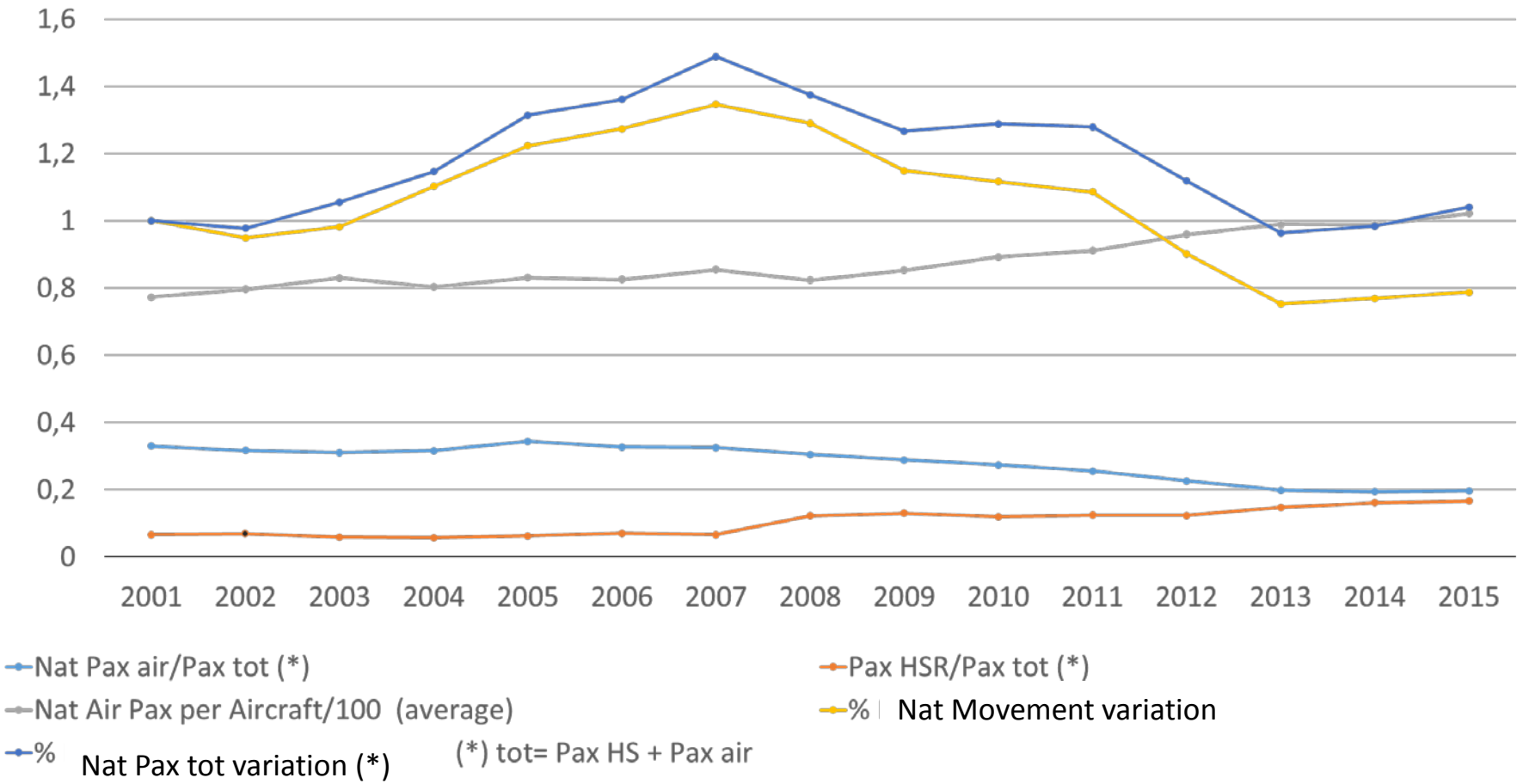

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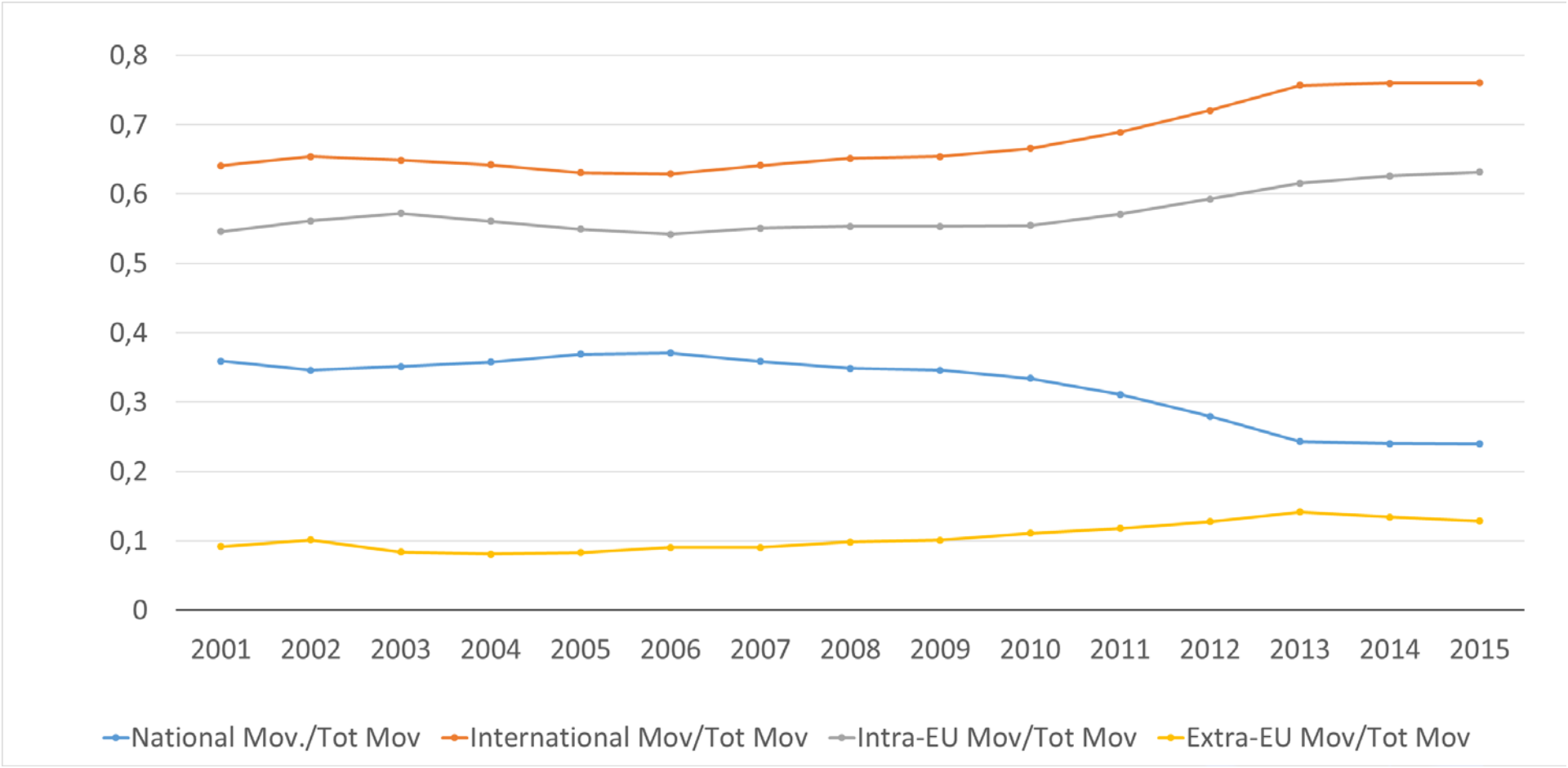
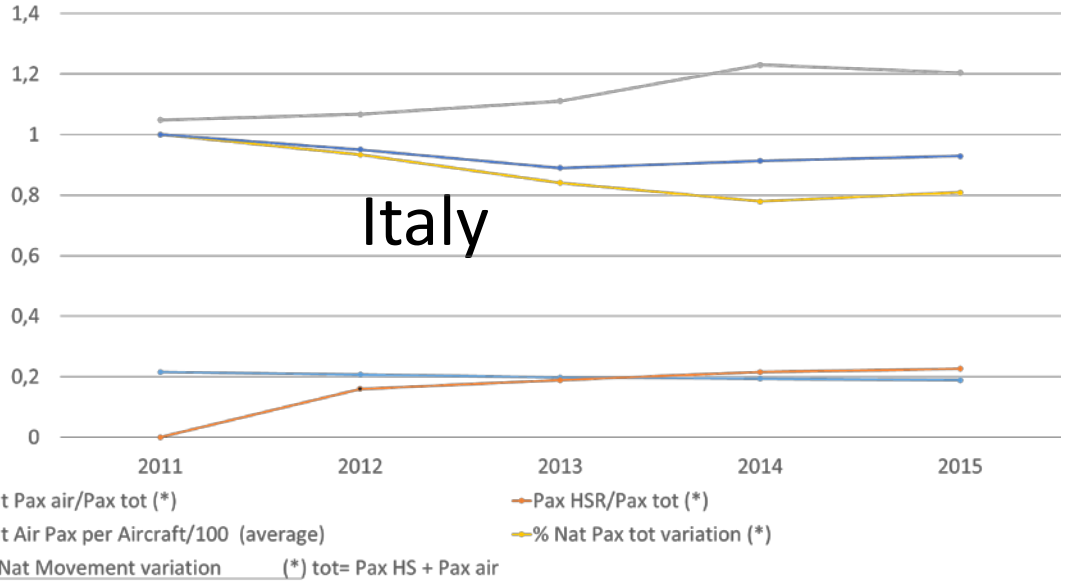
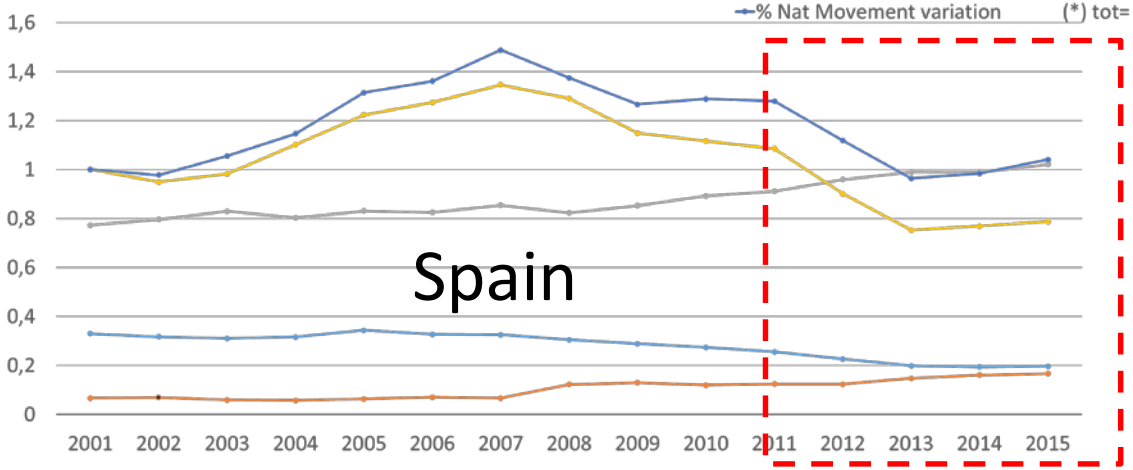


Spanish/Italian cases: pax and mov trends





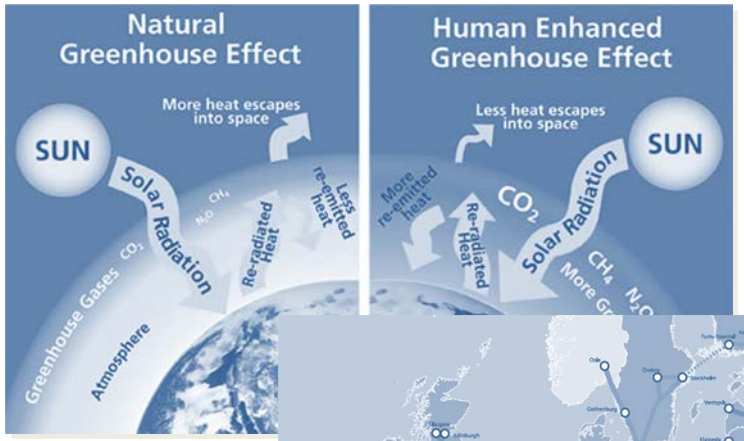
European context: some findings?

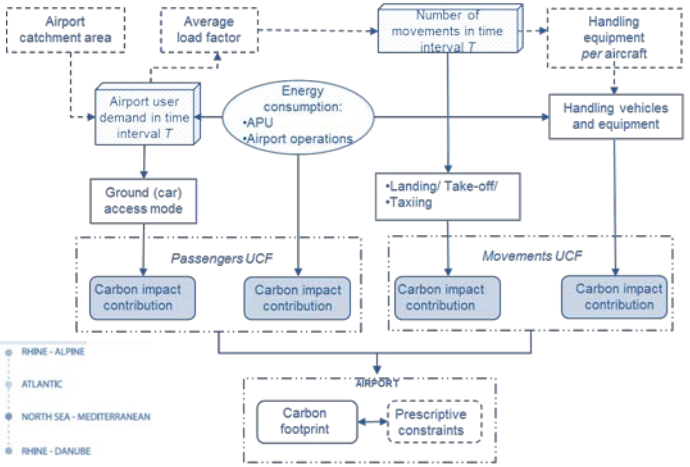
Movements (*and expected carbon/noise levels*?):

- decreasing trends at national level for countries were HS systems are operating, but….
- intra-EU air movements are still relevant. However….
- Increasing rate less than in the past, then…
- better use of HST and air transport ***could*** increase traveller demand by decreasing (or not increasing) the number of movements, and then less airport carbon/noise levels
- More investigation !

THANK YOU for your attention

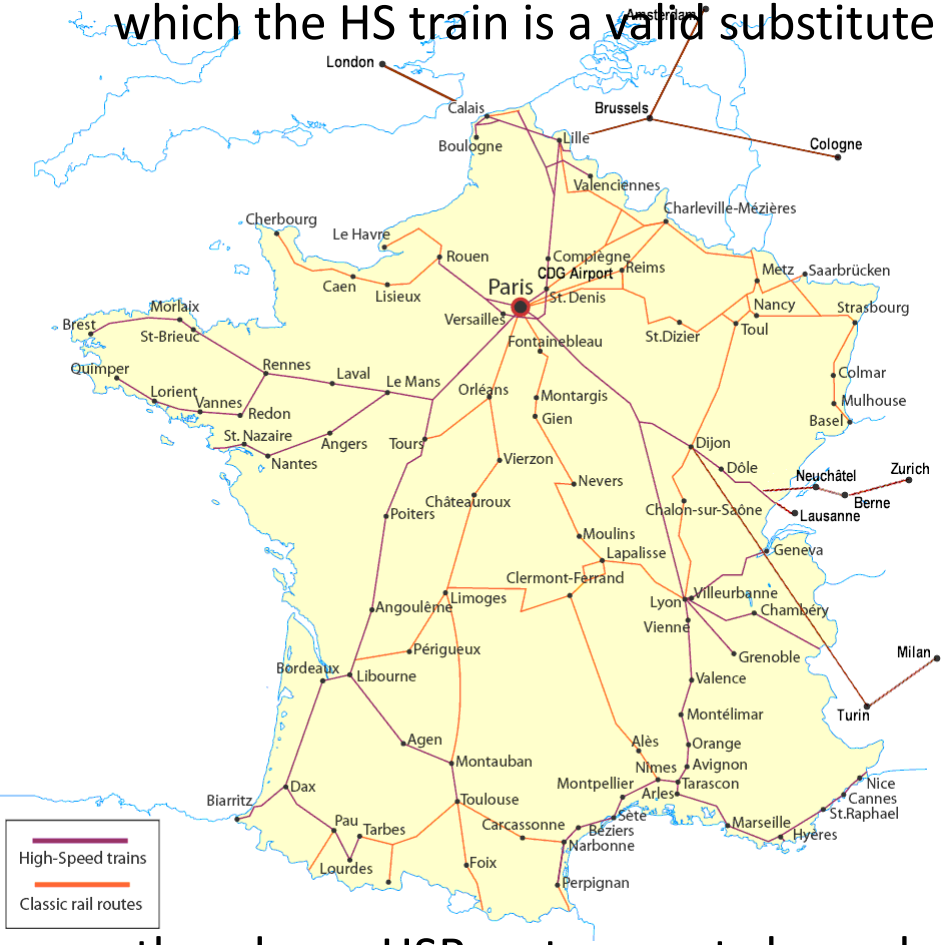
npostorino@unirc.it

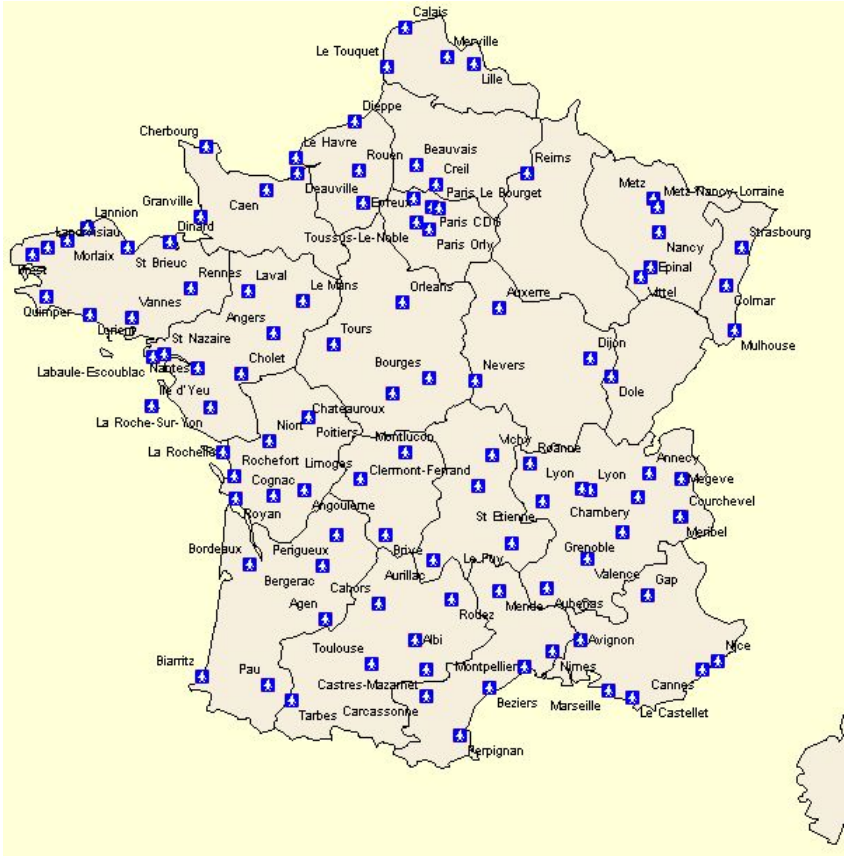




Lyon and the French context

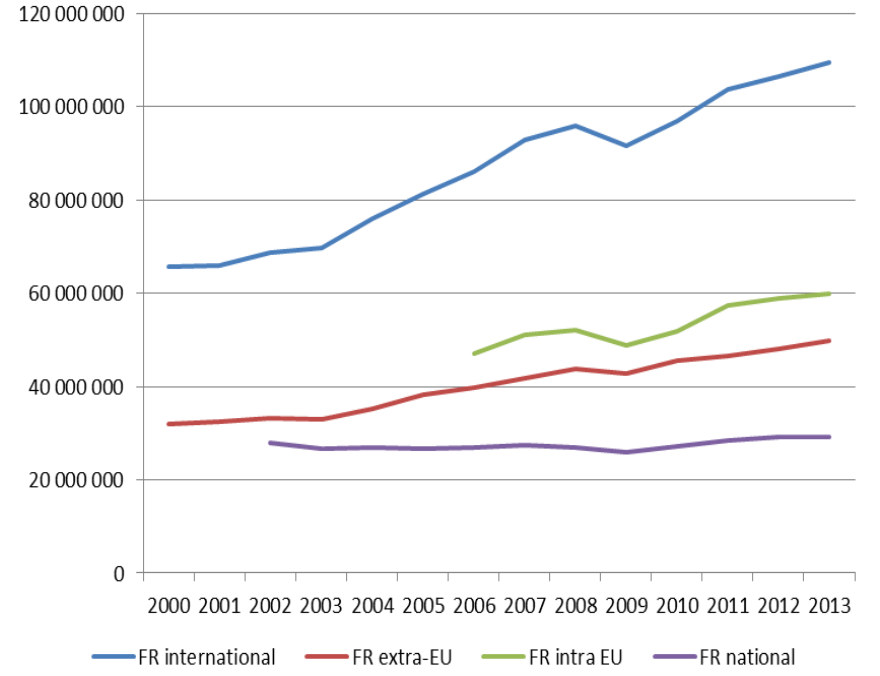
existing and planned HS system in France: origin-destination combinations for which the HS train is a valid substitute for air travel have been already covered



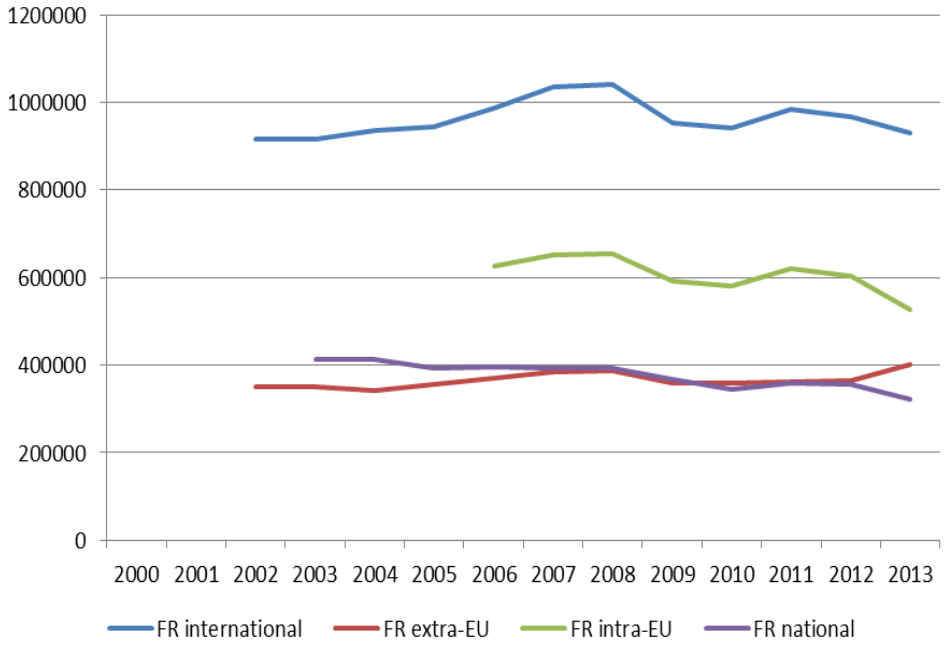


rather dense HSR system: not clear what is the possible level of complementarity between air/rail and the positive effect in terms of carbon impact reduction

The French case

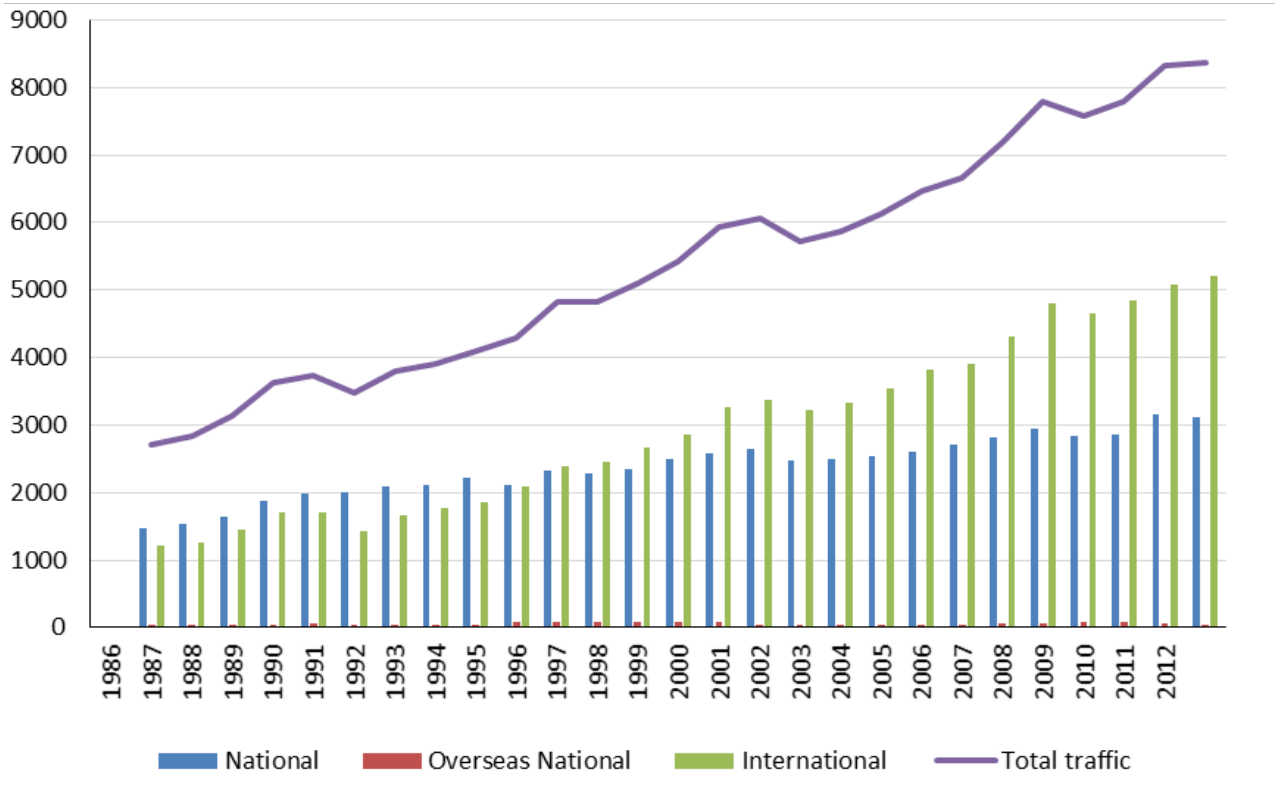


Air passenger traffic



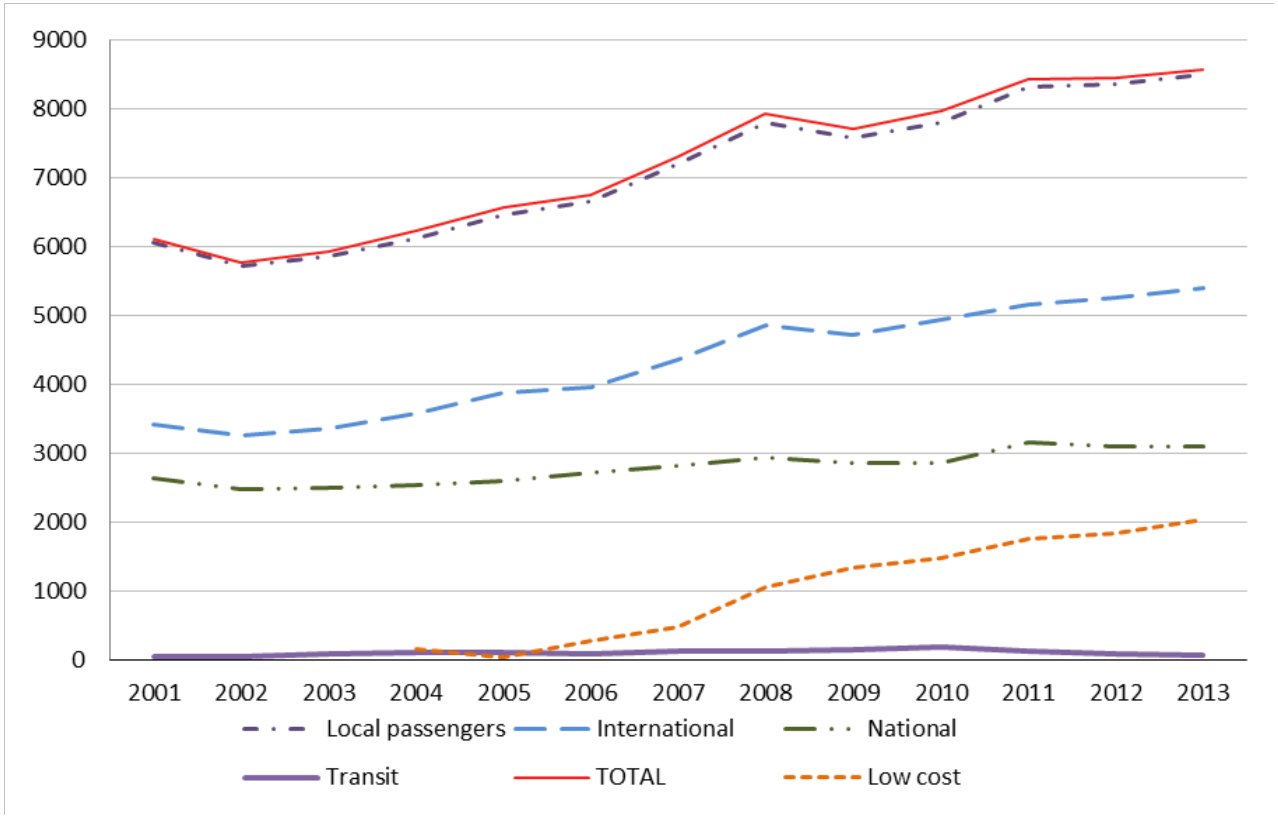
Air movements

Lyon airport: aggregate analysis



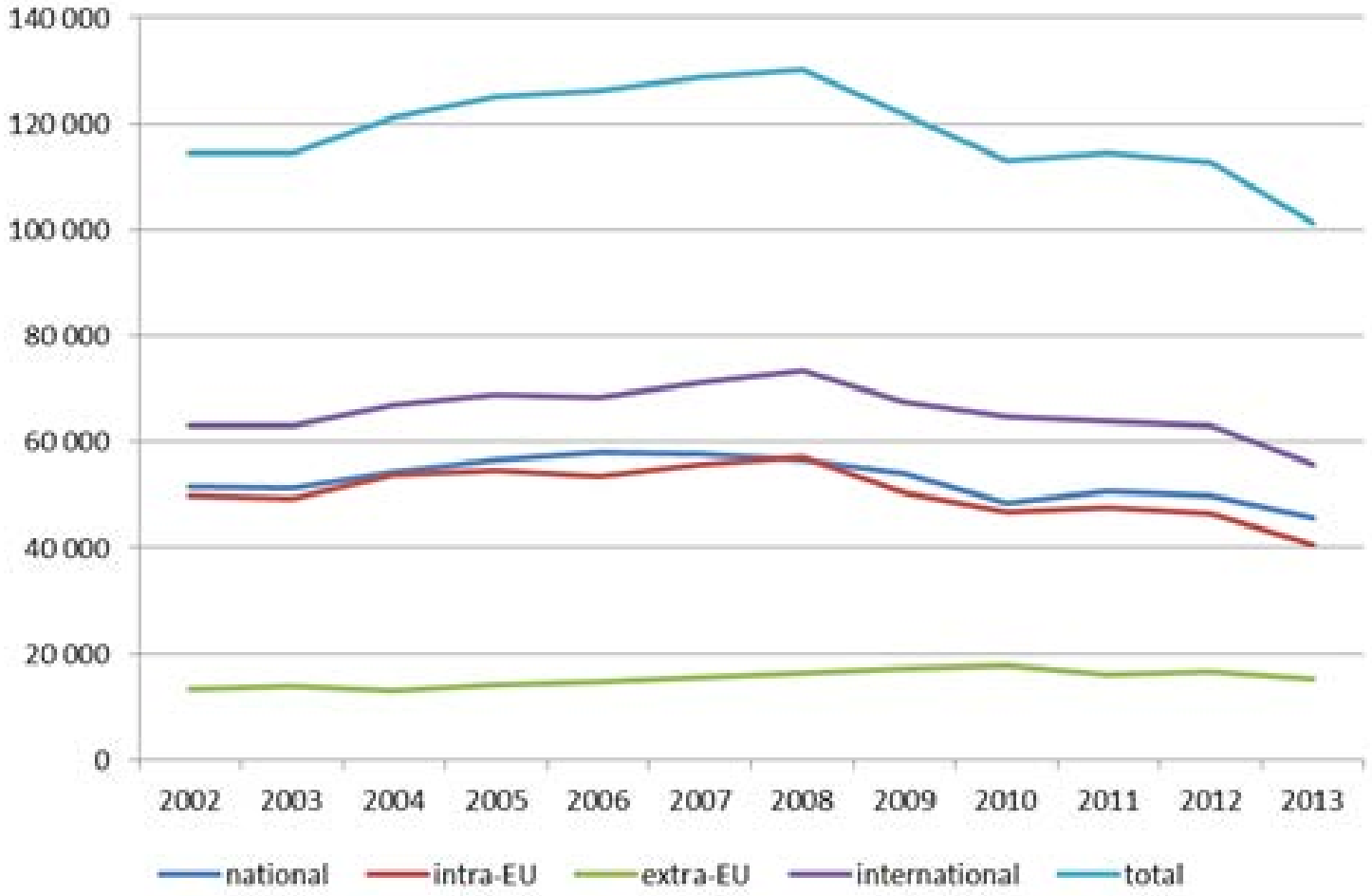
Lyon airport passenger trend
(source: DGAC/DTA/SDE)

Lyon airport: aggregate analysis



Lyon airport passenger distribution
(source: www.aeroport.fr)

Lyon airport: aggregate analysis



Lyon airport movement trend (source: Eurostat)

The EU situation

- Core network existing railway corridors

Corridor	Corridor length	Passengers per year (million)
Paris-Lyon	409 km	39
Valence-Marseille, LCV Med	250 km	20
Lyon-Valence, LGV Rhône-Alpes	115 km	19
Frankfurt-Koln	180 km	12
Paris-Nord de la France	333 km	6
Madrid-Sevilla	472 km	3
Madrid-Valencia	391 km	2