
Impacts of High Speed Railways on Equity and Quality of Life

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Paper index:

- 1) Introduction
- 2) Literature review
- 3) The Italian rail system
- 4) SpREI and SoREI for assessing HSR impacts on equity and quality of life
- 5) Case study
- 6) Conclusions and policy implications



Equity and QoL

Quality of Life as easiness/opportunity to access transport services

→ **Spatial accessibility**

Availability of transport options (service opportunity)

→ **Social accessibility**

Chances to purchase transport options (economic opportunity) **and** other constraints for selected groups (e.g. elderly, disabled)



HSR in Italy

High Speed Railways have recently boomed in both number of trains and passengers

→ **New rail service paradigm**

In-market competition in HSR + subsidized national and local services

→ **HSR trains: new services, new fares structure**

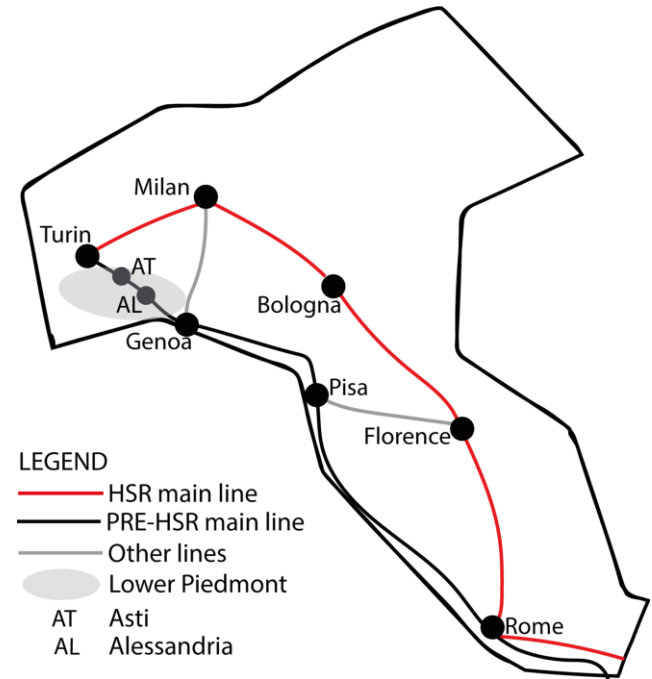
Market-based fares vary depending on: time of purchase, time of travel, level of service, and other factors

The rail connection between **Turin** and **Rome**

PRE-HSR: 10 bi-hourly “Intercity” service via Genoa and Tirrenica line.
Travel time approx. 8 hrs

POST-HSR: 99 HSTs via Milan and Dorsale line. Travel time between 4 and 5.5 hrs

Case study: **Asti**
and **Alessandria**




Fares and level of service

2002: First and second class on all trains, distance-based fixed fares



Today's "classes": Frecciarossa and Italo offer 4 levels of service: Standard/Smart, Premium/Comfort, Business/Prima, Executive/Club. Frecciargento and Frecciabianca offer first and second class

Today's fares are market-based and vary in price and flexibility according to time of purchase, chosen connection, offers and other factors



Fares: from
distance-based to
market-based

— HSR paradigm shift **impacts on equity and quality of life**

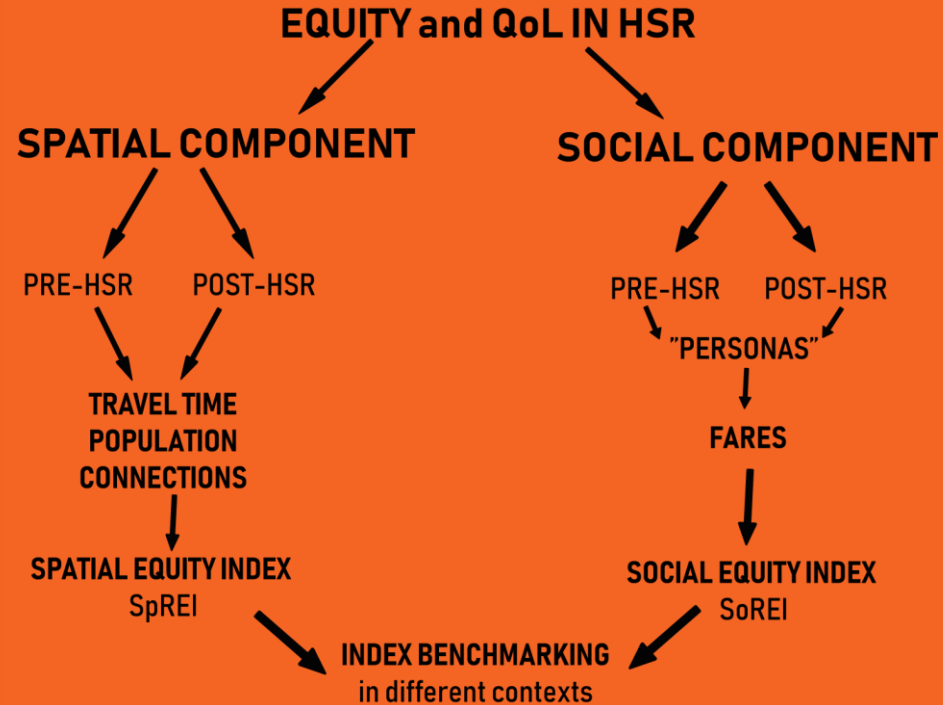
Evaluate through specific indexes the impacts that the shift described so far has produced for **mid-sized towns that have been excluded from the HSR network** and meanwhile from most national intercity services

Paper methodology

Personas

Personas used to best describe HSR travellers:

- Early birds*
- Business travelers*
- Last but must*



SpREI and SoREI

The SpREI can be calculated as the number of possible daily connections c divided by the travel time t and the natural logarithm of total population p

$$SpREI_A = \frac{[\alpha c_{wA} + \beta(365 - \alpha)c_{hA}]}{\{\ln p_A [\alpha t_{wA} + (365 - \alpha)t_A]\}}$$

$$SpREI_B = \frac{[\alpha c_{wB} + \beta(365 - \alpha)c_{hB}]}{\{\ln p_B [\alpha t_{wB} + (365 - \alpha)t_B]\}}$$

$$SpREI_o = \frac{(SpREI_A - SpREI_B)}{SpREI_B}$$

$A \rightarrow$ post-HSR (2019), $B \rightarrow$ pre-HSR (2002);
 α & β num. of work/holidays;
 w & h work/holidays

The SoREI is function of the ticket fare F for the od relationship. F , in turn, depends from the specific j , the desired level of service l and the possibility to plan ahead and buy promotional tickets in advance s

$$SoREI_A = \sum_{j=1}^n \frac{F^A_j}{n}$$

$$SoREI_B = \sum_{j=1}^n \frac{F^{B*}_j}{n}$$

$$SoREI_o = \frac{(SoREI_A - SoREI_B)}{SoREI_B}$$

$A \rightarrow$ post-HSR (2019), $B \rightarrow$ pre-HSR (2002);

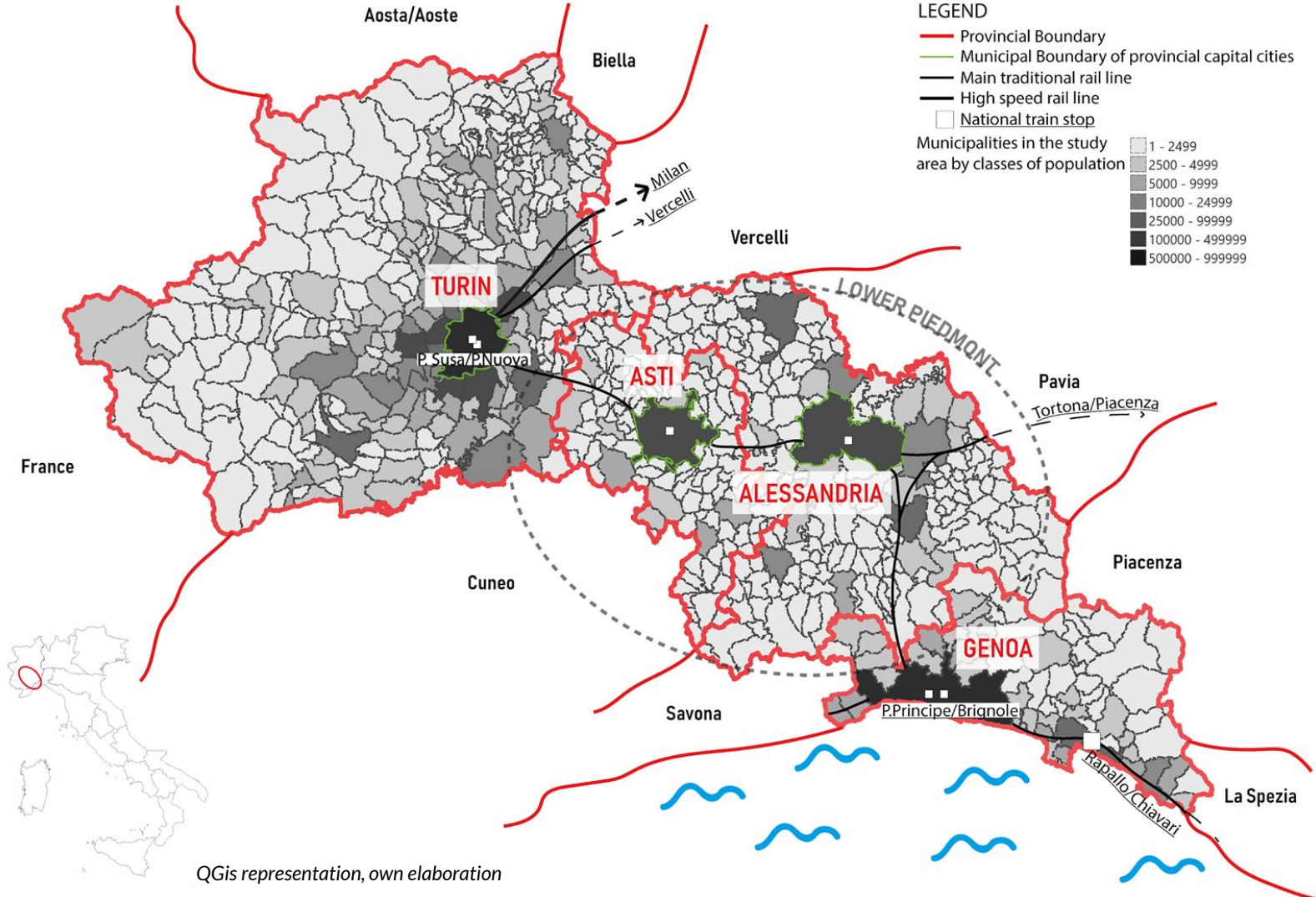
Case study:

Asti and Alessandria

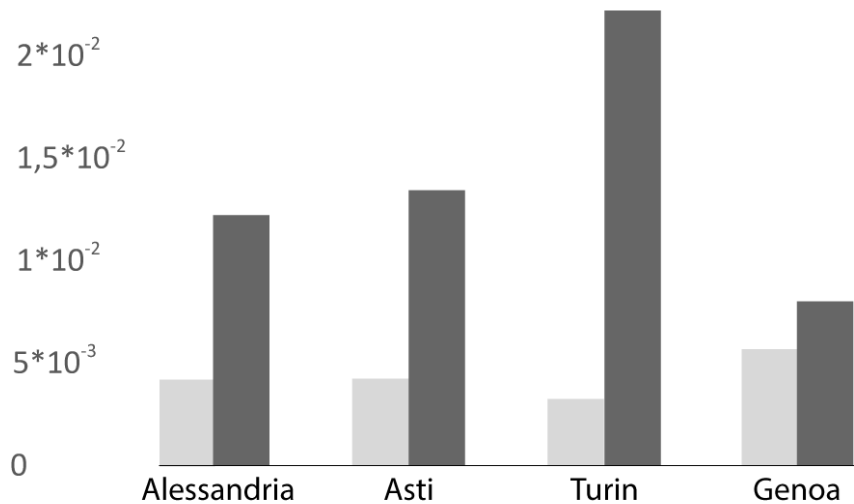
Pre-HSR: directly connected to Rome every two hours by Intercity trains

Post-HSR: a transfer and the use of local transport is necessary in most cases

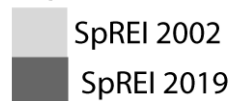
Connections with Rome	Alessandria	Asti	Genoa	Turin
Pre-HSR (2002): Weekday and holiday	20	20	24	20
Post-HSR (2019): Weekday	55	61	33	99
Post-HSR (2019): Holiday	52	43	41	86



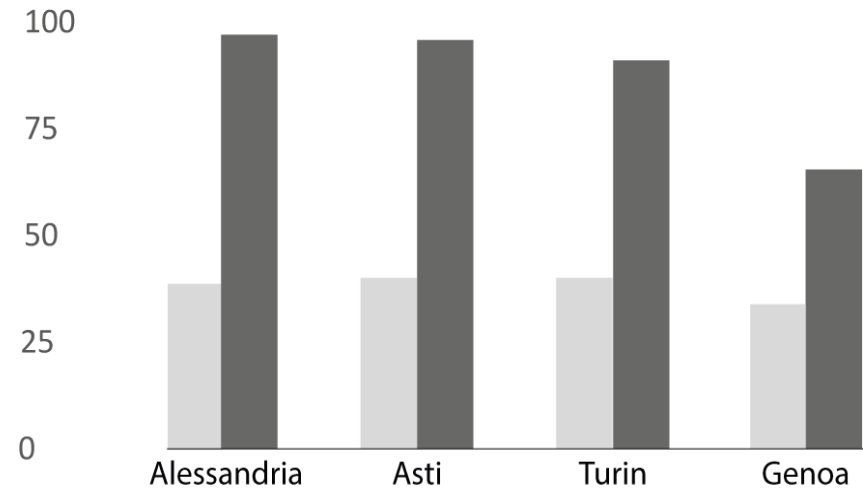
QGIS representation, own elaboration



Legend




 Spatial accessibility increase



Legend



 Fare increase → social accessibility decreases



Results: SpREI

Asti and Alessandria are not served by HSR. Their SpREI performance is however still positive thanks to more daily connections. **Turin** sees the best increase, with 99 daily direct trains and much quicker service. **Genoa** is reached by HSR trains but shows poor performances due to low number of connections and high travel time

→ From a spatial perspective, **HSR** has spread benefits over localities not directly served, such as Asti and Alessandria, thanks an improved network effect with local trains



Results: SoREI

Asti and Alessandria see fares increase of 127% and 146% respectively, on average . **Turin** and **Genoa** show lower values, especially for those able to purchase in advance.

Other factors, such as the necessary transfer, should be included since the region is facing ageing population trends and in compliance with recent citizens with disabilities agreements

- From a social perspective, **HSR** has penalized towns not directly served. Users now have to invest more and transfer between trains at a HSR hub

Conclusions & policy implications

The exclusion from HSR increases disparities within central and peripheral towns

Socially, the trend is preoccupying. Factors such as ageing population increase complexity

Policy implications go beyond HSR and even beyond the transport sector

Conclusions & policy implications

The integration between transport modes and rail services is a key to avoid disparity

The complexity of the Italian administrative system does not help marginalized territories and citizens

→ organizational + infrastructure + service problem. Transport and other tools to avoid disparity needed

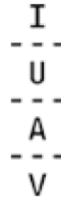
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