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Spatial equity and high speed trains: the example of France

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Abstract

This paper is aiming at qualifying the high speed trains in operation in France, with regards to spatial equity. To that end we begin by examining some of the various concepts enclosed in this polysemic word. Increased accessibility was one objective of the development of high speed rail. Thus we estimate a simple model to measure the possible effect of high speed rail on French regions. We did find a positive effect on GDP per capita and demographic growth. In a sense this is because they are growth-promoting that High speed lines are unfair. Beyond that, the pricing system set up by the train operator is based on yield management and intermodal competition. This results in a peculiar and singularly unfair pricing structure.

1. Introduction

Although transport improvements are growth enhancing, they are probably unfair from user's point of view. Some evidence of unfairness can be found in several effects. Transport improvements often lead to provide extraordinary privileges to some particular places: airports, stations, ports... So it can be considered unfair by the places which didn't benefit from these privileges. Conversely, transport improvements are almost constantly sources of negative effects: pollution, noise, severance effects and so on. It follows that the "winners" and the "losers" do not belong to the same place. This raises concerns about fairness.

Fairness, justice, equity have been the subject of many debates in the 90s. Given the particular context of High speed trains (HSTs) the question of equity of HSTs has again returned to the forefront. First the time elapsed since the inception of the first High Speed Lines (HSLs) in Japan and in France makes possible a long term appraisal of the spatial effects of HSLs (Albalade and Bel, 2012).

Second, an important country is building an impressive network of HSLs (China). And third the US (Levinson, 2012) and UK (Preston, 2012), until now reluctant to invest in HSLs are now seriously considering to develop their network. Equity matters are the subject of numerous debates in the UK (Preston, 2012). Spatial justice has been at the core of Chinese policy for a long time. In numerous European countries that already have high speed networks, the future HSLs are hotly debated (Spain, France, Italy, Sweden...). The commercially viable links have already been built and the future lines are more or less linked to questionable environmental considerations.

Equity might be related to the relative situation of two individuals or two group of people. By spatial equity we address the question of the relative situation of different group of people defined by their location. This location could be relative to a neighbourhood, a city, an urban area or even a region. It seems rather clearly since the 90s that transport investments in Europe tend to favour the trend of polarization, to the detriment of the periphery (Vikerman, 1999). At the national level it is less clear. In this article, we concentrate on French regions and cities.

Equity is a polysemic word. In the first part of the paper, we choose the different concepts that will be used in the remainder of the paper. By their very nature HST investment might be considered as inequitable, but to back up this judgment we have to quantify the effects of the accessibility gains. If the accessibility gains have had no consequence, the question of the spatial equity would have been different. So, the second part of the paper is devoted to the consequences of the increased accessibility due to HST. Then in the third part, we consider the fairness of the pricing system and the funding procedures.

2. Equity or fairness in transport

Equity is frequently viewed with consideration to the seminal work of Rawls (1971). But the rawlsian concepts cannot easily be applied to spatial analysis. Hay (95) defines eight concepts of Equity Fairness Justice (EFJ) with the design to carry out spatial studies. We will present briefly each one of them, with the meanings we give to the concepts, which might be slightly different from the ones given by Hay (95).

The first is “Procedural fairness”. This concept consists in Uniform application of the rules, without questioning the rules. This means consistency over time and space. The difficulty in applying the concept of procedural fairness to HSTs is that the rules are fairly flexible. The same rule doesn't apply everywhere. So, even if it distorts the concept, we consider that there is no procedural fairness if a rule doesn't apply everywhere with a reasonable spatial uniformity.

Fulfilment of *legitimate* expectations. We add legitimate as an attribute to the expectations. Regarding HSL, some very optimistic expectations can be observed. High speed is sometimes seen as the magic wand. Given some reasonable expectations, this concept leads to examine whether any arbitrary change occurred in the conditions under which these expectations were based. The concept is clear enough. Although it could prove difficult to determine the extent to which an expectation is considered legitimate.

Formal equality is a straightforward concept: like benefits (or burdens) are enjoyed (or suffered) by like persons. Obviously, depending on their location, citizens benefit more or less from the establishment of a HSL. The question is linked to the possible balance between the poor accessibility and the potential compensations. If we extend the standard model of urban theory, lower rent could be a compensation or lower accessibility. The concept of formal equity is strongly linked to the pricing system of HSTs.

Substantive equality means equality of outcomes (net benefits minus net burdens). This has to be linked to the balance between what the travellers pay and the benefits of their travel. Once again pricing of HSL is to be taken into consideration. With HSL, provided it is growth-enhancing, a surplus is created, but this economic benefit has to be shared between the traveller and the train operator. The operator might capture the surplus, because on certain links there is no more significant competition.

Equality of choices. By its very nature, a new infrastructure alters the choices sets of the customers. We consider in this paper, that HSTs are unfair according to this concept if a significant number of customers have a smaller number of choices after the HSL has been established. This is a difficult question, as the increased accessibility might not reduce the possibility to interact with a place with poor accessibility. But the comparative advantage might favour the places with better accessibility. Thus, for us, this concept has to be linked with relative accessibility. We do not exclude the fact that, resulting from an HSL, the accessibility might have decreased.

In accordance with merits (meritocracy). Some people might benefit fortuitously from any transport improvement, possibly to the detriment of others. It might be some firms or some private individuals. And such situations are frequently found in the transport sector. But the HSL are not randomly built. Generally they are built in the corridors with heavy traffic, because the new line is a way to avoid congestion and because the major traffic generators can make the investment profitable. There is no merit for a firm or for a household to be located in such corridors.

Rights. This concept might not be very relevant for our study. HSTs do not particularly breach fundamental rights of the citizens. Maybe, funding can be considered, but if we consider that we live in democratic societies, the central and local government decisions should be considered as not breaching the rights of the citizens. The only particularity of France is the so called “droit au transport” (right to transport). To a certain extent, we will consider that an HSL respects the right to transport if some measures are taken to make it more affordable (a quasi Rawlsian point of view).

Corresponding to the needs “Certain needs are so basic that failure to meet them is an injustice”. We can consider that HSTs are not concerned by basic needs. They don’t meet basic needs and they don’t prevent some basic needs to be met. Of course we have the usual effects of building a new infrastructure, but it is not specific to HSTs. To a certain extent the funding of subsidies can prevent some poor people of purchasing some basic goods in quantity or quality desirable (because of the VAT). But this remark is relevant for any subsidisation scheme and is linked to the difficult question of the social marginal cost of public funds. This is clearly beyond the scope of this paper. So, in the remainder of the paper we don’t consider this approach to Equity.

3. Accessibility and regional impacts of HSR in France: polarisation and diffusion

Solving the problems of the overcrowding of some rail links was one objectives of the development of HSLs. But increasing accessibility was equally looked for. To a large degree, this increase has been achieved in France, for the regions served.

According to the literature, the results of these accessibility increases are still unclear. The effects of HSTs on major links are obvious, but the intra-regional accessibility might diminish. Moreover, there is a kind of “tunnel effect” which consists of poor accessibility for cities located near the HSL, but with poor access to the main cities. Indeed some small cities have seen their link to Paris suppressed (FNAUT 2011).

Regarding the regional impact, there is abundance of conjecture but very few ex-post analysis, especially concerning long term effects. The literature on the ex-post assessment of high speed lines is limited to case studies. The consensus is that developing an HSL does not lead automatically to improvement in the economic situation of the cities served (Abalate and Bel, 2012; Givoni, 2006). The HST effects can be observed at various levels from regions to station neighbourhoods. The recent researches tend to favour a multi-level analysis (Garmendia et al. 2012; Urena et al., 2009). So far, the majority of the researches have been devoted to cities. In spite of a host of case studies it is still unclear whether HSTs have a true impact on firm’s location decisions, job creation and finally regional productivity. Particularly it is not clear whether the HSTs impacts are limited to major cities or if they extend to a greater region. However, Chen and Hall (2012) found that both the Lille region (Nord Pas de Calais) and the Manchester region have benefited from the arrival of HSTs, although not every sub regions.

Regarding France, the survey of Albalate and Bel (2012), mentioned the following impacts:

a) The first result to stand out, and which constitutes one of HSR’s most significant impacts, is that the most important hub could benefit the most from HSR. Bonnafous (1987) clearly illustrates this point noticing that journeys to Paris increased by 144%, while in the inverse direction, a 52% increase was observed. The HSR help to broad the business area of companies (services, shopping...) located in the primary hub, which are generally more competitive than those of smaller cities. But in the same article, Bonnafous (1987) raises another issue: the firms located in the Rhône-Alpes region (served by the HSL) have access to specific services located in Paris and, thus, have less incentives to move to Paris. Thus it still unclear which region benefit the most of the HST (Paris or the periphery).

b) As in Japan (Sands 1993), HSR has promoted the centralization of economic service activities in big hubs and favoured business trips to the main cities. By contrast, the impact on industrial activities

usually has been barely observable. The studies have failed to measure any real impact on business location.

c) In tourism, the impact is mixed with an attractive effect in favour of region more connected by HSL and the decrease of the duration of the stays due to the easier connectivity and accessibility.

d) Thus far, the regional positive impacts seem to be extremely limited when they are positive, although “a clear correlation” between transport endowment and regional growth has been observed (Vickerman, 1997). The positive effects are very far from being systematic. In spite of these asymmetries, big cities such as Lille and Lyon have also experienced positive effects as a result of the HST in the form of increased economic cooperation and exchanges with Paris. In Lyon, for instance, HST has attracted a significant number of third-sector firms—mainly regional offices from Paris—helping to consolidate this sector and improve Lyon’s image.

For spatial equity, it is important to measure the effect of HSLs on regions or cities served. Given that the literature is inconclusive, we have chosen to study the impact of HST at the regional level (France is divided in 22 *Regions*) for the following raisons:

- 1) The choice of this geographic level enables us to have economic and demographic data unavailable at a lower level
- 2) The spatial spillover effects are limited. The cities tend to expand into large urban areas with imprecise borders
- 3) Rail between cities belonging to the same Region are organised by a regional authority. The Regions tend to favour the access to the HSTs stations.
- 4) Some regions have HSTs and some have not, this enable comparison.

The main research hypothesis is thus that we suppose that the regional transport and the diffusion of the HSTs in regions permit to irrigate the regional territory. To test this hypothesis we will examine whether the benefit of greater accessibility is discernible with macroscopic data such as GDP or population. This has to be done in the long term, because a small growth differential can lead to a large effect over a period of 10-20 years. In the short run, asymmetric shocks can alter the comparison. We have thus two hypotheses:

- 1) The effects of HST can be observed at the regional level;
- 2) Long term effects are observable (over several decades).

Before presenting the data, we have to recognize that whatever the result is, this is only a test of two assumptions, several other hypotheses can be supported by the same data set. Econometrics can only reveals correlations.

The data offered by INSEE consist of GDP and population for the 22 (metropolitan) French *Regions* on the period 1990-2011.

The French HST were put into operation as follows:

1981 and 1983: South-East TGV (Paris-Lyon)

1989-1990: TGV Atlantic toward Britany and Aquitaine

1993: TGV North, toward Lille and later London and Brussels

2001: TGV Mediterranean between Lyon and Marseille and Montpellier

2007: TGV East toward Strasbourg

These accessibility gains were not limited to very large urban areas. For some technical reasons, HST can be operated only on specially designed tracks, if they have to run at high speed (300-320 kmph). But at ordinary speed (around 120-150 kmph) they can be operated on “classical” tracks. Thus some small cities can be served. For example the HSL toward Atlantic Ocean is only 282 km long but the HSTs are running on 2440 km (Vikerman, 1997). It follows that the accessibility gains can be spread on a large scale.

2011, the last year for which data are available, is only 4 years after the TGV East was put into operation. We have chosen to limit the analysis to the period 1990-2007. 2007 is close to 2001 (the TGV toward Mediterranean Sea) but the Mediterranean regions have benefited from speed increases gradually as shown by table 1.

Table 1. Travel time between Paris and Marseille

Year	1954	1962	1969	1981	1994	2001
Travel time	8h03	7h10	6h40	5h30	4h14	3h00

We created a special category for the regions adjacent to Paris. First the relative gain of accessibility is smaller than for the other regions. Secondly there is probably more trans-regional commuting with Paris. Thirdly, the HSLs serve only part of the region, and for some cities the former rail link to Paris has been worsened or even abandoned. Finally, as the regions are close to Paris, travelling by car could be the preferred alternative for some cities. So, the French regions are regrouped in three categories:

- The regions without TGV (which will be referred to as reference);
- The regions with TGV and adjacent to Paris (which will be referred to as TGV adj.);
- The regions with TGV and not contiguous to Paris (which will be referred to as TGV).

As we can see in table 2, the HSLs were not designed to serve the rich or the poor regions.

Table 2. The French regions listed by GDP per capita in 1990

Regions	GDP per capita, 1990	Types of regions, R= reference
Corse	13 869	R
Nord-Pas-de-Calais	13 996	TGV
Languedoc-Roussillon	14 128	TGV
Bretagne	14 631	TGV
Poitou-Charentes	14 491	TGV
Limousin	14 786	R
Basse-Normandie	14 787	R
Lorraine	15 028	R
Pays de la Loire	15 154	TGV
Picardie	15 266	TGV adj.
Auvergne	15 306	R
Franche-Comté	15 509	R
Midi-Pyrénées	15 607	R
Aquitaine	15 652	TGV
Bourgogne	15 972	TGV adj.
Haute-Normandie	16 517	R
Champagne-Ardenne	16 598	R
Centre	16 647	TGV adj.
Provence-Alpes-Côte d'Azur	16 672	TGV
France metropolitan	17 959	
Rhône-Alpes	18 292	TGV
Alsace	18 326	R
IDF (Paris)	27 291	R

Source: INSEE, the State French statistical bureau.

First, the GDP per capita will be examined between 1990 and 2007 (the opening of the TGV East). Even if the literature is inconclusive (Barro R.J and Sala I Martin X., 1991; Dall'Erba S. and Le Gallo

J. 2005), it is necessary to control for β convergence (the tendency of the poorest regions to have higher growth rate). We estimated one model which will be described by the following equation:

$$GDP_i = a.D_1 + b.D_2 + \beta \ln (GDP_{i0}), \text{ where:}$$

i denotes the region

GDP_i is the growth of the GDP per capita in region i divided by the growth of the national GDP during the period

GDP_{i0} is the initial per capita GDP of region i

D_1 is a dummy equal to 1 if the region is a TGV region

D_2 is a dummy equal to 1 if the region is a TGV adj. region.

The results with of the regression are presented in table 3.

Table 3. Regression of the relative growth of the regions served by TGV

Coefficient	Value	P value
a.	0,06	0,02
b.	-0,066	0,08
B	-0,13	0,15

The data are consistent with a GDP per capita growth for the TGV regions significantly higher than the no TGV regions (reference), around 6%. The GDP per capita of the TGV adj. grew less (6,6%) than the reference. The hypothesis has turned into a result. The hypothesis of β convergence is not supported by the data. But it is useful to keep the convergence hypothesis in order to control for this tendency. Some other specifications of the model did return a significantly negative β .

The difference between TGV regions and TGV adj. regions is important: 12,6% over 17 years. We estimated a control model with creating a new dummy grouping the five adjacent to Paris regions. The results were the same but the coefficient was not significant at the 10% level. So, we cannot be sure that there is a tendency, for the regions which share a border with Paris to have a smaller growth rate in terms of GDP per capita. Taken together, the five regions adjacent to Paris do not exhibit a slower trend in the GDP per capita growth. Thus it is limited to the TGV adj. regions.

Regarding demographic growth, the results are presented in table 4.

Table 4. Regional demographic growth in France

Group of regions	Growth 1990-2007 (%)
France (metropolitan)	12,5
Paris (IDF)	12,5
TGV regions	16,3
Non TGV regions	8,4
TGV adj.	6,1
Champaign	-0,1
Higher Normandy	6,4

We have added to the three previously identified regions categories, two adjacent regions with no TGV (Champaign and Higher Normandy. From this table, we can infer the following:

- Demographic growth is the largest in TGV regions;
- Demographic growth is le smallest in TGV adj. regions and in adjacent regions as well.

The evolution of GDP combines the evolution of population and of GDP per capita. The results are summarized in table 5.

Table 5. GDP per group of regions

Group of regions	Growth 1990-2007 (%)
France (metropolitan)	38,3
Paris (IDF)	39,5
TGV regions	43
Non TGV regions	32
TGV adj.	28
Champaign	27,5
Higher Normandy	33,6

The data summarized in table 5 are compatible with a concentration of growth in the TGV regions. TGV regions grew by nine points over non TGV regions (not adjacent). The TGV regions grew more than 3.5 % (expressed in percentage of base year) than Paris.

The evolution of GDP summarizes the dual tendencies:

- An increase of GDP per capita in the regions served by TGV (and not adjacent)
- An increase in population in the TGV regions (not adjacent).

This leads to a general conclusion on the effects of accessibility (to Paris) for the regions served. Data are consistent with a polarisation effect which favours the concentration of wealth and demographic growth in some regions. The “left out” regions are the ones which are adjoining Paris.

It is interesting to note that the GDP of Paris grew more than the French GDP but less than the GDP of the TGV regions. This fact doesn't support the fears, expressed in the 80s, that Paris would benefit the most from the HSLs. To the contrary the data are consistent with a “diffusion” process; Paris being the major node of the knowledge based economy, and the TGV regions benefiting from this engine.

Through this improved accessibility provided by HST, some privileges are created. By its very nature a HST is not a fair investment. More precisely, we can consider the HST accessibility effect with regards to the previously defined concepts of equity.

The concept of procedural fairness is not relevant for this accessibility gain. The decision to invest in a HSL is more a question of bargaining than a matter of applying some rules. If there is a rule, it could be that the highest traffic is sought together with the alleviation of rail congestion.

Equity as fulfilment of expectation is more relevant. If we consider what we called the TGV adj. regions, they could have expected that being served, at least partly, by the TGV should have had a beneficial effect on the GDP or the population growth. That is not the case. So we can judge that their expectations are not fulfilled. To the contrary, it seems that the TGV regions (not adjacent) have benefited from the HSLs. In a certain way, this is consistent with the expectation of the majority of people living in those regions. But we have to be cautious; HSLs might have given rise to some new way of life and some urban pattern that not everybody would have expected. In particular, if you don't use HSTs, you are facing some side effects (rent, congestion ...) without benefits.

The concept of formal equality leads to judge the investment as not fair: some comparable citizens of two cities are facing different prospects, depending if they are served by HSTs or not. The mere fact to be located in an important node of a busy corridor gives the right to enjoy the benefit of an HSL. The inhabitants of the chosen locations might benefit from a number of advantages if we trust the assumptions, consistent with the data, that HSL brings wealth and positive demographic evolution. A positive rent evolution might appear as windfall for some inhabitants, a detrimental for some others. This is not special to HSLs. To a certain extent this is true for any transport improvement, but in the case of HSLs, the effects could be region-wide.

For the same reason, HST might be considered unfair according to the substantive equality concept or the equality of choices. Indeed some “classical” trains have been suppressed, to the detriment of some small cities. Regarding meritocracy, the high speed lines were chosen according to the potential traffic, this is not linked to any kind of merits. According to the consensus, a strong commitment to regional

development is required in order to benefit from the economic and demographic impact of HSR. In a sense, one can argue that it is akin to some form of merit. That doesn't mean that the regions with no HSL are lower merits.

In the French context, a better accessibility generally means a better accessibility to Paris. But that is not the only result. For example, The TGV between Lyon and Marseille has increased the possibility to travel to Paris by inhabitants of the South East regions. But the new line provided more possibility to develop some local and regional connexions. Beyond that, there is a systemic effect associated with any HSL. We have to recognize that our macroeconomic picture doesn't capture fully this systemic effect. However this doesn't diminish very much the unfairness of HST, to the contrary.

The polarization of the national territory caused, among other factors, by the TGV has been previously noted (Monzon and al. 2013). It is not an equitable process as expected by Martinez Sanchez Mateosa and Givoni (2012). However if the diffusion hypothesis is confirmed, it is possible that the HSLs contribute to a more balanced territory as regards the weight of the capital. To a certain degree this improved accessibility might have caused both polarization and diffusion toward some privileged regions. But very much depends on the funding of the infrastructure and the price paid to use the HST.

4. Two other mains aspects: Pricing and funding policy

4.1. Pricing policy: empirical evidences

We'll start with the empirical results obtained from the study of the two main TGV travel: the first one, from Paris to Lyon, Nantes, Marseille, Lille, Strasbourg, Montpellier and Le Mans, and the second one from Lyon to Valence, Marseille, Montpellier, Lille and Nantes. We have selected the major large cities with a competitive HST service to Paris and a smaller city very close to Paris. Regarding the connections with Lyon, we have selected three cities close to Lyon (Valence and Marseille and Montpellier) and two other cities which imply to bypass Paris toward the North (Lille) and the West (Nantes).

All the following prices are calculated for second class without any reduction. Consumers can benefit reduced prices in several cases defined by state law (family, military, seniors, students, juniors...) or by the train company itself, if regular passengers with subscription or with special SNCF cards ("Frequent Travellers").

Table 6. Prices sample of some TGV's links

From	To	1 month discount	4 month discount	Length (road)	Cents per km (1 m disc.)	Cents per km (4 m.disc.)	Ratio 1 m / 4m
Paris	Lyon	92	30	466	19.7	6.4	3.1
	Le Mans	31.6	20	212	14.9	9.4	1.6
	Strasbourg	71	71	492	14.4	14.4	1.0
	Nantes	47	20	381	12.3	5.2	2.4
	Lille	26	15	221	11.8	6.8	1.7
	Montpellier	71	37	750	9.5	4.9	1.9
	Marseille	57	40	777	7.3	5.1	1.4
Lyon	Nantes	143,2	60	723	19,8	8,3	2,4
	Valence	18	14,3	104	17,3	13,8	1,3
	Lille	111,5	45	692	16,1	6,5	2,5
	Marseille	47,3	47,3	315	15,0	15,0	1,0
	Montpellier	27	20	303	8.9	6.6	1.4

Source: SNCF web site, visited on the 8th of May 2013. All these prices are relative to trains whose departure is between 6:15 and 6:30, only on Tuesdays. Distances are calculated with “Mappy” web site.

About HST pricing, we observe four main empirical results.

a) Tickets purchased four months in advance are practically always much less expensive than the same destination purchased one month before. The difference could be really huge, as we see, by example for Paris to Lyon, with 30 Euros in the first case and 92 Euros in the second. The differences can be noticed for the all destinations, as we see in the last column of the table 6. Some links really offer large discounts: the prices are divided by three for Lyon-Paris and are also profitable for the traveller for Paris-Nantes or also for Lyon-Lille or Lyon-Nantes. In contrast, few other links offer no discount due to the date of the purchase, e.g. Paris-Strasbourg and Lyon-Marseille. In average, on our sample, the ticket bought one month before are 80% more expensive than the same destination purchased four months before.

b) The second empirical evidence is that for TGV, SNCF's fare structure is not cost oriented. The average price of the TGV kilometre is never the same, but depending of each case, the destination and when the ticket is purchased. By example, purchased one month in advance, the Paris-Marseille (777 km) is less expensive €57, than the Paris-Lyon, €92 (446 km). The Lyon-Nantes is the most expensive (considering c. per km) with €19.8, followed by Paris-Lyon (€19.7) and Lyon-Valence (€17.3). Conversely, some destinations are very cheap; it's especially the case for Paris-Montpellier with 4.93 cents per km for a purchase four months before the travel date.

c) Considering the price per km, there is a huge difference between the highest (€19.7) and the lowest (€7.3). The most expensive, from Paris, is about 2.7 times more expensive than the cheapest one (and 2.2 times more expensive from Lyon). HST's fare structure seems to be oriented toward revenue maximisation which is probably due to yield management adopted by SNCF (the train operator).

d) We can observe that some links are submitted to very high fares (Paris-Lyon and Paris- Strasbourg). Is it monopoly pricing? On these links, there is no intermodal competition: the distances are too large for cars and too small for airlines. In the vocabulary of business management, we can call them “cash cow”.

How to explain these pricing results?

In contrast with others domestic passengers' tariffs, today pricing TGV operates on the principles of yield management. SNCF was the first railway company in the all world to apply yield management. Borrowed from the airlines - American Airlines for the software used by the SNCF - yield management is based on occupancy across time (Smith and al., 1992). Thus, when the departure nears, the price goes up; the same principle applies with occupancy rates.

a) The prices paid by users are set on the basis of regulated tariffs corresponding to the reference price of travels in second class;

b) Tariff's Modulation is left to the discretion of the railway company, but framed by ceiling between plus and minus 40% of the reference price;

c) SNCF must provide available discounted tickets to customers, corresponding to a percentage of the total annual ticket sales.

The issue of the reference price is crucial. In practice, there is not a single tariff ceiling for all TGV, but as far as tariff ceilings routes (over 500 caps). For HSR, the key factor of the SNCF's pricing, is clearly the potential of intermodal competition (low cost, Air France, coaches...). Prices are all the more important that intermodal competition is weak, as we can observe on Table 6, illustrated by the case of Paris-Montpellier (or Lyon-Montpellier) and Paris-Marseille.

The price variability regarding the date of purchase before departure has also a simple explanation. The railroad, like other modes of transport, is a service whose production risk is borne by upstream provider. Scheduled service, even without traveler, must be assured. Paying several months in advance

a ticket involves the client in the management of production risk. This sharing should logically be rewarded with a lower price travel. This is indeed the case, as we have seen in the table 6.

Overall, HSR's SNCF tariffs are subject to various constraints: obviously, intermodal competition and the huge fixe cost (to renewal rolling stocks). In Europe, operators are separated from infrastructure management and are request to pay infrastructure charges. These charges impact more and more the operating costs.

Considering the issue of equity

Regarding "procedural justice", HSR clients are facing the fact that there is no apparent rules, apart, possibly, the rule of maximising the revenue. TGV fares are routinely qualified to be non-transparent by travellers and users associations (FNAUT, 2011). So we can even say that the rules are not applied in a constant way across the different locations.

As regards "legitimate expectations", you can expect that, by booking your ticket four month in advance, you can benefit from substantial discount. This is usually the case, but is not true for every link. You would expect to pay less for a shorter distance. That is not the case as the Paris Lyon Marseille exemplifies. You pay more for Paris-Lyon than for Paris Marseille; and to go from Paris to Marseille, it is necessary to go first in Lyons (450 km) then to pursue to Marseille (about 300 km). The travellers, victim of monopoly pricing can, to a certain point, consider that their expectations are not met.

The "formal equity" is seriously breached. Depending where you depart from and where you want to go, you have to pay very different prices (on a cent per km basis) even for distance of comparable length. For example, from Paris to Montpellier, price is €71 (9.5 c. per km) and from Paris to Marseille, it's €57 (7.3 c. per km).

Regarding "substantive equality", we have to be moderate. To a certain extent, the customer who accepts to pay a given price for his travel should assess the benefits and the costs of his purchase. But, sometimes, the customer has no choice, and he/she or his/her firms has to pay, because the alternate transport modes are too expensive or not available. The introduction of the TGV network has been partly at the expense of the conventional rail network. Usually, nowadays the timetables and links are less attractive for the travellers departing from these "small" stations, compared with the situation existing before the setup of HSR.

It is obvious that the "equality of choices" is seriously breached. If you are Parisian and you have a limited amount of money to spend, you better go to Marseille than to Lyon or to Strasbourg. And conversely, to go to Paris, it is better to live in Marseille, than in Lyon or in Strasbourg. If you are a businessman from Lyon, you might prefer to attend a meeting in Montpellier than in Marseille. The use of the web site of SNCF (the train operator) provides some astonishing pictures of the crazy results of a hub and spokes network. For example, Bordeaux and Rennes are two western cities of France, both linked to Paris by HST. Buying a train ticket leads you directly to Paris.

Concerning the "consistency with merits", once again, the fare structure appears to breach the very concept of equity. If the fare structure is cost related, we could admit that there is a certain justice. But it is not the case. And thus having the merit to be in competition with a low cost carrier (e.g. Paris-Marseille) does not allow you to benefit from discounted fares. Having or not having an affordable alternative to HST is not a merit per se. We could also discuss here tariff benefits obtained by the salaries and retired from the SNCF; since they benefit from particularly favorable conditions, even though the company has to its economic viability for many, to the provision of public subsidies from taxpayers.

About the "rights", we will address how the legislature, in France, sought to enhance the right to transportation (LOTI, 2002), including high speed rail. According to the constraints imposed by the State to the national railway company, SNCF has to offer its customers a minimum number of tickets below the reference price. Another argument usually reported by the SNCF, is the high occupancy rate TGV in France, compared with high speed in Germany and Spain (Leboeuf, 2014). This is a fact which helps to establish real social attractiveness of the TGV. The criticism that the TGV is "the train for the riches" does not seem justified. TGV customers are socially diverse and that the TGV is

increasingly used by managers than other trains is undeniable. Is it not also the case with many domestic flights?

Comparison with others Europeans countries: is there others “Cash cow” HS trains?

Table 7. Prices examples of HSR’s destinations in others European countries

		Price 1 month discount.	Price 2 months discount	Distance (road, km)	Cents per road km 1 month	Cents per road km 2 months	Ratio one month to 2 months discounts.
Spain							
Madrid	Ciudad Real	37.2	36.4	204	18.24	17.84	1.02
	Zaragoza	54.6	54.6	314	17.39	17.39	1
	Cordoba	62.1	62.1	387	16.05	16.05	1
	Seville	75.5	75.5	529	14.27	14.27	1
	Barcelona	106.7	106.7	617	17.29	17.29	1
Germany							
Frankfurt	Koln	69	69	192	35.94	35.94	1
	Stuttgart	61	61	206	29.61	29.61	1
	Munchen	98	98	420	23.33	23.33	1
Berlin	Leipzig	46	46	196	23.47	23.47	1
Hanover	Munchen	129	129	631	20.44	20.44	1
UK							
		Pounds	Pounds	km	Euros c.	Euro c.	
London	Birmingham	14	14	190	8.69	8.69	1
	Manchester	108.5	34	322	39.76	12.46	3.19
	York	30.5	30.5	330	10.91	10.91	1
	Newcastle	28.5	38	446	7.54	10.05	0.75
	Glasgow	54	50	650	9.8	9.08	1.08

Source: National rail inquiries, RENFE web site, Bahn.com. Visited on the 13rd of May 2013.

Our first result is that, in contrast to France, yield management system is not the rule on the HST in others European countries. The price is usually stable in the time for all the links studied in our sample, with almost no discount price for purchase in advance (Table 7, last column).

Second result, the existence of Cash cow is not confined to the French HST. What is surprising is to find these practises both, in UK, the epitome of free market entrepreneurship and in France the epitome of state owned monopolies. London-Manchester is a perfect sample of cash cow price. Bought only one month before the departure, the price in cent per kilometre is €39.8 for only €12.5 for a ticket bought four months before. And we can also observe some cases of Cash cow price in Germany, by example between Frankfurt and Köln with monopoly price of €35.9 in cent per kilometre.

Third result, the intermodal competition is not really taking into account, in the HST prices, except few exceptions. Usually, the price per km doesn’t decrease substantially for long distance travel where competition is more in favour of air. The case of UK is very representative of this fact. The price per km is quite always the same (between €9-10) whatever the distance, except for London-Manchester which price is very expensive. In some case, we even can note the price reversal with London-Glasgow (650 km, £9.8) which is expensive compared with London-York (330 km, £10.9). In Germany, we find mainly the same results than in UK. The price per km is quite always the same

whatever the distance (between €3-20). We can also observe how expensive is the train-km in Germany compared with rail price in UK.

Conversely, in Spain, usually, the average price, in cent per kilometre, is decreasing with the distance. The competition of air is taking into account as in France. By example, we observe this fact for the small distance Madrid-Ciudad Real (204 km, €18.2) more expensive in comparison with Madrid-Seville with more long distance (529 km, €14.2). The exception is Madrid-Barcelona which could appear as a cash cow price (617 km, €17.2).

However, regarding the evolution of the European railway regulation (fourth railway package), we can ponder whether the introduction of competition can lead to a more equitable pricing system. Competition on the track can decrease the prices on the more heavily priced segments (notably Paris-Lyon and Paris-Strasbourg). But such a competition raises numerous questions (Pérennes, 2014).

Is Ouigo a new concept of HST regarding pricing equity?

However, to be comprehensive on this point, we would like to include in our analysis the impact of the high speed experience at low prices, provided by Ouigo; the brand of SNCF low cost, recently launched (April 2, 2013). The target aims to attract new customers previously using the car because of an insufficiently competitive rail service compared with the car (Ciry, 2014).

This new product is focused only on very busy links: Marne-La-Vallée-Chessy to Marseille and Montpellier. There are three return services a day and four on Sundays (62 links a week). In order not to compete with the TGV, the choice of the station is Marne-La-Vallée-Chessy, on the eastern suburb of the capital and, in Lyon, usually Saint-Exupéry, the airport of the city, but connected with the city centre by suburban rail (Figure 1).

Figure 1. Mapp of TGV Ouigo network



Source: <http://www.ouigo.com/fr/destinations-et-gares> - Visited on the 2 of March 2015.

The prices are really attractive, with fares for the single class – for a second-class kind of comfort - ranging from €10 to €85. Children (less than 12 years old), if accompanied by an adult, pay only a flat fare of €5. Moreover, by contract with the State, the SNCF has the obligation to provide 1 million of tickets each year at less than €25 (whatever the distance is). With these low prices, there is no more first class, tickets can exclusively be booked on line and services are limited, with only one piece of baggage free on charge, no bar onboard, and a check in before getting on the train at least 30 minutes

before departure. Moreover, the personal tickets are not refundable, except in the event of cancellation of the train and exchangeable with financial penalties. Booking can only be done maximum 10 weeks before the departure. Finally, strong constraint, the half of at the 10 stations served by Ouigo are outside the city and imposes an often consequent access time to the townsmen centers (in particular at the beginning of Marne La Vallée Chessy, Lyon Saint Exupéry), or sometimes a significant financial cost (especially with Lyon Saint Exupéry) the traveler Ouigo (Table 8).

Table 8. Examples of access to Ouigo stations by public transport.

Ouigo Stations	Marne-la-Vallée Chessy	Lyon –Saint-Exupéry Airport	Aix en Provence TGV	Valence TGV	Avignon TGV
Access time to the city center	50' (RER A)	30' (suburban rail, 'Rhône Express')	20' (county Bus)	20' (Express Bus, 'Inter Citéa')	Suburban rail: 5' 4,5 Km by car: 9'
Frequency	15'	15'	15'	15' (rush hour) -60' (off-peak hour)	60'
One way ticket price (excluding any discount)	7.6€	14.6€/ 25.7€ (round-trip ticket)	4.1€	1.2€	1.6€

Source : relevé sur le site Ouigo et transports publics - Visited on the 2 of March 2015.

To have a more clear idea of the fare structure of Ouigo, we realised a study of prices on main trains (Table 9). We obtain the following four major observations:

- a) Tickets purchased in advance are always less expensive for the same destination as those bought little before the departure, with a going ratio from 1.5 to 2.5.
- b) Secondly, Ouigo's fare are not cost oriented as we can observe in the similar price of the ticket from Marne La Vallée - Marseille and Marne La Vallée – Lyon for the same hour of departure!
- b) Ouigo's fare are not cost oriented. A similar price is possible for two very different distances, with the same starting point: €25 for Marne-la-Vallée Chessy - Marseille or for Marne-la-Vallée Chessy - Lyon!
- c) Potential of demand has a great impact on the price level. It's the reason for a higher price for the tickets taken during school holidays (Tuesday 21 of October).
- d) Ouigo low prices are reality: three weeks before departure, it's possible to find tickets for quite the all destinations proposed by this line for 10 or 15€ much cheaper than all others transport alternative choice, coaches, bus or even carpooling.

This pattern of pricing structure is similar to the main lines.

Table 9. Prices sample of some TGV's links with Ouigo

In euros	Tuesday 14 October	Tuesday 14 October	Tuesday 21 October	Tuesday 21 October	Tuesday 4 November	Tuesday 4 November
Marne La Vallée - Marseille	12:22: 25€	19:26: 30€	12:22: 45€	19:26: 45€	12:22: 10€	19:26: 10€
Marne La Vallée - Lyon	12:22: 25€	19:26: 30€	12:22: 45€	19:26: 45€	12:22: 10€	19:26: 10€
Marne La Vallée - Montpellier	11:00: 25€		11:00: 50€		11:00: 10€	

Marseille - Marne La Vallée	08:25: 15€	16:28: 10€	08:25: 45€	16:28: 30€	08:25: 10€	16:28: 10€
Lyon - Marne La Vallée	08:35: 20€	17:13: 45€	08:35: 40€	17:13: 50€	08:35: 10€	17:13: 15€
Montpellier - Marne La Vallée		15:24: 45€		15:24: 55€		15:24: 15€

Source: <http://www.ouigo.com/fr> - Visited on the 10th of October 2014.

To obtain these 'low fare', SNCF has to drastically reduce its operating and structure costs, by 30%. To succeed, SNCF introduced a cocktail of managerial and technical innovations. The choice of the departure stations allowed to spare on the infrastructure charges, each of the four double-deck TGV Duplex offer a total capacity of 1 268 seats, almost 25% more than a standard formation... And this material is call to run much more than the others TGV, with much reduced technical maintenance stops. This material is also intended to be used more intensely than other TGV materials, with greatly reduced term technical maintenance. A new organization of accompanying staff reduces the out of home nursing fees and most of the maintenance is done directly during the trip.

At the end, it appears that the balance of the tariff Ouigo fairness is important and generally positive. First of all, because of its competitive tariff offer, and singularly for the families, the young people and the small groups, Ouigo brings a significant increase of value for money and therefore of the "substantive equality". Ouigo is sometimes even cheaper than carpooling! Secondly, Ouigo brings a surplus regarding the right to transportation, by providing some affordable journeys. SNCF proclaims that, during the first year, Ouigo had already carried over 2.5 million passengers. Among them, 500 000 persons would not have travelled if Ouigo had not existed. In addition, Ouigo is manifestly attractive to families as a result of one price of 5 € for accompanied children. SNCF estimated that 40% of tickets sold correspond to this clientele.

On the other hand, Ouigo degrades the equality of the choices because of very small proportion of served population, currently, by the 10 stations of the Ouigo network. It also should be observed that the tariff initiative of Ouigo neither is isolated, nor completely new. It is part of a continuum of initiatives taken by SNCF to make the most attractive high speed, introduced with iDTGV, the first low cost offer, launched in 2004 with differentiated service, or later with such tariffs Prem's, available in limited quantities to certain destinations and some trains.

With less than two years of operating, it's too early to make a full assessment of this new HST pricing and these studies remain to be done. Furthermore, SNCF plans to extend the Ouigo network with the opening of new lines on Atlantic coast before 2017.

42. Funding policy: empirical evidences

The results for the French HST funding

Regarding the French HST funding, two main results appear. The first result shows the huge increase of the amount of each new HST project and the second result deal with the evolution of the payers (Leboeuf, 2014).

Approximately, the first line, Paris-Lyon costed Euros 4.8 million per kilometer (euro in constant value of the year 2003), compared with €9.3 for TGV Atlantic and €9.5 for Nord-Europe. More recently, the TGV Mediterranean cost €17.5 million per kilometer and €16.2 for the new line SEA (South-Europe-Atlantic).

The second result deal with the evolution of the payers. Who support the HSR funding in France? Funding for high-speed lines has gradually expanded. The analysis shows four specific steps.

In the first HSR invest period; the investments were fully supported by the SNCF budget, mainly by its own cash flow. The operator based his calculation by the hope that the high profitability of these lines would improve the financial health of the company.

On the second period, in relation to the deterioration of the financial position of the SNCF, the national railway operator asked and obtained a share between SNCF and the State. We can observe this public subsidy of 30% in the LN2 (TGV Atlantic).

For the third period, since the creation of RFF (1997), the independent infrastructure manager, mix involving a large subsidy from the State or the European Union, coupled with contribution from RFF and from local authorities. This new scheme can be clearly observed on the financing of the LN6 (East TGV, first stage) and LN7 (Rhin-Rhone TGV).

And the last step, we notice the call for new financing mechanisms, with concession for Perpignan-Figueras or with PPP mechanism for the SEA line (South-Europe-Atlantic) with Vinci, one of the main French construction company.

For the last 4 HSL construction projects in progress, on average, public funds represented 55%, RFF is barely 20%, and 25% from private. Among these 55% of public funds, 1% is coming from EU, 25% from local governments and 29% from the central government (Table 9, last column).

Table 9. Funding of HSR's links in France

	EAST (1)	BPL (1)	CNM (1)	SEA (1)	Total	
					Amount	%
Total cost (million euro)	2 000	3 300	1 800	800 ⁷	14 900	100,0
Length (km)	106	182	80	303	671	
Cost/km (million euro)	18,9	18,1	22,5	25,7	22,2	
Paid by RFF (million euro)	520	1 400	-	000 ¹	2 920	19,6
Paid by central government (million euro)	680	950	1200	1500	4 330	29,1
Paid by local government (million euro)	640	950	600	500 ¹	3 690	24,8
Paid by EU + Luxembourg (million euro)	160	-	-	-	160	1,1

Source: RFF.

(1) EAST: second phase of the East European High Speed Line; BPL: Bretagne, Pays de la Loire; CNL: line- Nimes/Montpellier bypass and SEA: South-East-Atlantic.

In short, funding sources have evolved rather quickly over the period on which HSL were build. SNCF (state owned operator) withdrew from the investment market to give room to central and local government. RFF, the owner of the track is risk adverse and doesn't want to be involved in risky investment. Some private funds might be involved (e.g. Continuation of the TGV Atlantic toward Bordeaux). Added to this, the aim of these new lines changed. Previously HSR lines were to link Paris and the main French cities to built a modern core rail network and more and more, the new lines projects aim to promote local and regional interest (supporting really less potential traffic) or to link French network with others Europeans' ones. It's the reason why the socio economic return of new extends HSR lines decreased significantly.

Funding considering the issue of equity

Regarding "procedural justice", HST funding mechanisms differ depending on the line chosen. This fact introduces spatial inequity. For the "chore three lines" (South East, Western, North) local taxpayers were not solicited. Conversely, "as time goes by", the new investment was on less travelled lines. Local government are requested to pay their share of the investment. This is the case, notably for the four HSL now planned or under construction in France (table 9). Political bargaining probably outweighs the economic calculation. So the rules are flexible.

About "legitimate expectation", the impact of a new high speed line on a regional economy and the wider benefits are very difficult to estimate (part. 3). They vary according to the line type. The local governments (and taxpayers) might not be in line with their expectations. Long term macroeconomics factors are very unpredictable and traffic modelling remains a very difficult art. All that leads HSR funding to be more and more risky with uncertain results.

As regards to "formal equity", we can observe a huge evolution: the conditions under which a decision to implement a new HS line are tightening over time. Recipients of the first lines did not directly contribute to pay for the investment (south-East; Atlantic), although citizens of the last lines are requested to pay, by local taxes.

For example, for the first stage of TGV East line, local authorities had to pay about 740 million, or 24% of the total. The "Bas-Rhin" (a local district about half of the Alsace region) had to support a funding, equivalent to the Ile de France (Paris), whereas the population of the former is 1.2 million against 11.8 million for the second.

With respect to "substantive equality", the different HST funders don't obtain similar net outcome. It depends of the line and of the context (demand, macroeconomics...). From the taxpayers' point of view, with state funding, we saw (part. 3) that the economics and demographics benefits are not similar on the all territory. All people contribute for this infrastructure, but only some of them receive HST benefits. From the local taxpayers', more and more requested to participate at the funding, the balance is actually unclear. By example, there are no available results to say if the local communities from Champagne-Ardennes, Alsace or Lorraine had received their money back for theirs invests in the EAST first stage.

Concerning "equality of choices", there is not equality of (spatial) distribution of choice sets for few reasons. The main reason is the finance public context. Actually, there is not enough public money available to finance the all plan of HST lines. Some projects have been blocked, not receiving a favourable context (Commission Mobility 21). The second is that some HSL projects may be eligible to the priorities of the European Union, by TEN-T funds (East, first and second phase), others not (SEA). European Union promotes the links between countries (Lyon-Turin). Some areas or local governments have the financial capacity or political will to co-finance the High Speed Rail, some others not. At the end, some regions and cities will stay out of the HST network.

The "consistency with merits", leads to qualify what is the merit of a HST projects. Based on the socio-economic rate of return, the results of LGV are very different (Leboeuf, 2014). Some projects could enjoy strong political support despite low profitability (Lyon-Turin). Few authors focus on the requested conditions to obtain effective benefits for local investments in HSR, huge involving of local policy, good planning, and localisation of rail stations and connectivity with others modes (Vickerman, 1997; Banister, Givoni, 2012). Some regions and cities succeed to do profitable their investments in HSR, others less or not.

5. Conclusions

Nineteenth century was the real time of high speed in ground transportation (Whitelegg and al., 1993). This had not entailed very much inequity for two reasons. First the rail networks achieved a dense territorial coverage. A very large distribution of the advantage of high speed ensued. Secondly, in an economy based upon industry, a certain degree of proximity was necessary between the productive activity and the service related to that activity. We are now in a knowledge based economy facing globalisation and digitalisation.

The data are consistent with a polarisation effect. In a sense, HSTs are unfair because they are growth-inducing. As in the nineteenth century, HSL were developed where the growth potential was higher although a few regions benefited of a windfall. But with a few exceptions, the regions served by TGV

are among the most dynamic in France. Surprisingly, although the TGV system is converging toward Paris, the Parisian region doesn't appear to benefit more than the other regions from this central position. We might call this tendency "diffusion" as the knowledge based economy, mainly based in Paris, is creating some benefits for the periphery. So, the spatial impact of TGV is mixed: polarisation, to the detriment of the regions not served, and diffusion of the benefits of the major engine of the knowledge based economy: Paris.

The transfer to the railway pricing system of yield management leads to a peculiar and singularly unfair situation. Fortunately, other modes can compete. Air transport seems to be more efficient than rail for intercity travel (Paris excluded) Moreover, air is not centralized on a major hub (so far for LCCs). For intercity travel in France and in Europe, air travel is more cost effective and faster than rail. This provides a "second chance" for the regions with no HSL. It remains to be seen whether car sharing could contribute to restore equity. The "green" argument in favour of railways seems to begin to weaken (Westina and Kagesona, 2012).

References

- ALBALATE Daniel, BEL Germa (2012). High-Speed Rail: Lessons for Policy Makers from Experiences Abroad. *Public Administration Review*, May-June, 336-349.
- ALDERIGHIA M., CENTOC A., NIJKAMP P., RIETVELDD P. (2012). Competition in the European aviation market: the entry of low-cost airlines. *Journal of Transport Geography*, 24, 223-233.
- BANISTER D., GIVONI M. (2012). Speed: The less important element of the High Speed Train, *Journal of Transport Geography* 22, 306-307.
- BARRO R.J., SALA I MARTIN X. (1991). Convergence across states and regions. Brookings papers on economic activity. Vol. 91, pp. 107-182.
- BONNAFOUS A., (1987). The regional impact of the TGV, *Transportation*, 14/2, 127-137.
- CHEN Chi-Lin and HALL Peter (2012), The wider spatial-economic impacts of high-speed trains: a comparative case study of Manchester and Lille sub-regions, *Journal of Transport Geography*, 24, 89-110.
- CIRY B. (2014). Ouigo : un concept pionnier de la SNCF. *Revue Générale des Chemins de Fer*, 234, janvier, 6-14.
- DALL'ERBA S., LE GALLO J. (2005). Dynamique du processus de convergence régionale en Europe. *Régions et Développement*, 21, 119-139.
- Décret n°97-444 du 5 mai 1997 relatif aux missions et aux statuts de Réseau ferré de France
- DE WITA J.G., ZUIDBERGC J. (2012). The growth limits of the low cost carrier model. *Journal of air transport management*, 21, 17-23.
- Directive 91/440/CEE du 29 juillet 1991 (JO du 24/08/1991). Relative au développement des chemins de fer communautaires.
- DOBRUSZKES F. (2011). High-speed rail and air transport competition in Western Europe: A supply-oriented perspective. *Transport Policy*, 18, 870-879.
- FNAUT (2011), Les arguments des opposants aux lignes à grande vitesse. Recensement, analyse et recommandations. 62 p.
- GARMENDIA M., RIBALAYGUAB C., UREÑAC J.M. (2012). High speed rail: implication for cities, *Cities*, 29, 526-531.
- GIVONI M. (2006). Development and Impact of the Modern High-speed Train: A Review. *Transport Reviews*, 26, 5, 593-611.
- GRAHAM M. (2009). Different models in different spaces or liberalized optimizations? Competitive strategies among low-cost carriers. *Journal of Transport Geography*, 17, 206-316.
- HAY Alan M. (1995). *Concepts of equity, fairness and justice in geographical studies*. Transactions of the Institute of British Geographers, New Series, 20, No. 4, 500-508.
- LEBOEUF Michel (2014), *Grande vitesse ferroviaire*. Cherche Midi, 860 p.
- LEVINSON David M. (2012). Accessibility impacts of high-speed rail. *Journal of Transport Geography*. 22, 288-291.
- LOTI (2002). Loi n° 82-1153 du 30 décembre 1982 d'orientation des transports intérieurs. Journal Officiel du 31 décembre 1982.

- MARTINEZ Sanchez, MATEOSA H.S., GIVONI M. (2012). The accessibility impact of a new High-Speed Rail line in the UK – a preliminary analysis of winners and losers. *Journal of Transport Geography*, 25, 105-114.
- MONZON A., ORTEGA, E. LOPEZ E. (2013). Efficiency and spatial equity impacts of high-speed rail extensions in urban areas. *Cities*, 30, 18-30.
- PERENNES P. (2014). Use of combinatorial auctions in the railway industry: Can the “invisible hand” draw the railway timetable?” *Transportation Research Part A: Policy and Practice*, 67, September, 175-187.
- PRESTON J. (2012). High Speed Rail in Britain: about time or a waste of time? *Journal of Transport Geography*, 22, 308-311.
- RAWLS J. (1971), A Theory of Justice. Harvard University Press, Cambridge, Massachusetts, 607 p.
- SANDS Brian D. (1993), The Development Effects of High-Speed Rail Stations and Implications for California. University of California Transportation Center, WP. 67 p.
- SMITH Barry C., LEIMKUHNER John F., DARROW Ross M. (1992), Yield Management at American Airlines, *Interfaces*, 22:1, January-February, 8-31.
- UIC (2011), High speed Rail as a tool for regional development. DB International GmbH. Frankfurt. 191 p.
- URENA J.M., MENERAULT P., GARMENDIA M. (2009). The high-speed rail challenge for big intermediate cities: A national, regional and local perspective. *Cities*, 26, 266-279.
- VICKERMAN Roger (1997), High-Speed Rail in Europe: Experience and Issues for Future Development. *Annals of Regional Science* 31(1): 21–38.
- WESTINA J., KAGESONA B. (2012). Can high speed rail offset its embedded emissions? *Transportation research part D*, 17, 1-7.
- WHITELEGG J., HULTEN S., FLINK T. (1993). Introduction in Whitelegg J. Hulten S., Flink T. (Eds) High speed trains: fast track to the future, Leading edge, London.