

Chapter 2

The Performance of International Passenger Rail Transportation: A Statistical Assessment



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2.1 Introduction

There are many advantages to taking the train. Unlike driving, rail allows travellers to avoid traffic, especially during rush hours. It also allows travellers to rest, especially over long distances. Moreover, there are 18 times fewer accidents by rail than by car. Unlike air travel, rail travel allows travellers to travel to and from a city centre or downtown area, as railroad stations are generally located within cities rather than on the outskirts, like airports. And rail travel does not involve arriving over an hour before departure. In terms of the environment, rail travel also has many advantages: a train uses on average 12 times less fuel per person than a car and 3 times less than an airplane (SNCF 2016). High-speed train (TGV) passengers reduce their CO₂ emissions per kilometre by 50 compared to a car, by 25 compared to a carpool and by 8 compared to a bus¹ (Spinetta Report 2018).

For many years, the European Commission has therefore been working to promote international rail transportation, especially with the Fourth Railway Package of 2016, which aims to realize a single European market for rail. This commitment has had some positive results, including visible improvements in service quality (Von Arx et al. 2018). This progress on international lines has been supplemented by national efforts, especially in mass transit links between cities or major metropolitan areas.

¹Only regional diesel trains emit more CO₂ than busses because of their low occupancy rates.

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However, the results for international rail do not seem to have measured up in terms of commitments or benefits. In 2017, the European Commission inventoried 365 existing cross-border railway lines in Europe. Of these lines, 202 are operational and 156 are frequently used. Only 57 are classified as “fully utilized,” 81 are “imperfectly utilized” and 18 are “not fully utilized” (Sipel 2018).

Just as rail has been overtaken in each country,² the same is happening in international travel. To understand these disheartening results for international rail travel, we will proceed in two steps. The first step will make a comparison at a time t (synchronous) and then compare the rate of progress (diachronic) of rail in European countries. Rankings will then be made to illustrate the diversity of European railways. These synchronous and diachronic comparisons will be put into perspective with the growth rates of rail’s main competitors: bus and air travel. We will then analyse the reasons behind international rail’s lacklustre performance.

Both of these steps require reliable data. The EU Eurostat database will be very useful for European comparisons. It will allow us to make a clear assessment through the use of percentages. This database will be supplemented primarily by data from ARAFER (the French government agency regulating rail and vehicle transport) for comparisons between modes of transportation and INSEE to look at the case of France.

2.2 Statistical Assessment: Comparisons in Europe and Between Modes of Transport

In this first step, we will assess passenger rail transport at time t (synchronous) in the first subsection, followed by a dynamic or diachronic assessment in the second subsection. Each subsection will include comparisons between European countries and between modes of transportation.

2.2.1 A First Synchronous Assessment

In passenger kilometres per inhabitant, Luxemburg, France, Czech Republic, Switzerland and Denmark had the most international rail travellers in the EU-18 in 2016, as can be seen in Fig. 2.1. These top five alone represent 63.7% of all rail passengers. To compare with transportation within the country, the countries with the most rail users per capita are, in order, Switzerland, Austria, the Netherlands,

²At the national level, the volume of vehicle transport is much higher than for rail: it is at least 10 times higher in the EU-28 from 1995 to 2015. Air travel is catching up, increasing by 86.5%, while the growth rate for rail in the same location over the same period was 26.1%. In international travel, rail made up 4.8% of total trips in Europe in 2016 (ARAFER 2018).

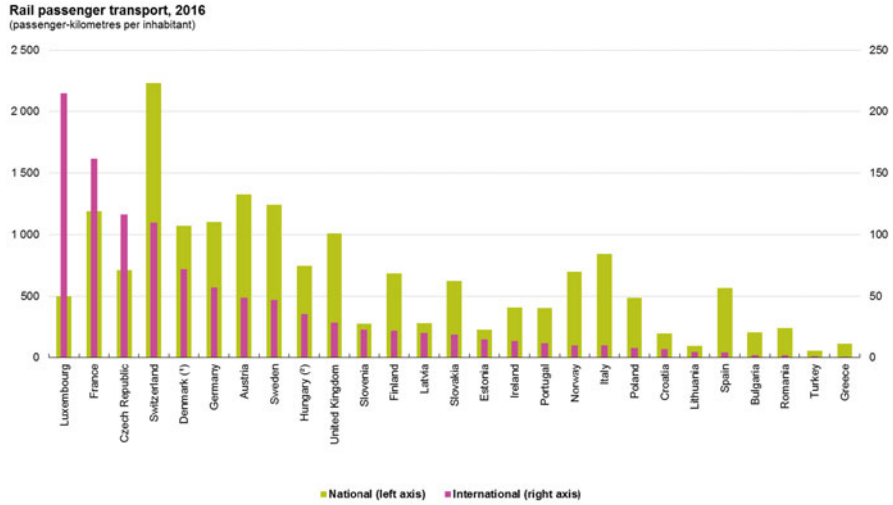


Fig. 2.1 International rail travellers in decreasing order of passenger kilometres per inhabitant, by European countries (Eurostat, 2018)

France and Sweden. These numbers can be explained by the geographic location of these countries, which have the most international borders, the number of cross-border workers and the speed offered by certain lines, as we will see in later sections.

More specifically, Table 2.1a presents a country ranking of passenger kilometres by inhabitant for domestic travel, in decreasing order. Table 2.1b presents a parallel ranking for international travel. It is interesting to note that among the 10 countries with the most national rail travel, nine of them are also in the top ten for international travel. Only Luxemburg is not in both rankings: it is the country with the most international travellers per inhabitant and also the country with the weakest multiplier between national and international travel. Besides this exception, the higher the amount of national travel, the more frequent international trips seem to be.

An analysis of how many thousands of international travellers enter and leave European countries can supplement this comparison of passenger kilometres by inhabitant. We first note the complete lack of data for five countries: Italy, Cyprus, Malta, the Netherlands and Austria. The lack of recent data is also problematic for our analysis (especially for France, where the Eurostat data end in 2009, and for Belgium, where there are no data after 2011). We have thus chosen to work with an average of the last 10 years. France is on average the country with the most travellers entering, followed by the UK, Germany and Switzerland, as seen in Fig. 2.2. France is also the country with the most travellers leaving the country, followed by the UK, Belgium, Germany and Switzerland. For comparison, bus travel carries an average of 4 million passengers from France to other countries (ARAFER 2018).

Table 2.1 Ranking of the top 10 European countries by national and international rail passengers, by passenger kilometre per inhabitant in 2016 (Eurostat, 2018)

(a) Country ranking for domestic travel				
Rank	Country	Domestic	International	Multiplier
1	Switzerland	2231	110	20.32862
2	Austria	1328	49	27.35377
3	Sweden	1243	47	26.40899
4	France	1189	162	7.355597
5	Germany	1102	57	19.31191
6	Denmark (2015)	1073	72	14.94853
7	UK	1009	28	36.02232
8	Italy	843	10	87.55479
9	Hungary (2014)	746	35	21.34783
10	Czech Republic	711	116	6.109845

(b) Country ranking for international travel				
N°	Country	Domestic.	Inter.	Multiplier
15	Luxemburg	502	215	2.336
4	France	1189	162	7.355597
10	Czech Republic	711	116	6.109845
1	Switzerland	2231	110	20.32862
6	Denmark (2015)	1073	72	14.94853
5	Germany	1102	57	19.31191
2	Austria	1328	49	27.35377
3	Sweden	1243	47	26.40899
9	Hungary (2014)	746	35	21.34783
7	UK	1009	28	36.02232

An analysis of the difference between those entering and leaving shows heterogeneity within the EU, as seen in Table 2.2. Belgium is the country with the highest negative balance, followed by Germany, France and Switzerland.

To supplement this average, a table of international travellers from each country reporting their destination country and a table of international travellers arriving in each country reporting which UE 28 country they are from would provide much valuable information. Unfortunately, the fragmentation of the data by year and country makes it impossible to build a reliable synthesis of this information.³ We therefore mainly use international tourism numbers to narrow down the origin and destination of passengers from one country abroad and then from abroad to a country. We chose to look at France because it has the highest number of arrivals and departures: France has 11 border regions. The flow of migration differs depending

³Here, we have in mind the Eurostat databases “international transport of passengers from the reporting country to the country of disembarkation” and “international transport of passengers from the country of embarkation to the reporting country.”

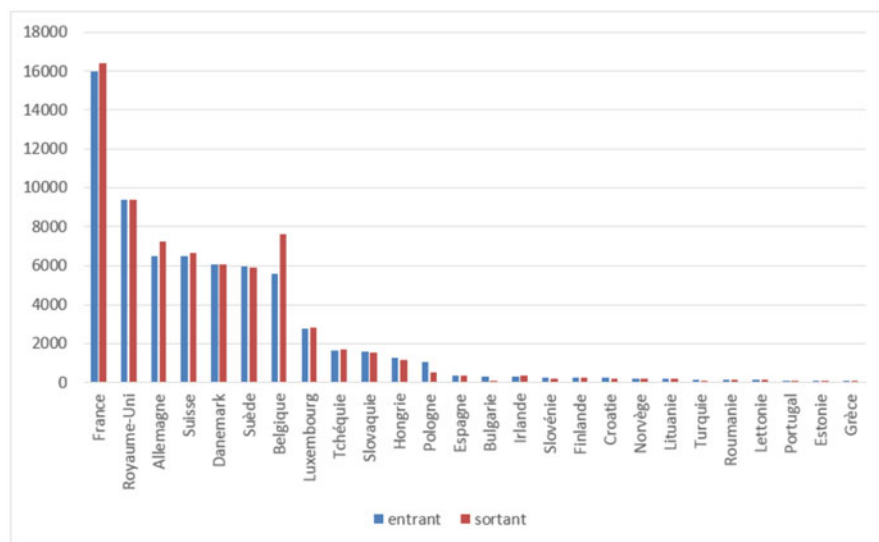


Fig. 2.2 Comparison of international rail travellers entering and leaving countries, on average, by thousands of passengers in Europe (Eurostat, 2018)

Table 2.2 Ranking of the top 10 European countries in terms of average number of international rail travellers entering and leaving, and the balance, in thousands of passengers (Eurostat, 2018)

Country	Average entering	Country	Average leaving	Country	Average balance
France	15,984	France	16,389	Belgium	-2070
UK	9389	UK	9389	Germany	-753
Germany	6463	Belgium	7616	France	-405
Switzerland	6461	Germany	7216	Switzerland	-188
Denmark	6040	Switzerland	6650	Ireland	-75
Sweden	5923	Denmark	6040	Czech Republic	-67
Belgium	5546	Sweden	5917	Luxemburg	-51
Luxemburg	2799	Luxemburg	2850	Romania	-13
Czech Republic	1644	Czech Republic	1711	Greece	-1
Slovakia	1601	Slovakia	1551	Spain	-1

on the country. In the case of France, we therefore distinguish between short and long trips and between business and leisure travel.

In 2012, 14% of business travel in France had an international destination. Short international trips (1–3 nights) made up 8% of all business travel and long trips abroad made up 6% (INSEE 2018). The estimated 350,000 commuters cross

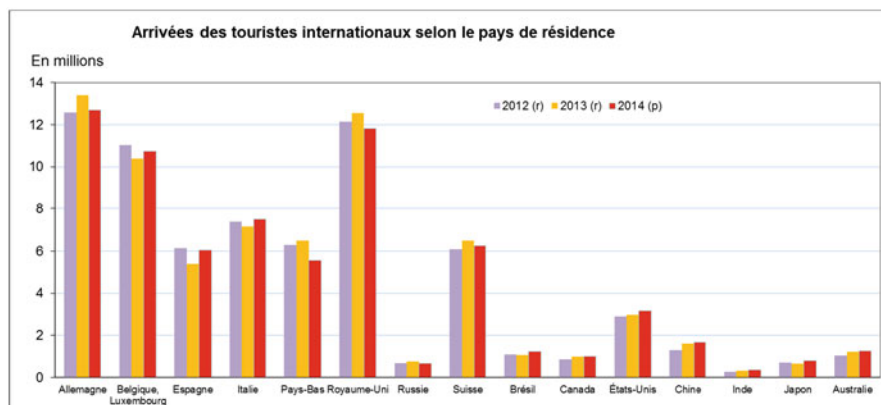


Fig. 2.3 Survey of visitors from abroad (DGE, Banque de France, 2013)

borders from France every day.⁴ In comparison, in all of Europe, 2 million people work in another country at least once a week as of 2015. And the trend of cross-border professionals has more than tripled in the last 15 years.⁵ In terms of mode of transportation, public transportation has a share of about 7% of cross-border mobility.

For leisure travel, 74.7% of trips had a destination in the EU: 17.2% to Spain and 11.6% to Italy. African countries were the second most popular destination (11.6%), followed by North and South America (8.2%) and Asia and Oceania (5.5%). At the same time, 84.8% of visitors to France came for leisure travel and 14.1% for business. Most of the international tourists arriving in France are travelling to France as their final destination (86.5%); France is not a transit country. Most of the most frequent visitors come from bordering countries as seen in Fig. 2.3.

The trips these international visitors take can also be analysed by mode of transportation. Worldwide in 2015, 54% of international arrivals came by air and 39% by vehicle (OMT 2017). In 2012, in France, 77.9% of international visitors came by vehicle, 14.5% by air, 4.9% by boat and 2.7% by train (DGCIS, Banque de France, EVE, 2013). At the same time, 58.8% of leisure trips from France to other countries were by air, 26.5% by car or motorbike and only 6.5% by train.

If we only look at cross-border travel, rail travel does not come out any more favourably. In fact, 90% of these trips are taken in private cars. On the other hand, rail travel makes up 80% of the remaining 10% of these trips. In France, there are over 20 rail lines that allow cross-border travel: the most popular go to Luxembourg,

⁴These flows should be qualified given the available databases as well as the flows clustered in these statistics due to factors like proximity or transit.

⁵<http://www.observatoire-des-territoires.gouv.fr/observatoire-des-territoires/fr/dynamiques-de-lemploi-transfrontalier-en-europe-et-en-france>.

Switzerland, Monaco, Italy and Germany. The distance between home and work, urban sprawl and traffic jams encourage people to use the railway (Forthoffer 2003).

Finally, within the railway offerings in France in 2014, international high-speed trains (TGV) made up 26 million kilometres of tracks, as opposed to 105 million for national TGV trains and 179 for regional trains (TER) (SNCF Network, ARAFER).

2.2.2 A Second Diachronic Assessment

We support the synchronous analysis with a diachronic analysis. Over the last 10 years, from 2008 to 2017, the Czech Republic and Spain have more than doubled the number of international rail passengers, followed by Norway with a growth rate of 80.64%. This trend is interesting because it shows the activity in these three countries that were ranked 10th, 14th and 11th in international rail travel in 2016 (Table 2.3).

If we compare this change to interior rail travel, the 10 countries where the number of passenger kilometres travelled by rail has grown the most between 2008 and 2015 are, in rank order, Poland, Bulgaria, Slovenia, France, Serbia, Croatia, Iceland, Latvia, Montenegro and Belgium (Fig. 2.4).

This progress is encouraging but should be seen in conjunction with other modes of transportation such as air travel. Air travel from France to other countries is clearly increasing: it grew by 379% from 1980 to 2017 and over 28% from 2008 to 2017. It is interesting to note that most of this travel is international and mostly within Europe, with the highest volume, 40.17 million passengers on average between 1980 and 2017, and the highest growth rate, over 588% in the same period, as well as one of the highest growth rates, over 38%, in the more recent period of 2008–2017 (Table 2.4).

Within Europe, 58.5% of international air travel from France goes to the UK, Spain, Italy and Germany (Table 2.5).

Table 2.3 Ranking of growth in the top 10 countries by international travellers, in thousands of passenger kilometres travelled by rail in Europe (Eurostat, 2018)

		2008	2010	2012	2014	2016	2017	% 2008–2017
1	Czech Republic	449	296	402	700	1229	1437	220.04
2	Spain	221	194	147	177	183	634	186.87
3	Norway	31	72	45	43	51	56	80.64
4	France	7546	–	10,698	10,810	10,810	9683	28.31
5	Finland	112	90	128	134	117	142	26.78
6	Germany	3870	4321	5124	5059	4700	4790	23.77
7	UK	1654	1720	1813	1905	1837	1872	13.18
8	Sweden	537	538	462	492	467	591	10.05
9	Portugal	120	103	90	111	120	124	3.33
10	Switzerland	912	998	1006	933	919	928	1.75

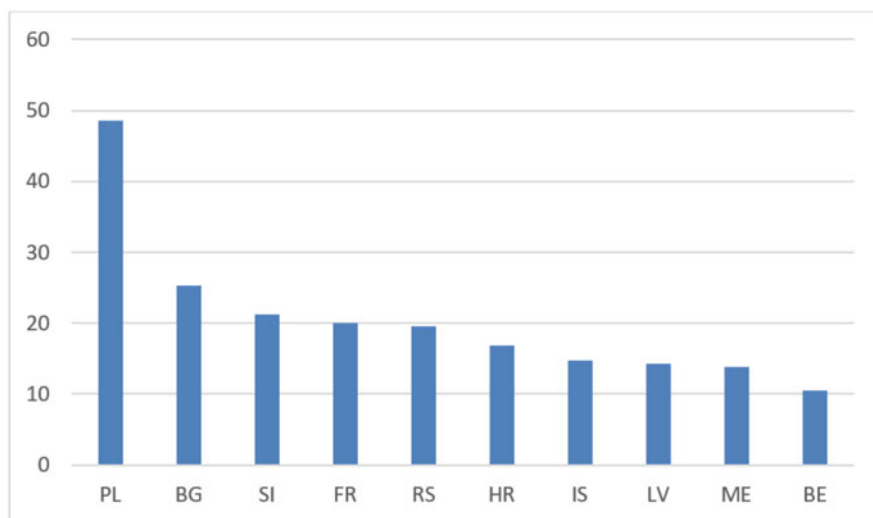


Fig. 2.4 Top 10 ranked countries of the EU-28 by growth rate in passenger rail travel, 2000–2015 (Eurostat, 2018)

Table 2.4 Air travel from France to other countries (DGAC 2018)

	% 1980–2017	% 2008–2017	Average 1980–2017
Total (mainland) France	379.29	28.31	87,304
France–International	488.17	32.11	63,562
France–Europe	588.91	38.80	40,172
France–Africa	200.78	13.34	10,317
France–America	575.63	15.83	7575
France–Asia	657.55	40.35	5483
France–Oceania	−99.97	-	14
France–France	144.33	12.42	21,047
Paris–Other Cities	91.66	−0.716	16,278
Other Cities–Other Cities	397.42	48.92	4769
Mainland France–French territories	474.05	25.44	2695
French territories–French territories	97.82	6.88	1703
French territories–International	166.57	25.48	1701
Total French territories	217.04	20.15	6099

Rail travel in France experienced four major phases in its development. The first phase extended from the Industrial Revolution to World War II: rail had a 90% share of transportation at the beginning of the twentieth century. The second phase took place between the 1930s and the 1970s. This period saw electrification in the 1930s and the beginnings of competition from private cars and air travel during the “trente glorieuses” period from the end of the war until the oil crisis of the 1970s. This new competition had clear effects: while over half the network was electrified in France,

Table 2.5 International air travel from France to Europe (DGAC 2018)

	% 2000–2017	Average 2000–2017
Europe	104.44	60,349
Spain	154.74	8663
UK	57.80	11,136
Italy	106.18	8151
Germany	58.23	7356
Portugal	312.96	3141
Netherlands	121.44	2620
Switzerland	15.38	2680

about 30,000 km of rail lines were deactivated between 1930 and 1970 (Spinetta Report 2018). The third phase, from the 1980s to the 2010s, was characterized by speed, with the development of the TGV and the construction of over thousands of kilometres of high-speed rails. The extension of the TGV network since the 1980s means that the TGV now carries half of all rail passengers (in passenger kilometres) even though the majority of trains in circulation are regional trains. The most recent development phase involves competition from new strategies and actors: budget air and bus travel as well as carpooling services. This competition explains in part the stagnation of TGV travel since 2011 (SDES 2016).

Looking at the passenger rail offerings in France in the last 3 years, one of the most significant declines is in international travel (−10%), as compared to domestic travel (−6%) and intercity trains (−13%).

2.3 The Performance of Rail and Its Competitors

To identify the difficulties rail travel is experiencing, we will analyse it with all the indicators traditionally used to evaluate the performance of modes of transport: cost, speed, punctuality, regularity and security. These indicators will be supplemented by environmental indicators such as greenhouse gas emissions, energy consumption and surface area.

2.3.1 *The Question of Cost for Rail Users*

Private cars are the preferred mode of transportation for most trips. At the same time, the cost of driving has gone up by about 34% over the past 40 years, adjusting for inflation, while public transportation prices have gone up by 12% (Beauvais Consultants 2013).

When this comparison includes the cost of rail transportation, the results are the same when compared to road transportation but differ when comparing rail transportation to other modes. More specifically, when looking at user costs for

short distances, the regional TER train costs 0.0794 € per passenger kilometre and public transportation costs 0.1145€ per passenger kilometre in the Paris metro area and 0.1282€ in the rest of France, while each kilometre of car travel costs 0.2694€. For long distances, rail travel costs 0.0911€ for intercity trains and 0.1098€ for the TGV, while budget air travel costs 0.0556€ and coaches 0.069€ per passenger kilometre. Only traditional air travel and private cars are more expensive than the train over long distances, costing 0.1511€ and 0.1921€, respectively, Beauvais Consultants (2013).

If we narrow the analysis to international rail travel, for French rail in 2015, we see that the average price per passenger for international travel is the highest: 46.1€ for the TGV, 22€ for the intercity trains and 3.8€ for the TER (ARAFER). It should be noted that it is difficult to make comparisons of rail prices across Europe. To compare the price of train tickets in two different countries, all of the services provided would have to be identical and rates would need to vary little over time. However, the services and prices offered by different rail companies are very different, and relying on an average price across European countries would hide too many disparities.⁶

Revenue earned from international rail lines is much lower than from domestic lines: international transportation generates only 15% of revenues. Profits from the TGV mostly come from same-day round trips between major cities (Spinetta Report 2018) (Tables 2.6 and 2.7).

Several factors could explain these prices. First of all, rail travel has less structural flexibility than air or bus travel, which does not allow it to adapt to demand much if at all (IRG-Rail 2015). Second, the average distance to international destinations is 309 km. Only the TGV has a higher average distance per trip of 445 km. However, rail travel is less competitive for long distances than budget air or bus travel. If we compare TGV prices with air travel, production costs per kilometre are much higher for rail as distances increase. For distances between 400 and 600 km, production costs are lower for rail, and for distances between 600 and 800 km, the rates are comparable for both types of travel. At distances over 800 km, the train becomes much more expensive than air travel (Spinetta Report 2018). In observing user

Table 2.6 Passenger transported from local, national and international rail lines (ARAFER 2016)

2015	Passenger kilometres transported (PKT)	Passengers transported
TER	13,418,267,929	267,500,000
Transilien	13,397,009,231	900,036,310
Intercités	7,175,684,263	28,900,000
TGV, domestic	45,945,391,552	103,167,355
International	7,390,411,856	23,915,895
Total	87,326,764,831	1,323,519,560

⁶GoEuro does offer a comparison of average prices.

Table 2.7 Revenue earned from local, national and international rail lines (ARAFER 2016)

2015	Sales revenue (€ H.T.)	Average passenger distance (km)	Average occupancy rate (%)	Revenue per PKT (€/100 PKT)	Revenue per train km. (€)	Average price per pass. (€)
TER	1,029,268,127	50	25%	7.7 €	5.9 €	3.8 €
Transilien	1,029,640,409	15	25%	7.7 €	17.3 €	1.1 €
Intercités	634,483,270	248	42%	8.8 €	19.3 €	22.0 €
TGV, domestic	4,470,306,341	445	61%	9.7 €	39.5 €	43.3 €
International	1,101,462,332	309	73%	14.9 €	44.0 €	46.1 €
Total	8,265,160,479	66	42%	9.5 €	20.6 €	6.3 €

behaviour in comparing rail to bus travel, 38% of users chose the bus or carpooling because of the cost of rail travel (ARAFER). Third, business regulations are often less constraining for bus and air companies (IRG-Rail 2015). Finally, rail travel includes extra fees. Access fees are very high in international trips, especially for the TGV and night trains. In addition, unlike air travel, rail travel is not exempt from VAT.

2.3.1.1 Trip Duration

In this section, analysing travel time, we focus only on rail and air travel. To understand the potential market share trains could have as opposed to air travel, we have calculated the market share of each mode by rail travel time. Switching from rail to air travel seems to occur with trips that take 3 to 4 h by train; travellers prefer rail for trips that take less time. When the trip takes 3 h, the market share for business day trips is evenly distributed between rail and air. For trips over that duration, air travel is preferred to train by about 80% of this clientele (Spinetta Report 2018, p. 60). For trips over 5 h, for example, train travel has a 10–20% market share (Mignauw, 1998). It would thus seem necessary to focus on rail itineraries that take 2–3 h in order to compete with air travel (Klein and Claisse 1997) as this is the competitive distance for rail. It should be noted that this distance is limited to the domestic market between major cities, as seen in the figure below (OECD). In fact, when rail trips are international, the flow of passengers is sharply reduced (Spinetta Report 2018).

2.3.1.2 Service Quality: The Punctuality, Cancellation and Security Triangle

We now measure these three indicators for rail and air travel by comparing domestic and medium-haul flights⁷ to domestic and international rail itineraries.

On average, rail travel always has fewer delays than does air travel. Within rail travel, delays are overall the same for international and TGV trips. Within air travel, there is always a higher delay rate for long-haul than for medium-haul flights and lower for domestic flights. If we focus on 2016 and 2017,⁸ the increase in delays was primarily caused by the number of flights. We can also see a reduction

⁷Air France's medium-haul network includes flights in Europe between the following countries: Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France (not counting domestic flights in France), Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Rumania, Russia, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, the UK and Ukraine. It also includes flights between Europe and North Africa (Algeria, Morocco and Tunisia) and Israel. Source: www.airfrance.fr.

⁸For air travel, we prefer to focus on the last few years because the method of evaluating delays was changed in 2016.

in “passengers” and “airlines” as causes for delays and an increase in “security” causes, especially in medium-haul flights.

On average, the cancellation rate in rail is extremely variable and hides various discrepancies. The cancellation rate for air is clearer and seems to be inversely proportional to the delay rate: higher for domestic flights, followed by medium- and long-haul flights.

In terms of growth rate, delays are stable overall for air travel, with some improvement in long-haul flights. On the other hand, for rail travel, there has been significant growth in the delay rate for TGV and international travel. For international rail travel, the lowest delay rate is for trips between France and Switzerland. Cancellations have decreased for domestic and medium-haul flights but have increased for long-haul flights. For rail travel, cancellations have sharply increased for TGV and international trips (Table 2.8).

Comparing rail and coach travel, it seems that rail travel is more punctual: 21% of coaches arrived at their final destination at least 15 min late. These delays increase for international trips, with 44% of them having a delay of over 15 min.

Looking at delays across rail types, international trips are the bad apple, with 23% of trains delayed by more than 5 min 59 s, as opposed to 22% for intercity trains, 21% for TGV, 10% for TER and 9% for the Paris regional train Transilien (Tables 2.9 and 2.10).

Rail travel is extremely safe: in France, 54 people were killed over 87 billion passenger kilometres in 2015. In the same year, 3461 people were killed in road travel over 809 billion passenger kilometres, making rail travel seven times safer than driving (Sipel 2018). Comparing all modes of transportation, rail, with 0.10 fatalities per billion passenger kilometres, comes just behind air, with 0.06. The bus is half as safe, with a fatality rate of 0.19, followed by water travel (0.27), cars (passengers) (0.85), cars (drivers) (1.82) and motorcycles (37.80) according to the European Railway Agency. The increase in rail safety in Europe is encouraging: the

Table 2.8 Cancellation and delay rate (AQST 2018)

		2012	2013	2014	2015	2016	2017
<i>Cancellation rate</i>							
Air	Domestic	1.1	1.4	3	0.7	1.6	1.1
	Medium-haul	0.8	1.4	1.4	0.7	1.1	0.8
	Long-haul	0.8	0.6	1.6	0.4	0.5	0.5
Rail	International	0.2	3	0.3			1.2
	TGV	0.1	0.3	1.1	0.3	0.3	1
<i>Delay rate</i>							
Air	Domestic	13.1	13.3	13.1	11.1	17.1	17
	Medium-haul	16.8	17.6	18.3	19.4	22.4	22.4
	Long-haul	33.5	27.5	25.6	25.8	27.4	26.6
Rail	International	13.5	12.6	9.4	11.1	10.3	15.3
	TGV	10.6	11.7	9.6	10.8	11.5	15.4

Table 2.9 Cancellations across rail types (AQST 2018)

	Daily circulation	Advance cancellations	Trains scheduled as of the day before at 4:00 pm	Completely last-minute cancellations	Partial last-minute cancellations
TER	6182	61	6121	86	35
Transilien	4832	100	4732	127	54
Intercities	282	5	278	2	1
TGV, domestic	615	4	611	2	4
International	178	2	176	1	0
All passenger lines except non-contractual long-distance trains	12,089	172	11,917	218	95

Table 2.10 Delays across rail types (AQST 2018)

	Trains running	Trains running with a delay of over 5 min 59 s at terminus	Trains delayed less than 5 min
TER	5999	595	5285
Transilien	4551	423	4033
Intercities	275	60	207
TGV, domestic	604	129	457
International	175	40	131
All passenger lines except non-contractual long-distance trains	11,605	1247	10,113

number of fatalities dropped from 1517 in 2007 to 963 in 2015, and the number of serious injuries in the same time period dropped from 1367 to 684 (European Railway Agency 2017).

At the same time, there are great disparities among European countries in terms of number of fatalities by train kilometre. The safest countries for rail travel are Ireland, Norway, Luxemburg, Great Britain, Switzerland and the Netherlands, in that order. The least safe countries for rail are mostly in Eastern Europe, such as Poland and Greece and especially Slovakia, as can be seen in the map in Fig. 2.5 below.

2.3.2 *The Environment, a Neglected Performance Indicator*

On the environmental level, the advantages of rail are also numerous. A train consumes 12 times less energy than a car and three times less than an airplane

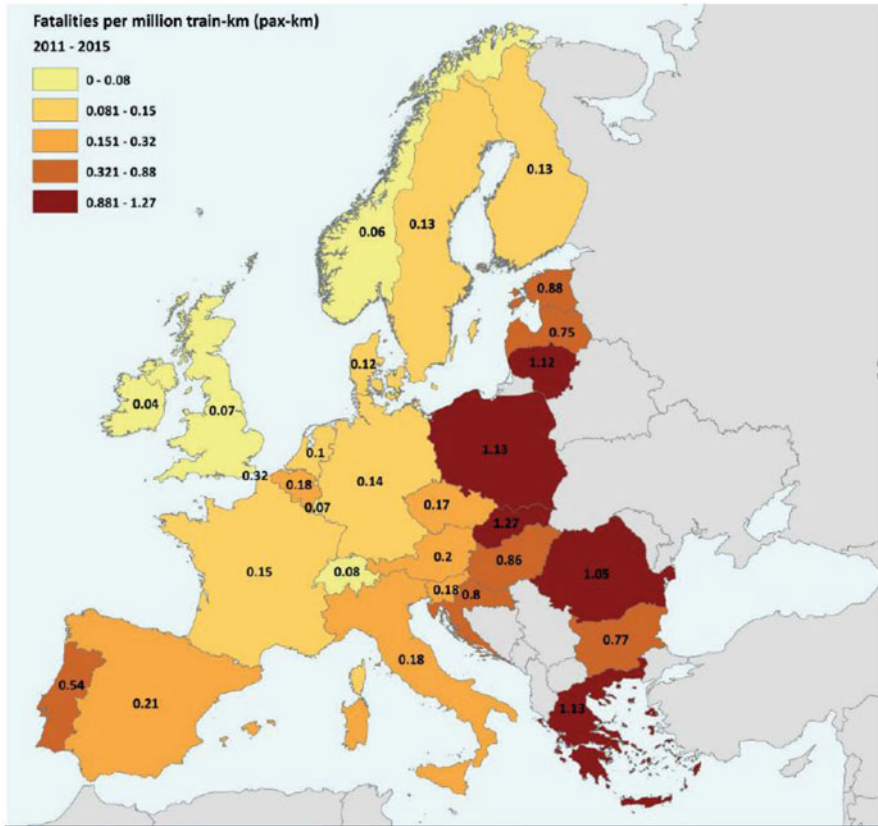


Fig. 2.5 Fatalities per million train kilometre (European Railway Agency 2017, Annual Report)

(SNCF, 2016). TGV passengers reduce their CO2 emissions per kilometre by 50 as compared to car travel, 25 compared to carpooling and 8 compared to bus (Spinetta Report 2018). And the average capacities of trains are well above other modes of transportation: a coach has an average of 20–80 seats and a domestic airplane has 40–220 seats, while a TGV has 380–1200 seats.

While energy consumption and greenhouse gas emissions are two important environmental indicators, land use should not be neglected as a factor, as it entails substantial negative externalities such as deforestation and loss of biodiversity. Rail travel uses much less land than does road travel. Considering the total surface area of the easement, a TGV line covers an average of 5–7 ha/km, while a motorway covers 9–10 ha/km for a 4-lane road and 10–11 for a 6-lane road (Setra). Overall volume is much lower for rail travel: 30,023 km in 2016 (including tracks used by the French rail company SNCF in conjunction with the Paris metro, regional commuter trains and trams) as opposed to the 1,103,366 km of roads in mainland France (SDES). There are 36 times more kilometres of road than of rail, and rail uses only 2.2

times more kilometres than do cycling and walking paths, estimated at 13,700 km. Of course, land use varies across Europe. Germany has the longest transportation network, with 37,775 km, followed by France with 28,987 km. Germany also has the highest density (0.47 km per 1000 inhabitants as opposed to 0.44 for France) according to Eurostat.

To compare land use between rail and air travel, it is clearly impossible to use the number of hectares covered by kilometre of roads or tracks. Rather, the comparison should be with the amount of land use for a similar number of passengers. Using this indicator, here too, rail expropriates less land: for a comparable number of passengers, the Paris-Lyon TGV line uses 2400 ha, while the Charles de Gaulle airport uses 3000 ha (source).

2.4 Conclusion

International rail travel faces a great deal of competition from coach and air travel. However, rail is safer and more environmentally friendly. Rail travel also avoids two future risks: it does not depend on variations in fuel prices and is not affected by road and flight path congestion. In this sense, the future success of international rail is contingent upon the failings of the other modes of transportation.

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