



When to invest in High Speed Rail Links and Networks

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Outline

1. History and Objectives
2. Impact on mode split
3. Costs and benefits
4. Ex post appraisals
5. Generalisation
6. Network effects
7. Pricing Policy
8. Conclusions



Origins and objectives of HSR

- (HSR = speeds of 250 km per hour or more)

- 1964 Tokaido Line Speed and Capacity
- 1981 Paris-Lyon Speed and capacity
- 1981 Rome-Florence (1st section) Speed
- 1988 Fulda-Wurzberg Relief of bottlenecks
- 1992 Madrid-Seville Speed

- 2008 European total 5558km
- World 10034

Source: UIC

Before and After High Speed Market Shares



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	TGV Sud-Est		AVE Madrid-Seville	
	Before	After	Before	After
Plane	31%	7%	40%	13%
Train	40%	72%	16%	51%
Car and Bus	29%	21%	44%	36%

Source: COST318 (1996).



Costs and Benefits

COSTS

- Capital costs
- Net Operating costs
- Net External costs (environment, safety)

BENEFITS

- Time savings
- Additional capacity
- Diversion from other modes
- Generated traffic
- Wider economic benefits

Value of Time Savings for rail Passengers in the UK



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Standard Valuations	(£ per hour, 2002 market prices)
Leisure	4.46
Commuting	5.04
Business	39.96

Source: DfT: WEBTAG Unit 3.5.6 (www.webtag.org)



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Capacity benefits

- Increased traffic on hsr route
- Increased traffic on other routes
- Reduced overcrowding
- Improved reliability



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Benefits of diversion from car or air

- Reduced congestion
- Environmental pollution
- Accidents
- Release of airport capacity for long distance flights

Energy consumption by mode (MJ per pass km)



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- Inter city train at 44% load 0.5
- High speed train at 49% load 1.08
- High speed train at 70% load 0.76
- Air (500km flight) at 70% load 2.57
- Diesel car on motorway at 36% load 0.94

Source CE Delft (2003)



External Costs (eurocents per km)

	External Cost	Charge
Car peak	16.1 – 24.4	7.8 – 15.6
Off peak	4.4 – 5.6	7.8 – 15.6
Air <500km (per passenger km)	7.5	-

Source: GRACE (2005)
IMPACT (2008)

Generated traffic
(valued at half the benefits to existing traffic)



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- Leisure
- Commuting
- Business

Does this reflect?

- Increased tourism
- Expansion of catchment areas for jobs
- Expansion of firms due to wider markets

Wider economic benefits from generated traffic



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- Causes?
 - Uncompetitive labour market
 - Agglomeration externalities

Magnitude 2-40% of direct benefits?

Ex post appraisal of French high speed line construction

	Sud Est	Atlantique	Nord	Inter Connection	Alpes	Meditarranean
Passengers in first year (m)	15.8	26.7	19.2	16.6	18.6	19.2
Social return (%)	30	12	5	13.8	n.a.	n.a.

Source: Conseil Général des Pont et Chaussées (2006) Annex 1

Benefits of high-speed train in Spain (millions of 1987 pesetas)



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	Social benefit of HST*
COSTS	
Infrastructure	-237.761
Residual Value	17.636
Trains	-58.128
Maintenance	-41.410
Operation	-135.265
<i>Net present value of HST</i>	-258.329

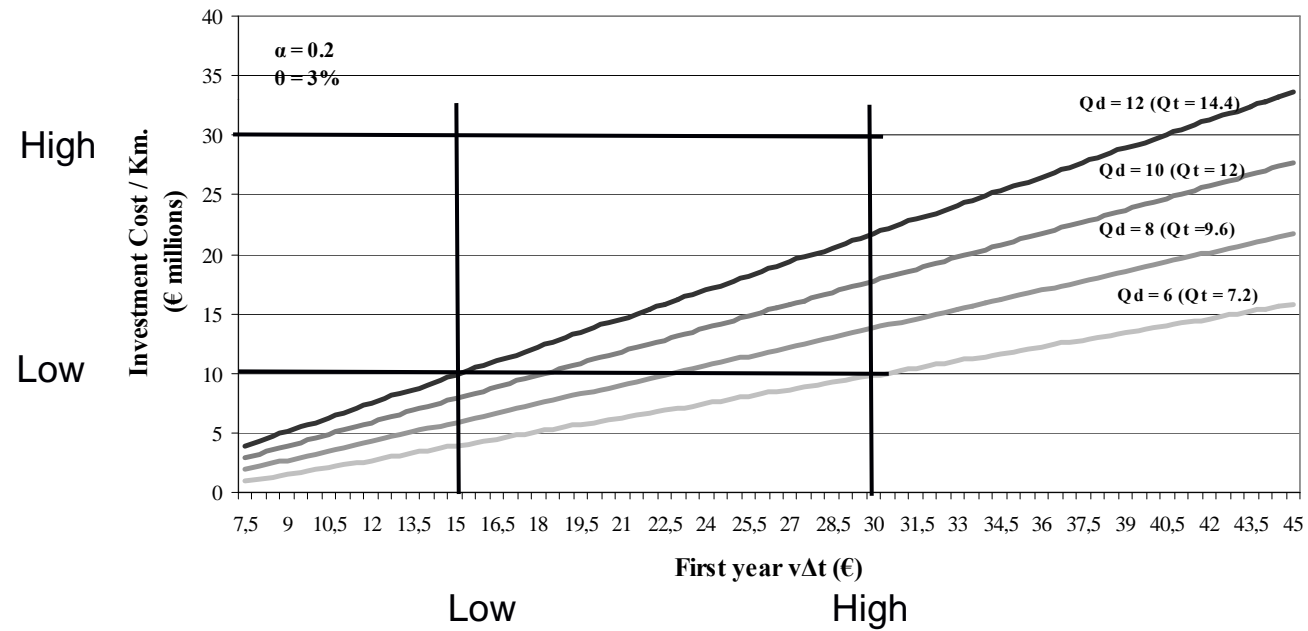
* Project life (30 years), GDP growth (2.5%), social discount rate (6%)



First year demand required for breakeven ($\alpha = 0.2$ $\theta = 3\%$)



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The Atkins study in Britain- results



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Figure 1.1 – HSL Route Network

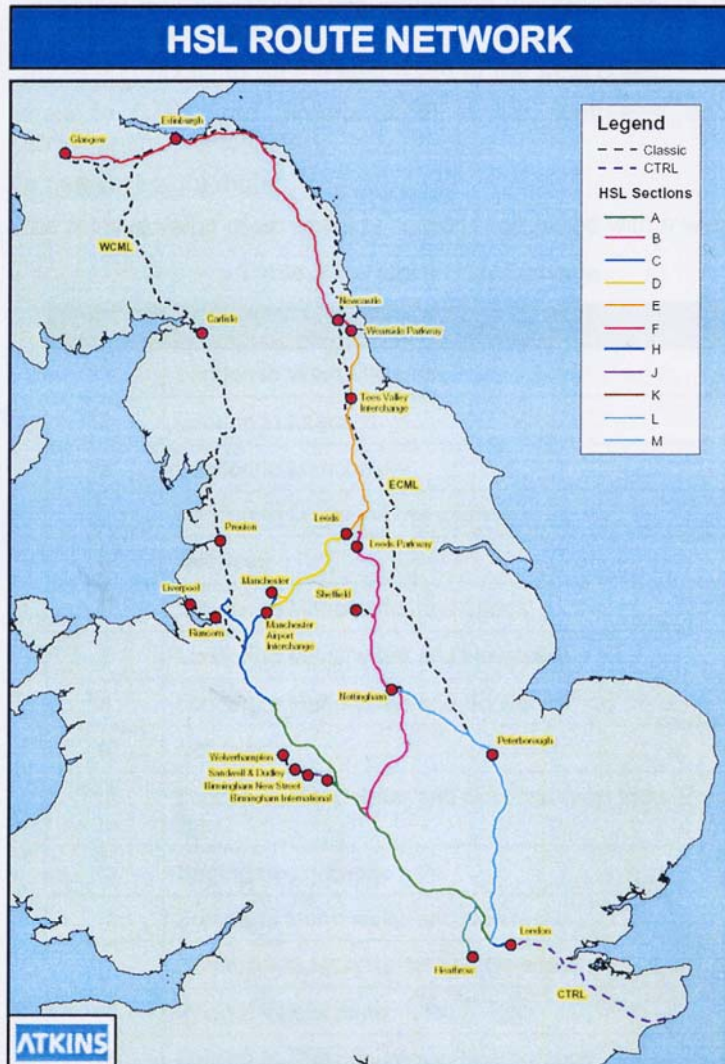


Figure 1.1



Appraisal of Options 1 and 8 (£bn PV)



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	Option 1	Option 8
Net revenue	4.9	20.6
Non financial benefits	22.7	64.4
Released capacity	2.0	4.8
Total benefits	29.6	89.8
Capital costs	8.6	27.7
Net operating costs	5.7	16.3
Total costs	14.4	44.0
NPV	15.3	45.7
B/C	2.07	2.04

Source Atkins (2003) Summary report, Addendum, Table 2.1 with transcription errors corrected



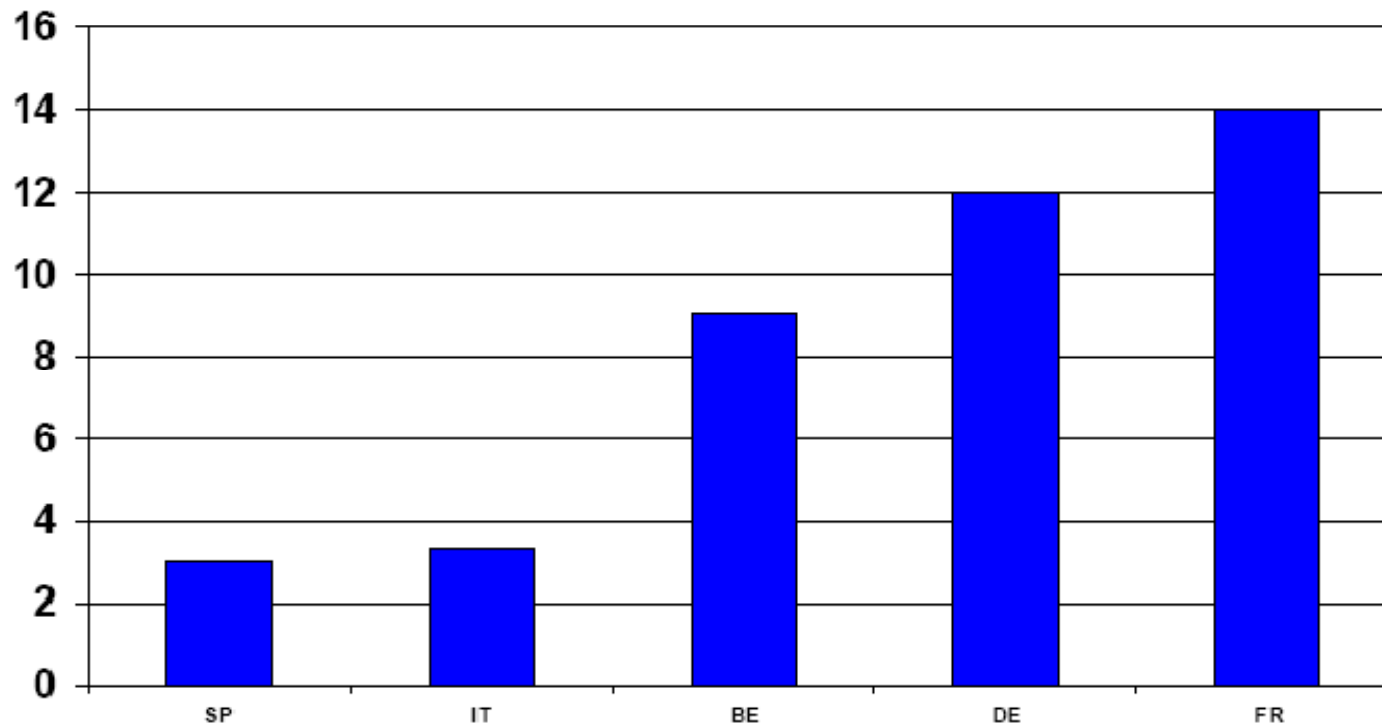
Atkins study - incremental Costs and Revenues

Option	Train km	Capital cost per train km £	Net revenue per train km £
1	55474	2.58	1.47
8	162067	2.85	2.12

Typical Access Charges for high speed passenger trains € per train-km in 2008



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Source: ITF (2008), based on the approach of ECMT (2005)



Conclusions

- The costs of high speed rail can be justified in terms of time savings
- But this depends on construction costs, amount of time saved and traffic volume
- In the most favourable conditions, 6m trips p.a. are needed; more commonly 12m
- High speed rail also provide extra capacity and environmental benefits by diverting traffic from air and road
- Wider economic benefits are more uncertain