Competition and Cooperation between High Speed Rail and Airlines: The Cases of China and Other Countries

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* Fu, X., A. Zhang and Z. Lei (2012), "Will China's Airline Industry Survive the Entry of High Speed Rail?" <u>Research</u> in Transportation Economics, Vol. 35, pp. 13-25.

Mode splits in China's inter-city passenger travel: RPK share



Source: China Statistical Year Book, 2009

Plan of Chinese national HSR network

 First elaborated in a National Development Plan in 2004; revised in 2008

 E.g. Beijing-Tianjin (Aug. 2008) Wuhan-Guangzhou (Dec. 2009) Zhengzhou-Xi'an (Feb. 2010) Shanghai-Nanjing (July 2010)
Speed 350 km/hour (vs. max 160 km/hour in 2004) Over 10,000 km HSR in operation: 250-350 km/hour - Beijing-Shanghai line (June 30, 2011) - Beijing-Guangzhou line (Dec. 2012) This gives China the world's largest HSR network: - Japan (1964) 2,500 km - Europe (France's TGV, 1981; Spain, 1992) 5,764 km - Korea (2004) Seoul-Daejeon 155 km (-Busan 330 km) - Taiwan (2007) Taipei-Kaohsiung 340 km ... and greater than the rest of world combined

■ 18,000 km HSR coverage planned for 2020
→ "Leapfrogging development"

A network of 4 vertical and 4 horizontal lines

Planned high-speed rail networks in China



Source: Ministry of Railways, China and Goldman Sachs

Advantages of high-speed railway

 Likely have time advantage for routes shorter than 900 km or within 4 hours of travel time, shorter "generalized travel time":

- Rail stations often located in city centers
- Simpler boarding/de-boarding procedures

- HSR travelers spend 92% of journey time on train (vs. 62% on air planes)

- HSR ticket price is usually less than air ticket
- In general, not affected by inclement weather
- Delays less likely (in general)
- Modern HSR trains are perhaps more comfortable than aircraft, offering more space, full tables and opportunities to move freely around a carriage
 - Hold small meetings

Advantages of aviation

Airlines have higher frequency

Long journeys are still more easily travelled by air:

- Complex journeys (starting or ending in small cities) are easier by air

Impact of HSR on airline flights

 May 2009: HSR connecting Wuhan and Yangtze River Delta area started its operation

→ Demand for flights <u>between Wuhan and</u> <u>Shanghai/Nanjing/Hangzhou</u> fell sharply: flight frequency reduced by about 1/3

- October 2009: Spring Airlines stopped running <u>Shanghai-Zhengzhou</u> flights because of HSR
- March 2010: all flights between <u>Zhengzhou and</u> <u>Xi'an</u> (505 km) suspended, 48 days after HSR
- 2009: Hainan Airlines stopped operating flights between Changsha and Guangzhou (707 km)

Daily flights on <u>Wuhan-Guangzhou</u> (1,069 km) reduced from 15 to 9 (1 year after HSR), and air fares cut to as low as 280-470 RMB to compete with HSR

Airline monthly scheduled seats: Guangzhou–Changsha (707 km)



Source: OAG database

Airline monthly scheduled seats: Guangzhou–Wuhan (1,069 km)



Source: OAG database

Air traffic diversion to HSR vs. HSR travel hours: Chinese Market



Source: Xin-Ye Security House

Insights from other markets

 Short routes not served by air: e.g. Tokyo-Nagoya Paris-Brussels

 By contrast, HSR has captured just 10% of the 1,070 km Tokyo-Fukuoka route

Before and after HSR:
e.g. 425 km Paris-Lyon: air share 31% → 7%
536 km Madrid-Seville: air share 40% → 13%
340 km Taipei-Kaohsiung: air share fell by 85% (similar for Seoul-Daejon)

To summarize:

 "Disruptive" impact for routes point-to-point journeys under 500 km

• "High" impact for those at around 800 km

- 20-30% of total demand in Chinese airlines' network

Demand on 1,000-1,200 km routes fell by 15-20%

Little impact for routes longer than 1,200 km

China's domestic air travel distribution: by distance

2001									
Distance	Route #	Available Seats	Seat %	Total Frequency	Frequency %				
< 300km	40	2,231,219	2%	22,141	3%				
300-800km	253	34,052,329	34%	248,201	38%				
800-1,200km	206	30,192,746	30%	186,133	29%				
> 1,200km	235	33,840,008	34%	190,607	29%				
2010									
	Route	Available	Seat	Total	Frequency				
Distance	#	Seats	Share	Frequency	%				
< 300km	65	5,145,404	2%	51,360	2%				
300-800km	422	97,868,870	30%	699,501	32%				
800-1,200km	349	103,244,595	31%	658,888	30%				
> 1,200km	464	124,041,183	38%	754,442	35%				

Source: Compiled from OAG database

 Regional point-to-point routes under 800 km do not contribute much to airline profits

 \rightarrow Airlines might give up on this market segment

For small communities, airlines should use <u>hub-and-spoke network</u>

- At moment, point-to-point
- Capacity constraint at hubs; rising fuel price
- But, single-aisle aircraft development and COMAC's C919
- ... and Develop <u>international markets</u>

Traffic volume splits of major Northeast Asian airlines



Scheduled tonne-kilometers performed by airlines of ICAO contracting states (passengers, freight and mail)

	Total Operations (millions)				International Operations (millions)					
Country	2008 Rank	2008	2007	2003	2008 - 2003 Change	2008 Rank	2008	2007	2003	2008 - 2003 Change
United States	1	156,644	160,973	131,389	19%	1	58,658	57,368	43,259	36%
Mainland China	2	37,169	36,062	17,641	111%	10	12,554	12,741	6,246	101%
Hong Kong		17,904	16,920	10,278	74%		17,904	16,920	10,278	74%
Germany	3	30,060	29,670	21,937	37%	2	29,139	28,740	21,097	38%
United Kingdom	4	24,101	23,494	20,689	16%	3	23,378	22,755	19,942	17%
Japan France	5	20,457	21,364	21,071	-3%	8	14,354	15,113	14,643	-2%
Gulf States	7	20,241 18,017	20,305 16,416	15,727 8,275		5	18,320 17,958	18,305 16,360	12,462 8,259	47%
Korea	8	16,283	16,404	12,134	34%	7	15,753	15,835	11,402	38%
Singapore	9	15,902	16,279	13,062	22%	6	15,902	16,279	13,062	22%
Netherlands	10	14,314	14,108	11,382	26%	9	14,313	14,107	11,374	26%

Source: ICAO database. Some data in 2008 were estimated by ICAO.

Competition of two modes

The HSR challenge to aviation is essentially a challenge for domestic city-to-city services

The competitive challenge may pressure Chinese airlines to give priority to hubbing:

A transit airline hub is likely to experience less impact from HSR service

And to international activities

- <u>Traffic delay</u>: A big problem for China's airline industry in its competition with HSR is low punctuality, caused partly by capacity shortage at major airports
- Nov. 14, 2010: State Council and the Central Military Commission published "Suggestions about Further Reforming the Management of Low Attitude Aerospace," a sign of loosening air space control
- At same time, the Air Traffic Management Bureau proposed to share the military aerospace with civil aviation

- China's railway planners appear to have not adopted a low ticket price strategy for HSR, which may reduce the negative impact on aviation
- The "7.23 rear-ending" accident in Wenzhou (2011) showed some weaknesses in planning and monitoring

Questions

Effect of reducing airport congestion and delays?

- Effect of reducing HSR speed on the rail and air prices, etc.?
- Effect of railway reform?

See:

Yang, H. and A. Zhang (2012), "Effects of Highspeed Rail and Air Transport Competition on Prices, Profits and Welfare," <u>Transportation Research, Part B</u> (Methodological), Vol. 46, pp. 1322-1333.

Air-rail cooperation

 Air-rail combination now being offered by Lufthansa in Frankfurt, and Air France in Paris, suggests an indicative response by airlines to HSR

- Flights dropped on Frankfurt-Stuttgart and Frankfurt-Cologne; Passengers instead offered connecting rail tickets

- Similarly, rail tickets offered on CDG-Brussels by Air France; emulated by Emirates, American Airlines and United Airlines



Fare	Fligh	ht	Departure	Arrival	Duration	Operate	d by	Class	
2 921 CAE) WSS	536	8:40 AM Vancouver	4:20 PM Montreal (YUL)	17h55	WestJet		Economy	Ξ
	AF3	47	7:55 PM Montreal (YUL)	8:35 AM Paris (CDG) +1 Day		Air Franc	ce	Voyageur	
	AF7	207	10:40 AMParis (CDG) +1 Day	11:35 AMLille +1 Day		Air Franc	ce	Voyageur	
WS536	8:40 AM Van	couv	er, Vancouver Intl - 4:20 PM Mont	treal, P Trudeau Intl	Non-stop fli	ght	Aircraft :	Boeing 737-	
	Transfer tim	e : 03	3h35				700		
AF347	7:55 PM Mon	ntreal	l, P Trudeau Intl - 8:35 AM +1 Day	Paris, Charles de Gaulle	Non-stop flight Airc		Aircraft :	Aircraft : Boeing 777-	
	Transfer tim	e : 02	2h05				300ER		
AF7207	10:40 AM +1	Day	Paris, Charles de Gaulle - 11:35	AM +1 Day Lille, Lille Europe	Non-stop fli	ght	Aircraft :	Train	
	Railway St To	GV							_
🔘 2 925 CAE) WS7	712	9:30 AM Vancouver	4:52 PM Toronto (YYZ)	15h46	WestJet		Economy	Ξ
	AF3	51	6:50 PM Toronto (YYZ)	8:10 AM Paris (CDG) +1 Day		Air Franc	ce	Voyageur	
	AF7	235	9:16 AM Paris (CDG) +1 Day	10:16 AMLille +1 Day		Air Franc	ce	Voyageur	
WS712	9:30 AM Van	couv	er, Vancouver Intl - 4:52 PM Toro	nto, Pearson intl	Non-stop fli	ght	Aircraft :	B 737 800	
	Transfer tim	e : 01	1h58						
AF351	6:50 PM Toro	onto,	Pearson intl - 8:10 AM +1 Day Pa	aris, Charles de Gaulle	Non-stop fli	ght	Aircraft :	Boeing 777-	
	Transfer tim	e : 01	1h06				200		
AF7235	9:16 AM +1 D Railway St TC)ay F GV	Paris, Charles de Gaulle - 10:16 A	AM +1 Day Lille, Lille Europe	Non-stop fli	ght	Aircraft :	Train	

Motivation

 On the other hand, airports especially hub airports are becoming more and more congested HSR service can also be used as one leg of the hub-and-spoke operation

Economies of traffic density

Easy connectivity between an HSR rail station and an airport is likely to have a strong impact on the competitiveness of airport

Policy question

What is the welfare implication of such Airline-HSR cooperation?

 On the one hand, it may hurt competition between the two modes

 On the other hand, it may reduce the congestion level of some major airports under capacity constraint Degree of competition between air and rail prior to their cooperation

 Both transportation modes exhibit substantial economies of traffic density which appears to favor cooperation other than competition

Easy connectivity between an HSR rail station and an airport is likely to have a strong impact on the competitiveness of airport

THANK YOU

高铁已开通线路波及航线的分流统计

线路	高铁里程	高铁时速	高铁直达时间	分流率	
北京-徐州	692	300	2.62	42%	
北京-南京	1,023	300	3.65	20%	
北京-无锡	1,210	300	4.78	14%	
北京-上海	1,318	300	4.92	13%	
天津-南京	918	300	3.45	68%	
天津-上海	1,196	300	4.83	25%	
济南-南京	617	300	2.48	89%	
济南-上海	912	300	3.38	49%	
合肥-武汉	362	250	2.53	100%	
郑州-西安	505	300	2.18	100%	
武汉-广州	1,046	300	3.68	30%	
长沙-广州	684	300	2.27	53%	
长沙-武汉	362	300	1.33	100%	

数据来源: CAAC、兴业证券研究所