The impact of total liberalization of domestic air transport on the social welfare and on the dynamic of competition: comparison between United States and the European Union

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Abstract

Since the $1^{st} of April 1997$ date of the implementation of the third package of the liberalization, air transport within the european Union has become totally liberalized. In the United States the deregulation of domestic air traffic was earlier and faster since it took place in October 1978 after the adoption of the only act of deregulation. This paper, in its first part, deals with the liberalization of the industry of air traffic in the european union. After a comparison with US system based on market demand, fare policy and network restrictions, we present our descriptif results coming from treatments on the OAG data. These results present several aspects such as the evolution of the competitive structure of the intra-european routes, the level of airport dominance and the growth of hub structure.
The second part of the paper presents models of entry in the airline industry. As profitability of route flown explains correctly decisions taken by airlines to serve or not a route, the paper focuses on the specification and the estimation of the determinants of city pair profitability in the european union. Treatments done on the OAG data show a rapid development of leasing space agreement(partial and total) and code sharing practices between 1995 and 2000 in Europe that's why we differentiate first between the two type of competitive strategy of entry(direct

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entry and leasing space agreement) and second between the competitive strategy of entry and the alliance strategy of code sharing. So the estimation of model will be able to answer the question if the european air transport market is contestable and in case not to see if the decision of entry is more directed by the level of airport dominance (as in the domestic United States market)or essentially by the competitive structure of the routes. We try to explain the nature of entry(direct leasing or code sharing) by the different levels of these two determinants.

The deregulation of domestic air transport in the united states took part considerably in the reduction of plane tickets real fares, a fall which involved a social welfare profit estimated on average at 4.04 dollars of 1977 per passenger (over the period 1978-1983) according to S.A.Morrisson and C.Winston [13]. Fares variation was done in such a way that tariffs suggested become more adequate with costs supported by the airlines to offer their service on different markets. The proliferation of tariffs is another consequence of the deregulation which is explained by the policy of price discrimination practised by companies to discriminate between passengers according to their willingness to pay.
The adoption of hub and spokes networks is another principal consequence of the deregulation. The number of real competitors (inverse of herfindhal index) have been reduced on a national scale giving place to a greater concentration but this didn't prevent the intensification of competition on the route level. This new structure of network also led to a stronger concentration of the airports which became dominated by one or two airlines.
The travellers saw the quality of certain aspects of service worsening. The flights duration and the average load factor increased so it becomes more difficult to find a place in time preferred flights. However, these losses have been widely compensated by the improvement of other quality aspects of service, in particular the increase in flights frequencies and the reduction of interconnected flights (connected flight between two different airline)(M.Gaudry et R.Mayes[15]).

1 The experiment of the liberalization of the air transport in Europe

1.1 Comparison with domestic air transport in the United States

Compared to american domestic air transport market, the intra-european market presents different characteristics. In the demand side, the competing potential of the other means of transport is more significant in Europe than in the United States. Indeed, although the population of Europe is more significant than that of the United States (380 million against 280 million in 2001), Europe presents

a smaller geographical space . This difference of surface results on an average distance per flight less significant into Europe than with the United states. In 2000 the average distance traversed by the intra-european flights was estimated (balanced by the annual frequency of the flights) at 869 km whereas with the United states it was established to 1665 km (Air Transport Association ATA). This relatively short stage length explains the stronger competition of the other means of transport in Europe. Moreover, the technological projection of high-speed trains allows a more significant competition of railroads transport in Europe.
The aggregate size of the european airlines is less significant than that of the american air companies. In 2000, the joined production of all the american airlines rose to 1114 billion passenger kilometers whereas the european airlines (members of the AEA) generated 613 billion passenger kilometers during the current of the same year. Moreover the traffic of the european companies is much more directed towards the international. Indeed, only 26.6% of the total passenger traffic of the American airlines in 2000 (measured as a passenger kilometers) (corresponds to 8% of passengers)was international whereas more than 91.1% of the european airlines traffic was international (55% of passengers). This international orientation is partially explained by the small size of countries composing Europe, but if Europe is seen as a one geographical entity, the percentage of the international traffic (towards country except european geographical space) remains relatively high with 77.5% (45% of the passengers) (Source ATA and AEA).
The charter traffic (low-cost included), much more present in Europe than in the United States, is an additional side of divergence. Indeed in 2000 25% (50% of the passengers) of the european airlines traffic was served in charter mode, a mode which transports a broad part of the leisure traffic at a very competing tariffs. This same figure does not exceed the 1.3% (0.8% passengers) for the american airlines. All these characteristics of the air transport industry in Europe imply that the demand side benefit from liberalization will be less significant in Europe than from deregulation in the United States.
In the side of pricing policy, the european process of liberalization, in its first package, offer airlines the possibility to propose reductions until 55% less expensive than the coach fare. The second package had more flexibility by authorizing reductions until 70% and by weakening the constraint of double approval, henceforth a tariff will be implemented if the two respective governments do not notify

their refusal at the end of 30 days after the fare demand . The third package came into effect in January 1993 and introduced the complete liberalization of the tariffs from January 1996. Although these measurements of liberalization allowed a fare's drop of 20% on average, the yield in Europe remained relatively high. Indeed in 2000 the yield from american airlines domestic traffic was only of 0.09$ per passenger kilometers transported (PKT) whereas the european airlines ones related to the intra-european traffic was established at 0.37$. The average distance, relatively more important, in the United States can explain a part of this yield's difference but this effect remains partial. In fact, following the deregulation, the yield of the domestic traffic in the United States dropped much more quickly than the one of intra-european traffic following the liberalization process.

One of the most popular explanation of the relatively high yields in Europe is that the european airlines would profit from a significant market power which rise from the practices of collusive pricing strategy. Indeed, the system of bilateral agreements which existed between the states members of the european union is suspected of having implemented then reinforced such collusive practices between airlines.

However measurements which were made concerning market power in the industry of air transport in Europe do not plead for a cooperative pricing system. Indeed the estimate of the standard conjectural variations model(see Good, Roller and R.c sickles [3]) leads to a parameter of behavior which suggests a pricing in conformity with cournot model. It is true that the studies made on Europe are based on aggregate data and thus a heterogeneous behavior of the airlines with respect to different routes remains possible.

Brander and Zhang [17] studied the question of market power in the industry of the american airlines and they concluded that the data are much more compatible with the model of cournot competition than the Bertrand one or the model of collusive behavior. Another branch of the literature suggests the existence of a significant market power in the industry of air transport in the United States. Hurdle [16] and Whinston and Collins[23] studied the assumption of contestability of air transport market in the United States. They found that the market isn't contestable and that on some routes, airlines are able to increase excessively their profit . This joins the remarks made by Borenstein [2] and Berry[20][21] which specify that the airlines are able to increase their yields on a given route through

a strong presence on the two extreme airports and the domination of a hub.
Neven, Roller and Zhang[5] conclude the market power in the air transport european market is not appreciably more significant relative to the market of domestic transport in the United States. Moreover the available aggregate data suggests that the european airlines do not exert any collusive practice of pricing. Indeed they estimate that the profit margins observed are coherent with a non cooperative nash equilibrium.
Given these results, it appears obvious that it is necessary to seek elsewhere for the explanations of the relative rise of the yield in Europe. There were several explanations presented in the literature. All these explanations put forward a relatively high unit cost in Europe. This high unit cost can be explained either by a higher prices of factors or productive inefficiencies.
Neven, Roller and Zhang[5] estimated a model that endogenizes costs and the dynamics of competition on the market of transport in Europe. They concluded in addition to the fact that the prices observed are not in conformity with a colluding practices, that the relative rise of prices of the factors cannot explain the level of unit cost of the airline in Europe and that the most reasonable explanation would be the technical lack of efficiency.
Indeed when the firms are technically inefficient, the weak profit margins can be associated high unit costs that the firms can allow themselves because of the lack of competing pressure. In this case the fares will be high because the costs are so and the margin fare-unit cost will be small. Encaoua [9] and Good[4]were leaning on the question of productive efficiency of the european airlines. They highlighted that, compared with the american airlines, the european airlines are of 50% to 70% less productive.

1.2 Descriptive results of intra-european air transport

The liberalization process of the airline industry was set up with the aim of ending with the situation of monopoly from which profits several airlines, and of dropping fares through the intensification of the level of competition within the european union.
In what will follow we will present our results from treatments on OAG data. These data were available for the years 1995, 1999 and 2000 i.e for the period of partial

liberalization (1995) and that of total liberalization (after 1997). These results are articulated around three axes: the competing structure within the intra-european routes, growth of hub structure and the level of domination of european airports. It's important to mention that all results concern only intra-european flights for which traffic is totally liberalized. This is done to find the most credible comparison with domestic air traffic in the united states.
Concerning the domestic air traffic industry in the united states, JAN K.Brueckner and Pablo T.Spiller [14] mentioned that after an initial decline, industry concentration has increased at the national level over the post-deregulation period. They also remarque that despite this rising national concentration of the industry, competition in the average city-pair market has grown over the period.

	1995	1999	2000	%(1995/2000)
Q1	146	161	164	12.3
Q2	152	172	169	11.2
Q3	153	167	175	14.3
Q4	157	169	187	19.1
Annual	181	197	210	16.0

TAB. 1 – *The Evolution of airline's number operating within the european union*

The evolution of the number of airlines operating regular routes within european union gives an overview of liberalization incidences. Indeed, as shown in table 1 this number rose on average by 16% between 1995 and 2000 with differences over quarters. This rising number of operating airlines doesn't necessarily mean a concentration's decline in the european union because the level of concentration depends on the distribution of market shares between airlines companies.
Table2 show the level of concentration within the european union based on ASK (Available seat kilometers) shares.
The level of concentration doesn't appear to be sensitive to seasonality phenomenon, so the level of concentration is globally the same for high and low season. The main information shown in table 2 is a marked decrease in market concentration between 1995 and 2000. Indeed, the real number of competitors increased by more than 41% from 18 to 26. Thus the real number of airlines increased much more rapidly than the number of airline operating which implies an intensification of competition in

		Real airline's number[1]
High season(Q2+Q3)	1995	18.40
	1999	22.04
	2000	26.04
Low season(Q4+Q1)	1995	18.29
	1999	21.93
	2000	25.39

1: Defined as the inverse of Herfindhal index

TAB. 2 – *Level of traffic's concentration within the European union*

the city-pair market level.
So, the intra-european concentration decreased at the aggregate and city-pair levels between 1995 and 2000 allowing more route competition.
It is interesting to see how this competition growth had affected flight distribution between different airports. To do this, we proceeded by classifying intra-european airport into four categories: large hub, medium hub, small hub and nonhub. Thus an individual airport falls into one of four hub classifications based on that airport's percentage of total ASK at intra-european airports. Those airports treating 1 percent or more of the total are classified as large hubs, airports treating between 0.25 and 0.99 of the total are classified as medium hubs, airports treating between 0.05 and 0.24 percent of the total are classified as small hubs, and those treating less than 0.05 percent of the total are classified as nonhubs. For example, in 2000, there were 29 large hubs, 41 medium hubs, 68 small hubs and 131 nonhubs.

Larges Hubs	1995	29
	1999	30
	2000	29
Moyens hubs	1995	37
	1999	38
	2000	41

TAB. 3 – *Hubs number for domestic traffic within european union*

Table **??** insists on the fact that the number of large hubs remained stable between

1995 and 2000 whereas the one of medium hubs grew from 37 to 41. This means that the companies were developing their traffic around the medium hubs probably because of the saturation of large hubs.

		Large Hub	Medium Hub	Small Hub	Nonhub
1995	Large Hub	31.8	22.0	16.2	15.4
	Medium Hub		2.1	3.8	2.5
	Small Hub			2.9	2.4
	Non Hub				1.1
Nb. total scheduled flights[1]: 2821					
		Large Hub	Medium Hub	Small Hub	Nonhub
1999	Large Hub	29.2	25.3	16.2	14.2
	Medium Hub		2.6	4.7	2.3
	Small Hub			2.5	2.2
	Non Hub				0.9
Nb. total scheduled flights: 3997					
		Large Hub	Medium Hub	Small Hub	Nonhub
2000	Large Hub	28.7	27.1	15.2	13.3
	Medium Hub		2.9	5.0	1.9
	Small Hub			2.7	2.6
	Non Hub				0.7
Nb. total scheduled flights: 4249					

1: thousands

TAB. 4 – *Distribution of scheduled flights per pairs of classified hubs within the European union (expressed as a percentage)*

This observation is widely consolidated by results from table4 on the distribution of scheduled flights within the European union. Indeed, this table shows that more than 80% of total flights, come from or go to a large hub which emphasis the preponderance of hub structure networks in serving intra-european traffic demand. The number of scheduled flights grew rapidly between 1995 and 2000, more than 50% in five years. This growth had been mainly absorbed by flows of traffic between large and medium hubs. Indeed the share of flights between large hubs decreased between 1995 and 1999 whereas the one between large and medium hubs increased

by 5 points. Airlines appear to prefer developing regional hubs where slots are much more easily obtained and the delays are less significant.

	1995	1999	2000
FRANKFURT	100	114	112
PARIS(C.DEGAULLE)	89	102	104
AMSTERDAM	89	93	96
BRUSSELS	88	80	86
PARIS(ORLY)	87	64	65
MUNICH(INTL)	84	102	107
DUESSELDORF	75	101	98
MADRID	75	75	77
LONDON(GATWICK)	73	79	81
BARCELONA	73	78	80
LONDON(HEATHROW)	73	65	61
HAMBURG	71	78	82
COPENHAGEN(INTL)	71	69	69
NICE	71	68	60
ATHENS	67	62	63
ROME(FIUMICINO)	67	72	73
STOCKHOLM(ARLANDA)	67	78	81
MILAN (LINATE)	62	68	71
STUTTGART(ECHTERDINGEN)	59	66	74
DUBLIN	57	56	61
LONDON(STANSTED)	41	62	81

TAB. 5 – *Number of cities within the european union connected to large hubs*

Table 5 and 6 show the evolution of the number of endpoints served by large and medium hubs within the european union. We note that globally the number of city connected for large hubs doesn't grow as faster as the number of endpoints connected to medium hubs. This can be explained by the fact that for large hubs the jump in number of connected cities have been already done before 1995 whereas medium hubs are now in full extension.

	1995	1999	2000
NUREMBERG	32	47	52
BIRMINGHAM	34	35	43
ALICANTE	25	33	41
EDINBURGH	27	36	39
NAPLES(INTL)	22	36	39
FARO	20	34	38
PORTO	28	28	38
BOLOGNA	22	36	35
MARSEILLE	32	33	34
TOULOUSE	29	39	33
BREMEN	23	29	32
TURIN	22	23	27
BILBAO	21	23	25
LYON(ST. EXUPERY)	53	54	52

TAB. 6 – *Number of cities within the european union connected to medium hubs*

The different type of operations are defined as follows:

1. Leased space flight: A flight where the operating airline leases some seats/space to one or more other airlines and all participants to such an agreement sell their seats/space on that flight under their own designator(s)
2. Joint operation flight a flight on which more than one airline operates one or more of its legs.
3. Code shared flight: A flight where the operating airline allows seats/space to be sold by one or more than one airline and all participants to such an agreement sell their seats/space on that flight under their own Flight Designator. Operating airline pays monetary compensation to other airlines.
4. Franchised flight: A flight where the operating airline operate only under the designator of an other airline and pays much more monetary compensation.

2 A model of entry in the intra-european airline industry (to be continued)

		Direct [1]	Total leased[2]	Partial leased[3]	Joint[4]	Franchised [5]	Code share [6]
AIR-FRANCE	1995	170	8 (8)[7]	7 (6)	20 (10)	3 (3)	7 (7)
	1999	161	10 (4)	12 (5)	1 (0)	56 (53)	0 (0)
	2000	193	21 (9)	73 (33)	0 (0)	82 (74)	0 (0)
FINNAIR	1995	61	1 (0)	2 (1)	3 (2)	2 (1)	1 (0)
	1999	75	5 (2)	17 (10)	0 (0)	16 (16)	0 (0)
	2000	71	4 (1)	14 (9)	0 (0)	2 (2)	0 (0)
ALITALIA	1995	132	0 (0)	0 (0)	1 (0)	1 (0)	0 (0)
	1999	144	6 (0)	23 (6)	0 (0)	1 (0)	8 (3)
	2000	150	12 (4)	28 (19)	0 (0)	106 (106)	0 (0)
BRITISH-AIRWAYS	1995	135	0 (0)	0 (0)	0 (0)	110 (4)	0 (0)
	1999	151	4 (3)	3 (2)	0 (0)	144 (36)	0 (0)
	2000	162	13 (3)	29 (10)	0 (0)	168 (50)	11 (5)
CONDOR-FLUGDIENST	1995	140	0 (0)	0 (0)	0 (0)	79 (56)	0 (0)
	1999	219	0 (0)	0 (0)	0 (0)	76 (53)	0 (0)
	2000	222	23 (21)	0 (0)	0 (0)	68 (61)	0 (0)
AER-LINGUS	1995	40	2 (2)	1 (1)	0 (0)	0 (0)	0 (0)
	1999	41	1 (1)	4 (1)	0 (0)	0 (0)	0 (0)
	2000	42	3 (2)	3 (1)	0 (0)	0 (0)	0 (0)
RYANAIR	1999	34	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	2000	44	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
IBERIA	1995	115	7 (4)	1 (1)	16 (0)	5 (4)	0 (0)
	1999	132	3 (1)	5 (3)	14 (1)	116 (83)	1 (1)
	2000	120	19 (1)	29 (16)	12 (1)	82 (33)	0 (0)
KLM-ROYAL-DUTCH-AIRLINES	1995	32	0 (0)	2 (2)	4 (4)	25 (4)	0 (0)
	1999	31	18 (2)	37 (6)	3 (2)	29 (16)	1 (0)
	2000	31	9 (0)	35 (10)	0 (0)	31 (14)	0 (0)
LUFTHANSA-GERMAN-AIRLINES	1995	246	0 (0)	0 (0)	31 (4)	68 (51)	36 (5)
	1999	265	7 (1)	53 (11)	4 (1)	125 (85)	120 (17)
	2000	286	126 (90)	128 (44)	5 (1)	155 (139)	8 (7)
OLYMPIC-AIRWAYS	1995	80	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	1999	71	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)
	2000	80	3 (0)	4 (1)	0 (0)	0 (0)	0 (0)
AUSTRIAN-AIRLINES	1995	20	0 (0)	6 (3)	22 (3)	7 (2)	1 (0)
	1999	24	7 (4)	15 (11)	9 (4)	3 (2)	6 (2)
	2000	25	13 (5)	40 (14)	4 (0)	9 (5)	25 (11)
SAS-SCANDINAVIAN-AIRLINES	1995	92	2 (0)	5 (0)	6 (2)	0 (0)	0 (0)
	1999	91	40 (11)	106 (39)	0 (0)	0 (0)	0 (0)
	2000	105	48 (21)	119 (51)	0 (0)	0 (0)	0 (0)
SABENA	1995	50	2 (2)	4 (4)	0 (0)	2 (2)	3 (3)
	1999	61	10 (4)	15 (10)	0 (0)	9 (8)	0 (0)
	2000	58	16 (5)	45 (14)	0 (0)	59 (53)	45 (12)
TAP-AIR-PORTUGAL	1995	50	2 (1)	7 (3)	0 (0)	1 (1)	1 (1)
	1999	51	2 (2)	4 (1)	0 (0)	3 (2)	5 (4)
	2000	57	5 (1)	12 (9)	0 (0)	2 (2)	9 (8)

1: Direct operations flight, 2: Totally leased space flight , 3: Partially leased space flight, 4: Joint operation flight , 5: franchised flight, 6: Code shared flight , 7:Commun routes with direct operations

TAB. 7 – *Distribution of operated routes per airline and type of operation within the european union*

		1995		1999		2000
	LH	67.5	LH	65.5	LH	63.2
FRANKFURT	BA	4.7	BA	4.3	BA	4.5
	AZ	3.3	DE	3.0	DE	2.8
	AF	43.9	AF	70.0	AF	56.5
PARIS(C.DEGAULLE)	BA	11.0	AZ	5.2	LH	6.4
	AZ	9.2	BA	4.3	BA	5.7
	KL	35.3	KL	22.5	KL	21.5
AMSTERDAM	UK(Buzz)	11.2	UK(Buzz)	16.5	UK(Buzz)	15.3
	BA	5.3	EW	7.06	EW	6.8
	SN	52.4	SN	54.0	SN	38.6
BRUSSELS	BA	8.5	TV	12.2	QG	12.3
	LH	5.1	BA	5.6	TV	10.8
	AF	67.6	AF	57.9	AF	58.1
PARIS(ORLY)	IJ	9.8	IJ	17.9	IJ	18.0
	IW	6.7	IW	11.1	IW	10.5
	LH	60.5	LH	47.4	LH	46.8
MUNICH(INTL)	DI	9.1	DI	12.2	DI	12.3
	LT	5.4	BA	4.2	LT	3.8
	AZ	74.0	AZ	66.9	AZ	61.3
ROME(FIUMICINO)	IG	6.8	AP	4.2	AP	6.5
	BA	3.5	IG	4.2	LH	3.6
	LH	41.9	LH	33.9	LH	35.5
DUESSELDORF	LT	17.3	LT	17.6	LT	16.6
	DI	7.4	DI	8.0	DI	7.3
	IB	49.6	IB	46.6	IB	48.1
MADRID	AO	17.9	UX	12.3	JK	14.7
	UX	6.9	AO	10.5	UX	13.6
	BA	39.1	BA	40.8	BA	37.7
LONDON(GATWICK)	JY	10.2	FD	10.3	FD	16.3
	FD	8.2	JY	8.0	JY	7.0
	IB	47.0	IB	35.6	IB	40.0
BARCELONA	AO	16.4	UX	14.6	UX	15.7
	UX	7.0	AO	9.4	JK	9.3
	BA	44.7	BA	45.9	BA	42.9
LONDON(HEATHROW)	BD	16.3	BD	18.9	BD	20.7
	LH	7.1	EI	5.7	EI	5.9
	LH	65.7	LH	45.7	LH	46.1
HAMBURG	BA	4.6	DI	8.2	DI	7.1
	LT	4.1	HF	8.0	HF	7.1
	SK	58.8	SK	63.0	SK	62.0
COPENHAGEN(INTL)	DX	9.6	QI	5.3	QI	5.2
	DM	5.6	DM	5.0	DM	5.1
	AF	49.4	AF	31.0	AF	26.1
NICE	IW	14.1	FU	10.3	FU	16.1
	BA	6.2	IW	10.1	IW	9.3
	OA	72.9	OA	54.8	OA	48.6
ATHENS	AZ	6.1	X5	9.4	A3	13.2
	LH	4.9	AZ	5.8	X5	11.2
	SK	63.7	SK	60.7	SK	64.3
STOCKHOLM(ARLANDA)	TQ	14.1	BU	6.8	JZ	7.9
	JZ	4.1	JZ	6.2	BA	4.6
	LH	50.3	LH	39.4	LH	38.1
STUTTGART(ECHTERDINGEN)	DI	8.8	DE	7.2	DE	6.8
	DE	6.7	DI	6.5	HF	6.7
	UK	49.3	FR	33.1	FR	41.6
LONDON(STANSTED)	FR	28.2	OG	22.4	OG	24.2
	JY	7.9	UK	20.6	UK	10.8

TAB. 8 – *Carrier ASK (available Seat Kilometres) share at selected large hubs (percentage of all intra-european union ASK at hub)*

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