EU-US Open Skies Agreement: what is changed in the north transatlantic skies?

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ABSTRACT

This paper presents an analysis of air service and competition dynamics in the north transatlantic market since the EU-US Open Skies Agreement (OSA) in 2008. By comparing the schedules of nonstop and two-step flights in a typical off-peak week of 2007 and 2010, we investigate whether the EU-US OSA has led to more choices for transatlantic travelers and greater exploitation of commercial agreements. We examine the impact of the EU-US OSA on competition between carriers, alliances, and airports in hubbing operations. The results show unexpected changes in the service level and competition. The number of direct transatlantic connections and served airport pairs decreased and the competition rate increased only in indirect traffic. Yet, the impact varies across European countries but not in accordance with the previous regulatory regime.

Keywords: Air transport, EU-US OSA, competition, service level

1. INTRODUCTION

Regulation of the civil aviation area between the USA and EU, the most important intercontinental air transportation market in the world, traditionally has been based on bilateral Air Service Agreements (ASAs) of a relatively protectionist nature. The economic benefits of previous liberalization processes and a warning by the European Commission about the negative effects of bilateral OSAs between single state members and the USA on European market unity led to negotiations between the US and EU governments for the restructuring of the transatlantic civil aviation area. As a result, at the end of March 2008, the EU-US Open Skies Agreement (OSA), a first step towards an EU-US Open Aviation Area (OAA), came into force, removing restrictions on route rights, air fares, and cooperation in marketing agreements that had limited EU and US airlines operating between the EU and USA.

Before the EU-US OSA, three different approaches existed in this area. Sixteen EU Member States[1] had signed bilateral "open skies" treaties with the USA. These agreements, characterized by nationality clauses, gave the participating EU airlines the right to fly—without restrictions on capacity or pricing—to any point in the USA but only from their home country. In contrast, the so-called "fifth freedom" in the bilateral OSA combined with the existence of a European Common Aviation Area (ECAA) gave US airlines the rights to operate flights within the ECAA. Air transport from the UK, Ireland, Spain, Greece, and Hungary to the USA and vice versa was ruled by bilateral ASAs, which set rules regarding permitted routes, airlines, capacity, frequency, and pricing restrictions. In other countries, there was no legal basis for direct flights to and from the USA.

The first-stage agreement of the EU-US OSA allowed any EU airline to fly from any EU city to any US city, without any restrictions on pricing or capacity. The agreement permitted EU carriers to continue flights beyond the US towards third countries and to fly between the US and non-EU countries that are members of the ECAA, such as Norway. The EU-US OSA also allowed any US airline to fly into any EU airport and from there onto third destinations. It allowed unlimited code-sharing for both sides and more freedom for wet-leasing or further commercial agreements. Moreover, it qualified alliances between EU and US airlines for antitrust immunity by the Department of Transportation (DOT; Chang et al., 2009).

The first stage of the EU-US OSA did not address issues of foreign ownership. Under the agreement, US companies may own only 49% of voting rights in European airlines, which in turn may hold only 25% of

[1] Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, and Sweden.

voting rights in US airlines (although they may own up to 49% of nonvoting shares). The first stage of the EU-US OSA also did not provide full cabotage rights to EU airlines and postponed the debate on foreign ownership to the second stage of negotiation, which ended in 2010. This situation has given rise to a temporary imbalance in terms of market access, ownership, and control rules for US and EU carriers. In particular, under the agreement, US airlines may operate domestic EU flights, whereas EU airlines cannot do the same in the USA.

It has now been 4 years since the first stage of the EU-US OSA was enacted. This paper evaluates its impact on transatlantic service levels and competition. The analysis considers all scheduled direct and one-stop flights between the EU and USA and vice versa in a typical off-peak week. In particular, this study overcomes the gap in empirical studies about the effect of the EU-US OSA, which have previously focused on case studies (i.e., evaluations of the impact on a specific airport).

2. IMPACT OF EU-US OSA

2.1 Expected effects of liberalization

Based on previous deregulation experiences, the EU and US governments expect to benefit from competition and regulatory convergence in air transport. Such expectations have encouraged the liberalization of the EU-US civil aviation area. In the last 20 years, the USA and EU have been engaged in restructuring their aviation regulations towards a less protectionist approach, which has been deemed a success by the governments. Early deregulation was focused on domestic aviation areas, and its extension to international areas enabled several improvements in the air transport industry. US domestic deregulation and the establishment of the Single European Aviation Market stimulated new and better air services that fostered traffic growth (Goetz, 2002; Graham, 1998). Airlines had the chance to optimize their networks, operation efficiency, and average load factor, which increased their cost competitiveness (Oum et al. 2005) and resulted, in some cases, in the reduction of fares. Finally, improvements in the air transport industry generated positive externalities on the overall economy and contributed to economic development (InterVISTAS-ga, 2006).

Although homogeneous results have generally been obtained from evaluations of the liberalization of domestic skies, evidence about the impacts of the liberalization of international air services through bilateral OSAs has been mixed. For bilateral open skies treaties between the USA and some EU countries, overall increases in service levels appear in only 7 of the 16 cases. In 3 cases no change is visible; in other cases, the service levels actually decrease (Cosmas et al., 2010). Moreover, the increase in capacity between countries signing OSAs seems to be due entirely to the expansion of immunized alliances on the routes between hubs (Whalen, 2007). Yet, the flight ticket prices are decreased to a greater extent in the open skies markets.

These contrasting impacts of the bilateral open skies treaties motivated several studies to forecast the impact of the EU-US OSA. These studies predict benefits for both passenger and cargo markets (Brattle, 2002[2]; InterVISTAS-ga, 2006; Booz Allen Hamilton, 2007; Pels, 2009; Button, 2009). They assume that OSAs allow airlines to feed their transatlantic routes and coordinate their activities more effectively, benefitted by the anti-trust immunity that the DOT usually grants to alliances between US airlines and airlines belonging to countries that sign an OSA with the USA. This scenario is expected to result in a more efficient air transport system and a reduction of the average cost of carriage. If cost savings are passed to passengers, then the OSA is expected to impact fares and increase passenger volumes, according to the demand elasticity[3].

In the same way, the cost reduction of cargo services and the greater efficiency of access to air express services may stimulate additional tons of cargo, equivalent to an increase of 1-2% of the transatlantic cargo market. Fares are expected to decrease due to the increased competition and frequency of flights between the EU and USA. Changes in competition and efficiency should decrease market prices by about 9-10% (Peterson and Graham, 2008). However, if the response to the EU-US OSA by airlines is supposed to resemble their reactions to earlier deregulations of the EU countries and US markets, rather than to

[2] Brattle and Booz Allen Hamilton (an update of Brattle) predict the effects of an OAA that will be reached if the present EU-US OSA is supplemented by cabotage rights and abrogation of restrictions about foreign ownership.

[3] Brattle (2002) predicts a traffic growth of between 4.1 to 11 million passengers per year, depending on demand elasticity. Booz Allen Hamilton predicts an increase of 26 million international passengers between the EU and USA. Inter-VISTAS-ga (2006) predicts an almost 29% increase in traffic.

enhance competition, then airlines are expected to enter alliance agreements. Competition should arise from the new entry of low-cost carriers into the intercontinental market, whose expansion could be limited by long turnaround times (Pels, 2009).

Besides the direct positive consequences on the aviation sector, predictive studies identify potential indirect impacts on tourism and catalytic effects from air service development. In particular, labor market effects are predicted. Traffic growth requires additional resources to satisfy the demand, and this need generates employment in the aviation industry and supporting industries. For instance, the additional liberalized major country-pair markets (USA with UK, Spain, Ireland, and Greece) could generate 117,000 jobs (InterVISTAS-ga, 2006). Studies also agree on the positive impact on economic prosperity (e.g., improvements of the air transport system may stimulate foreign direct investments and boost gross domestic product [GDP]), although they are not able to quantify these impacts. Finally, scholars expect higher impact in countries and their airports and airlines that have been ruled by ASAs prior to enactment of the EU-US OSA.

In summary, numerous consequences have been predicted with passage of the EU-US OSA, which is expected to stimulate competition and the creation of additional routes. The increased competition may reduce the relative market power of airlines and, thus, stimulate more cooperation and coordination of prices and schedules. All of these changes result in the reduction of costs and fares. Thus, we expect our analysis to highlight improvements in the transatlantic service level, such as a higher frequency of connections and the introduction of new routes, as well as a more competitive context.

2.2 Observed effects of liberalization

Empirical studies monitoring the international transatlantic civil aviation area are rare and mainly focus on the countries and airports ruled by ASAs until the EU-US OSA. As a result, few insights are available about the actual impacts of the EU-US OSA.

The literature indicates that not all of the predicted effects actually occur, and the true impacts mainly regard routes changes. In particular, studies report that 1 year after enactment of the EU-US OSA, routes from Ireland to the USA increased from 3 to 10, and passengers were offered time savings through opportunities to fly directly from Dublin (Barrett, 2009). Route changes, which generally target the rationalization of services in London, are also observable in the UK-US segment, as British Airways moved its services from Gatwick to Heathrow, and Air France introduced a daily service between Heathrow and Los Angeles (Morrel and Humpreys, 2008). The substantial expansion of Heathrow is due to the access of US airlines to this airport (Luongo, 2010). Notwithstanding, there is not a significant impact on passenger numbers coming from London, although traffic growth attributable to the EU-US OSA is registered in Amsterdam (Pitfield, 2011).

This paper seeks to give a comprehensive view of changes in the north transatlantic skies since passage of the EU-US OSA, thereby filling a considerable gap in the literature.

3. DATA

The empirical analysis, aimed at highlighting changes in service level and competition in the north transatlantic market 3 years after its deregulation, is performed on data provided by the OAG's worldwide database of airline schedules and associated data[4]. The study deals with both nonstop and one-stop scheduled flights from the USA to EU and from the EU to USA and regards the scheduling of a typical off-peak week, to measure changes that are persistent over time and not the results of on-off additional offers during demand peaks. In particular, the schedules of the 46th week of 2007 and 2010 are compared.

The research consists of two phases, devoted to direct and indirect connections, respectively. The connections are identified with the methodology exploited by Redondi et al. (2011) but focusing only on two-step flights. Indirect connections are identified by combining direct transatlantic flights with nonstop flights inside the USA and direct European domestic flights, such that the connecting time is more than 45 minutes[5] and the two segments of the flight are carried out either by the same carrier or by members of a

[4] OAG MAX provides information about all airline-scheduled flights worldwide. For each flight, the dataset includes some basic information about departure and arrival airports, departing and arrival times, flight times, frequency, carriers, and number of seats.

[5] The average connecting time of one-stop flights included in the sample is 148 and 152 minutes in 2007 and 2010, respectively. A sensitivity analysis, carried out by requiring a minimum connecting time equal to 90 minutes, highlights

global airline alliance[6]. Thus, we exclude "self-help hubbing" opportunities that are transfers between two independently operated flights arranged by the passengers themselves. The sample of indirect connections is further reduced by restricting to flights connecting origin-destination (O-D) airport pairs linked in both directions. By assuming that passengers are travel-time sensitive[7], the analysis of indirect connections concerns only flights whose total travel time is no more than 20% longer than the quickest alternative connecting the same airport pairs, considering both direct and indirect opportunities. Essentially, this analysis drops the alternatives with high routing factor[8]. In addition to reflecting passenger behavior, this selection criterion drops connecting paths that have no attractiveness, like a two-step flight connecting EU cities to New York passing through Los Angeles.

4. RESULTS

The description of the empirical analysis results is subdivided into two subsections. The first subdivision describes changes in the transatlantic service level provided by direct connections and changes in competition at the airline and airport levels by operating these services. The service level between two countries is measured by the volume of supply (i.e., number of weekly connections and weekly passenger capacity) and by the wideness of customer choice (i.e., number of airport pairs). The dynamics of competition is highlighted by the concentration index (e.g., Gini or Herfindhal index) and by considering the number of players per route. The second subsection is devoted to two-step flights and shows which changes affect customer choice, connectivity of EU and US cities with transatlantic destinations, competition among carriers, and competition among airports in hubbing operations.

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that this parameter does not affect the comparison between air transport services in 2007 and 2010. Assuming a minimum connecting time equal to 90 minutes, the reduction of the sample is about 30% both in 2007 and 2010. Moreover, the number of O-D pairs in 2007 decreases of 2.6% whilst in 2010 of 2.2%.

[6] Airlines alliances (i.e., OneWorld Alliance, SkyTeam, and Star Alliance) generally offer to coordinate indirect service for their clients.

[7] We assume that, whenever a direct service is available between a given O-D pair, passengers consider a two-step flight as a valid alternative only if its travel time does not exceed the direct flight's travel time by a certain threshold. Moreover, indirect connections between a given O-D are not all equivalent. In particular, indirect connections are supposed to be attractive only if their travel time does not exceed the quickest path connecting the same airports by a certain threshold.

[8] Routing factor is the ratio between the distance flown to complete the connection and the direct "as the crow flies" distance between origin and destination.

4.1 Direct connections

Given the symmetry between EU-US direct connections and US-EU connections, only changes in the supply of US-EU service are shown.

4.1.1 Transatlantic service level: number of connections and available seats

Comparing annual data about passengers of north transatlantic nonstop flights in 2007 and 2010, we observe a decrease in demand that is larger than the observed decreases in the overall US and overall EU international air transport flows[9]. In recent years, the supply of air transport services on the north transatlantic segment has reacted to passenger flows by adjusting its capacity[10]. Consequently, between 2007 and 2010, we observe a decrease of 8% in the number of US-EU connections and a decrease of 5.5% in the number of available seats on this route.

The adjustment of flights and capacity varies across European countries and US states. Considering scheduled flights at the European country level (Table 1), we observe that the decrease of nonstop connections from the USA does not affect all countries, and that dissimilar trends coexist. In Belgium, Finland, France, Spain, and Sweden, the number of connections per week increases. In terms of capacity, Spain shows the best performance (+47%), and its rank in the classification of the "more connected" countries to the USA improves (i.e., Spain surpasses Ireland). Interestingly, Spain is the only country among those without a previous bilateral OSA with the USA that is characterized by the growth of available seats.

Table 1 about here

For the US states, those states with few direct connections in 2007 do not show improvement. Maine and Connecticut lose all nonstop connections, and all other poorly connected States are characterized by no change in the number of connections (i.e., Arizona, Maryland, Ohio, Oregon, and Tennessee). In some cases, the reduction in the number of flights is balanced by the enhancement of aircraft capacity (e.g.,

[9] Compound annual growth rate of EU-US passengers is -4.9% vs. -0.6% for EU international passengers and -3% for US international travelers.

[10] Load factor of EU-US flights is almost the same (more or less 80%) in the last 10 years.

California, Massachusetts, and Michigan). The greatest negative changes affect Ohio, whereas increased connectedness is observed in North Carolina, Texas, and Utah, which is not connected to the EU by nonstop flights in 2007 (Table 2).

Table 2 about here

Thus, data on the capacity and frequency of flights do not verify the expected impact of the EU-US OSA on transatlantic air service. Undoubtedly, the net drop of capacity and frequency of flights is partially due to the global economic crisis. Yet, the economic crisis does not provide full explanations about the dynamics of transatlantic air transport service. In fact, the gross domestic product trend at European country level between 2007 and 2010 is not exactly correlated with the changes in scheduled flights (see for instance the increase of Spanish and Finnish non-stop traffic against the reduction of GDP per capita, table 3). Moreover, data on traffic in US and EU domestic markets and in international markets highlight that the negative impact on US-EU connections is higher than on the overall international air transportation and lower than on domestic flights (tables 4 and 5). Yet, looking at changes at European country and American state levels we observe different trends. In particular, Spain and Sweden on the European side, and California, Colorado, Florida, Maryland, Minnesota, North Carolina and Texas on the America side, are characterized by an higher increase of available seats on US-EU flights than on the global international market. It has to be noted that the performance of Spain strongly affects the statistics of total EU-27. In fact, if we do not take into account Spain results, decreases in US-EU market are equal to 7.5%, close to EU domestic market reductions.

Tables 3, 4 and 5 about here

A further explanation of the observed trends is based on the EU-US market maturity. In 2007, before introduction of the EU-US OSA, the supply of transatlantic air service is quantitatively adequate to the demand. Load factors testify that there is even a surplus. In the absence of a strong reduction of fares, demand could not be stimulated and, consequently, the supply does not change.

4.1.2 Transatlantic service level: customer choice

In addition to the cancellation of nonstop transatlantic connections to/from two European countries (i.e., Hungary and Romania) and to/from two US states (i.e., Connecticut and Maine), customer choice deteriorates in 2010 because of a reduction in the served nonstop city pairs and airport pairs. In 2007, before enactment of the EU-US OSA, 40 European cities are connected by nonstop flights to/from the USA. In 2010, the number of European destinations decreases to 34. Similarly, the number of city pairs with at least one nonstop connection per week drops from 168 to 155. The number of airport pairs drops from 197 to 181.

A close look at nonstop routes highlights that the transatlantic service level changes because 42 routes are removed, while only 26 new routes are introduced[11]. The UK is the European country most affected by route changes: 17 US-UK routes are erased, and only 7 new routes are scheduled. The beneficiary of these changes is Heathrow airport, with 5 new routes for the USA. The transatlantic service level is enhanced in France, Spain, and Sweden, where no routes are removed and airport pairs are enhanced by 5, 2, and 1 unit, respectively (Table 1).

On the US side, new routes mainly impact Texas, New York, Florida, North Carolina, and Minnesota. The removal of routes particularly impacts New York, Georgia, New Jersey, Illinois, and Ohio. A net improvement in customer choice is seen in North Carolina, Texas, Massachusetts, and Florida (Table 2).

Thus, the opportunity to fly from any EU city to any US city and vice versa is not yet widely exploited by US and EU airlines, as testified by changes in scheduled direct routes. Actual changes in transatlantic service levels vary across EU countries and US states. Liberalization positively affects customer choice only in Spain, among all of the EU countries without past bilateral OSAs with the USA.

4.1.3 Carrier competition and the role of alliances

[11] Maps about new direct routes and direct routes eliminated are available on request.

Contrary to the expected effects of the EU-US OSA, industry competition is reduced. The Gini index, which is calculated on the number of available seats, increases from 0.690 to 0.764. Thus, in 2010 a greater inequality in the distribution of seats characterizes the north transatlantic market.

The number of airlines providing nonstop transatlantic air services decreases from 45 to 33 between 2007 and 2010, due to service interruption by 16 carriers and service introduction by only 4 carriers (Air Berlin, Thomson Airways, Open Skies, and Air Europa). Three of these entrants are driven by replacement aims. Air Berlin entered the transatlantic market after purchasing LTU International, inheriting its routes and, partially, market shares. As a result of the merger of First Choice Airways with Thomsonfly, the new carrier Thomson Airways operates on transatlantic routes instead of First Choice Airways. The new carrier Open Skies was similarly founded in 2008 by British Airways to operate between France, Netherland, and US, after the acquisition of L'Avion by British Airways.

The reduction of carriers operating in transatlantic skies is due to the closure of some minor carriers (i.e., FlyGlobeSpan, SilverJet, Zoom Airlines, EOS airlines) and to the aforementioned mergers. Most carriers that cease to operate in the transatlantic air service industry (i.e., Air India, BMI, Emirates, Malev Hungary, Malaysia Airlines, Maxjet Airways, Olympic Air, and Czech Airlines) are airlines with a residual market share in the UK-US segment or carriers that operate to/from European countries most affected by the drop of the demand (i.e., Hungary, Greece, and Czech Republic). The low profitability derivable from the covering of services omitted by these carriers discourages the entry of new players. Moreover, the merger between Northwest and Delta contributes to the reduction of the number of carriers serving US-EU routes but also makes Delta the leader in direct transatlantic air services. In 2010, Delta replaces British Airways in the first position.

Apart from the reduction of the number of carriers operating in transatlantic skies, the competition is also reduced because of the strengthening of the market position of major players (i.e., British Airways, Delta, American Airlines, United Airlines, and Lufthansa; see Table 6). The overall market share of the major players moves from 49.4% to 58.2%. Most of this change is due to the increasing market share of the first three players: Delta Airlines increases its market share from 9.7% to 15.9% thanks to the merger with Northwest, British Airways market share experiences an increase from 12.6% to 13.5% whilst Lufthansa experiences the largest increase (i.e. from 9.3% to 10.5%). Moreover, we observe a lack of new entry in routes with a predominant player. Entries and exits in the last 3 years enhance the role played by US carriers and reduce the role played by carriers belonging to neither the USA nor the EU (Table 7). Carriers belonging to strategic alliances also increase their market share. Thus, the market share of strategic alliances moves from 83.7% to 89.6%. In 2010, Star Alliance plays a predominant role, thanks to the joining of Continental Airlines and the increase of 3% of market shares of its senior members (Table 8).

Tables 6, 7 and 8 about here

4.1.4 Airport competition

At the airport level, Europe and the USA experience the EU-US OSA in different ways. In the USA, the distribution of seats among airports does not change substantially (Gini coefficient of 0.623 in 2007 vs. 0.627 in 2010). In 2010, Europe is characterized by a higher spatial concentration among airports (Gini coefficient of 0.702 in 2007 vs. 0.767 in 2010). Heathrow, the major airport in London, increases its market share by about 3.5%. The market share of Frankfurt, the second player, rises 4.6%. Spanish airports (MAD and BCN) also record a growth in available seats. The performances of LHR, MAD, and BCN differ from those of other airports in European countries without previous bilateral OSAs, whose positioning worsens.

4.2 Indirect connections

With regard to changes in the service level and competition between carriers and alliances, this subsection reports the results of the analysis of US-EU one-stop flights. With regard to indirect flights, there is not a perfect directional symmetry between directions because of differences between domestic US and internal EU flights. The subsection closes with a comprehensive analysis about hubbing operations. This discussion is of interest because of the relevance of the hub-and-spoke network to the operation of long-haul flights and the increasing competition among hubs.

4.2.1 Transatlantic service level

Considering only one-stop connections whose segments are operated by the same carrier or carriers belonging to the same global alliance, in 2010, we observe a fall off in airport pairs compared to 2007 (Table 9). The supply of indirect air transport services on the transatlantic market sustains a loss of about 10% in terms of total O-D pairs. This contraction is mainly caused by the restructuring of indirect services totally operated by the same carrier (i.e., the percentage decrease of the number of O-D pairs served by the same carrier is about -15%). The role of global alliances as coordinators of two-step flights is greater in 2010 than in 2007. Global alliances supply 45.2% and 49% of the indirect routes in 2007 and 2010, respectively.

Table 9 about here

An analysis of changes at the European country level highlights the heterogeneity of the situation[12]. More than half of the European countries show an overall deterioration of service level. The highest worsening is reported in Slovakia and Czech Republic (i.e., -70.9% and -66.7%, respectively). The reduction of served O-D pairs also concerns Ireland, UK, Greece, and Hungary, four of the countries characterized by a previous lack of a bilateral OSA with the USA. The service level improves in Slovenia, Spain, France, Belgium, Luxembourg, Sweden, and Portugal. In particular, Portugal stands out, with an increase of +20.9%. However, the size of the changes is not so great as to affect the rank of EU countries according to the number of connected O-D increases (Figure 1).

Looking for an explanation for the changes in the number of indirect flights at the country level, we observe that they are not perfectly correlated either to alterations in direct transatlantic flights or to variations in intra-EU air transport service. Changes in one-stop supply are due to decreasing performances in guaranteeing connection between transatlantic and domestic flights at main hubs.

[12] Changes in the number of O-D pairs per European Country and American State are available on request.

The analysis of changes in transatlantic air transport service at the US state level provides a similar picture (Figure 2). We observe a reduction of service level in most states, which only partially reflects the contraction of domestic US flights. Thus, like the EU, data about the USA suggest that a worse coordination of domestic and transatlantic flights affects the transatlantic market. The greatest negative impact of coordination changes is seen in Connecticut, Maine, and Mississippi, whereas West Virginia shows the greatest benefit.

Figures 1 and 2 about here

At the city level, we observe a reduction in the number of EU cities connected by indirect flights to the USA but an increase in the number of US cities with one-stop connections to reach the EU. Among the top 10 EU-connected cities in 2007, we observe a prevailing negative trend in terms of service coverage (i.e. percentage of US cities connected to the specific city on the total US cities connected to EU). Paris, Frankfurt, Brussels, and Madrid, which show an increase at least of 6% of US cities from which they are reachable, are exceptions. Although London, the most connected city in 2007 and 2010, is reachable from two more US cities, changes shorten the gap between it and other EU cities. The greatest impact is on Madrid connectivity. With regard to US cities, we observe changes of smaller magnitude that generally favor the connectivity of cities on the East Coast and damage cities on the North-West Coast. Among the top US connected cities, Miami is characterized by the best improvement (Table 10).

Table 10 about here

The quality of service, defined by travel time and flight frequency, is decreased in most of the O-D pairs. About 53% of O-D pairs linked both in 2007 and in 2010 by one-stop connections are affected by a decrease of flight frequency or an increase of total travel time (Table 11). In most of cases, the increase in travel time is due to a worsening of coordination that causes an increase of waiting time in the hub. In about 40% of cases the increase of travel time is due to higher routing factors.

Table 11 about here

4.2.2 Competition in one-stop flights

Competition in one-stop transatlantic service increases between 2007 and 2010[13]. In particular, in 2010, a higher percentage of airport pairs are served by two or more players[14] (Table 12). This is the consequence of the entry of new players in 15.5% of 2007's monopolized routes. Looking at O-D served by each global alliance it results that in 2007 the one with the wider supply was Sky Team whils in 2010 the alliance providing the widest supply is Star Alliance. Yet, this is mainly because of the transfer of Continental Airlines from SkyTeam to Star Alliance (Figure 3). Thus, Star Alliance in 2010 becomes the prevailing player. This change in predominance is also visible from the extent of the monopoly on single routes by global alliances (Table 13).

Tables 12,13 and Figure 3 about here

4.2.3 Competition among airports in hubbing operations

The list of airports that play a hub role in one-stop north transatlantic flights changes between 2007 and 2010. This alteration arises from changes in origins and destinations of direct flights (e.g., in 2010 BDL, BGR and BUD cease acting as intermediate airports, while SLC and LCY become hubs in one-stop transatlantic connections) and from the different coordination performances of airports with a minor role in hubbing operations (e.g., GLA ceases acting as an hub, while SNN and STR become hubs). These alterations result in a reduction of the number of hubs (i.e., from 61 to 58 airports) and changes in the top rankings of the airports in terms of served O-D pairs (Table 14). The only airports that hold their positions are Newark,

[13] The analysis of indirect competition is carried out on global alliance level since their relevance in coordinating carriers'scheduling to provide one-stop flights. Consequently, the count of players on a route considers carriers competing only if they belong to different alliances or are not related to any alliance.
[14] The increase of routes served by more than one player is confirmed also after controlling for the effect of membership's change of Continental Airlines.

which has the greatest share of O-D connections both in 2007 and 2010, Frankfurt, and Charles De Gaulle. Among all of the changes, the increasing role of London Heathrow, which stands in the second place in 2010 from the ninth position in 2007, stands out. US airports at the top of the rank are affected by a decrease of both % of served O-D and % of O-D where they are the only hub. EU airports in the top 10 are affected by an opposite trend. Thus, EU airports are gaining more relevance as intermediate airports in one-stop transatlantic flights even if, in 2010, there is the predominance of US stations in the top positions.

Table 14 about here

Contrasting results are observed with regards to competition in hub operations. We observe a reduction of O-D connections with no opportunities to choose among more than one intermediate airport (i.e., the percentage of O-D pairs with only one hub decreases from 55.1% to 52.4%). However, a narrow share of O-D pairs is characterized by an increase of hub opportunities (20.4%), whereas most of the O-Ds are not subject to changes (55.2%). Thus, for the case of O-D with only one hub opportunity in 2007, passengers have more choices when planning their itineraries in 2010. However, they do not perceive particular benefits in most other cases.

To address competition, hubs implement different strategies (Table 15). Half of the airports seek to improve coordination performance to guarantee lower waiting time, whereas a few seek to enhance the number of connections to guarantee a higher flight frequency. In particular, some airports, such as Stockholm Arlanda (ARN), Bruxelles (BRU), and Copenhagen (CPH), improve the quality of connections both by reducing waiting times and by enhancing flight frequency. Some airports, such as New York JFK and Atlanta, enhance only flight frequency and others, such as Athens (ATH), Dallas (DFW), and Boston (MIA), only apply better temporal coordination.

Table 15 about here
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5. CONCLUDING REMARKS

This paper seeks to identify whether changes in north transatlantic air transport services after the enforcement of EU-US OSA have been consistent with expectations about its impact on competition and service level. The results show a decrease in both direct and one-stop connections and a fall-off of the O-D pairs linked by them. This result is due to the removal of some routes served in the past, with only partial replacement by new ones. Thus, customer choice deteriorates. Considering the number of cities linked to transatlantic destinations by nonstop and two-step flights, the analysis highlights the contrasting trends of the service diffuseness in the EU and USA. In particular, a widening of service affects the USA and a contraction characterizes the EU, although the changes in transatlantic service level differ across European countries and American states. On the EU side, these different trends are not correlated with different regulations in force before the EU-US OSA. In particular, a similar impact is not observed in countries without previous bilateral OSAs with the USA (i.e., UK, Ireland, Spain, Greece, and Hungary). Among them, Spain is the only one with a positive effect. In fact, the positive impact on Ireland registered by Barrett (2009) is not confirmed after 3 years.

Competition between carriers in the supply of direct transatlantic flights is decreased because of the reduction of players and the consolidation of the market share of major players. Moreover, a lack of new entry in routes with a predominant player is observed. An opposite behavior affects the supply of two-step flights where an increased competition rate affects routes that are served by only one carrier in 2007. The exploitation of coordination inside global alliances is enhanced and competition among airports in hubbing operations is increased in 2010. The rank of the top 10 hubs see advancements of positions by EU airports, given the improved quality of their services.

Economic crisis, the delay in the development of a long-haul low cost business model and the presence of entry barriers for new players related to slot allocation contribute to the explanation of the unexpected impact of the deregulation process. The economic crisis affecting EU and USA in the last years makes travel demand for US-EU market lowers of 14.1%. This results in less incentives towards expansion strategy by carriers and in particular, towards the exploitation of opportunities provided by the EU US OSA.

The impact of EU US OSA is also the consequence of the lack of new players. What differentiates this deregulation process from the domestic ones is the lack of entry of low cost carriers that would enhance competition. The traditional low cost business model does not fit with long haul flights. Cost advantages reachable to the application of low cost business model to long-haul are not so high as in short-haul (Francis et al., 2007). Moreover, service quality of low cost carriers are not adequate to long-haul passengers' needs that are sensitive not only to price but also to on-flight services, timing and routing.

Furthermore the entry of new players in this market organized as a hub-and-spoke system is hampered by grandfather rights and unavailability of slots in main airports.

Concerning the impact of EU US Open Skies Agreement, some questions remain. In particular, since our analysis highlights changes in the supply of air transport services and in industry concentration rate, a complementary study should deal with fares dynamics in order to control for changes in the trade off price-quality. Thus, next investigations should control for the role played by travel prices on the observed service level changes and competition.

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FIGURES AND TABLES

Figure 1. Airport pairs served by one-stop flights per European Country

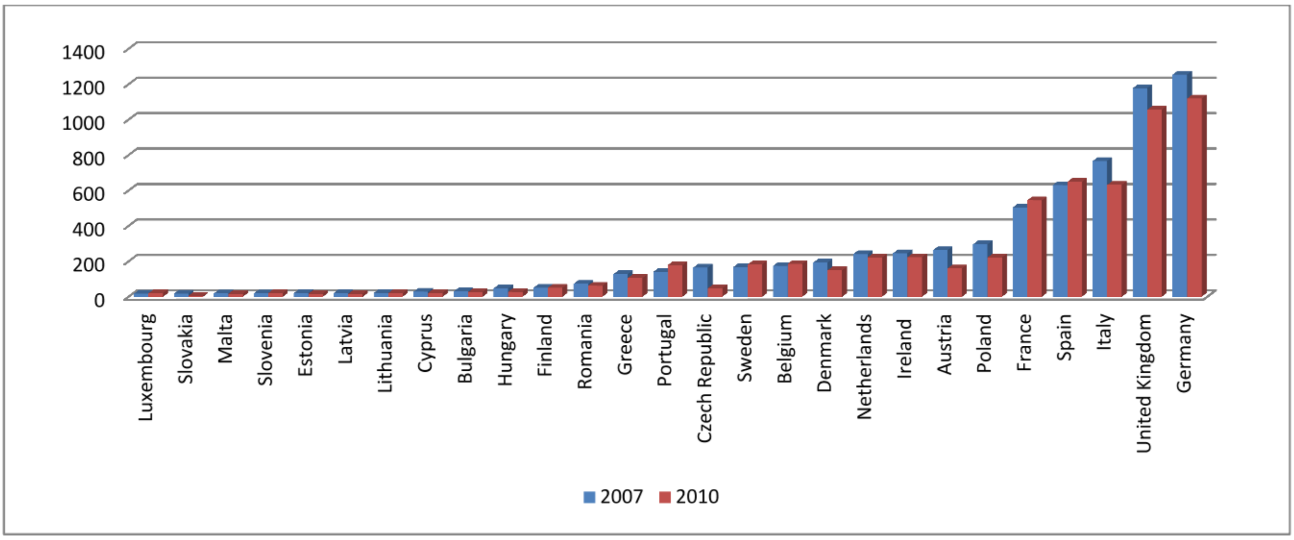

Figure 2. Airport pairs served by one-stop flights per American State

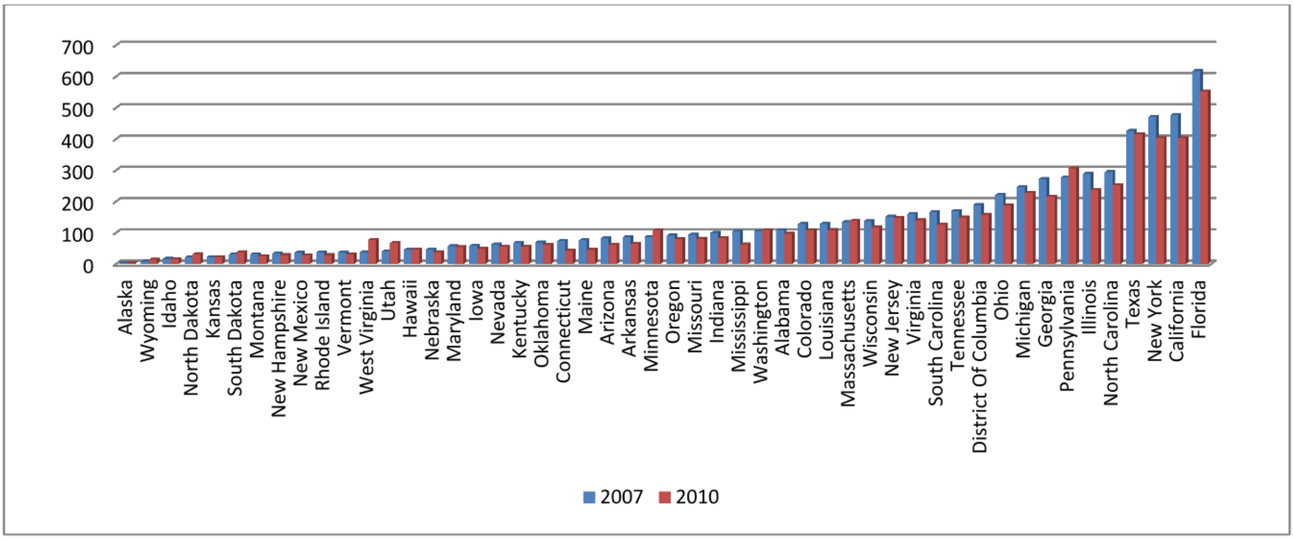

Figure 3. Coverage of indirect flights by alliances

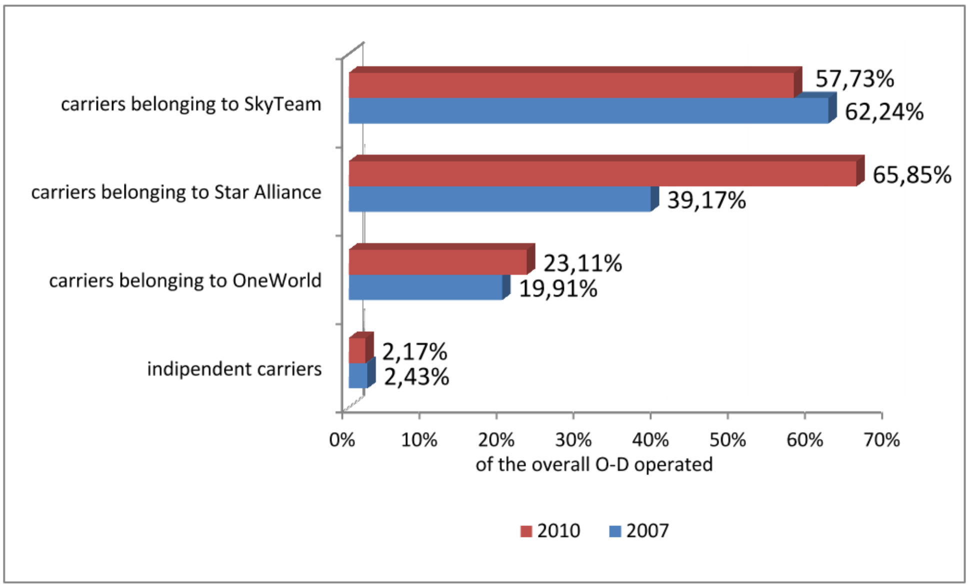

Table 1. Non-stop flights US to EU per European Country

	2007			2010			% Change 2007-10		
	flights	**seats**	**airport pairs**	**flights**	**seats**	**airport pairs**	**flights**	**seats**	**airport pairs**
Spain	86	20708	11	119	30376	13	38.4%	46.7%	18.2%
Sweden	18	4291	2	23	5431	3	27.8%	26.6%	50.0%
Finland	5	1410	1	6	1624	1	20.0%	15.2%	0.0%
Belgium	60	15925	6	68	15622	6	13.3%	-1.9%	0.0%
France	266	69469	17	272	69036	22	2.3%	-0.6%	29.4%
Latvia	1	264	1	1	207	1	0.0%	-21.6%	0.0%
Italy	124	28571	16	122	30881	15	-1.6%	8.1%	-6.3%
Germany	417	112324	43	384	108864	40	-7.9%	-3.1%	-7.0%
Denmark	34	8151	5	31	7490	4	-8.8%	-8.1%	-20.0%
United Kingdom	826	214395	48	717	192717	38	-13.2%	-10.1%	-20.8%
Netherlands	211	54567	17	183	49144	17	-13.3%	-9.9%	0.0%
Poland	16	3952	4	13	3211	3	-18.8%	-18.8%	-25.0%
Ireland	101	25432	13	79	20002	10	-21.8%	-21.4%	-23.1%
Portugal	18	3696	3	14	3160	3	-22.2%	-14.5%	0.0%
Greece	15	3415	2	10	2209	2	-33.3%	-35.3%	0.0%
Austria	20	4572	4	13	3111	2	-35.0%	-32.0%	-50.0%
Czech Republic	11	2304	2	5	1205	1	-54.5%	-47.7%	-50.0%
Hungary	8	1696	1	0	0	0	-100.0%	-100.0%	-100.0%
Romania	4	856	1	0	0	0	-100.0%	-100.0%	-100.0%
Total EU-27	2241	575998	197	2060	544290	181	-8.1%	-5.5%	-8.1%

Table 2. Non-stop flights US to EU per American State

	2007			2010			% Change 2007-10		
	flights	**seats**	**airport pairs**	**flights**	**seats**	**airport pairs**	**flights**	**seats**	**airport pairs**
North Carolina	27	1032	4	33	1773	6	22.2%	71.8%	50.0%
Texas	119	5243	7	129	6882	9	8.4%	31.3%	28.6%
Florida	137	10305	16	148	11894	18	8.0%	15.4%	12.5%
District of Columbia	156	8634	11	167	8987	11	7.1%	4.1%	0.0%
Pennsylvania	91	4732	12	94	4746	11	3.3%	0.3%	-8.3%
Arizona	6	291	1	6	337	1	0.0%	15.8%	0.0%
Maryland	7	216	1	7	252	1	0.0%	16.7%	0.0%
Minnesota	28	1192	2	28	1575	3	0.0%	32.1%	50.0%
Oregon	5	260	1	5	243	1	0.0%	-6.5%	0.0%
Tennessee	7	243	1	7	243	1	0.0%	0.0%	0.0%
Nevada	17	1797	5	16	1071	3	-5.9%	-40.4%	-40.0%
New Jersey	332	15300	31	312	14431	27	-6.0%	-5.7%	-12.9%
Massachusetts	92	5642	9	86	5563	10	-6.5%	-1.4%	11.1%
New York	469	27290	29	436	25274	26	-7.0%	-7.4%	-10.3%
Washington	28	1548	4	26	1602	4	-7.1%	3.5%	0.0%
Georgia	152	7248	18	139	6695	15	-8.6%	-7.6%	-16.7%
California	188	10198	13	151	10750	11	-19.7%	5.4%	-15.4%
Illinois	250	14371	17	193	11716	15	-22.8%	-18.5%	-11.8%
Colorado	19	860	3	13	933	2	-31.6%	8.5%	-33.3%
Michigan	80	3735	6	52	3560	4	-35.0%	-4.7%	-33.3%
Ohio	21	642	3	7	241	1	-66.7%	-62.5%	-66.7%
Connecticut	7	185	1	0	0	0	-100%	-100%	-100%
Maine	3	657	2	0	0	0	-100%	-100%	-100%
Utah	0	0	0	5	241	1	100%	100%	100%
Total USA	2241	121621	197	2060	119009	181	-8.1%	-2.1%	-8.1%

Table 3. Changes in economic perfomance and available seats on direct flight US-EU

	% change available seats on non-stop flights	GDP growth (2007-2010)	CAGR GDP 2007-2010
Austria	-32.0%	3.3%	1.1%
Belgium	-1.9%	3.2%	1.0%
Czech Republic	-47.7%	1.2%	0.4%
Denmark	-8.1%	1.9%	0.6%
Finland	15.20	-1.2%	-0.4%
France	-0.6%	0.7%	0.2%
Germany	-3.1%	2.7%	0.9%
Greece	-35.3%	1.0%	0.3%
Hungary	-100%	7.6%	2.5%
Ireland	-21.4%	-19.8%	-7.1%
Italy	8.1%	-1.9%	-0.6%
Latvia	-21.6%	-12.3%	-4.3%
Netherlands	-9.9%	1.4%	0.5%
Poland	-18.8%	20.1%	6.3%
Portugal	-14.5%	1.2%	0.4%
Romania	-100%	24.3%	7.5%
Spain	46.7%	-2.9%	-1.0%
Sweden	26.6%	3.1%	1.0%
United Kingdom	-13.2%	1.7%	0.6%

Source: Personal elaboration of data on gdp per inhabitant supplied by Eurostat

Table 4. Traffic trend in EU International and domestic market (2007-2010)

	% change 2007-10 in available seats in		
	US-EU market	**EU domestic market**	**international market**
Austria	-32.0%	-5.7%	9.1%
Belgium	-1.9%	-0.1%	24.2%
Czech Republic	-47.7%	-22.4%	5.4%
Denmark	-8.1%	0.2%	8.1%
Finland	15.2%	2.3%	22.8%
France	-0.6%	-12.9%	8.1%
Germany	-3.1%	-2.2%	14.4%
Greece	-35.3%	-2.8%	-5.1%
Hungary	-100%	-2.7%	-8.2%
Ireland	-21.4%	-30.8%	-17.0%
Italy	8.1%	0.9%	14.9%
Latvia	-21.6%	14.1%	38.4%
Netherlands	-9.9%	-9.1%	9.9%
Poland	-18.8%	-16.2%	23.7%
Portugal	-14.5%	5.0%	14.8%
Romania	-100%	15.9%	24.0%
Spain	46.7%	-9.9%	17.3%
Sweden	26.6%	-9.1%	20.3%
United Kingdom	-10.1%	-15.5%	1.2%
Total EU-27	-5.5%	-7.8%	10.2%

Table 5. Traffic trend in US International and domestic market (2007-2010)

	% change 2007-10 in available seats in		
	US-EU market	**US domestic market**	**international market**
Arizona	15.8%	-14.2%	22.8%
California	5.4%	-17.0%	-11.6%
Colorado	8.5%	0.9%	-34.2%
Connecticut	-100%	-15.9%	-47.2%
District of Columbia	4.1%	-1.9%	4.7%
Florida	15.4%	-11.0%	-2.3%
Georgia	-7.6%	-5.1%	2.7%
Illinois	-18.5%	-13.4%	-13.6%
Maine	-100%	-5.9%	-32.1%
Maryland	16.7%	-5.1%	13.0%
Massachusetts	-1.4%	2.0%	-11.8%
Michigan	-4.7%	-11.4%	-22.3%
Minnesota	32.1%	-13.4%	-7.3%
Nevada	-40.4%	-23.5%	-14.6%
New Jersey	-5.7%	-10.0%	6.1%
New York	-7.4%	-10.3%	1.1%
North Carolina	71.8%	3.5%	12.0%
Ohio	-62.5%	-31.3%	-35.8%
Oregon	-6.5%	-16.2%	-23.9%
Pennsylvania	0.3%	-7.2%	7.9%
Tennessee	0.0%	-16.2%	-31.7%
Texas	31.3%	-8.1%	9.3%
Utah	100%	-10.5%	-14.2%
Washington	3.5%	-8.0%	5.9%
Total USA	-5.5%	-11.5%	-3.2%

Table 6. Concentration Ratios in direct connection

	2007	**2010**
CR1	12.6%	15.9%
CR2	22.4%	29.4%
CR3	31.7%	40%
CR4	40.7%	49.1%
CR5	49.4%	58.2%

Note: The ration are calculated on the basis of available seats

Table 7. Carriers operating direct flights by nationality

	EU carriers	**USA carriers**	**Others**
2007	51.3%	44.1%	4.6%
2010	50.5%	47.2%	2.3%

Table 8. Market share of alliances in direct flights

	StarAlliance	SkyTeam	OneWorld	Others
2007	26.1%	34.2%	23.4%	16.3%
2010	36.7%	28.4%	24.4%	10.5%

Table 9. Changes in US-EU one-stop flights

	2007	2010	Change(%)
Total n° O-D pairs	6721	5990	-10.9%
n° O-D pairs served by the same carrier	5760	4894	-15.0%
n° O-D pairs served within alliance	3038	2936	-3.4%
n° origins	287	295	2.8%
n° destinations	227	205	-9.7%

Table 10. Rank of cities according to their connectivity

	EU as arrival cities in indirect flights US to EU						US as departure cities in indirect flights US to EU					
	2007			2010			2007			2010		
		N° origins	%[§]		N° origins	%[§]		N° destinations	%[#]		N° destinations	%[#]
1	London	262	91.3%	London	264	89.5%	New York	219	96.5%	New York	199	97.1%
2	Frankfurt	245	85.4%	Paris	261	88.5%	Chicago	165	72.7%	Chicago	157	76.6%
3	Amsterdam	226	78.7%	Frankfurt	260	88.1%	Washington	148	65.2%	Boston	133	64.9%
4	Munich	221	77.0%	Amsterdam	221	74.9%	Boston	129	56.8%	Miami	132	64.4%
5	Paris	219	76.3%	Munich	207	70.2%	Atlanta	124	54.6%	Washington	128	62.4%
6	Manchester	189	65.8%	Madrid	194	65.8%	Miami	123	54.2%	Dallas/Fort Worth	118	57.5%
7	Duesseldorf	175	61%	Brussels	182	61.7%	Philadelphia	114	50.2%	Los Angeles	114	55.6%
8	Brussels	172	59.9%	Manchester	163	55.2%	Houston	111	48.9%	Atlanta	110	53.7%
9	Rome	172	59.9%	Rome	158	53.6%	Los Angeles	111	48.9%	San Francisco	109	53.2%
10	Vienna	169	58.9%	Duesseldorf	156	52.9%	San Francisco	111	48.9%	Philadelphia	106	51.7%

[§]Ratio between the number of US cities connected to the specific EU city and the total number of US cities connected to EU by one-stop flights

[#]Ratio between the number of EU cities connected to the specific US city and the total number of EU cities connected to US by one-stop flights

Table 11. Changes in service quality level of indirect flights

	n°	%
O-D operated both in 2007 and 2010	5152	
O-D with improved flight frequency	1966	38.2%
O-D with the same flight frequency	737	14.3%
O-D with lower total travel time	2381	46.2%
O-D with the same total travel time	21	0.4%
O-D with higher frequency and lower time fight	663	12.9%

Table 12. Number of players and O-D in indirect US-EU flights

	2007	2010
%O-D served by only one player	70.1%	66.6%
%O-D served by two players	22.2%	23.5%
%O-D served by three players	7.4%	9.6%
%O-D served by four players	0.4%	0.3%
%O-D served by five players	0.01%	

Table 13. N°O-D where the alliance is the only option

	2007		2010	
OneWorld	456	6.8%	389	6.5%
SkyTeam	2820	42%	1504	25.1%
Star Alliance	1351	20.1%	2034	34%

Table 14. Top 10 hubs

		O-D (%)	O-D where is the only one hub (%)	FREQ	Travel time	Waiting time		O-D (%)	O-D where is the only one hub (%)	FREQ	Travel time	Waiting time
1	EWR	42.1%	4.7%	14.1	817.5	171.6	EWR	43.7%	3.5%	13.5	795.9	161.7
2	ATL	38.6%	3.2%	15.1	838.4	151.9	LHR	34.0%	2.0%	23.2	790.3	132.3
3	ORD	35.7%	1.8%	18.5	783.6	141.0	ATL	33.6%	2.7%	17.9	830.8	156.0
4	FRA	32.3%	2.4%	16.4	826.0	163.4	FRA	32.8%	2.8%	16.4	856.0	191.2
5	JFK	26.0%	1.7%	11.5	814.7	140.0	ORD	30.2%	2.0%	17.8	786.2	147.7
6	CDG	25.1%	0.9%	17.7	769.7	121.4	CDG	27.8%	1.8%	13.6	776.7	121.6
7	PHL	23.6%	0.1%	10.8	726.9	126.3	AMS	25.4%	1.3%	14.1	781.8	128.6
8	IAD	22.9%	0.0%	17.7	748.7	123.9	JFK	24.3%	0.7%	12.8	827.2	151.8
9	LHR	22.7%	1.4%	25.9	780.3	128.0	IAD	22.7%	0.9%	16.7	761.0	143.2
10	AMS	22.1%	0.9%	17.8	764.6	125.5	PHL	21.3%	0.2%	12.3	718.5	125.9

Table 15. Changes in hub airports' performance

	% change in frequency	% change in waiting time	change in % served O-D
airports with all improved features			
ARN	39.7%	-9.7%	0.0%
BCN	13.8%	-17.2%	0.3%
BRU	19.8%	-28.5%	0.9%
HAM	250.0%	-33%	0.1%
PDL	14.3%	-23.4%	0.0%
TPA	26.7%	-2.4%	0.0%
WAW	6.2%	-15.3%	0.1%
airports with an higher frequency and lower waiting time			
CPH	12.5%	-24.6%	-0.6%
DUB	33.7%	-6.5%	-0.4%
HEL	33.5%	-15.3%	-0.1%
PHL	13.8%	-0.3%	-0.3%
RDU	19.7%	-0.1%	-0.1%
VIE	15.5%	-5.5%	-0.2%
LAS	27.3%	-83.5%	-0.4%
airports with higher frequency and higher % O-D served			
BFS	350.0%	225.6%	0.0%
DUS	9.8%	121.1%	1.3%
MCO	24.0%	8.7%	0.1%
airports with lower waiting time and higher% of O-D served			
EWR	-4.7%	-5.7%	2.3%
LIS	-1.2%	-11.7%	0.1%
MEM	-0.8%	-12.2%	0.1%
airports with higher frequency			
ATL	18.5%	2.7%	-6.6%
JFK	10.9%	8.4%	-1.1%
airports with lower waiting time			
ATH	-16.7%	-7.7%	-0.2%
BOS	-13.9%	-3.2%	-0.7%
DTW	-17.0%	-4.12%	-0.5%
LGW	-27.7%	-5.4%	-2.8%
MXP	-63.7%	-40.3%	-2.4%
PRG	-13.1%	-8.2%	-0.4%
SEA	-12.3%	-14.7%	-0.1%
VCE	-25.0%	-80.6%	-0.0%
PDX	-53.1%	-47.3%	-0.1%
airports with an increase of %o-d served			
AMS	-21.1%	2.5%	1.9%
CDG	-22.9%	0.2%	3.5%
CLT	-5.8%	10.8%	3.4%
DFW	-28.5%	5.6%	1.8%
FCO	-29.1%	36.8%	2.2%
FRA	-0.4%	17%	1.3%
IAD	-5.5%	15.5%	1.7%
IAH	-44.0%	3.1%	0.4%
LHR	-10.3%	3.4%	3.7%
MAD	-1.7%	7.4%	1.1%
MIA	-8.6%	7.7%	0.2%
MSP	-35.6%	11.0%	1.5%
MUC	-0.4%	5.5%	2.4%
NCE	-50.8%	4.6%	0.1%
SFO	-33.3%	39.3%	0.2%
TXL	-61.8%	147.3%	0.2%
airports with all deteriorated features			
CVG	-1.4%	7.2%	-3%
DEN	-23.1%	4.0%	-0.7%
LAX	-12.1%	45.0%	-0.3%
MAN	-3%	33.2%	-0.2%
OPO	-18.2%	95.4%	-0.0%
ORD	-3.7%	4.7%	-2.4%