The effects of joint ventures in the transpacific airline market

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Abstract

In this paper, we explore the effects of two joint ventures approved in November 2010 at the same time between Japanese airlines and the U.S. airlines, All Nippon Airways("NH") with United Airlines("UA") and Japan Airlines International("JL") with American Airlines("AA") in trans-pacific routes. We use the route-level data for the period from 2006 to 2019 to utilize difference-in-difference analysis. We find two joint ventures entirely had negative effects on trans-pacific routes. The joint venture between NH and UA provides evidence that the cooperation resulted in reduced the number of provided seats on the routes where they jointly operated and linked their hub airports. Regarding the case of JL and AA, the number of provided seats increase on their cooperating routes. We conjecture that these contradicting results are because of outer shocks to JL which made it to reduce its services to overcome financial crisis in 2010.

Key Words: Air transportation, Joint Venture, All Nippon Airways, United Airlines, Japan Airlines International, American Airlines, Trans-pacific routes, Difference-in-difference

1. Introduction

Airline alliances have been major trends in international air transport market more than 20 years. Until now, three largest global alliances so-called Star Alliance, oneworld, Skyteam were created and they have expanded their network all over the world. Countless intercontinental routes are operated by the member airlines of the three major global alliances.[1] Even though there are various reasons for this phenomenon, the most crucial reason is the exclusive rights of airlines for flight operation within their own countries. For air travel between non-hub cities, therefore, no one airline is able to provide a flight between any two countries because the trip consists of both a domestic route and a foreign route. For example, if any passenger is considering a trip to Kyoto from Sevilla, she is able to fly from Sevilla to Madrid, Madrid to Tokyo and Kyoto to Tokyo. However, Japanese national airlines have no rights to offer flights within Spain, they have to cooperate with other European national airlines being able to carry passengers on the routes between Sevilla and Madrid.

Another reason behind is the relatively lower demands on the routes between non-hub cities, which hinder each airline from operating every direct flights by itself. For example, there would not be enough demands for a direct flight on the routes between Sevilla and Kyoto. To overcome these limitations, airlines choose the cooperation with other airlines in forms of interline, codeshare, mutual recognition of frequent flyer programs etc, as the name of airline alliances. Airline cooperation evolved deeper and deeper and reached the Joint Venture(JV) in which airlines make their core decisions jointly on prices, schedules, capacities etc, and then sharing their profits on the specific routes. JV is the strongest cooperation which airlines are able to form in real. (see Table 1)

[1] At the beginning of 2020, Skyteam included 19 carriers from five continents, flew to more than 1030 destinations in about 170 countries and operated more than 15,440 flights daily. In case of one oneworld had 14 members and 30 affiliated airlines, served about 1100 airports in more than 180 territories with approximately 14,000 daily departures. (Joan Calzada et al, 2022). Star alliances had 26 member airlines and networks beyond 1200 airports over 50 global hubs. https://www.staralliance.com/en/about

Table 1. Degrees of airline cooperation.

Degree of cooperation	Type	Contents
Stronger	JV	· revenue, cost & benefit sharing
↕	ATI	· direct coordination on prices, capacity & scheduling
	Alliance	· shared sales offices, maintenance, frequent flyer program, etc
	Simple codeshare	· consolidated marketing and ticket sales
Weaker	Simple interline	· disjoint marketing and ticketing

Source: European Commission and the U.S. Department of Transportation (DOT), Transatlantic Airline Alliances: Competitive Issues and Regulatory Approaches fig 1. Nov. 16, 2010. & Calzaretta et al (2017).

Merger and Acquisition (M&A) is not generally allowed between airlines with different nationalities except extremely special cases. At the same time, almost every country prohibits another nation's airlines from utilizing traffic rights in its domestic routes through bilateral air service agreement if the nationality of the airline is not consistent with "substantial ownership and effective control".[2] Therefore, airlines' endless strategy to enhance competitiveness and expand their network resulted in JV. Since making joint decisions on factors that may affect participant' behaviors is "collaborator act" banned by Antitrust Laws, for implementing JV, the airlines have to be granted antitrust immunity("ATI") from competition authorities in the related countries. Some countries do not discriminate JV and alliances with ATI and regard them as same type of cooperation when they examine application of JV and ATI since both case require the airlines to get approvals of the competition authority in terms of collaborator behaviors.[3] However, even though it is common that both cases are granted ATI from the authorities, JV means stronger cooperation than alliance with ATI in terms of sharing costs and benefits so that changing the strategic choices of the member airlines. Therefore, JV and alliance with ATI need to be dealt with separately.

Motivations that lead airlines to JV can be summarized as follows: First, the airlines are able to overcome regulatory constraints that put limitations on competitions among airlines. Since

[2] Article 7, Convention on International Civil Aviation, Dec. 7, 1944., Although there are examples of firms holding equity stakes in international airlines, most governments do not allow complete foreign ownership of domestic carriers and airport facilities through Bilateral Agreement (Lazzarini, 2007).

[3] In case of Korea, Ministry of Land, Infrastructure and Transport ("MOLIT") and KFTC (Korea Fair Trade Commission) only focus on the potential and prospective effects of joint decisions on prices, capacities, frequencies etc. The sharing revenue and profit itself is the matter of the airlines, not government.

the 1944 Chicago Convention, all commercial international air transports have been regulated by bilateral or multilateral air service agreements. Even though the degree of competitions allowed by the agreements are different from characteristics of aviation market in the countries, they have limited substantially expansions of flight networks. To overcome these restrictions, not being allowed M&A between airlines with different nationality, entering JV can be the best option to obtain accessibility to new markets and to provide new services. (Wang, 2002). Second, airlines are able to increase efficiency and decrease fixed costs down by deeper cooperation in the related fields. JV enables them to choose various types of aircrafts and schedules which are more suitable for the demand of a specific route. Sharing airport facilities, staff and ground handling also reduce the fixed costs. Mutual baggage transfers, check-in, ticket promotions can be another example. (Amoah, 2011) For example, after introducing of JV between Korean Air ("KE") and Delta Air Lines ("DL") in 2018, DL is taking advantage of sharing staffs, lounges, ground handling, customer services with KE in Incheon International Airports where KE's largest hub airport. Third, by forming JV, the airlines increase their ability to exercise market power which can induce the lower level of competition. If airlines strategically gather the traffic demands on their hub-airports and agrees to cooperate with respective of competitive advantages over their incumbent, it can create network effects that raise barriers to entry. (Iatrou, 2007). For some airlines, the motive to deter the rival's entry is one of the important factors in adopting hub-and-spoke network as well. (Aguirregabiria et al, 2012).

According to the list of active ATI cases updated in Oct 2020 by the U.S. DOT, most of the ATI granted to airline alliances related to the U.S. have been achieved between the U.S. airlines and European airlines. Among 12 active antitrust immunized alliances granted by the U.S. DOT[4] in total, only 4 alliances were related to trans-pacific routes excluding Australia and New Zealand[5] and only 3 airlines are from Northeast Asian countries (Japan and the Republic of Korea) among 25 participating airlines in total. 3 JV cases are known between U.S airlines and Northeast Asian airlines and two of them were JVs of All Nippon Airways ("NH") with United Airlines ("UA")[6] and Japan Airlines International ("JL") with American Airlines ("AA") in 2010. The rest is between Korean Air ("KE") and Delta Air Lines ("DL") in 2018 which is relatively late compared to former

[4] https://www.transportation.gov/sites/dot.gov/files/2022-10/Active-ATI-cases-list-2022_Oct_f1.pdf (last visited April, 10, 2023)

[5] There are few feeder routes beyond Australia and New Zealand due to geographical feature of these countries. Therefore, starting or end points of the flights that connect these two countries and the U.S. are usually Sydney and Auckland

[6] Continental (CO) was merged by United Airlines (UA) on Oct in 2010. (Calzaretta et al, 2017)

cases. This paper analyzes the effects of JV between Japanese airlines and the U.S. airlines in trans-pacific routes on the provided seats: the JVs between NH and UA ("StarJV"), JL and AA ("OneJV") approved (i.e., granted ATI) in 2010.[7]

Nevertheless, the effects of JVs in trans-pacific routes were not studied compare to those in trans-atlantic routes. Most of literature have focused on the trans-atlantic cases. As far as we recognize so far, the study by Brueckner and Singer in 2019 was only the one that examined the effects of JVs in trans-pacific routes. However, in this study, the main objective was to analyze the effects of airlines cooperation in terms of fare on whole routes that connects the U.S. as well.

The aim of this paper is to make an analysis the effects of two JVs, StarJV and OneJV on the number of provided seats, which were approved on Nov in 2010. Specifically, we try to find out the effects of JVs when each JVs are strong competitors to each other and ones of the JV members in both JVs are having exactly same hub airports in Japan in contrast to the JV cases in trans-atlantic routes. We use a dataset of international flights from Japan to the U.S. Data is from 2006 to 2019 which is long period enough to identify the changes of the number of provided seats in both affected and unaffected routes by JVs. The data covers 66 different routes with 3,465 observations and the information on 18 airlines and 33 airports 29 cities in the U.S. and 7 airports in 6 cities is contained in this data.

We utilize a difference-in-difference method to examine the effects of the JVs. In detail, we compare the difference in the number of provided seats on the routes affected by JVs relative to the difference on the routes unaffected by JVs before and after JVs become effective. This process allows us to examine the effects of two JVs and each JV respectively.

We find evidence that two JVs between NH with UA and JL with AA induced less provided seats entirely. StarJV reduced the number of seats offered, on the other hands, OneJV increased the number of provided seats. It means that in case of two JVs and StarJV, competition effects are larger than market expansion effects so that the entire effects function in the way of decreasing the provided seats. Considering circumstances that market expansion effect is absorbed by the other competing airlines from different Northeast Asian countries, the results related to two

[7] Through the mergers of airlines, the final members of StarJV are NH, NQ, UA and CO, and those of OneJV are JL, JO, AA and US respectively. In case of US, it did not carry traffic between Japan and the U.S. in period of our analysis. Hence, when AA and US merged in 2015, the only affected by the merger was the increase of the number of hubs airports in OneJV.

JVs and StarJV seem reasonable. In contrast, the effects of OneJV with positive sign on provided seats suggest that there might be unknown background. We guess that the result might be from another outer shock which makes JL decrease their services on the trans-pacific routes.

Regarding the evolution in terms of no overlaps routes, the results of estimations show reduction in the number of seats albeit there are no competition effects in those routes. We suggest that this might be due to the strategical behaviors of airlines that try to avoid competition and concentrate their joint operation under the circumstance of predicting each other's strategies.

The rest of this paper is organized as follows. Section 2 presents literature review regarding airlines' cooperation including JV. Section 3 explains general characteristics of the U.S. – Japan alliance and trans-pacific aviation market and Section 4 describes the data which we made use of in the analysis. In section 5, our empirical strategy is explained and then, in section 6, we suggest the main results of our analysis. Section 7, finally comments our conclusions.

2. Literature review

After disclosure of Brueckener's seminal paper which analyzes the effect of alliances on fare in 2001, the literatures have identified two contradicting effects in terms of fares and quantities related to alliances with ATI grants: a positive effect in interline markets (i.e., connecting markets) and a negative effect in interhub markets (i.e., trunk route markets or gateway-to-gateway markets). Economic theory explains that ATI brings about two effects. Firstly, it eliminates double marginalization of nonaligned airlines when they decide the fares. If interline trips are operated by nonaligned airlines, each airline tries to maximize its profits respectively. It makes the fare of interline trips higher compared to the case of airlines cooperation. Therefore, their decisions produce negative externalities oppressing the demands which could increase with the airline's cooperation otherwise. There are also some studies that the prospective effects of JV would not be realized for many reasons. Lazar (2018) points that for realizing theoretically prospective effects of JV, there are many obstacles to overcome. To eliminate double marginalization by JV, the airline members of JV have to know very well about the demand curves, but not in fact. Different business cultures and strategies, difficulty in consolidating computer systems, different decision process could be the reasons that restrict materialization of JV effects. On the other side, he points that switching costs, accessibility to airports slots etc would be barriers that induce less competition.

Many theoretical studies on the effects of alliances on interline and interhub markets have issued. For interline markets, the evidence indicates that stronger cooperation between airlines lead to lower fare. The related studies supporting the results were made by Brueckner and Whalen (2000), Brueckner (2003), Whalen (2007), Brueckner et al (2011), Calzaretta et al (2017). Brueckner (2019) also provides empirical evidence on fares set by international airline alliances by using the usual DOT fare data which includes confidential fare data reported by the foreign alliance partners of the U.S. airlines. The empirical results are in favor of earlier findings that alliances charging lower fares than nonaligned carriers. In terms of the effects of alliances in the frequencies, Czerny et al. (2016) show that collaboration will always increase vehicle number and fleet capacity if both vehicle numbers and sizes are changeable. Czerny et al. (2021) also show that airlines with cooperation are more inclined to expand networks and/or increase frequencies than those without cooperation and airlines collaboration eliminate double marginalization so that bring about incentives to extend networks, even though it can be limited compared to the level of the social desirability with the model of a two-stage game.

For interhub markets, on the one hand, there is no clear evidence of anticompetitive effects of alliances and the results can be inferred from the studies of Oum et al (1996), Park and Zhang (1998), Brueckner and Whalen (2000), Gayle and Brown (2014) and Fageda et al (2019). Oum et al (1996) show that non-leader airlines' complementary cooperation of code-sharing increase passenger volume and thus reduce fares of the market leader airline. Park and Zhang (1998) find that most of the partners have greater traffic increase on their alliance routes than those on their non-alliance routes. Brueckner and Whalen (2000) do not find clear evidence in favor of increase in fares caused by an alliance between previously competing airlines. On the other hand, Gillespie and Richard (2012), Alderighi et al (2015), Brueckner and Singer (2019) find the opposite results that indicate alliances bring about lower competition level in interhub markets. Gillespie and Richard (2012) provide evidence on that the lower level of competition in trans-atlantic routes with non-stop service as a result of ATI affects passengers adversely[8] and that ATI grants do not allow

[8] The U.S. DOT has required in the past that carriers in an alliance "carve out" certain non-strop routes because of anti-competitive effects of JV by reducing the number of seats and thus increasing fares. However, more recently, the U.S. DOT has abandoned carve-out requirements for ATI approvals in favor of making a JV agreement among core members a precondition of ATI grants. (Calzaretta et al, 2017) Instead of "carve out", government authorities can impose conditions on minimum number of seats or frequencies. For example, MOLIT in Korea approved JV between KE and DL on condition of not reducing the number of provided seats and operating routes.

the JV members to attain the pricing efficiencies coming from unified control. Alderighi et al (2015) show that code-sharing raise fares especially for early bookers. Bilolotach and Hüschelrath (2013) obtain mixed results.

Recently, some literatures study the effects of degrees of cooperation (alliances with or without ATI, JV). Calzaretta et al (2017) show that ATI grants have been strongly procompetitive, generating lower fares on interline markets and if they are coupled with the formation of JV, the magnitude of effects increase. Fageda et al (2019) find that stronger airline cooperation lead to more traffic in both interhub and interline markets. Fageda et al (2020) also show that granting ATI to existing alliances lead to a down ward pressure on fares and service quality, whereas non-ATI alliances result in opposite. Ustaömer et al (2015) analyze the effect of the individual JV case of AA, British airways ("BA") and Iberia on economy and business class fares in trans-atlantic markets. The paper show that there is only a statistically significant difference in BA's economy class fare and no significant difference in AA, Iberia's fares and BA's business class fare.

Noticeably, the study of Brueckner and Singer (2019) show the effects of airlines' cooperation on fares in trans-pacific markets. For the economy class fare, airlines cooperation brings about beneficial fare effects on passengers only when it comes in the form of online and JVs. However, the ATI grants does not lead positive effects on fares in trans-pacific routes which is a counterintuitive. Since the study considers only NH-UA, JL-AA JV cases that started in 2010 and the fare data used is from 1997 to 2016, it can be the only study that has been tried to research the trans-pacific JV cases. (considering the period data used, KE-DL JV case which was approved in 2018 is not included).

3. The U.S.-Japan alliance and trans-pacific aviation market

NH-UA and JL-AA applied for ATI to Ministry of Land, Infrastructure, Transport and Tourism("MLIT") in Japan and Department of Transport("DOT") in the U.S. to strengthen their competitiveness through deepening their cooperation and expanding their networks on trans-pacific routes. For all four airlines, the JV was indispensable in common to expand their networks. Japanese airlines can carry the traffic between the U.S. and Japan, and beyond the U.S. In perspective of Japanese airlines, it means that they can offer one-stop travel from Tokyo to the various cities including many large and small cities covering American continent through hub airports of

counterpart U.S. airlines. Likewise, from viewpoint of the U.S. airlines, they can provide one-stop flight services from the U.S. to the cities covering East Asian regions where it is almost impossible to provide direct flights. It was win-win situation for them.

StarJV submit the application in Dec 2009 to DOT followed by OneJV after approximately two months. OneJV requested DOT to consolidate two cases in terms of that the cases share common state of competition on routes between and beyond the U.S. and Japan, thus it would be more efficient for DOT to address the issues. StarJV did not oppose in condition of that there would be no delay for examining its application. In the result, the DOT consolidated the cases as U.S-Japan alliances case. (see table 2)

Table 2. Process of U.S- Japan Alliance case.

Date	Actions
Dec. 11. 2009	MILT of Japan and DOT of the U.S. agreed to Air liberalization
Dec. 23. 2009	Joint application of NH/CO/UA for ATI to DOT
Feb. 12. 2010	Joint application of AA/JL and they request to consolidate the two proceedings.
Feb. 24. 2010	NH/CO/UA did not oppose consolidation, however, expressed that their consent is based on the premise that "the Department determines that such action will expedite, not delay, final decision on its application.
Mar. 11. 2010	DOT ordered consolidating proceedings and named as "U.S-Japan Alliance case"
June. 18. 2010	JL/AA and NH/CO/UA applied ATI to MLIT
Oct. 6. 2010	DOT issued an "Order to Show Cause" with its proposed decision
Oct. 22. 2010	MILT granted ATI to both groups
Oct. 25. 2010	Signing of Japan-U.S. open skies agreement
Nov. 11. 2010	DOT grants final approval of ATI for both groups

Sources: MLIT, Press release, Oct. 22. 2010., DOT-OST-2010-0059-0001, Japan Airlines, Press release, Oct. 22. 2010.

An interesting point is that relation between these JVs and Japan-U.S. air liberalization. Japan has been one of the closest allies with the U.S in many fields such as national defense, economy etc. However, the open skies agreement("OSA") between two countries was concluded only in Oct 2010, which was 8 or 10 year late compared to those of other Northeast Asian countries.[9] Japan was the last one which has ample international air transport market excluding

[9] The date of OSA: Taiwan - Feb 1997, Singapore - Jan 1997, South Korea - April 1998, Hong Kong - Oct 2002. Open Skies Partners released by the Bureau of Economic and Business Affairs (Nov 14, 2016).

China at that time. Furthermore, DOT prerequisite the OSA that lift the limitations on the number of designated airlines, the type of aircraft used, flight frequencies, the starting and ending points between the countries where the airlines applying ATI belong to. Thus, based on the date of JV applications and the OSA between them, it can be assumed that the U.S. government make use of deepening cooperation of airlines to draw out the OSA.[10]

This paper analyzes the effects of two JV cases among Japanese airlines and the U.S. airlines in 2010 on provided seats on the routes between Japan and the U.S. These two cases have distinct features compared to general JV cases. First, two Japanese airlines, JL and NH put their hub airports in Tokyo which is one of the largest metropolitan cities in the world. The population of Tokyo itself was approximately 9.2 million people in 2015. If it includes the surrounding provinces, the number of population in "Kanto major metropolitan area" increased to 37.2 million people which was almost one third of total population in Japan.[11] Thus, these two airlines have no other choice but to put their hubs in Tokyo. There are two international airports in Tokyo which are Narita International Airport and Haneda Airport. Haneda airport has been handling mainly domestic flights after Narita Airport opened in 1978. Nowadays, Japanese government tries to make use of Haneda Airport for international flights since the location of Haneda Airports is much closer to Tokyo than that of Narita Airport.[12] Second, two JV cases were approved (i.e., granted ATI) by U.S. DOT at the same time on Nov, 2010. All Nippon Airways (NH) and United Airlines (UA) jointly applied DOT for ATI on Dec 2009, approximately two months earlier than Japan Airlines and American Airlines did. However, the latter insisted to consolidate the two proceedings for the reasons that the two applications present common issues regarding the state of competition on the routes between and beyond the U.S. and Japan so that DOT would be able to address the issues more efficiently, and it would not delay a decision on either application.[13] Third, there have been intensive competitions among the Northeast Asian countries to attract and to gather the traffic demands from Southeast Asian countries to the U.S. The strategies of

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[10] According to Anthony Sampson's research "Empires of the sky: The Politics, Contests and Cartels of World Airlines 145 (1984)" The U.S. government utilized open skies agreement as a means of putting pressure on recalcitrant government in the same geographic area. Thus, under this "encirclement" theory, the United Kingdom was to be pressured by expansion of air service to and via Belgium and The Netherlands. Not too much later a new agreement with South Korea was intended to put pressure on Japan.

[11] Statistical handbook of Japan 2022, https://www.stat.go.jp/english/data/handbook/index.html

[12] The expanded slots in Haneda airport due to the 2020 Tokyo Olympics allocated to international airlines and Haneda airport is 23km away from and geographically closer to Tokyo city (Shinjuku Station) than Narita airport. Therefore, more airlines are planning to either switch from Narita to Haneda, or to fly to both hubs. https://www.oag.com/blog/tokyos-airports-is-haneda-out-recovering-narita

[13] DOT-OST-2010-0059-0001, https://www.regulations.gov/document/DOT-OST-2010-0059-0001

Northeast Asian countries such as South Korea, Taiwan, Singapore and even Japan have been making use of these demands from outside their own countries to provide flights service on more routes and more frequencies which may not be possible only with their own demands to the U.S. The number of immigrants from Philippines and Vietnam to the U.S, which scored the first and second largest immigrants during 2011 to 2020 were more than 496 thousand and 333 thousand people respectively.[14] Compared to their demands, the provided seats of direct flights on the routes between Philippines and the U.S. and Vietnam and the U.S. have been relatively small. Thus, those Northeast Asian countries compete to carry these traffics through their hub airports. This is also one of the reasons that they have been trying to keep competitiveness of their airports. For example, Changi airport in Singapore won the SKYTRAK World Airport Awards known as the most prestigious awards in the field of airports industry in 2023. The other airports, Haneda, Incheon, Narita, Hong Kong, Taoyuan ranked 2nd, 4th, 9th, 33rd and 82nd respectively. In addition, JVs of home airlines are beneficial to prosper their hub airports in terms of increase in the number of passengers, flight frequencies and freights. (Hwang et al, 2018)[15]

These characteristics make StarJV and OneJV different from former trans-atlantic JVs between the U.S. airlines and European airlines in a few points. First, starting or ending point of their competing hub to hub routes is same as Tokyo all the times. Starting point of Japanese airlines is Tokyo and ending point of the U.S. airlines is Tokyo. In case of European airlines, they are allowed to operate within the EU territories even though they are not their home.[16] For example, Air France is able to carry traffic on the routes between Atlanta in the U.S. and Barcelona in Spain. However, in fact, each airline chooses their major hub airports within their home. For example, Iberia Airlines put its hubs in Madrid and Barcelona, not in Paris. In case of the U.S. airlines, even though there are a few airports where more than one major airlines put as their hubs such as New York, Los Angeles, thus relatively duplicating, each airline has their own hub airports in different cities. This difference induces the structural difference in terms of competition. For example, Air France and Lufthansa does not compete on the same routes between Paris in France and Atlanta

[14] https://worldpopulationreview.com/country-rankings/us-immigration-by-country

[15] According to Effect of Joint ventures between airlines on international airport performance, the paper written in Korean, JV bring about positive effects on the airline's hub airports in terms of passenger, flight frequencies and freights and thus insists that governments need to consider this aspect when they establish policies to raise competitiveness and when examining the JVs.

[16] Of course, the airlines must be owned and effectively controlled by Member States and/or nationals of Member States, and their principal place of business must be located in a Member State. https://www.europarl.europa.eu/factsheets/en/sheet/131/air-transport-market-rules

in the U.S. From the standpoint of Lufthansa, it is not a good idea to compete on that route since it cannot take advantages of choosing to compete on the route at all since neither Paris nor Atlanta are its hub airports which provide every supports for flights with lower costs. On the other hands, competing airline alliances, Air France and Delta Air Lines can benefit from having hub airports on that route, which make them possible to provide flights with relatively lower costs. Considering disadvantages of competing on the route between Paris and Atlanta, Lufthansa would cooperate with UA which belongs to same Star alliances, on the route between Frankfurt and New York where are their hub airports respectively.

Secondly, due to the simultaneous approvals of ATI to two JVs, it is not easy to identify the pure effects of each JV. However, at the same time, they allow us to analyze the effects of JVs when there exist strong competitors who have same hub airport. Economic theory indicates that ATI could lower the level of competition and increase fares by the means of eliminating overlapping partner's flights. And thus, enhance their market power on fares by reducing the provided seats.[17] However, in this case, it is not possible to reduce many flight seats due to the existence of strong rival JVs on the similar routes which have same starting or ending point in Tokyo. In respective of passengers from Tokyo, there would be alternatives for trip to the U.S. with high probability because they have to be back Tokyo anyway. Thus, if any JV decides to exercise market power and increase the fares, another JV would benefit from higher fares like "prisoner dilemma".

Fig. 1 shows the evolution of provided seats in Japan – the U.S. air transport market. Neither StarJV nor OneJV cases do not show dramatic changes for whole period even for before and after the approval of JVs. Among the other airlines, Delta Air Lines, Hawaiian Airlines ("HA") and Singapore Airline Limited ("SQ") are the airlines which carry notable traffic on the routes between Japan – the U.S.

Table 3 provides traffic statistics for the route between Japan - the U.S, and Japan - Hawaii respectively. During entire period we examine except 2021, the number of seats provided by StarJV is greater than that by OneJV in the route between Japan – the U.S. The market shares of StarJV and OneJV ranges approximately from 29.9%(2012) to 42%(2007) and 23.5%(2011) to 31.8%(2017)

[17] To prevent airlines from abusing market power after granting ATI, some recent approvals for ATI require the airlines of JVs not to decrease the total number of seats or not to stop operating flights on incumbent routes. For example, when Korea government approved the JV of Korean Air and Delta Air Lines, it set conditions prohibiting them from decrease the total number of seats annually unless any natural disasters.

respectively. On the other hands, for the route between Japan – Hawaii, the performance of OneJV have prevailed that of StarJV for entire period except 2017. The market shares of StarJV and OneJV ranges approximately from 14.6%(2019) to 27.8%(2007) and from 27.8%(2014) to 50.4%(2009) respectively before 2020. In short, StarJV has provided more seats than OneJV on the routes between Japan – the U.S. and Japan – the U.S main territories routes.

There are also the other 3 airlines[18] from Japan or the U.S. Their market shares were from 24.6%(2006) to 36.4%(2012) in the entire market. 8 foreign airlines from 3rd countries[19] carried the traffic between Japan and the U.S. by exercising 5th freedom and their market shares were from 2.6%(2017) to 9.6%(2012) in Japan – the U.S. market.

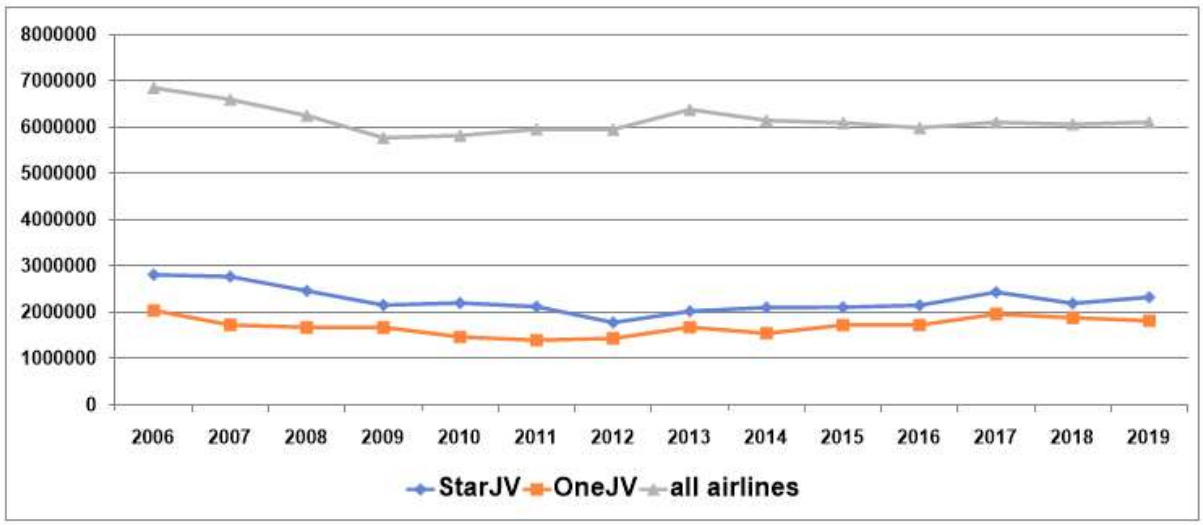

Fig 1. Japan-the U.S. traffic of StarJV, OneJV and all airlines (passengers)
Source: Our own elaboration based on RDC aviation data

Table 3. The market shares of Japan – the U.S. air transport market.

	2007		2010		2013		2016		2019	
	Total	**Main**	**Total**	**Main**	**Total**	**Main**	**Total**	**Main**	**Total**	**Main**
StarJV	42.0	46.5	37.8	44.3	31.7	38.8	35.9	42.6	38.1	46.3
OneJV	26.2	22.0	25.2	19.1	26.3	25.2	28.8	29.1	29.8	30.1
The others	26.5	26.5	30.9	31.0	33.9	29.1	29.5	25.3	26.4	21.4
3rd countries	5.3	5.0	6.0	5.7	8.1	7.0	5.7	3.0	5.8	2.3

Source: Our own elaboration based on RDC aviation data

[18] the airlines from Japan or the U.S. but not members of StarJV and OneJV.
[19] The airlines from 3rd countries such as Korea, Taiwan, Malaysia, Singapore, Thailand. They are KE, SQ, CI, CO, MH, D7, TR, TG

4. The Data

In this paper, empirical analysis considers a dataset of international direct flights between the U.S. and Japan at route level from 2006 to 2019[20]. The timeframe has a data of long period before and after JVs enough to analyze the effects of JVs which were approved on Nov in 2010. When it comes to the U.S. we exclude the U.S. minor outlying islands (Wake Islands and Henderson Field). The dataset covers 33 airports in 29 cities in the U.S. and 7 airports in 6 cities in Japan and thus includes 3,465 observations at the airline-route level in total.

Data on the detailed flights is from RDC aviation (Apex schedules). Information on the number of provided seats of each airlines at the route level are a quarterly basis[21]. Data for population at the city level is obtained from United Nations (World Urbanization Prospects) and is annual.

The sample covers 20 airlines including network, 3 regional and 2 low cost carriers[22]. 8 out of 20 airlines are from East Asian countries[23]. The primary interest in the airlines are the final participants of StarJV (NH, UA, CO and NQ) and of OneJV (AA, JL, JO and US), which carried the traffic on the route Japan and the U.S. in the period this paper examines[24]. The paper also considers the hub airports of the member of two JVs. (see table 4). Unlike the other trans-atlantic JV cases, the hub airports of Japanese airlines (NH and JL) are same (NRT, HND, KIX and NGO).

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[20] Although we have data for 2020-2021, we exclude them since the flight traffic dropped dramatically due to COVID-19 outbreak and it might bring about bias in our samples.

[21] We exclude all airlines that operated less than one flight per week to count only scheduled flights.

[22] This paper defines regional airline is the airlines which operate only on the route between Honolulu and Japan and there are 3 airlines (HA, NQ and JO). In addition, the paper refers to the list of LCC from ICAO and there are 2 airlines (TR and D7.)

[23] In principal, foreign airlines are not allowed to carry the traffic on the route between 3rd countries. If there are the agreements with exceptional clauses (5th freedom) that allow it among the governments, then it is possible for foreign airlines to carry the traffic on the route between 3rd countries.

[24] There have been four mergers between the airlines (NH with NQ, CO with UA, JL with JO and AA with US) which are related to the two JVs.

Table 4. History of the hub airports[25] in two JV cases.

Date	StarJV				OneJV			
	NH	**NQ**	**CO**	**UA**	**AA**	**JL**	**JO**	**US**
Before 2010	NRT, HND, KIX, NGO	NRT, HND	EWR, IAH, CLE	ORD, DEN, IAD, LAX, SFO	ORD, DFW, LAX, MIA, JFK, LGA	NRT, HND, KIX, NGO	NRT, KIX	CLT, PHL, PHX, DCA
April. 2010 NH-NQ Merger	NRT, HND, KIX, NGO		-	-	-	-	-	-
Oct. 2010 UA-CO Merger	-		EWR, IAH, CLE, ORD, DEN, IAD, LAX, SFO		-	-	-	-
Nov. 2010 Both JVs' approval	(JP) NRT, HND, KIX, NGO (US) EWR, IAH, CLE, ORD, DEN, IAD, LAX, SFO				(JP) NRT, HND, KIX, NGO (US) ORD, DFW, LAX, MIA, JFK, LGA		-	-
Dec. 2010 JL-JO Merger	-				(JP) NRT, HND, KIX, NGO (US) ORD, DFW, LAX, MIA, JFK, LGA			-
April. 2015 AA-US Merger	-				(JP) NRT, HND, KIX, NGO (US) ORD, DFW, LAX, MIA, JFK, LGA, CLT, PHL, PHX, DCA			

Sources: https://aviationweek.com/air-transport/airports-networks/continental-uniteds-mega-merger., Haobin Fan (2020)., Christian Bontemps (2021).

The mergers between the airlines affect the hub airports of the JVs as well when the members of mergers had different hub airports and therefore, they change the effects of the JVs. For example, OneJV has approved on Oct in 2010 and after that, AA merged US on April in 2015. Hence, the hub airports of OneJV were only 10 airports in both countries from Oct in 2010 to Mar in 2015. After that, due to the merger between AA and US, the number of the hub airports increases from 10 to 14 since they had the different hub airports. However, this does not affect our analysis since OneJV have not operated any routes from the hub airports added due to the merger. On the other hand, the merger between UA and CO affect the status of StarJV hub airports since UA operated the routes from IAH which was added by the merger.

Table 5 is the list of the routes affected by two JVs. In case of LAX-NRT and ORD-NRT routes, both StarJV and OneJV operated and origin & destination airports are the hubs of the JV participants, therefore those are affected by two JVs at the same time. On the other hand, some routes are affected by only one of two JVs. For example, IAD-NRT route and DFW-NRT route

[25] There are a couple of cities with more than one airport; Tokyo (NRT, HND) and New York (EWR, JFK, LGA)

are affected by StarJV and OneJV respectively. The routes which are not on the list are the routes not affected by two JVs and include the case of that even both JV members are operating on the same routes but one of the airports are not the hub airport of them such as the route HNL-NRT.

Table 5. Routes affected by two JVs.

Route	JV	Operating airlines	Periods
L.A., Los Angeles International (LAX) - Tokyo, Narita (NRT)	StarJV & OneJV	NH – UA & JL - AA	Q1 2011 – Q4 2019
Chicago, O'Hare International (ORD) - Tokyo, Narita (NRT)	StarJV & OneJV	NH – UA & JL - AA	Q1 2011 – Q4 2019
Washington, Tulles International (IAD) - Tokyo, Narita (NRT)	StarJV	NH-UA	Q1 2011 – Q4 2019
San Francisco, San Francisco International (SFO) - Tokyo, Narita (NRT)	StarJV	NH-UA	Q1 2011 – Q4 2019
Houston, George Bush Intercontinental (IAH) - Tokyo, Narita (NRT)	StarJV	NH-UA	Q2 2015 – Q4 2019
Dallas, Ft. Worth International (DFW) - Tokyo, Narita (NRT)	OneJV	JL-AA	Q4 2015 – Q4 2019
New York, John F. Kennedy International (JFK) - Tokyo, Narita (NRT)	OneJV	JL-AA	Q1 2011 – Q2 2012

Fig 2. Shows the flows of the number of provided seats on the routes affected by two JVs from 2006 to 2019. The evolution of provided seats are different between StarJV and OneJV. After two years of JVs, StarJV provided seats similar or more than before. However, OneJV provided less and less seats until 2013 and after then recovered slowly. The decrease of seats of OneJV in that period was covered by the increase of seats provided by the StarJV and control airlines.

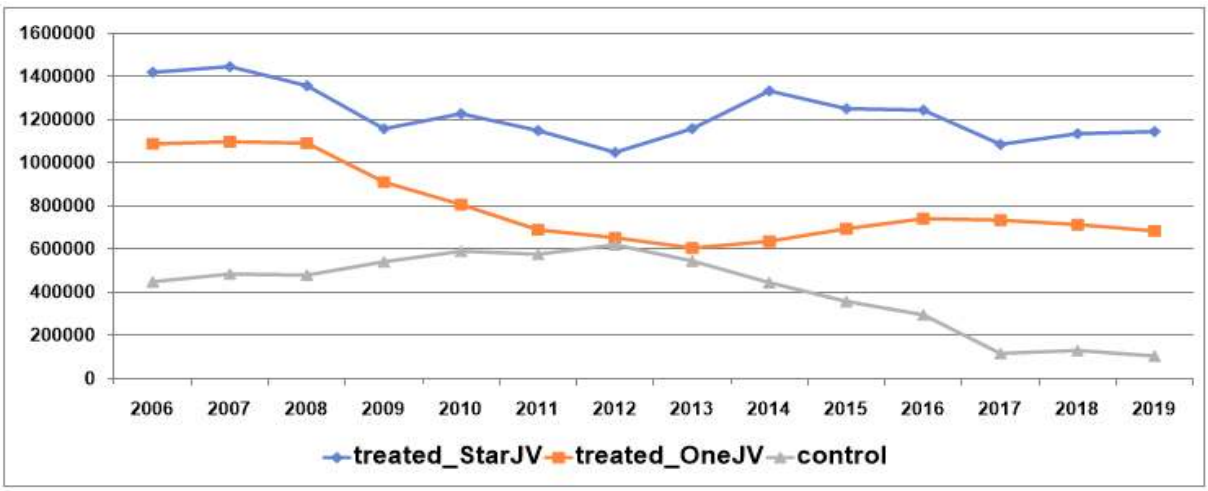

Fig 2. The number of provided seats over time on the routes affected by two JVs.

5. Empirical Model

The objective of this paper is to examine the effect of the two JVs (NH with UA and JL with AA respectively) on the number of provided seats on the inter-hub routes between Japan and the U.S. In this paper, we assume two things: First, if airlines form JV and if they operate the hub airports of the counterpart, then they can benefit advantages of having counterpart's airport as the hub airports. For example, after forming OneJV, JL can benefit when it operates the flights to JFK airports in New York where the counterpart AA has its hub airport. Hub airports can benefit the airlines putting them as their hub airports by reducing the costs for operating and maintaining flights through the economics of density. Airlines can utilize the properties they possess in hub airports in terms of workers and the facilities needed to provide air transport service. Furthermore, in terms of attracting travelers, some travelers value the services such as higher frequencies, accessibility to lounge services and check-in with 24 hours which can be provided in the hub airports by achieving the more operation of an airline. Aguirregabiria et al. (2012) provided empirical results by using data of the U.S. domestic flights concerning the effects of hub-size on fixed costs, entry costs and even of deterrence the entry of competitor: the larger Hub-size is, the less fixed costs and entry costs an airline has and thus plays a role as entry barriers to competitors. Second, as many other studies provided, the JVs would introduce anticompetitive effect in forms of reducing the number of provided seats by cooperating flight capacities on relevant routes. Thus, we consider that the effects of JVs would show up when both of the members in each JVs are operating on same routes at the same times. DOT also focuses on the loss of competition where JV partners provide competing non-stop flights during its antitrust examine proceeding. These two assumptions are reflected in the following equations.

To examine the effects of the JVs, we implement a difference-in-difference (DiD) model that considers the forming of two JVs as a shock in the trans-pacific market. In detail, we compare the difference in the number of provided seats on the routes affected by the two JVs before and after the JVs were approved, relative to routes not affected by the JVs from 2006 to 2019. For this analysis, we divided the treatment and control by the existence of shock at some point and we set dummy variables as 1 when the routes are affected by two JVs since 1st quarter in 2011 where the JVs approved. Through this process, we can identify the changed in the number of provided seats on the routes affected compared to those on the routes unaffected.[26]

[26] The similar methodology used in air transport is Calzada et al (2022) and Bernardo and Fageda (2017)

DiD approach require a parallel trend as a key assumption in both the treated and control group in the absence of shock, in our case the approval of JVs. Thus, the prospective estimate of the changes in the number of provided seats in treated group can be represented by the changes in the number of provided seats in control group in absence of the approval of JVs. Ass this assumption cannot be tested, we provide evidence that treated and control groups have parallel trends before the approval of JVs on Nov in 2010. To test their parallel trends, an equality of means tests of the number of provided seats on the treated and control groups on a yearly basis is performed. The results on Fig 3. show that the null hypothesis of equality of means between treated and control groups cannot be rejected for all years of pre-shock period.

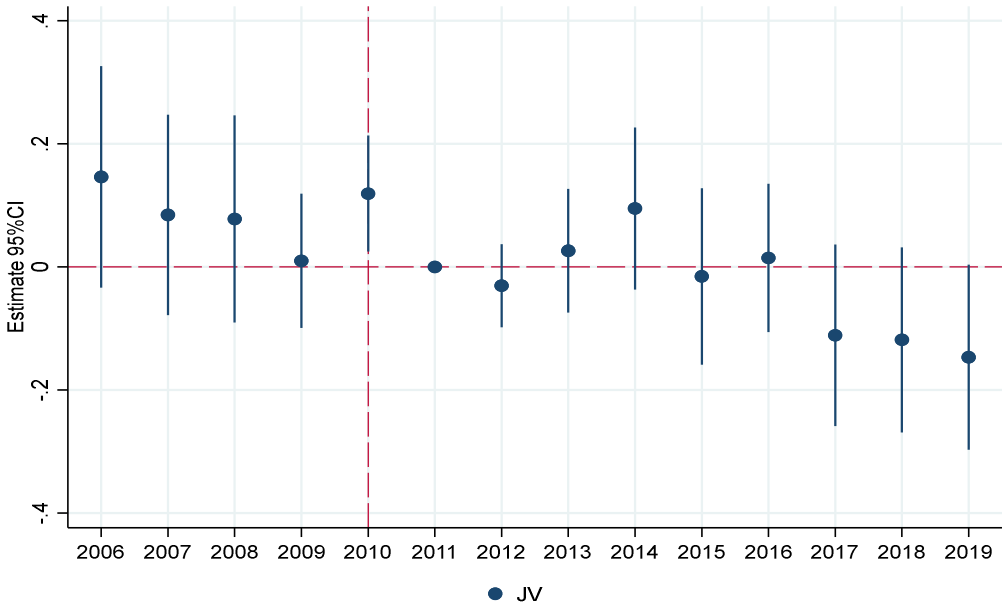

Fig 3. Mean differences in the number of seats provided by period. Treated and control groups.

Considering that our goal in the analysis is the number of provided seats, we estimate the following equations at the airline-route level i for year y and quarter q:

$$\textbf{Eq (1): } \log(\text{Provided\_seats})_{tyq} = \beta_0 + \beta_1 \cdot \text{twoJVs}_{tyq} + \beta_2 \cdot \text{No\_overlaps}_{tyq} + \beta \cdot X_{iy} + \delta_i + \lambda_y + \gamma_q + \varepsilon_{iyq}$$

$$\textbf{Eq (2): } \log(\text{Provided\_seats})_{tyq} = \beta_0 + \beta_1 \cdot \text{StarJV}_{tyq} + \beta_2 \cdot \text{OneJV}_{tyq} + \beta_3 \cdot \text{No\_overlaps}_{tyq} + \beta \cdot X_{iy} + \delta_i + \lambda_y + \gamma_q + \varepsilon_{iyq}$$

In the all model (1) to (2), the dependent valuable is provided_seats, which is the number of seats provided by airlines on each airport-pair route i. The number of provided seats (i.e., seats capacities) is one of main indicators[27] that can be considered as the results of the cooperation of JVs. The crucial explanatory variables in the two equations are dummy variables that takes the value 1 after the quarter and year where the routes were affected by any of two JVs. The objectives are different for the two equations. First equation is for examining the overall effects of the two JVs in Japan – the U.S. market, which means that the variable twoJVs clarities the routes affected by both formations of StarJV and OneJV.

The goal of second equation is to divide the potential differential effects of twoJVs into each JV, StarJV and OneJV. Hence, the dummy for StarJV takes a value of 1 when both members of StarJV operate on the same routes which consist of their hub airports and the same process is applied to the dummy for OneJV as well. The applied period is from 1st quarter of 2011 since both StarJV and OneJV got approved at the same time on Nov in 2010.

The models include the variable No_overlaps which take a value of 1 when the routes present no overlaps between the members of StarJV or between the members of OneJV. Thus this value is 1 only when only one or any partner is operating the route.

The interactions between variables twoJVs and No_overlaps, StarJV and No_overlaps, OneJV and No_overlaps, which are for identifying the effects of JVs without overlaps are not included in the model. This is because forming of any JVs only affected the routes on which any members of JVs were jointly operating before the JVs. In other words, the members did not provide services on new routes, but kept operating the routes where they were operating before. As a result, most of interactions variables take value of 0 and show autocorrelation when we contain and regress them.

As abovementioned, "competition effects" and "market expansion effect" could be present when there is JVs. Since the competition effects play a role in reducing the provided seats on the routes where the members of JVs are jointly operating by the result of their cooperation and the market expansion effect bring about the increase the volume of connecting passengers in

[27] Fare data can be another indicator since JVs members cooperate in setting price jointly, but the fare data needed for our analysis is only available for the authorized by DOT.

all routes, the sign of variable twoJVs can be positive or negative, depending on the relative size of those two effects.

The model also contains a vector f controls ($\mathbf{X}_{iy}$) that reflect additional factors that may have effects on the number of provided seats on the route. The vector contains population in city-level, Hirshman-Herfindal Index(HHI) in route-level. Fare data is not included as an explanatory variable since it is commonly known as second step decisions after airlines' decision on supply.

The variables of population GNI per capita and distance are from a gravity equation which is usually modelled in explaining air transportation demand side. The gravity equation assumes that the passenger volumes are positively related on the income and population at both points of the routes and the negatively related on the distance. The effects of GNI per capita and distance are captured by route and time fixed effects, and thus are not included in the model. In this respective, the number of provided seats should be higher on the routes with high demand that connect the points with large population.

HHI dummy variable is also included in our model to capture the intensity of competition at the route level. HHI is the sum of squared shares of the provided seats across airlines operating on each route. Since more competition bring about more provided seats, we expect the routes with low HHI may show more provided seats. On the other hands, we do not include LCC dummy variables since LCC only operate on the routes between Japan and Hawaii in our data, hence the presence of LCC is irrelevant with the two JVs considering the fact that the routes are not affected by any of JVs.[28]

To identify changes from one period to another, we consider route-level fixed effects. Therefore, the model includes three fixed effects which are route fixed effects ($\boldsymbol{\delta}_i$), year fixed effects ($\boldsymbol{\lambda}_y$) and quarter fixed effects ($\boldsymbol{\gamma}_q$). By including route fixed effects, we can control for time-invariant and omitted variable which have correlation with variables of interest. The other two fixed effects, year fixed effects and quarter fixed effects, control yearly effects common to all routes and seasonal variations respectively. The error term ($\boldsymbol{\varepsilon}_{iyq}$) is also included.

As typically used in gravity model, the variables of the number of provided seats and population are in forms of log values to minimize the effects of outliers and to interpret the

[28] When we include LCC dummy variables in our model, the results of estimations on LCC dummy variables show autocorrelation.

coefficient as percentages. Expressing in log also can reduce the difference between the number of provided seats across the routes. Table 6 is the descriptive statistics of the variables used in our analysis.

Table 6. Descriptive statistics of the variables used in the empirical analysis

Variable	Time period and data source		Mean	Standard error	Min. Value	Max. Value
Capacity: the number of provided seats per quarter	2006 – 2019 RDC aviation (Apex schedules)		24,841.38	13,152.53	1,636	133,450
Population: thousands of inhabitants per year	2006 – 2019 United Nations (World urbanization Prospects)	Origin	6,030.293	5,590.898	469	18,819
		Destination	32,451.81	9,492.695	2,217	37,468
HHI: concentration index – quarterly seats	2006 – 2019 RDC aviation (Apex schedules)		0.557	0.339	0.128	1
StarJV: dummy variable	2006 – 2019 RDC aviation (Apex schedules)		0.212	0.409	0	1
OneJV: dummy variable	2006 – 2019 RDC aviation (Apex schedules)		0.126	0.332	0	1
twoJVs: dummy variable	2006 – 2019 RDC aviation (Apex schedules)		0.227	0.420	0	1

6. Estimation and results

We first estimate our model for entire samples and then for the samples only from the route between Japan and the U.S. mainland which does not include Hawaii. (HNL and KOA). The features of two JVs are, 1) there is no effect on the route between Japan – Hawaii since Hawaii does not have hub airports of any airlines in StarJV and OneJV and 2) it seems that the demand for flights to Hawaii is mainly due to tourism, thus the Hawaii is destination itself, not place for transferring to other cities unlike the other cities in the U.S. mainland. Considering these two aspects, the effects of two JVs should be more clear in the second estimations. To address the problems of heteroscedasticity and of autocorrelation, the standard errors are robust to heteroscedasticity and we compute standard errors in the clusters by routes.

Table 7. Result of the estimates – provided seats from 2006 to 2019.

		Entire routes		Only mainland	
		(1)	(2)	(3)	(4)
Population	Ori.	0.145 (0.214)	0.137 (0.206)	0.128 (0.187)	0.127 (0.184)
	Dest.	0.023 (0.046)	0.024 (0.046)	0.107 (0.069)	0.114 (0.069)*
HHI		0.119 (0.140)	0.126 (0.137)	0.129 (0.153)	0.150 (0.150)
twoJVs		-0.092 (0.054)*	-	-0.090 (0.061)	-
StarJV			-0.092 (0.068)	-	-0.140 (0.055)**
OneJV			-0.018 (0.067)	-	0.065 (0.036)*
No overlaps		-0.090 (0.070)	-0.075 (0.059)	-0.088 (0.075)	-0.070 (0.054)
Intercept		8.688 (1.841)***	8.733 (1.786)***	7.868 (1.815)***	7.777 (1.792)***
R^2		0.007	0.005	0.096	0.076
N. of observation		3,465	3,465	2,622	2,622

Note: Standard errors in parenthesis (robust and clustered at the route level). All regressions include fixed effects of route, year and quarter. Statistical significance at 1%(***), 5%(**), 10%(*) level.

Table 7 shows the results of the estimates. Column (1) and (2) are results of estimates for entire sample and the rest column (3) and (4) are for samples only from the routes between Japan - the U.S. mainland. Column (1) and (3) present the overall effects of twoJVs and column (2) and (4) do the separate effects of formation of StarJV and OneJV.

Concerning the control variables, we could not find statistically significant evidence of relevant effects of population and HHI except only the case of population of destination considering only mainland. The sign of effect for population variable was positive as expected and an estimate in column (4) is statistically significant at 10% significance level. The reasonable explanation for these estimates might be that the effect of population is captured by route fixed effects. For HHI, the estimates are all positive meaning that airlines provide more seats on the route with lower competition albeit they are not statistically significant. This result is different from our expectation[29] that airlines offer more seats on the routes in which airlines are competing harsher. This unusual result might be explained by the fact that higher HHI are due to the

[29] Normally, HHI have a negative impact on the flight frequency (Calzada et al, 2022) and provided seats. (Bernardo and Fageda 2017).

counterpart of same JV, not other competing airlines and thus, they offer more seats on the routes to harden their market powers.

The estimates for the variable twoJVs are negative. The magnitudes are -0.092 and -0.090 in column (1) and (3) respectively, which are very similar although the former is statistically significant at 10% significance level and the latter are not. Approximately 9.0% to 9.2% less seats are provided on the routes affected by TwoJVs. These results suggest that the twoJVs have negative impact on the number of provided seats in total and that competition effects are relatively greater than market expansion effects.

Results for the separate effects of the twoJVs, we find quite different results for StarJV and OneJV from column (2) and (4). When we consider entire sample including the routes between Japan – Hawaii, both estimates have a negative sign, which means that competition effects are greater than market expansion effects in both cases. However, when we choose the samples related to only the U.S. mainland, the magnitude of StarJV estimate, which is statistically significant at 5% significance level, gets larger compared to the entire sample and in case of OneJV, the sign is even changed from negative to positive and the estimate is statistically significant at 10% significance level. Thus, we are able to get statistical significant evidence that 14% less seats are provided on the routes where StarJV is and 6.5% more seats are offered on the routes where OneJV is.

These results in the estimation with the U.S. mainland suggest that in case of StarJV, competition effect is greater than market expansion effect, while market expansion effect is greater than competition effect in case of OneJV. To explain these conflicting results, we consider the circumstance of the two JVs that they are competing with. Many Northeast Asian countries and their national airlines are providing the seats to attract the passengers traveling on the routes between Southeast Asian countries and the U.S. Hence, market expansion effects caused by two JVs might be offset by the reaction of other national airlines that are offering seats through their own countries. (or maybe the other national airlines such as Korean Air and Singapore Airlines that are providing seats through Narita airport to the U.S. can do similar offset roles). This characteristic might be a big difference between trans-pacific routes and trans-atlantic routes. Considering the competition circumstance surrounding two JVs, the fact that sign of estimate in valuable OneJV is positive is hard to be explained.

It may be possible to explain this result with an outer shock happened to JL in 2010. JL filed for bankruptcy due to billions of dollars of debt caused by mismanagement and inefficiency

in 2010. To prevent collapse of JL which might have broad impacts on Japanese economy, Japanese government decided a state-led restructuring plan that accompanied more than 15,700 lay-offs and 30 unprofitable routes cutting. Therefore, the number of seats provided by JL and AA on the route between Japan and the U.S. mainland decreased even after forming of OneJV and the large portion of decreased were from JL. In the process of recovering its flight services, JL and AA had to choose on which routes to increase services and they might decide to provide seats on routes with incumbent airlines. On the other hands, NH did not go through economic crisis and thus was able to cooperate with its JV partner UA right after forming of JV.

Results for not overlapping routes, which are not influenced by competition effect, have little differences. No matter which sample (column (1), (2), (3) and (4)) we use, the estimates of no overlaps have negative signs even though all estimates are not statistically significant. Magnitude ranges from -0.090 to -0.070, which means approximately from 9.0% to 7.0% less seats are offered on no overlapping routes. These results are unexpected. There should be only market expansion effect, even it is not big, that provides more seats since there is no competition effect on no overlapping routes. One possible explanation is that the members of JVs are reconstructing their strategies considering both their own and competitors' evolving cooperation. For example, UA was the only airline that provided the service on the routes between Boston (BOS) and Narita (NRT) from 1st quarter of 2006 to 1st quarter of 2012. But after that, UA stopped the operation and JL started to offer the seats from 2nd quarter of 2012 on the same routes. AA also started to operate from 1st quarter of 2016, thus after that they are jointly operating on BOS – NRT route. For StarJV, instead of stopping operation on BOS – NRT routes, NH started to operate SEA – NRT route from 3rd quarter of 2012 in which only UA were operating. Considering these aspects all together, the strategical reconstructing routes of two JVs might be reasonable explanation for the unexpected results from the estimations.[30]

Overall, when we consider the U.S. mainland, we find that twoJVs have negative effects and these negative impacts seem to be from StarJV not from OneJV since sign of estimate from OneJV is positive. The estimate of StarJV is 5% level significant and that of OneJV is statistically significant at 10% significance level. The unexpected sign of OneJV estimate might from outer shock happened to JL which made the members of OneJV harder to consolidate their cooperation

[30] Interesting point is that BOS and SEA are the hub airports of Delta Air Lines which is not a member of StarJV nor OneJV, and Delta Air Lines does not provide any service on the routes BOS-NRT and SEA-NRT. Therefore, StarJV and OneJV might be capable of offering the seats on those routes.

for a while. For the results of twoJVs and StarJV variables, the results are consistent with the theory on JV effects and can be explained by the cases with larger competition effect than market expansion effect. It is not strange that competition effect is larger than market expansion effect considering that Tokyo city is competing with the other major cities in Northeast Asia to attract more traffic from Southeast Asian countries. Market expansion effect caused by two JVs might shrinks and disperse by their competitors.

Table 8. the number of seats offered by JL and AA (Japan – the U.S. mainland only)

	2006	2008	2010	2012	2014	2016
JL	786,964	661,024	378,388	432,676	510,286	583,387
AA	498,432	430,213	448,799	460,642	380,991	538,017
Total	1,285,396	1,091,237	827,187	893,318	891,277	1,121,404

Source: Our own elaboration based on RDC aviation data

7. Conclusions

This paper investigates the effects of two JVs between Japanese airlines and the U.S. airlines (NH with UA and JL with AA) on Nov in 2010. The aim of the investigation is to analyze their effects on the number of provided seats on the routes between Japan and the U.S. We assume that JV participants are beneficial to being part of JV members only when they are operating jointly on the routes that consist of their hub airports.

We consider that a formation of JV, which is strongest type of cooperation between airlines with different nationality, brings about competition and market expansion effects on inter-hub routes. The relative size of the two effects determines the size and magnitude of JV impacts. Without overlaps of partners, competition effect does not occur so that result in an increase of provided seats. However, in the case at hand most of routes affected by the JV are operated by the two JV's partners so that the competition effect is playing a relevant role.

Our estimates show that the formation of StarJV generates a decrease in provided seats meaning that competition effect is relatively larger than market expansion effect. This result might be because of harsh competition among Northeast Asian countries to attract passengers going Southeast Asian countries to the U.S. On the other hands, OneJV generates opposite result that more seats are provided. We suggest the outer shock happened to OneJV might be one possible

explanation on the unexpected result. The estimates regarding StarJV and OneJV are both significant when considered only the U.S. mainland.

Furthermore, the JVs induce less seats on no overlap routes. This might be because of the strategic behaviors of two JVs having considered the competition circumstance caused by deeper cooperation among airlines.

Even though our analysis provides evidence regarding the effects of JVs on the number of provided seats, more proper information that express consumer welfare is fare data. Due to unavailability of those existing data, we only use flight seats data. It would be of interest that if possible, further studies are needed with the fare data that DOT is managing to find out the effects of JVs on the routes between Japan and the U.S. It would be also interesting that comparing the results of this study with a case of South Korea to find out the influence of an existing strong competitor. Korea has similar circumstance with Japan in terms of having two major full service carriers, but has difference in respective of only one of them, KE, formed JV with DL.

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