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New international services and the competitiveness of Tokyo International Airport

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Abstract:

With the completion of Narita International Airport (Narita) in the Greater Tokyo Area, Tokyo International Airport (Haneda) was practically downgraded to a domestic airport. It lost its position as a key traffic hub for domestic to international air transport in Japan. Now the Japanese government is trying to expand its international role again by the resumption of international air services at the airport. A route choice probability model is applied to show how Haneda's hub competitive position in its connecting markets from Japan has changed since the resumption of these services.

The results reveal that Haneda's market shares increased significantly in the markets between Japan and Asia & Oceania, between Japan and Europe and between Japan and North America. The dense domestic networks offered at Haneda appear to connect well with the newly started international flights to Asia & Oceania, Europe and North America. The competitive position of Haneda in the connecting markets from Japan is expected to increase towards 2013 when its international air networks will be expanded further.

Key Words:

Route choice probabilities; Market shares of hub airports; Airport competition; NetCost model and Tokyo International Airport (Haneda)

1. Introduction

Until the opening of Narita International Airport (Narita) in 1978, Tokyo International Airport (Haneda) was the only primary airport serving the Tokyo Metropolitan Area. Traffic was divided between the two airports; Haneda handled almost all domestic traffic, while Narita handled the majority of international flights. This strict division of domestic and international traffic made it practically impossible to transfer from domestic to international flights and vice versa at either airport. In case one wanted to transfer in Tokyo from a domestic to an international flight, one had to travel, in most cases, from Haneda to Narita by public transport and continue from there.

Narita, a relatively small airport compared with other primary airports in Asia (Burghouwt et al., 2009), faces congestion problems and has limited opportunity to expand. The capacity shortage at the airport is partly the result of its limited opening hours from 6:00 to 23:00. In 2003, the Japanese government decided to re-open Haneda for international scheduled charter services. Haneda, on the other hand, has more capacity with non-restrictive opening hours. As an additional benefit, it is located closer to Tokyo's city center (14 km), compared to Narita (58 km). The international role of Haneda expanded significantly after the completion of its fourth runway in October 2010. The Japanese government intends to expand this role further to retrieve the competitive position Japan once had as a key traffic hub for international air transport in Asia.

In this paper, we show how Haneda's market shares in its connecting traffic from Japan have changed since the opening of the international scheduled services in 2010. In addition, a scenario analysis is performed to show how Haneda's market shares are expected to develop until 2013. The NetCost route choice probability model is applied to estimate Haneda's market shares in the connecting markets served from Japan. The next section provides an overview of the literature on airport competition, with a focus on competition in connecting markets. Section 3 describes the development scheme and outline of Haneda. In Section 4, we introduce the NetCost route choice probability model to estimate the market shares of Haneda in its connecting markets. Results are described in Section 5, followed by the conclusions in Section 6.

2. Literature review

To date, the issue of airport and airline competition has been addressed in a wide range of studies with a focus on airport choice or functional division in metropolitan areas with multiple airports (Pels et al., 2000, 2003, 2009; Derudder et al., 2010; Lian and Rønnevik, 2011), commercialization and privatization of airports (Barrett, 2000), vertical cooperation between airports and airlines (Barbot, 2009), location of airline hubs (Schwieterman, 1988;

Huston and Butler, 1991; Berechman and De Wit, 1996; Adler and Berechman, 2001), freight airlines airport choice (Zhang and Zhang, 2002; Zhang, 2003; Gardiner et al., 2005), structure of global airport hierarchies (Matsumoto, 2004, 2007; Derudder and Witlox, 2008, 2009; Grubesic, 2009) and development of low-cost carriers (Gillen and Lall, 2004; Zhang et al., 2008). Meanwhile, some researchers capture airline network structures, schedule coordination and the resulting hub performance to compare the competitive position of airports. In their studies on airline and airport connectivity, the level of schedule coordination in airline networks and structure of hub-and-spoke networks have been included (Burghouwt et al., 2003; Dennis, 1994a, 1994b; Burghouwt and de Wit, 2005). Veldhuis (1997) analyzed the position of Amsterdam-Schiphol Airport as a hub in terms of the quality and frequency of connecting flights, applying the NetScan connectivity model. Using the same model, Burghouwt and Veldhuis (2006) evaluated the competitive position of West European airports in the transatlantic market. Other airport connectivity studies using different methods include Bootsma (1997), Burghouwt (2007) and Malighetti et al. (2008).

Not surprisingly, the studies on the competitive position of major airports in international air transportation draw considerable attention, particularly in Asia. Hansen and Kanafani (1990) explored the competitive position of Narita within the transpacific market from an economic standpoint. Schwieterman (1993) analyzed the eight major airports in this region for a prospective hub site of express air cargo in terms of airport capacity, location advantage, market size, terminal service and government policy. Park (2003) assessed the competitive status of major airports in East Asia based on five factors: service, demand, managerial, facility and spatial qualities. Ohashi et al. (2005) compared five airports in Northeast Asia with respect to intercontinental air cargo transshipment. De Wit et al. (2009) and Burghouwt et al. (2009) measured and compared the performance of airline networks at primary airports in the Asia-Pacific rim and in East and Southeast Asia, respectively. These studies showed that Hong Kong, Singapore, Seoul/Incheon or Shanghai/Pudong are strengthening their positions as international air traffic hubs, at the expense of Narita.

3. Development scheme and outline of Haneda

3.1. Historical background

Haneda was originally the main airport serving the Tokyo Metropolitan Area until Narita opened in 1978. After the opening of Narita, it was designated to serve as the center for domestic flights in the Tokyo region. In recent years, however, international scheduled services at Haneda returned with the opening of regular charter services to Seoul/Gimpo in 2003, Shanghai/Hongqiao in 2007, Hong Kong in 2008 and Beijing/Capital in 2009. With the completion of a fourth runway in October 2010, Haneda's international role expanded with international services to new destinations outside Japan. Table 1 shows the historical background of Haneda.

Table 1
Historical background of Haneda.
Source: Compiled by authors.

Recently, the Japanese government reached agreements to start international scheduled services to/from Haneda with thirteen countries; seven in Asia & Oceania (Korea, China, Taiwan, Thailand, Malaysia, Singapore and Vietnam), four in Europe (UK, France, Germany and the Netherlands) and two in North America (US and Canada). The government is now negotiating with counterparts for further expansion of international scheduled services at Haneda.

3.2. Development scheme and future outline

The new 2,500 m D-runway was installed on the southern seaboard of the existing airfield to adequately meet the demand for air transport. With the completion of this fourth runway in 2010, Haneda’s operational capacity increased from 303,000 to 371,000 movements per year. By 2013, capacity will be phased up to 447,000 movements (Table 2).

Table 2
Capacity of Haneda.
Source: Japanese Civil Aviation Bureau.

In addition to the new runway, a third terminal for international flights and an international air cargo facility were constructed. The capacity of this new international terminal will be doubled by 2014 (Fig. 1).

Fig. 1. Expansion plan of Haneda.
Source: Made by authors.

3.3. Air traffic statistics

Haneda handled 64.1 million passengers in 2010 (Domestic: 60.2 million, International: 3.9 million). By passenger throughput, it was the fifth busiest airport in the world, after Atlanta/Hartsfield-Jackson (89.3 million), Beijing/Capital (73.9 million), Chicago/O'Hare (66.8 million) and London/Heathrow (65.9 million) in 2010, as indicated in Table 3. It is the primary base of Japan's two major airlines, Japan Airlines (JAL) and All Nippon Airways (ANA), as well as low-cost carriers, Hokkaido International Airlines (ADO), Skymark Airlines (SKY), Skynet Asia Airways (SNA) and StarFlyer (SFJ).

Table 3
Top ten airports by total passengers, 2008 and 2010.
Source: Airports Council International.

Haneda offers operational capacity of 30,000 movements during the day and another 30,000 during late night and early morning hours per year, which corresponds around 40 flights each, approximately 80 flights in all per day. Table 4 summarizes the traffic statistics on Haneda.

Table 4
Traffic statistics on Haneda.
Notes: (1) * means the numbers in the third week of September, 2011. (2) ** means the up-to-the-minute numbers in 2010.
Source: Japanese Civil Aviation Bureau.

4. Assessment of network quality

The effects of resuming international services at Haneda will be expressed in terms of market share changes in the connecting markets it serves from Japan. These market shares will be estimated using the NetCost route choice probability model. This section describes the working of the NetCost model and model assumptions.

4.1. Concept of NetCost model

The NetCost model was first presented by Heemskerk and Veldhuis (2006a, 2006b) and developed by Veldhuis and Lieshout (2009). First, the Netcost model identifies all direct and indirect connections in a specific airline market using the Official Airline Guide (OAG) flight schedules. As opposed to direct connections, indirect connections contain a stop at an intermediate hub airport. A hub airport is an airport at which at least one airline is coordinating its incoming and outgoing flights in such a way as to optimize transfers between these flights.

Next, the model determines the generalized travel costs for each alternative. Generalized travel costs are a representation of all inconveniences passengers are confronted with. They consist of three components: travel time costs, schedule delay costs and airfares. Using a utility function, these costs are converted into utility values. Combined with the frequencies supplied, this determines the route choice probabilities and airline or airport market shares in a certain market. Fig. 2 shows the scheme of the NetCost model.

Fig. 2. Scheme of NetCost model.

4.2. Generalized travel costs

4.2.1. Travel time costs

The first cost component refers to the costs related to travel time. Direct connections have the shortest travel time. Travel time increases for indirect connections, because these involve circuity time and connecting time at an intermediate hub. Flight time, circuity time and connecting time are all valued differently by the average passenger. Therefore, these need to be separated before one can estimate the costs related to travel time.

First, the great circle distance between each origin and destination is determined. This distance is measured by taking the geographical coordinates of the two ends and computing the distance in kilometers. By assuming a particular speed and allowing some time for taking-off and landing, the flight time of direct connections between two airports, x and y, is determined;

t_{xy}^{flight} : flight time (in hours) between an origin airport x and a destination airport y. (1)

The flight time of indirect connections is calculated by adding the flight times of the respective flight legs;

$$t_{xhy}^{flight} = t_{xh}^{flight} + t_{hy}^{flight} \tag{2}$$

Where,

t_{xh}^{flight} : flight time (in hours) between an origin airport x and an intermediate hub h.

t_{hy}^{flight} : flight time (in hours) between an intermediate hub h and a destination airport y.

In case of indirect connections, the total flight time is longer than the non-stop flight time between x and y. The difference is circuity time;

$$t_{xhy}^{circuity} = t_{xh}^{flight} + t_{hy}^{flight} - t_{xy}^{flight} \tag{3}$$

In addition, there is connecting time at an intermediate hub, which is also added to the total travel time;

$t_{h}^{connecting}$: connecting time (in hours) at an intermediate hub h. (4)

Hence, the total travel time has now three components: flight time, circuity time and connecting time. Circuity time and connecting time are zero by definition for direct connections. Therefore, the total travel time equals;

$$t_{xhy}^{total\ travel\ time} = t_{xy}^{flight} + t_{xhy}^{circuity} + t_{h}^{connecting} \tag{5}$$

The three components of total travel time do not, however, lead to the same degree of inconvenience. Circuity time and connecting time are perceived with a higher degree of inconvenience than flight time. Therefore, circuity time and connecting time are penalized with specific factors in the model. The model assumes a penalty factor, depending on the flight distance. This factor will decrease with flight time, which means a larger penalty factor on a short-haul route and a smaller one on a long-haul route (De Wit et al., 2009);

$$\mu_{xy} = 3 - 0.075 * t_{xy}^{flight} \tag{6}$$

This formula implies that the penalty factor for an indirect connection on a short-haul route with a direct flight time of - say - three hours is close to 3, whereas the penalty for an indirect connection on a long-haul route with a direct flight time of - say - twelve hours is a little over 2. The difference between these penalty factors on a short-haul and a long-haul route is justified by the recognition that one hour of circuity holds relatively more inconvenience in a short distance than in a long distance. The same argument applies for connecting time, although the penalty factor for connecting time is slightly higher, as connecting time is perceived as even more inconvenient than circuity time. With these assumptions, the perceived travel time is able to be determined, which has the above penalty factors incorporated;

$$t_{xhy}^{perceived\ travel\ time} = t_{xy}^{flight} + \alpha * \mu_{xy} * t_{xhy}^{circuity} + \beta * \mu_{xy} * t_{h}^{connecting} \tag{7}$$

$$(\alpha = 1, \beta = 1.25)$$

In case of direct connections, the perceived travel time equals flight time, as there is no circuity time nor connecting time.

Finally, the perceived travel time needs multiplying with the Value of Travel Time (VoTT) to obtain the generalized travel costs related to travel time.

$$c_{xhy}^{time} = VoTT * t_{xhy}^{perceived\ travel\ time} \tag{8}$$

4.2.2. Schedule delay costs

A flight hardly ever leaves exactly at the date and time desired by passengers. The travel delay resulting from this is called the schedule delay. The costs of this delay increase as frequencies decrease. The schedule delay is converted into costs by estimating the delay and multiplying this delay with the Value of Waiting Time (VoWT). The schedule delay is approximated by taking the average time between two subsequent flights. Assuming the operational length of a day as 16 hours, the total operational length of a week equals 112 hours. The average schedule delay for a flight between an origin airport x and a destination airport y with an airline (alliance) a is approximated by taking the half of the average time between two subsequent flights f_{xya};

$$t_{xya}^{schedule\,delay} = (0.5*112)/f_{xya}^{direct} = 56/f_{xya}^{direct} \tag{9}$$

Where,

f_{xya}^{direct} : weekly direct frequencies on a route between an origin airport x and a destination airport y with an airline (alliance) a.

This equation represents the average schedule delay for direct connections. To determine the frequency level on indirect connections, a similar approach is adopted. For indirect connections, the schedule delays of the respective flight legs may be added up;

$$t_{xhya}^{schedule\,delay} = 56/f_{xha}^{direct} + 56/f_{hya}^{direct} \tag{10}$$

Where,

f_{xha}^{direct} : weekly direct frequencies on a route between an origin airport x and an intermediate hub h with an airline (alliance) a.

f_{hya}^{direct} : weekly direct frequencies on a route between an intermediate hub h and a destination airport y with an airline (alliance) a.

As the schedule delay is an inverse function of the frequency level, so is the frequency level an inverse function of the schedule delay. Therefore,

$$f_{xhya}^{indirect} = 56/t_{xhya}^{schedule\,delay} \tag{11}$$

Where,

$f_{xhya}^{indirect}$: weekly indirect frequencies on a route between an origin airport x via an intermediate hub h and a destination airport y with an airline (alliance) a.

When looking at the generalized travel costs related to schedule delay of a specific airline (alliance), indirect as well as direct frequencies have to be aggregated. For indirect connections, there may even be distinct routes via more hubs.

$$f_{xya}^{total} = f_{xya}^{direct} + \sum_{h} f_{xhya}^{indirect} \tag{12}$$

Therefore, the average schedule delay of an airline (alliance) a will be;

$$t_{xya}^{schedule\,delay} = 56 / f_{xya}^{total} \tag{13}$$

This specification, however, leads to unrealistically high average schedule delay costs for routes with low weekly frequencies. If the frequency level is as low as only once per week, for example, the schedule delay results in 56 hours, using this specification. It can be assumed that passengers in reality do not perceive the full length of the schedule delay as inconvenience, as this period may be used productively. Therefore, some adjustments are made for the frequency level lower than 28 per week (4 daily). In the model, the schedule delay for frequencies lower than 28 per week is determined as;

$$t_{xya}^{schedule\,delay} = 3.96 - 0.07 * f_{xya}^{total} \quad \text{if } f_{xya}^{total} < 28 \tag{14}$$

The final process is the determination of the schedule delay costs. This requires multiplying the average schedule delay by the Value of Waiting Time (VoWT). The determination of the generalized travel costs related to schedule delay is now;

$$c_{xya}^{schedule\,delay} = VoWT * t_{xya}^{schedule\,delay} \tag{15}$$

4.2.3. Airfares

The final component of the generalized travel costs is airfares. Readily available data on the accurate airfares is lacking at large, therefore the model estimates airfares by looking at the systematic factors that determine them.

One of these systematic factors is clearly the flight distance between an origin airport and a destination airport, irrespective of the route flown. Airfares are therefore based on the great circle distance (in hours) between them. From this distance, a ‘reference airfare’ is computed. Adjustment factors can be applied to this airfare. These shall be described next.

4.2.3.1. Route type

Generally, airfares on direct routes are higher than those on indirect routes, even though the distance flown on an indirect route is longer. The rationale behind this is that the perceived quality and therefore the willingness-to-pay of indirect routes are lower. In this model, the route adjustment factor (π_r) is introduced to reflect this difference in airfares.

4.2.3.2. Carrier type

Airfares also depend on the type of carrier operating a certain route. The NetCost model distinguishes two types of carriers: network carriers and point-to-point carriers. Network carriers are generally the established flag carriers which develop networks around their central hubs. Point-to-point carriers do not develop networks at their home bases, but offer frequent direct services. The latter category includes charter services and so-called low-cost carriers. The second adjustment factor, therefore, depends on the carrier type (π_o).

4.2.3.3. Specific carriers

Airfare differences between airlines or alliances within these two main carrier types can be reflected, if necessary, by introducing an additional adjustment factor for particular airlines or alliances (π_a).

4.2.3.4. Passenger travel purpose

The model also has an option for assuming an adjustment factor for passenger travel purposes (π_p). Higher airfares are commonly paid by business passengers than by leisure passengers for some extra benefits, such as extra legroom, a flexible ticket, access to business lounges at airports et cetera.

4.2.3.5. Competition level

The final adjustment applied to the reference airfare is based on competition in the market. Generally, airfares in a highly competitive market are significantly lower than those in a market with low competition. Competition is usually measured in terms of market concentration. In concentrated markets, where most of the services are provided by a limited number of carriers, competition is generally limited. Markets with low concentration, where many competing carriers provide the services, are generally characterized by strong competition.

Various concentration indexes or measures have been suggested in the field of industrial economics. The most frequently used are the Concentration Ratio (CR) and the Herfindahl-Hirschman Index (HHI). Other measures, such as Lorenz Curve, Gini Coefficient, Inverse Index and Entropy are less frequently employed in industrial economics and competition policy analysis than the CR and the HHI. A thorough review of these measures is outside the scope of this chapter. For further information, see Singer (1965).

We chose the HHI to measure competition. For air traffic markets, the HHI is calculated by summing the squared market shares of competing direct and indirect flights. The HHI is widely used to measure concentration in economic markets, including air traffic markets (Reynolds-Feighan, 1998), and it is easily interpretable. However, it also has two important shortcomings. First, it is sensitive to the incorrect measurement of market shares. Since it involves the squared market shares, any measurement error will also be squared. A correct measurement of the market shares depends to a large extent on a correct definition of relevant markets (Lijesen, 2004a). A customer willing to travel from Tokyo to Amsterdam is not interested in the average concentration in the market between Japan and the Netherlands, but in the concentration in the city-pair market between Tokyo and Amsterdam. We overcome the first shortcoming by defining markets as airport-pairs. The second shortcoming of the HHI is its failure to account for close substitutes (Lijesen, 2004a). Usually, market shares of a specific city-pair are calculated using frequencies. This implies, however, that direct flights are treated in the same way as indirect flights. Indirect flights are, however, of lower quality than direct flights due to the extra travel time involved. This quality aspect should be taken into account when calculating the concentration level at a certain city-pair. Therefore, connectivity shares of competing direct and indirect flights in specific airline markets are used to compute the concentration index instead of frequency shares. The connectivity shares are based on the connectivity levels of each competitor in a specific airline market. The connectivity levels are obtained by weighing the frequency levels for quality, using a quality index. This way, the quality aspect is accounted for when calculating the HHI. For details on how to weigh frequencies for quality, see Veldhuis (1997), Burghouwt and Veldhuis (2006), De Wit et al. (2009) and Burghouwt et al. (2009).

The total connectivity from an origin airport x to a destination airport y with an airline (alliance) a is determined as;

$$CNU_{xya} = f_{xya}^{direct} + \sum_{h} (f_{xhya}^{indirect} * q_{xhya}) \tag{16}$$

Where,

CNU_{xya} : weekly connectivity units on a route between an origin airport x and a destination airport y with an airline (alliance) a.

f_{xya}^{direct} : weekly direct frequencies on a route between an origin airport x and a destination airport y with an airline (alliance) a.

$f_{xhya}^{indirect}$: weekly indirect frequencies on a route between an origin airport x via an intermediate hub h and a destination airport y with an airline (alliance) a.

q_{xhya} : quality index ranging from 0 to 1.

These connectivity levels with airlines (alliances) are used to determine the concentration index in the market between x and y. Aggregating the squares of connectivity shares of each of the competing airlines (alliances) in a specific market between x and y results in the HHI of the market;

$$HHI_{xy} = \sum_{a} (CNU_{xya} / \sum_{a} CNU_{xya})^2 \tag{17}$$

The final issue is to determine the adjustment to the reference airfare based on this competition level. This adjustment factor (π_c) is supposed, in the model, to be a function of competition level;

$$\pi_c = \eta + \varphi * HHI_{xy} \tag{18}$$

Finally, the expected airfares are expressed with all adjustment factors;

$$c_{xya}^{airfares} = (reference\,airfare) * \pi_r * \pi_o * \pi_a * \pi_p * \pi_c \tag{19}$$

In summary, the generalized travel costs can now be determined by adding up these three components ((8), (15) and (19));

$$c_{xhya}^{total} = c_{xhy}^{time} + c_{xya}^{schedule\,delay} + c_{xya}^{airfares} \tag{20}$$

4.3. Consumer values and route choice probabilities

The generalized travel costs are a main determinant of the attractiveness and route choice of a particular route alternative. A utility function is used to derive the utility of a single flight to passengers. The utility is a function of generalized travel costs;

$$U_{xhya} = \exp(\rho * c_{xhya}^{total}) \tag{21}$$

Where,

U_{xhya} : utility of a connection between an origin airport x via an intermediate hub h and a destination airport y with an airline (alliance) a. In case of direct connections, h=0.

ρ : spread parameter, indicating passenger sensitivity to cost changes.

The attractiveness of a certain route alternative, however, does not only depend on the generalized travel costs vis-à-vis other alternatives, but also on the flight supply offered. Airline (alliances) offering more flights than their competitors generally obtain an even higher market share. This is also known as the s-curve effect. Therefore, the utility values are multiplied by the frequency levels for each route alternative. This results in the consumer values of each route alternative between an origin airport x (via an intermediate hub h) and a destination airport y with an airline (alliance) a;

$$CV_{xhya} = f_{xhya} * U_{xhya} \tag{22}$$

Where,

CV_{xhya} : consumer values of a connection between an origin airport x via an intermediate hub h and a destination airport y with an airline (alliance) a. In case of direct connections, h=0.

Consumer values are used in assessing the route choice probabilities (or market shares) of a certain route alternative vis-à-vis other routes;

$$p_{xhya} = CV_{xhya} / \sum_{h} \sum_{a} CV_{xhya} = CV_{xhya} / CV_{xy} \tag{23}$$

Where,

p_{xhya} : probabilities a connection (via an intermediate hub h) with an airline (alliance) a is chosen in the market between x and y. In case of direct connections, h=0.

CV_{xy} : consumer values in the market between x and y.

4.4. Assumptions on parameters

The assumptions on the model parameters are summarized in Table 5. These are basically in line with the literature applied in Europe (Spiller, 1989; Reiss and Spiller, 1989; Lijesen, 2004b) and with experiences in the European context.

In the model, the market shares for leisure and business passengers are estimated separately. The ratio of the former to the latter is not assumed. It is because distinguishing passengers with business travel purpose is quite difficult, as pointed out in Derudder et al. (2011). The Value of Travel Time (VoTT) of 20 euro per hour is assumed for passengers with leisure travel purpose and 50 euro per hour for passengers with business travel purpose. The Value of Waiting Time (VoWT) is assumed only 40 % of the Value of Travel Time (VoTT). Background of this is that the time involved with the schedule delay can be used more productively than the travel time. Hence, the Value of Waiting Time (VoWT) equals 8 euro for passengers with leisure travel purpose and 20 euro for passengers with business travel purpose.

As for the reference airfare, it is assumed to start with 80 euro and for each additional hour of flight time, 40 euro is added. With regard to the adjustment factor on route types (π_r), the assumption is made that the airfares on direct routes are 5 % higher than the reference airfare and those on indirect routes are 5 % lower than the reference airfare. This means that this factor has a value of 1.05 on direct routes and 0.95 on indirect routes. Regarding the adjustment factor on carrier types (π_o), it is assumed in the model that airfares of point-to-point carriers are, on average, 30 % lower than those of network carriers. Concerning the adjustment factor on passenger travel purposes (π_p), it is assumed that passengers with business travel purpose pay airfares 25 % above the reference airfare, while passengers with leisure travel purpose pay airfares 25 % below the reference airfare. Finally, as for the adjustment factor on competition levels (π_c), the assumption is made that for leisure passengers, airfares are 25 % lower in case of maximum competition (η=-0.25, HHI_{xy}=0) and 25 % higher in case of monopoly (η=-0.25, ψ=0.5, HHI_{xy} =1). For business passengers, it is assumed that airfares are 10 % lower in case of maximum competition (η=-0.10, HHI_{xy} =0) and 10 % higher in case of monopoly (η=-0.10, ψ=0.2, HHI_{xy} =1).

Table 5
Model assumptions.

5. Haneda's market shares in its connecting markets from Japan

The previous section addressed the methodology behind the determination of generalized travel costs and route choice probabilities with the NetCost model. This section shows an application of the model; how the model may be used in estimating the route choice probabilities and market shares of hub airports with regard to passengers departing from Japan.

5.1. Data used and classification of study area

Airline network data (origin, destination, published carrier and number of operations) was retrieved from the Official Airline Guide (OAG) flight schedules for representative weeks before (third week of September, 2010) and after (third week of September, 2011) launching international scheduled services from Haneda. In this study, only online connections are considered as viable connections. In other words, transfers have to take place between flights of the same airline or the same global airline alliance.

We also estimated the market shares of hub airports in 2013 when more slots are scheduled by the Japanese government to be allocated to international services at Haneda, as indicated in Table 2. Table 6 shows the assumption on international scheduled services at Haneda in 2013, which is based on the up-to-the-minute information provided by the Japanese Civil Aviation Bureau. Other services, international as well as domestic, are assumed to be the same as those in the third week of September 2010 to avoid the influence of the Tohoku Earthquake in March 2011, which drastically downsized the international services to/from Japan. Although this might seem a rather blunt assumption, it is the best we can do. It is very uncertain how air traffic will develop over the coming years. Air traffic could either improve or decline compared with 2010, depending on how fast the economic situation improves and Japan recovers from the influences of the Tohoku Earthquake.

The study area consists of eight market segments; the domestic Japanese market and the markets between Japan and Asia & Oceania (excluding Japan), Europe, North America, Latin

America, the Middle East, Africa and the World (excluding Japan).

Table 6
Assumptions on international scheduled services at Haneda.
Note: The same numbers are assumed on arrival.
Source: Japanese Civil Aviation Bureau.

5.2. Results

5.2.1. Market shares of direct and indirect connections

Table 7 shows the market shares of direct and indirect connections in each market segment in September 2011. In the short-haul markets, such as the domestic Japanese market and the market between Japan and Asia & Oceania (excluding Japan), direct connections had a market share of nearly 100 % for both travel purposes. These direct connections are of a higher quality because of lacking circuity time and connecting time, which enables these connections to obtain very high market shares over short distances. In these markets, circuity time and connecting time of indirect connections are relatively large, compared with direct connections with high frequencies. In short-haul markets where many direct flights are available, these flights often obtain a combined market share of close to 100 %.

Meanwhile, as for the markets between Japan and North America and between Japan and the Middle East, an estimated 70 % of all passengers chose direct connections. Slightly more than half of leisure and business passengers chose an indirect connection as for the market between Japan and Europe. In the long-haul market to Latin America, indirect connections had a much larger share of approximately 90 %, as far as leisure passengers were concerned. EgyptAir was the only carrier that connected Japan and Africa directly in 2010. It is suspending these services in 2011 on account of the Tohoku Earthquake. Therefore, all connections in the market between Japan and Africa are now indirect ones.

Table 7
Market shares of direct and indirect connections in each market segment, September 2011.

5.2.2. Market shares of hub airports on indirect connections

Table 8 shows the market shares of hub airports before (September 2010) and after (September 2011 and September 2013) the resumption of international scheduled services at Haneda in the connecting markets served from Japan.

Haneda is the most important hub for domestic connections in Japan, followed by Osaka/Itami, Nagoya/Chubu, Fukuoka, Sapporo/Chitose, Naha (Okinawa) and Osaka/Kansai. In the previous section, it was shown, however, that indirect connections in the domestic market have a marginal market share.

In the market between Japan and Asia & Oceania (excluding Japan), the hub airports, Seoul/Incheon and Shanghai/Pudong together account for almost half of the total market shares in these three years. In this market, Haneda was ranked tenth in 2010 with a market share of around 3 %. Due to the resumption of international services, its market shares rose to 5 % in 2011. Haneda's shares are expected to increase to 8 % by 2013 when more international services are added, ranking it third, just behind Seoul/Incheon and Shanghai/Pudong.

As for the market shares on indirect connections between Japan and Europe, the European hubs, Frankfurt, Helsinki, Amsterdam and Paris/Charles de Gaulle are most popular. The striking finding is that Seoul/Incheon is ranked among the top five hubs, occupying a market share of almost 10 %. As for Haneda, it was ranked seventeenth in 2011 with a market share of around 2 %. With the resumption of international services to London/Heathrow, Paris/Charles de Gaulle, Frankfurt and Amsterdam in 2013, its market shares are expected to increase to 7 %, ranking it sixth.

In the market between Japan and North America, the main hubs are Chicago/O'Hare, San Francisco and Narita. Haneda was ranked ninth in 2011 with a market share of nearly 5 %. In 2013, it is expected to become the second most important hub, just behind Chicago/O'Hare, with a market share of around 15 %, due to the resumption of international services to New York/John F. Kennedy, Los Angeles, San Francisco, Detroit and Vancouver.

Dallas-Fort Worth, Houston, Los Angeles and Mexico City are dominant hubs in the market between Japan and Latin America, which together occupy a market share of around 80 % of all indirect connections. Four hubs in the Middle East, Dubai, Doha, Abu Dhabi and Istanbul, and three hubs in Asia, Seoul/Incheon, Beijing/Capital and Hong Kong are the top seven hubs in the market between Japan and the Middle East. In the market between Japan and Africa, three hubs in Europe, Rome/Fiumicino, Paris/Charles de Gaulle and Frankfurt for a historical reason, and three hubs in the Middle East, Istanbul, Dubai and Doha for a geographical reason, connect this market well, on top of Cairo, a major gateway into Africa. Haneda has no market shares in these markets, as it does not offer direct flights to Latin America, the Middle East and Africa.

When all international markets are taken together, Seoul/Incheon and Shanghai/Pudong appear the most important hubs, with a combined market share of around 50 %. Haneda's overall market shares in the international markets increased from around 3 % in 2010 to 4.5 % in 2011. Its market shares are expected to increase to around 8 % in 2013 when more international services are launched, ranking it third, just behind Seoul/Incheon and Shanghai/Pudong.

Seoul/Incheon plays a more and more crucial role as a transfer airport between Japan and the rest of the world by the strategic network developments of Korean air carriers from

Seoul/Incheon to Japanese airports. It is ranked first in the markets between Japan and Asia & Oceania (excluding Japan) and between Japan and the Middle East, fourth in the market between Japan and Europe and fifth in the market between Japan and North America in 2011. Seoul/Incheon is now a strong competitor against hub airports in Japan.

Although the basic policy on functional division is supposed to be retained by the Japanese government; Narita and Haneda are mainly used for international and domestic services, respectively. Further developments of international air networks at Haneda may have some impacts on Narita.

Table 8

Market shares of hub airports on indirect connections in each market segment before and after resumption of international scheduled services at Haneda.

1. Japan - Japan (domestic).
2. Japan - Asia & Oceania (exc. Japan).
3. Japan - Europe.
4. Japan - North America.
5. Japan - Latin America.
6. Japan - Middle East.
7. Japan - Africa.
8. Japan - World (exc. Japan).

6. Conclusion

Airport and airline competition draw considerable attention in Asia. In this paper, we applied the NetCost route choice probability model to evaluate the effects of resuming international scheduled services at Haneda on its hub competitive position.

We estimated the market shares of Haneda in the connecting markets it serves originating in Japan, before and after the resumption of international scheduled services at Haneda. The international role of Haneda expanded significantly after the completion of its fourth runway in October 2010. Its market shares increased, especially in the markets between Japan and Asia & Oceania (excluding Japan), between Japan and Europe and between Japan and North America. In September 2011, Haneda had a network with about 498 round-trip flights a day linked with 48 airports around the country, and with about 52 round-trip flights a day linked with 17 international airports outside Japan. The dense domestic networks offered at Haneda appear to connect well with the newly started international flights.

The Japanese government intends to expand its international role further to retrieve the competitive position Japan once had as a key traffic hub for international air transport in Asia. The hub competitive position of Haneda is expected to improve with the expansion of its international air networks.

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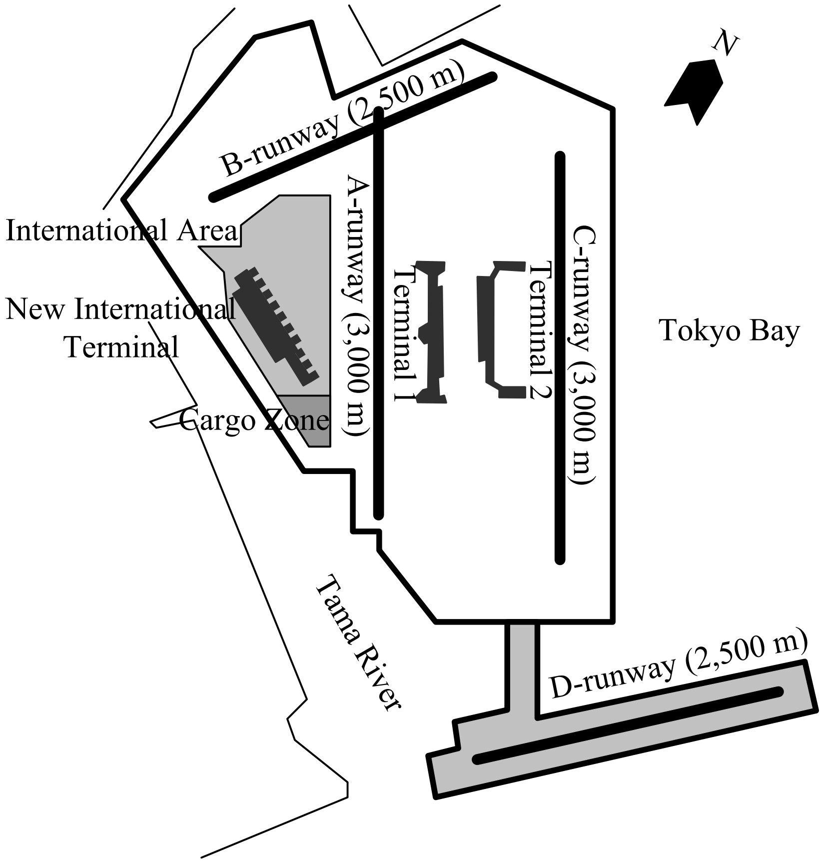

Fig. 1. Expansion plan of Haneda.
Source: Made by authors.

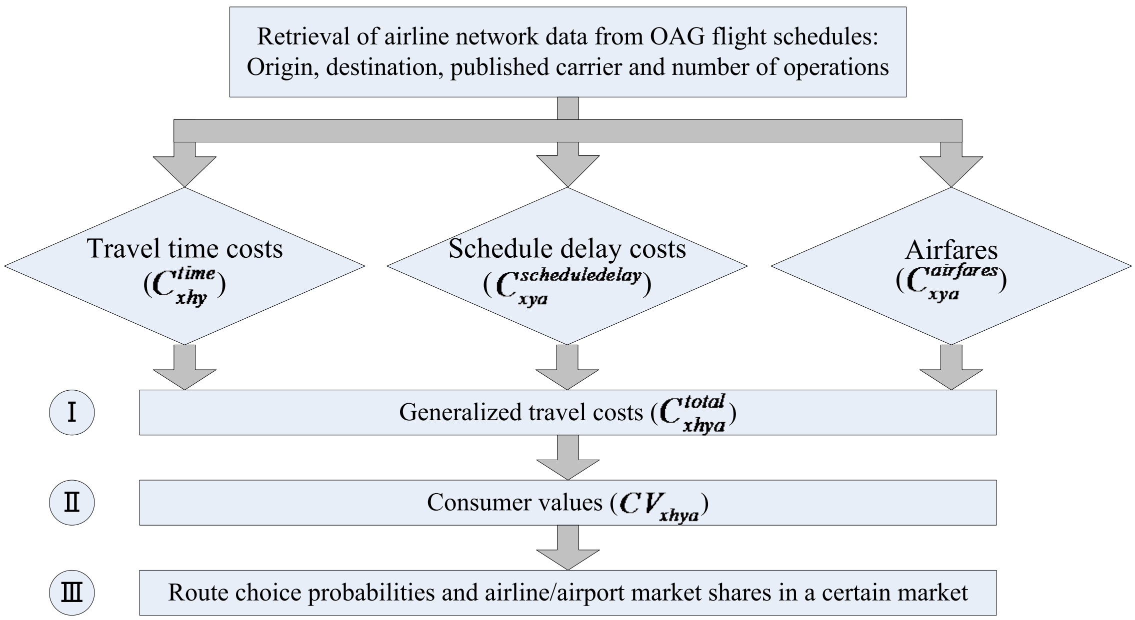

Fig. 2. Scheme of NetCost model.

Table 1

Historical background of Haneda.

Year	Development or expansion scheme
1931	Haneda opened as Haneda Airfield. Its initial area was 53 hectare with one 300 m runway.
1939	The first runway was extended to 800 m and a second 800 m runway was constructed.
1945	The US military took over the airport and renamed it Haneda Army Air Base. It put forward with many construction projects, including the extension of the first runway to 1,650 m and the second to 2,100 m.
1952	The US military gave part of the base back to the Japanese government.
1958	The remainder was returned to the Japanese government.
1970	A third runway and an international terminal were completed.
1978	New Tokyo International Airport (Narita) opened, taking over almost all international flights from Haneda practically became a domestic airport.
1978-2002	Taiwan's airlines continued to use Haneda as an exception. (China Airline from 1978 to 2002, Eva Airways from 1989 to 2002)
1984-2007	The expansion was put forward with a large-scale landfill project in Tokyo Bay.
1988	A-Runway was moved and extended on the landfill area.
1993	The old airport terminal was replaced by a new West Passenger Terminal built on the landfill area.
1997	C-runway was moved and extended on the landfill area.
2000	B-runway was moved and extended on the landfill area.
2003-	International scheduled charter services started to Seoul/Gimpo (in 2003), Shanghai/Hongqiao (in Hong Kong (in 2008) and Beijing/Capital (in 2009).
2004	Terminal 2 opened for ANA, ADO, SNA and SFJ, and Terminal 1 built in 1993 became the base for JAL, SKY and SFJ.
October 2010	A fourth runway (D-runway), a third terminal for international flights and an international air cargo facility are in use. International scheduled services started to destinations in Asia, Europe and North America.

Source: Compiled by authors.

Table 2

Capacity of Haneda.

Area (ha)	1,421		
Number of runways	4 (A-runway: 3,000m×60m, B-runway: 2,500m×60m, C-runway: 3,000m×60m, D-runway: 2,500m×60m)		
Maximum aircraft movements (,000)	371 (60 for international services) in 2010 → 447 (90 for international services) in 2013		
	Domestic	International	Total
Passenger terminal (,000 ㎡)	Terminal 1 (290.0), Terminal 2 (205.2)	159.0	654.2
Cargo terminal (,000 ㎡)	70.7 (East Side + West Side)	Terminal 1 (34.5), Terminal 2 (18.3), Other (3.1)	126.6

Source: Japanese Civil Aviation Bureau.

Table 3

Top ten airports by total passengers, 2008 and 2010.

Rank	City	Airport Code	2008		City	Airport Code	2010	
			Passengers	% Change			Passengers	% Change
1	Atlanta	ATL	90,039,280	0.7	Atlanta	ATL	89,331,622	1.5
2	Chicago	ORD	69,353,876	-9.0	Beijing	PEK	73,948,113	13.1
3	London	LHR	67,056,379	-1.5	Chicago	ORD	66,774,738	4.1
4	Tokyo	HND	66,707,213	-0.2	London	LHR	65,884,143	-0.2
5	Paris	CDG	60,874,681	1.6	Tokyo	HND	64,069,098	3.7
6	Los Angeles	LAX	59,497,539	-4.7	Los Angeles	LAX	59,070,127	4.5
7	Dallas/Fort Worth	DFW	57,093,187	-4.5	Paris	CDG	58,167,062	0.5
8	Beijing	PEK	55,937,289	4.4	Dallas/Fort Worth	DFW	56,906,610	1.6
9	Frankkfurt	FRA	53,467,450	-1.3	Frankfurt	FRA	53,009,221	4.1
10	Denver	DEN	51,245,334	2.8	Denver	DEN	52,209,377	4.1

Source: Airports Council International.

Table 4

Traffic statistics on Haneda.

	Domestic	International	Total
Number of destinations	48*	17*	65*
Number of flights (per day)	3,483* (498*)	362* (52*)	3,845* (549*)
Passenger volume (,000)	60,187**	3,882**	64,069**
Cargo volume (,000 ton)	729.3**	31.2**	760.5**

Notes: (1) * means the numbers in the third week of September, 2011. (2) ** means the up-to-the-minute numbers in 2010.

Source: Japanese Civil Aviation Bureau.

Table 5
Model assumptions.

	Leisure passengers	Business passengers
1. Travel time costs Value of Travel Time (VoTT) per hour	€ 20	€ 50
2. Schedule delay costs Value of Waiting Time (VoWT) per hour	€ 8	€ 20
3. Airfares Reference airfare	€80 + €40 * flight time	
3.1. Route type (π_r)	5% higher than reference fare on direct routes (π_r=1.05) 5% lower than reference fare on indirect routes (π_r=0.95)	
3.2. Carrier type (π_o)	Airfares of point-to-point carriers are 30% lower than those of network carriers	
3.3. Specific carriers (π_a)	An additional adjustment factor for particular airlines or alliances, if necessary	
3.4. Passenger travel purpose (π_p)	25 % below reference fare (π_p=0.75)	25 % above reference fare (π_p=1.25)
3.5. Competition level (π_c)	25 % lower in case of maximum competition (π_c=0.75)	10 % lower in case of maximum competition (π_c=0.90)
	25 % higher in case of monopoly (π_c=1.25)	10 % higher in case of monopoly (π_c=1.10)

Table 6

Assumptions on international scheduled services at Haneda.

Region	Airport, Counrty	September, 2010 (actual)		September, 2011 (actual)		September, 2013 (assumed)	
		No.of flights per week	Airlines	No.of flights per week	Airlines	No.of flights per week	Airlines
Asia & Oceania	Seoul/Gimpo, Rep. of Korea	56	JL (14), NH (14), KE (14), OZ (14)	84	JL (21), NH (21), KE (21), OZ (21)	112	JL (28), NH (28), KE (28), OZ (28)
	Seoul/Incheon, Rep. of Korea	2	OZ (2)	14	KE (7), OZ (7)	28	JL (7), NH (7), KE (7), OZ (7)
	Pusan, Rep. of Korea	2	OZ (2)	−	−	28	JL (7), NH (7), KE (7), OZ (7)
	Beijing/Capital, China	28	JL (7), NH (7), CA (14)	28	JL (7), NH (7), CA (14)	84	JL (21), NH (21), CA (21), CZ (21)
	Shanghai/Hongqiao, China	28	JL (7), NH (7), MU (7), FM (7)	28	JL (7), NH (7), MU (7), FM (7)	84	JL (21), NH (21), MU (21), FM (21)
	Hong Kong, China	11	JL (4), NH (7)	28	JL (7), NH (7), CX (14)	84	JL (21), NH (21), CX (21), HX (21)
	Dalian, China	−	−	−	−	28	JL (7), NH (7), CA (7), CZ (7)
	Taipei/Songshan, Chinese Taipei	−	−	56	JL (14), NH (14), CI (14), BR (14)	84	JL (21), NH (21), CI (21), BR (21)
	Hanoi, Vietnam	−	−	−	−	14	JL (7), VN (7)
	Ho Chi Minh, Vietnam	−	−	−	−	14	NH (7), VN (7)
	Bangkok/Intl, Thailand	−	−	21	JL (7), NH (7), TG (7)	28	JL (7), NH (7), TG (14)
	Kuala Lumpur/Intl, Malaysia	−	−	3	D7 (3)	14	NH (7), D7 (7)
	Kota Kinabalu, Malaysia	−	−	4	MH (4)	7	MH (7)
	Singapore/Changi, Singapore	−	−	28	JL (7), NH (7), SQ (14)	28	JL (7), NH (7), SQ (14)
	Vladivostok, Russia	−	−	−	−	7	S7 (7)
	Honolulu, USA	−	−	21	JL (7), NH (7), HA (7)	42	JL (14), NH (14), HA (14)
	Guam, USA	7	CO (7)	−	−	14	JL (7), CO (7)
Europe	London/Heathrow, UK	−	−	5	BA (5)	14	NH (7), BA (7)
	Paris/Charles De Gaulle, France	−	−	7	JL (7)	14	JL (7), AF (7)
	Frankfurt, Germany	−	−	−	−	28	JL (7), NH (7), LH (14)
	Amsterdam, the Netherlands	−	−	−	−	14	JL (7), KL (7)
North America	New York/John F. Kennedy, USA	−	−	7	AA (7)	14	NH (7), AA (7)
	Los Angeles/Intl, USA	−	−	14	NH (7), DL (7)	14	NH (7), DL (7)
	San Francisco/Intl, USA	−	−	7	JL (7)	14	JL (7), UA (7)
	Detroit/Metropolitan, USA	−	−	7	DL (7)	14	DL (14)
	Vancouver, Canada	−	−	−	−	14	NH (7), AC (7)
Total number of flights per week		134 (19 flights per day)		362 (52 flights per day)		840 (120 flights per day)	

Note: The same numbers are assumed on arrival.

Source: Japanese Civil Aviation Bureau.

Table 7

Market shares of direct and indirect connections in each market segment, September 2011.

Market segment	Direct connections		Indirect connections	
	Leisure passengers	Business passengers	Leisure passengers	Business passengers
1. Japan - Asia & Oceania (exc.Japan)	97.51%	96.54%	2.49%	3.46%
2. Japan - Europe	45.01%	48.94%	54.99%	51.06%
3. Japan - North America	64.76%	63.43%	35.24%	36.57%
4. Japan - Latin America	12.20%	35.28%	87.80%	64.72%
5. Japan - Middle East	70.40%	67.23%	29.60%	32.77%
6. Japan - Africa	0.00%	0.00%	100.00%	100.00%
7. Japan - Japan (domestic)	99.42%	99.28%	0.58%	0.72%
8. Japan - World (exc.Japan)	97.51%	96.52%	2.49%	3.48%

Table 8

Market shares of hub airports on indirect connections in each market segment before and after resumption of international scheduled services at Haneda.

1. Japan - Japan (domestic).

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	**Tokyo/Haneda**	**43.54%**	**44.57%**	**1**	**Tokyo/Haneda**	**44.00%**	**45.48%**	**1**	**Tokyo/Haneda**	**43.54%**	**44.57%**
2	Osaka/Itami	20.03%	19.29%	2	Osaka/Itami	25.51%	23.62%	2	Osaka/Itami	20.03%	19.29%
3	**Nagoya/Chubu**	**9.61%**	**9.62%**	**3**	**Nagoya/Chubu**	**9.46%**	**9.20%**	**3**	**Nagoya/Chubu**	**9.61%**	**9.62%**
4	Sapporo/Chitose	7.17%	7.50%	4	Sapporo/Chitose	6.13%	6.85%	4	Sapporo/Chitose	7.17%	7.50%
5	Fukuoka	7.04%	7.03%	5	Fukuoka	4.44%	4.52%	5	Fukuoka	7.04%	7.03%
6	Naha (Okinawa)	3.37%	4.29%	6	Naha (Okinawa)	2.81%	3.74%	6	Naha (Okinawa)	3.37%	4.29%
7	**Osaka/Kansai**	**3.34%**	**2.78%**	7	Sendai	2.52%	2.13%	**7**	**Osaka/Kansai**	**3.34%**	**2.78%**
8	Sendai	2.13%	1.76%	**8**	**Osaka/Kansai**	**1.98%**	**1.81%**	8	Sendai	2.13%	1.76%
9	Kagoshima	1.09%	0.94%	9	Kagoshima	0.88%	0.73%	9	Kagoshima	1.09%	0.94%
10	Komatsu (Kanazawa)	0.92%	0.69%	10	Niigata	0.80%	0.66%	10	Komatsu (Kanazawa)	0.92%	0.69%
	Others	1.76%	1.51%		Others	1.46%	1.25%		Others	1.76%	1.51%
(12)	Tokyo/Narita	0.56%	0.51%	(12)	Tokyo/Narita	0.48%	0.45%	(12)	Tokyo/Narita	0.56%	0.51%
	Total	100%	100%		Total	100%	100%		Total	100%	100%

2. Japan - Asia & Oceania (exc. Japan).

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Seoul/Incheon	31.92%	30.44%	1	Seoul/Incheon	34.94%	32.46%	1	Seoul/Incheon	31.30%	29.13%
2	Shanghai/Pudong	21.61%	21.78%	2	Shanghai/Pudong	19.28%	22.52%	2	Shanghai/Pudong	15.58%	18.32%
3	**Osaka/Kansai**	**5.38%**	**4.94%**	**3**	**Osaka/Kansai**	**5.30%**	**4.35%**	**3**	**Tokyo/Haneda**	**7.77%**	**8.83%**
4	Beijing/Capital	5.35%	7.06%	4	Pusan	5.10%	3.93%	4	Pusan	6.28%	4.73%
5	Pusan	5.28%	4.27%	5	Fukuoka	4.99%	4.19%	**5**	**Osaka/Kansai**	**6.00%**	**4.52%**
6	Fukuoka	5.19%	4.87%	6	Beijing/Capital	4.94%	5.98%	6	Beijing/Capital	5.92%	7.28%
7	Dalian	4.44%	4.04%	7	Dalian	4.46%	4.21%	7	Dalian	5.10%	4.77%
8	Taipei/Taoyuan	3.91%	3.77%	**8**	**Tokyo/Haneda**	**4.35%**	**4.85%**	8	Fukuoka	4.91%	4.16%
9	**Nagoya/Chubu**	**3.68%**	**3.38%**	9	Taipei/Taoyuan	3.34%	3.19%	9	Taipei/Taoyuan	3.25%	3.09%
10	**Tokyo/Haneda**	**2.98%**	**3.71%**	**10**	**Nagoya/Chubu**	**3.13%**	**2.77%**	**10**	**Nagoya/Chubu**	**3.20%**	**2.83%**
	Others	10.26%	11.76%		Others	10.17%	11.55%		Others	10.70%	12.35%
(11)	Tokyo/Narita	2.27%	2.43%	(11)	Tokyo/Narita	2.14%	2.31%	(12)	Tokyo/Narita	1.94%	2.02%
	Total	100%	100%		Total	100%	100%		Total	100%	100%

3. Japan - Europe.

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Frankfurt	14.34%	15.01%	1	Frankfurt	14.25%	14.74%	1	Frankfurt	18.25%	18.51%
2	Helsinki	12.52%	12.97%	2	Helsinki	11.92%	12.28%	2	Helsinki	9.77%	9.91%
3	Seoul/Incheon	10.39%	9.54%	3	Amsterdam	8.72%	8.23%	3	Paris/Charles de Gaulle	8.31%	8.31%
4	Munich	8.13%	8.64%	4	Seoul/Incheon	8.65%	9.17%	4	Amsterdam	8.30%	8.00%
5	Paris/Charles de Gaulle	8.10%	8.29%	5	Munich	7.93%	7.98%	5	Seoul/Incheon	7.69%	7.76%
6	Amsterdam	7.33%	7.15%	6	Paris/Charles de Gaulle	7.16%	7.12%	**6**	**Tokyo/Haneda**	**6.95%**	**8.11%**
7	London/Heathrow	5.17%	4.46%	7	London/Heathrow	5.30%	4.86%	7	London/Heathrow	6.61%	5.57%
8	Copenhagen	4.61%	4.30%	8	Copenhagen	4.72%	4.11%	8	Munich	6.42%	6.60%
9	Beijing/Capital	4.24%	3.37%	9	Beijing/Capital	4.33%	3.57%	9	Beijing/Capital	3.93%	3.20%
10	**Tokyo/Narita**	**4.12%**	**4.70%**	10	Moscow/Sheremetyevo	4.21%	3.93%	10	Copenhagen	3.64%	3.28%
	Others	21.05%	21.58%		Others	22.82%	24.02%		Others	20.13%	20.74%
(17)	Nagoya/Chubu	0.78%	0.98%	(13)	Tokyo/Narita	3.25%	3.81%	(11)	Tokyo/Narita	3.18%	3.65%
(18)	Osaka/Kansai	0.46%	0.75%	(17)	Tokyo/Haneda	1.59%	1.79%	(18)	Nagoya/Chubu	0.68%	0.82%
―	Tokyo/Haneda	0.00%	0.00%	(18)	Nagoya/Chubu	0.79%	0.92%	(19)	Osaka/Kansai	0.46%	0.65%
				(19)	Osaka/Kansai	0.44%	0.60%				
	Total	100%	100%		Total	100%	100%		Total	100%	100%

4. Japan - North America.

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Chicago/O'Hare	19.76%	16.53%	1	Chicago/O'Hare	17.93%	14.61%	1	Chicago/O'Hare	15.97%	11.81%
2	San Francisco	11.72%	14.77%	2	San Francisco	11.92%	13.76%	**2**	**Tokyo/Haneda**	**14.03%**	**16.08%**
3	**Tokyo/Narita**	**11.41%**	**10.71%**	3	Los Angeles	10.18%	11.07%	3	San Francisco	10.71%	13.18%
4	Los Angeles	8.79%	9.35%	**4**	**Tokyo/Narita**	**9.96%**	**9.00%**	**4**	**Tokyo/Narita**	**8.51%**	**7.70%**
5	Dallas-Fort Worth	6.53%	6.20%	5	Seoul/Incheon	6.52%	6.01%	5	Los Angeles	7.90%	8.20%
6	Minneapolis-Saint Paul	5.94%	5.39%	6	Dallas-Fort Worth	6.05%	5.57%	6	Detroit	5.89%	7.93%
7	Seoul/Incheon	5.86%	5.68%	7	Detroit	5.81%	7.86%	7	Vancouver	5.61%	8.02%
8	Detroit	5.78%	6.56%	8	Minneapolis-Saint Paul	5.36%	4.70%	8	Dallas-Fort Worth	5.28%	4.43%
9	Washington/Dulles	3.91%	3.86%	**9**	**Tokyo/Haneda**	**4.32%**	**5.90%**	9	Minneapolis-Saint Paul	4.81%	3.85%
10	Vancouver	3.71%	4.68%	10	Washington/Dulles	3.66%	3.40%	10	Seoul/Incheon	4.79%	4.38%
	Others	16.59%	16.26%		Others	18.29%	18.12%		Others	16.50%	14.42%
(19)	Osaka/Kansai	0.34%	0.41%	(18)	Osaka/Kansai	0.59%	0.46%	(18)	Osaka/Kansai	0.53%	0.40%
(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%
(—)	Tokyo/Haneda	0.00%	0.00%								
Total		100%	100%	Total		100%	100%	Total		100%	100%

5. Japan - Latin America.

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Dallas-Fort Worth	27.86%	23.46%	1	Dallas-Fort Worth	32.36%	28.00%	1	Dallas-Fort Worth	27.46%	22.52%
2	Houston	23.11%	24.49%	2	Houston	25.10%	25.89%	2	Houston	22.78%	23.50%
3	Los Angeles	17.43%	15.34%	3	Los Angeles	15.51%	15.91%	3	Los Angeles	17.66%	16.24%
4	Mexico City	13.27%	16.15%	4	Atlanta	8.26%	8.48%	4	Mexico City	13.08%	15.51%
5	Atlanta	6.06%	7.14%	5	San Francisco	5.49%	5.78%	5	Atlanta	5.98%	6.85%
6	Chicago/O'Hare	4.06%	3.48%	6	Chicago/O'Hare	2.68%	2.26%	6	Chicago/O'Hare	4.00%	3.34%
7	San Francisco	2.07%	1.88%	7	Toronto/Pearson	2.54%	3.39%	7	San Francisco	2.40%	2.40%
8	Toronto/Pearson	1.87%	2.84%	8	Newark	2.14%	2.86%	8	Toronto/Pearson	1.84%	2.73%
9	Newark	1.45%	2.15%	9	Salt Lake City	1.43%	1.23%	9	Newark	1.42%	2.06%
10	Salt Lake City	1.26%	1.06%	10	Vancouver	1.31%	1.19%	10	Salt Lake City	1.24%	1.02%
	Others	1.58%	2.00%		Others	3.20%	5.02%		Others	2.14%	3.83%
(—)	Tokyo/Narita	0.00%	0.00%	(—)	Tokyo/Narita	0.00%	0.00%	(—)	Tokyo/Narita	0.00%	0.00%
(—)	Osaka/Kansai	0.00%	0.00%	(—)	Osaka/Kansai	0.00%	0.00%	(—)	Osaka/Kansai	0.00%	0.00%
(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%
(—)	Tokyo/Haneda	0.00%	0.00%	(—)	Tokyo/Haneda	0.00%	0.00%	(—)	Tokyo/Haneda	0.00%	0.00%
Total		100%	100%	Total		100%	100%	Total		100%	100%

6. Japan - Middle East.

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Seoul/Incheon	18.96%	23.15%	1	Seoul/Incheon	20.95%	26.52%	1	Seoul/Incheon	19.91%	24.03%
2	Dubai	18.86%	16.12%	2	Dubai	17.70%	15.49%	2	Dubai	17.79%	15.60%
3	Doha	13.06%	10.41%	3	Doha	13.68%	11.10%	3	Doha	12.32%	10.08%
4	Beijing/Capital	10.14%	7.08%	4	Beijing/Capital	12.63%	8.49%	4	Beijing/Capital	11.72%	8.04%
5	Hong Kong	8.90%	5.57%	5	Hong Kong	9.31%	6.12%	5	Hong Kong	9.85%	6.34%
6	Abu Dhabi	6.84%	5.49%	6	Istanbul	7.01%	14.90%	6	Abu Dhabi	6.45%	5.31%
7	Istanbul	6.26%	15.04%	7	Abu Dhabi	6.67%	5.23%	7	Istanbul	5.90%	14.55%
8	Cairo	2.92%	2.51%	8	Bangkok/Suvarnabhumi	2.20%	1.32%	8	Cairo	2.77%	2.43%
9	Guangzhou	2.50%	1.47%	9	Guangzhou	2.16%	1.28%	9	Guangzhou	2.36%	1.42%
10	New Delhi	2.16%	1.46%	10	New Delhi	1.58%	0.98%	10	Bangkok/Suvarnabhumi	2.13%	1.31%
	Others	9.39%	11.70%		Others	6.12%	8.57%		Others	8.80%	10.89%
(13)	Tokyo/Narita	1.13%	2.21%	(12)	Tokyo/Narita	1.01%	2.06%	(13)	Tokyo/Narita	1.13%	2.13%
(16)	Osaka/Kansai	0.62%	1.31%	(13)	Osaka/Kansai	0.86%	1.64%	(15)	Osaka/Kansai	0.80%	1.49%
(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%
(—)	Tokyo/Haneda	0.00%	0.00%	(—)	Tokyo/Haneda	0.00%	0.00%	(—)	Tokyo/Haneda	0.00%	0.00%
Total		100%	100%	Total		100%	100%	Total		100%	100%

7. Japan - Africa.

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Cairo	15.15%	19.99%	1	Istanbul	18.93%	18.11%	1	Frankfurt	14.59%	12.63%
2	Istanbul	13.76%	11.42%	2	Rome/Fiumicino	12.63%	11.87%	2	Cairo	13.56%	18.11%
3	Rome/Fiumicino	12.67%	9.65%	3	Paris/Charles de Gaulle	12.51%	14.76%	3	Istanbul	12.32%	10.35%
4	Paris/Charles de Gaulle	10.42%	10.15%	4	Dubai	11.25%	10.84%	4	Paris/Charles de Gaulle	12.28%	12.19%
5	Frankfurt	10.33%	9.13%	5	Frankfurt	11.19%	13.43%	5	Rome/Fiumicino	11.34%	8.74%
6	Dubai	9.82%	7.87%	6	Doha	10.08%	9.00%	6	Dubai	8.79%	7.13%
7	Doha	8.78%	6.09%	7	Beijing/Capital	8.93%	8.21%	7	Doha	7.86%	5.52%
8	Beijing/Capital	4.56%	4.81%	8	Abu Dhabi	3.46%	2.69%	8	Beijing/Capital	4.13%	4.52%
9	**Tokyo/Narita**	**2.26%**	**6.88%**	9	Bangkok/Suvarnabhumi	2.23%	2.25%	9	London/Heathrow	2.86%	2.09%
10	London/Heathrow	1.76%	1.31%	10	London/Heathrow	2.08%	2.58%	**10**	**Tokyo/Narita**	**2.02%**	**6.24%**
	Others	10.49%	12.70%		Others	6.70%	6.27%		Others	10.24%	12.48%
(12)	Osaka/Kansai	1.52%	4.69%	(—)	Tokyo/Narita	0.00%	0.00%	(12)	Osaka/Kansai	1.40%	4.36%
(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Osaka/Kansai	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%
(—)	Tokyo/Haneda	0.00%	0.00%	(—)	Nagoya/Chubu	0.00%	0.00%	(—)	Tokyo/Haneda	0.00%	0.00%
				(—)	Tokyo/Haneda	0.00%	0.00%				
Total		100%	100%	Total		100%	100%	Total		100%	100%

8. Japan - World (exc. Japan).

September, 2010				September, 2011				September, 2013			
Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business	Rank	Airport	Leisure	Business
1	Seoul/Incheon	31.88%	30.30%	1	Seoul/Incheon	34.90%	32.32%	1	Seoul/Incheon	31.26%	28.98%
2	Shanghai/Pudong	21.58%	21.66%	2	Shanghai/Pudong	19.26%	22.39%	2	Shanghai/Pudong	15.55%	18.20%
3	**Osaka/Kansai**	**5.37%**	**4.91%**	**3**	**Osaka/Kansai**	**5.29%**	**4.32%**	**3**	**Tokyo/Haneda**	**7.77%**	**8.84%**
4	Beijing/Capital	5.35%	7.03%	4	Pusan	5.10%	3.90%	4	Pusan	6.27%	4.70%
5	Pusan	5.27%	4.24%	5	Fukuoka	4.98%	4.17%	**5**	**Osaka/Kansai**	**5.99%**	**4.50%**
6	Fukuoka	5.18%	4.84%	6	Beijing/Capital	4.94%	5.96%	6	Beijing/Capital	5.91%	7.24%
7	Dalian	4.43%	4.01%	7	Dalian	4.45%	4.18%	7	Dalian	5.09%	4.74%
8	Taipei/Taoyuan	3.91%	3.74%	**8**	**Tokyo/Haneda**	**4.35%**	**4.85%**	8	Fukuoka	4.91%	4.13%
9	**Nagoya/Chubu**	**3.68%**	**3.36%**	9	Taipei/Taoyuan	3.33%	3.17%	9	Taipei/Taoyuan	3.24%	3.07%
10	**Tokyo/Haneda**	**2.98%**	**3.68%**	**10**	**Nagoya/Chubu**	**3.12%**	**2.75%**	**10**	**Nagoya/Chubu**	**3.20%**	**2.81%**
	Others	10.38%	12.22%		Others	10.28%	11.98%		Others	10.81%	12.79%
(11)	Tokyo/Narita	2.28%	2.45%	(11)	Tokyo/Narita	2.15%	2.33%	(12)	Tokyo/Narita	1.95%	2.04%
Total		100%	100%	Total		100%	100%	Total		100%	100%