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Fleet Strategies in Business Aviation Segment: Homogeneity Versus Heterogeneity

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Abstract. Compared with many studies focused on business models and strategies of scheduled airlines, the evident research gap exists in the field of strategies in business aviation segment. Business models in business aviation segment are defined entirely according to an ownership status, respectively nature of operation. Complex analysis of business aviation airlines strategies is absent despite the dynamics of the business aviation segment. In our research we have focused on identifying different fleet strategies in business aviation segment since the fleet is the basic asset of an airline. By comparing several fleet aspects of 30 business aviation operators in three world regions we have proved the existence of different fleet strategies in business aviation segment and therefore the need for further and more complex research of business models in the particular segment.

Keywords: business aviation, fleet, strategy, homogeneity, heterogeneity, business model.

JEL Classification: R49, M20.

Conference topic: Modern Business Management Problems and Perspectives.

Introduction

The development of business aviation segment in different world regions is expected and the presence of business aviation in the North America and Europe is already evident and becomes more significant. For example, in 2012 in the North America, approximately 64% business aircraft from the total number of business aircraft in the world were registered (NEXA Advisors 2013). In 2011 in Europe, 7.1% of the total number of flights accounted just business flights (Oxford Economics 2012). Despite of the dynamic development of business aviation segment the evident research gap exists in the field of strategies in business aviation segment especially when compared with many studies focused on business models and strategies of scheduled airlines. Business models in business aviation segment are defined entirely according to an ownership status, respectively nature of operation and three basic models are distinguished: on-demand charter, fractional ownership and full ownership. With the on-demand charter business aviation airlines, the customers don't have the share on the aircraft ownership and pay only for appropriate services (in other words they use aircraft on a pay-as-you-go basis). In fractional ownership separate parties share the ownership of aircraft and split flying time and costs. In full ownership model the individual or company in different sector owns an aircraft (Oxford Economics 2012; GBTA 2011).

One of the general definitions of business model says: "A business model describes the rationale of how an organization creates, delivers and captures value" (Osterwalder, Pigneur 2013). Definition of business aviation business models only according to an ownership status is insufficient and complex analysis of business aviation airlines models and strategies is absent. Also the basic definition of business aviation is not uniform and different organizations provide their own definitions. Federal Aviation Authority defines busines aviation as any use of general aviation for business purpose (NBAA 2010). Eurocontrol uses definition based on types of aircraft used (Eurocontrol 2006). International Business Aviation Council provides more detailed view on busines aviation definition with three subcategories – commercial business aviation, corporate business aviation and business aviation operated by owner (EBAA 2015), which are above mentioned existing defined business models of business aviation. International Civil Aviation Organization even doesn't provide definition of business aviation (EBAA 2015).

Based on the research gap in business aviation business models and strategies, the first step in our long-term research and the aim of this paper is to analyse the fleet strategies and differences of business aviation airlines providing charter flights (on-demand charter).

The fleet is the basic asset of an airline and forms the significant part of product portfolio (Sherali *et al*. 2005). Brüggen and Klose (2010) analyses how fleet commonality influences operating performance of low-cost airlines and claims that the fleets are capital intensive and long-lived, thus determining the performance of airlines for years. Belánger *et al.* (2006) focuses on fleet assignment problem of scheduled airlines. Dožić and Kali (2015) also focuses on methodological approach for the fleet planning process. Authors deales with fleet size and f leet composition. But all mentioned studies focuses only on scheduled airlines, not on business aviation airlines which provide flights on-demand, so the schedule factor is not relevant.

Study of NEXA Advisors (2013) provides overview of business aircraft registrations by type (jets and turbo-props) in the world regions. Roland Berger Business Aviation Study (Roland Berger Strategy Consultants 2011) provides historic development of the business jet market and market forecast. Hovewer both studies focuses only on aircraft type market overview, not on fleet composition and fleet strategies of particular business aviation airlines. Therefore the aim of this paper is to analyse fleet aspects of 30 business aviation airlines in three world regions.

Methods

To investigate fleet strategies of business aviation airlines a comparative and quantitative analysis is employed. We have analysed 30 business aviation airlines (Table 1) in three world regions – Europe, North America and Asia (10 business aviation airlines in each selected region). Due to the major development of business aviation, Europe and North America were selected. In Asia dynamic development of business aviation is expected. Particular business aviation airlines were selected according to the availability of necessary data and randomly since there is no complex database of business aviation operators.

Table 1. Overview of analysed business aviation airlines (Source: authors based on database)

	Business aviation airline	Headquarter	Establishment
EUROPE	Abelag	Belgium	1964
	ABS Jets	Czech Republic	2004
	Air Alsie	Denmark	1988
	Air Hamburg	Germany	2001
	CAT Aviation	Switzerland	1987
	Executive Airlines	Spain	2010
	FAI	Germany	1986
	Flying Group	Belgium	1995
	Jetflite	Finland	1980
	TAG Aviation	Switzerland	1998
NORTH AMERICA	Avjet	USA	1979
	Blackcomb Aviation	Canada	1989
	Clay Lacy	USA	1968
	Excelaire	USA	1985
	Jet Edge	USA	2007
	Landmark Aviation	USA	1957
	Martin Air	USA	1986
	Meridian Air Charter	USA	1946
	Priester Aviation	USA	1945
	West Coast Charter	USA	1987
ASIA	Airfast Indonesia	Indonesia	1971
	Arab Wings	Jordan	1975
	Executive Aviation Taiwan Corp.	Taiwan	2010
	Princely Jets	Pakistan	2005
	Raymond Aviation	India	1996
	Royal Jet	UAE	2003
	Sabah Air	Malaysia	1975
	Spanair	India	1995
	Swan Aviation	Turkey	2007
	Tajair	India	1996

Firstly, for analysis of business aviation airlines' fleet, we needed to collect a raw data of the companies' fleet. The only source of necessary data was the official websites of analysed companies.

For each aircraft in airlines' fleet we collected data about its capacity (in passengers number) and its range (in km). Based on these data it was possible for each airline to determine or compute following aspects of fleet:

– Total number of aircraft in fleet;
– Number of aircraft' types in fleet;
– Number of aircraft of specific type;
– Herfindahl-Hirschmann index;
– Total capacity supply (in passengers number);
– Weighted average capacity of aircraft in fleet;
– Capacity spectrum of fleet – minimum and maximum capacity of particular aircraft in fleet;
– Maximum range (in km) – maximum possible range of particular aircraft in fleet.

Herfindahl- Hirschmann index (HHI) is frequently used index for measuring market concentration. HHI in applied version can be used for measuring diversity or in other words homogeneity or heterogeneity of airlines' fleet. HHI works with the total number of aircraft in fleet and share of the particular aircraft type in relation to whole fleet in line with the following formula:

$$HHI = \sum_{i=1}^{n} s_i^2 , \tag{1}$$

where:
s_i – share of one aircraft type in relation to the total number of aircraft in fleet;
n – total number of aircraft in fleet.

Value interval of HHI ranges from 0 to 1. Value 1 indicates homogenous fleet. It means that airline' fleet consists only of one type of aircraft. At the other side values closed to 0 indicate heterogenous or diverse fleet consisting of many types of aircraft in fleet.

Total capacity supply (CS) was computed as sum of the capacity of each aircraft in airline' fleet in line with the following formula:

$$CS = \sum_{i=1}^{n} c_i , \tag{2}$$

where:
c_i – capacity of particular aircraft in fleet.

Weighted average capacity of aircraft in fleet ($\overline{C}_a$) was computed as multiple of capacity and appropriate number of aircraft with this capacity, divided by total number of aircraft in fleet in line with the following formula:

$$\overline{C}_a = \frac{c_1.a_1 + c_2.a_2 + ... + c_n.a_n}{a_1 + a_2 + ... + a_n} , \tag{3}$$

where:
c_1 – capacity of the aircraft;
a_1 – multitude of the aircraft.

On the basis of created database of analysed airlines' fleet aspects (available to see in Appendix 1) we made a comparative analysis of these aspects focused mostly on:

– Corelation between fleet size and level of fleet diversity expressed throught HHI;
– Maximum possible range of particular aircraft in fleet;
– Capacity spectrum of fleet.

Research results and discussion

Fleet size and HHI index

The airline fleet can be described by the total number of aircraft and the specific types of aircraft that it operates (Neufville *et al.* 2013). In the Figure 1 is shown relation between fleet size expressed in total number of aircraft in fleet and fleet diversity expressed throught HHI. As we mentioned before, values of HHI that are close to 1 indicate homogenous fleet and values that are close to 0 indicate heterogenous fleet. Analysed business aviation airlines have

HHI values ranging from 0.03 to 0.42. Low values of business aviation airlines' HHI point out the variety of business aviation airlines' fleets. Mainly by comparing with the fleet of scheduled airlines, where legacy carriers operate mixed fleets and fleet of low cost carriers consisting of one type of aircraft (Hussain, Sahay 2006), business aviation airlines have relatively low values of HHI and so diverse fleet. But despite of this, it is also possible to identify differences in diversity of business aviation airlines' fleets.

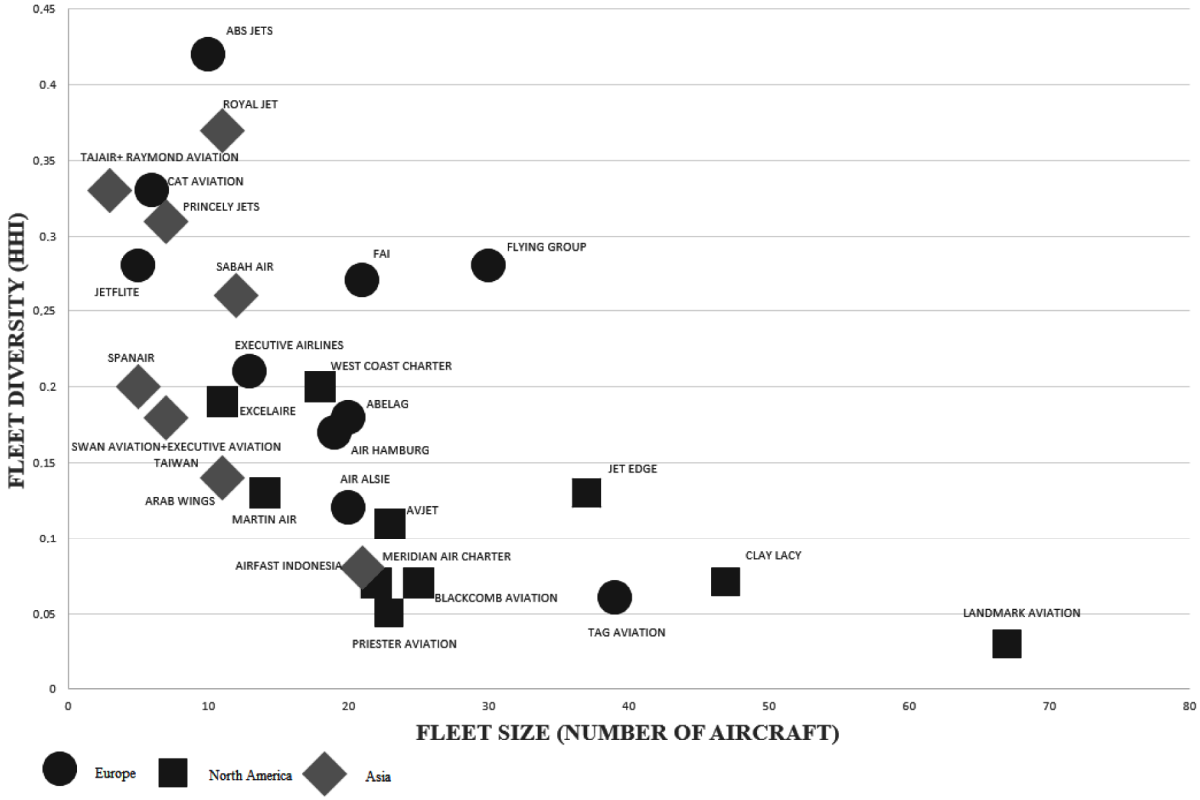

Fig. 1. Relation between fleet size and HHI (Source: authors)

In Figure 1 the dependence of the HHI (fleet diversity) on the size of the fleet is evident. The larger fleet of the airlines is, the more diverse it is. When comparing the fleet in the world regions, the largest and most diverse fleets have business aviation airlines in North America. European and Asian business aviation airlines have different levels of fleet diversity but fleets of European business aviation airlines are more numerous.

We divided Figure 1 to the four equal segments according to the interval of values with the aim to define different fleet strategies of analysed business aviation airlines:

1. *Large and heterogenous fleet* – number of aircraft in fleet >33; HHI < 0.21.
   Business aviation airlines in this segment are focused on offering large scale of different types of aircraft and therefore they are able to satisfy requirements of wide customer's portfolio. From analysed business aviation airlines only three from North America (Landmark Aviation, Clay Lacy and Jet Edge) and TAG Aviation from Europe dispose of large number of aircraft in fleet and simultaneously of very heterogenous fleet. Landmark Aviation has amongst all analysed airlines the largest and the most diverse fleet (67 aircraft and HHI = 0.03).
2. *Small and heterogenous fleet* – number of aircraft in fleet ≤33; HHI < 0.21.
   Business aviation airlines in this segment have still diverse fleet so customers can choose from different types of aircraft. But overall number of aircraft in fleet declines in comparison with the first segment which means that particular airlines can transport fewer passengers at one time. The majority of analysed airlines (approximately 53.3%) dispose of small and heterogenous fleet.
3. *Small and homogenous fleet* – number of aircraft in fleet ≤33; HHI ≥ 0.21.
   The third segment consists of airlines with a smaller number of aircraft in fleet and simultaneously smaller number of aircraft types. Smaller and not very diverse fleet has approximately 33.3% of analysed airlines.
4. *Large and homogenous fleet* – number of aircraft in fleet >33; HHI ≥ 0.21.
   The case of large and concentrated fleet is not occurred. It is again reassuring depence that if a company owns a large number of aircraft in fleet, the fleet is diverse and thus the HHI declines.

From the results is obvious that business aviation airlines adopt different strategies in terms of fleet size and diversity. Decision about the fleet composition is for airline significant. Rosskopf *et al.* (2014) use fleet optimization model that determines the optimal fleet composition in terms of number and type of aircraft. Merkert and Henshe (2011) argue that mixed fleets have significant impact on airline efficiency.

Maximum range

The individual aircraft types have different performance characteristics. The range of an aircraft is the maximum distance it can fly without stopping for additional fuel, while still carrying a reasonable payload of passengers and/or cargo (Neufville *et al.* 2013). In Figure 2 is comparison of maximum possible range of aircraft in fleets of analysed business aviation airlines. Lozano and Gutiérrez (2011) explain that airlines may operate more short-range or more long-range aircraft and this leads to different fleets characteristics. Maximum possible range of particular aircraft in fleets of airlines varies between 1852 km and 14 816 km. Precise values of maximum possible range of aircraft in fleets of analysed airlines are in tables in Appendix 1.

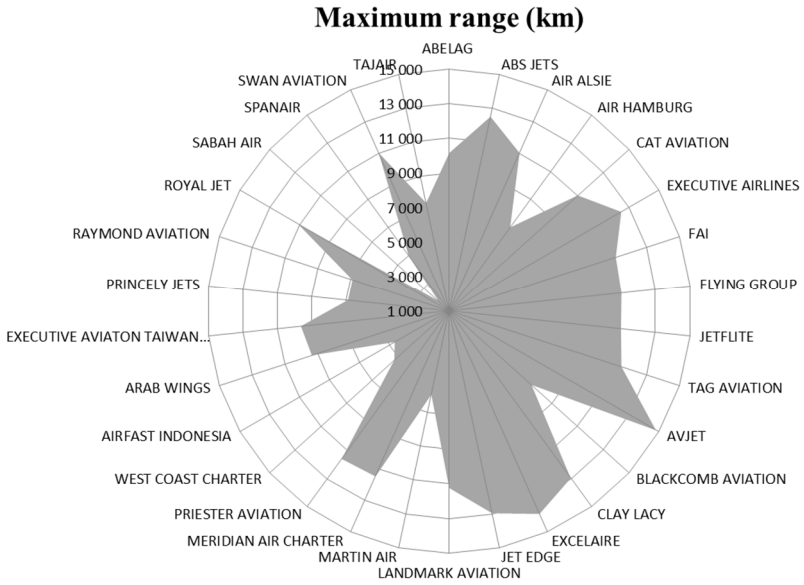

Fig. 2. Maximum possible range of aircraft in fleets (Source: authors)

Not all analysed business aviation airlines have in fleet aircraft with long range and thus provide transport only for short or medium distances. Predominantly within the Asian business aviation airlines the long range aircraft is a rarity. Only Royal Jet and Swan Aviation have long range aircraft (11 112 km and 11 020 km, respectively). At the other side European airlines are able to transport passengers for long distances, with the exemption of Air Hamburg.

Capacity spectrum

Similarly as range, the capacity of different aircraft types varies too. Business aviaton user can choose from large scale of aircraft also according to capacity. Customers' capacity requirements vary between the need to transport one passenger to the need to transport larger group of passengers. Cadarso and Marín (2013) deal with scheduling problem (which is hovewer not relevant for business aviation) and different capacity of aircraft, which should meet the demand. For this reason we made a comparison of capacity spectrum of analysed business aviation airlines' fleet (Fig. 3). We chose aircraft with minimum capacity and aircraft with maximum capacity from each airline' fleet. It was therefore possible to examine whether the airline is focused on transporting smaller or larger group of passengers or if airline has a broad range of capacitance and thus is able to satisfy the demand of different customers. In Figure 3 is capacity spectrum of particular airlines' fleet expressed by horizontal column. Weighted average capacity of aircraft in fleet is expressed by black point. For better visualization of capacity spectrum we didn't involve the maximum capacity of Asian airlines – Airfast Indonesia and Royal Jet in Figure 3. We can observe the deviation in fleet structure of mentioned airlines since Airfast Indonesia dispose of McDonnell Douglas MD-83 with the capacity 150 passengers and Royal Jet dispose of six Boeing Business Jets with the capacity 46 passengers. Aircraft with high capacity in the fleet of mentioned Asian airlines distort the overall capacity results.

We can observe that the capacity spectrum of analysed airlines' fleet is diverse. With the exemption of Airfast Indonesia and Royal Jet, the capacity spectrum of analysed Asian business aviation airlines is narrower than capacity spectrum of airlines in Europe and North America.

Weighted average capacity of aircraft in fleet allows defining the usage of predominantly low capacity or high capacity aircraft. Values of weighted average capacity of aircraft in fleet again vary amongst analysed airlines, but aircraft with lower capacity are operated mostly in Asian region. If two airlines have the same capacity spectrum it doesn't have to mean that they have also the same weighted average capacity of aircraft in fleet. The reason is that the aircraft with lower or higher capacity can prevail in the fleet. For example, ABS Jets and FAI have the same value of capacity spectrum (from 7 to 18) but different weighted average capacity of aircraft in fleet (13.1 and 12, respectively).

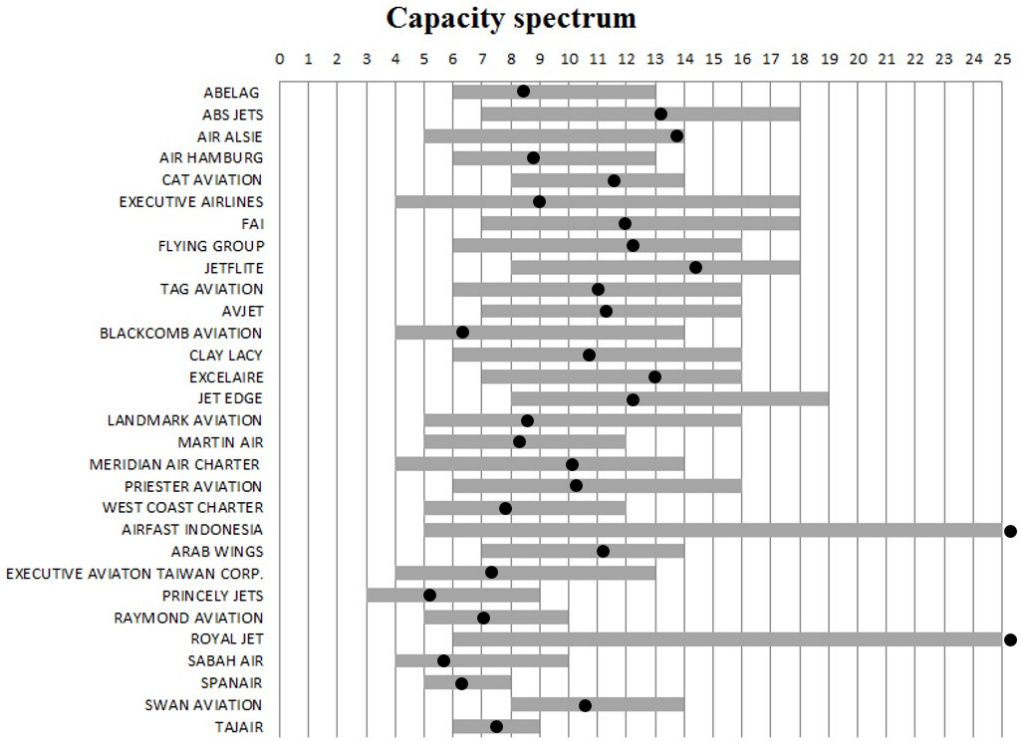

Fig. 3. Capacity spectrum of analysed business aviation airlines (Source: authors)

Conclusions

Analysis of fleet aspects on the sample of 30 business aviation airlines revealed that business aviation airlines apply different fleet strategies. The fleets differ in terms of size and also in terms of diversity. Only a few from analysed business aviation airlines can be described as "big players" with large and heterogenous fleet. Approximately 53.3% of analysed airlines dipose of small and heterogenous fleet and the rests dispose of small and simultaneously homogenous fleet. None from analysed airlines applies strategy of large and homogenous fleet. The dependence of the HHI (fleet diversity) on the size of the fleet is evident – if a company owns a large number of aircraft in fleet, the fleet is diverse and thus the HHI declines. Differences occur among the world regions also. From analysed business aviation airlines in North America, none have less diverse fleet. Except TAG Aviation, European and Asian airlines dispose of smaller fleet size. Maximum range and capacity spectrum of fleets vary significantly, too. By comparing several fleet aspects of 30 business aviation operators in three world regions we have proved the existence of different fleet strategies in business aviation segment and therefore the need for further and more complex research of business models in the particular segment which would take into account various components of business model.

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Disclosure statement

We declare that we don't have any competing financial, professional, or personal interests from other parties.

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Appendix 1

Table 2. Fleets aspects of business aviation airlines in Europe (Source: authors)

EUROPE								
Business aviation airline	Fleet	Aircraft' types number	HHI	Total capacity supply	Weighted average capacity	Minimum aircraft capacity	Maximum aircraft capacity	Maximum range (km)
Abelag	20	7	0.18	167	8.4	6	13	10 150
ABS Jets	10	4	0.42	131	13.1	7	18	12 501
Air Alsie	20	12	0.12	278	13.9	5	14	11 019
Air Hamburg	19	9	0.17	169	8.9	6	13	7 000
CAT Aviation	6	4	0.33	71	11.8	8	14	11 019
Executive Airlines	13	8	0.21	117	9.0	4	18	12 501
FAI	21	5	0.27	156	12.0	7	18	11 140
Flying Group	30	11	0.28	367	12.2	6	16	11 027
Jetflite	5	4	0.28	72	14.4	8	18	11 000
TAG Aviation	39	26	0.06	430	11.0	6	16	11 482

Table 3. Fleets aspects of business aviation airlines in North America (Source: authors)

NORTH AMERICA								
Business aviation airline	Fleet	Aircraft' types number	HHI	Total capacity supply	Weighted average capacity	Minimum aircraft capacity	Maximum aircraft capacity	Maximum range (km)
Avjet	23	14	0.11	261	11.3	7	16	14 816
Blackcomb Aviation	25	17	0.07	160	6.4	4	14	7 408
Clay Lacy	47	24	0.07	506	10.8	6	16	12 964
Excelaire	11	7	0.19	143	13.0	7	16	13 853
Jet Edge	37	12	0.13	451	12.2	8	19	12 964
Landmark Aviation	67	40	0.03	543	8.6	5	16	11 242
Martin Air	14	9	0.13	118	8.4	5	12	5 955
Meridian Air Charter	22	16	0.07	223	10.1	4	14	11 482
Priester Aviation	23	20	0.05	237	10.3	6	16	11 587
West Coast Charter	18	14	0.2	143	7.9	5	12	5 278

Table 4. Fleets aspects of business aviation airlines in Asia (Source: authors)

ASIA								
Business aviation airline	Fleet	Aircraft' types number	HHI	Total capacity supply	Weighted average capacity	Minimum aircraft capacity	Maximum aircraft capacity	Maximum range (km)
Airfast Indonesia	21	14	0.08	753	35.9	5	150	4 635
Arab Wings	11	9	0.14	123	11.2	7	14	9 360
Executive Aviation Taiwan Corp.	7	6	0.18	51	7.3	4	13	9 630
Princely Jets	7	4	0.31	36	5.1	3	9	6 884
Raymond Aviation	3	3	0.33	21	7.0	5	10	6 886
Royal Jet	11	4	0.37	325	29.5	6	46	11 112
Sabah Air	12	6	0.26	69	5.8	4	10	1 852
Spanair	5	5	0.2	32	6.4	5	8	5 000
Swan Aviation	7	6	0.18	74	10.6	8	14	11 020
Tajair	3	3	0.33	23	7.7	6	9	7 408