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# THE ROLE OF NATIONAL/REGIONAL IDENTITY IN AIRCRAFT ORDERING

*Martin Grančay*

## **Abstract**

The goal of this paper is to analyze impacts of the factor of national/regional identity on aircraft ordering by airlines and other corporate clients. The main focus is on Airbus and Boeing as these are the most important airliner producers of today. After an extensive study of aircraft orders from the past 20 years we come to a conclusion that national/regional identity plays a significant role – North American clients prefer Boeing whereas customers from Europe favor Airbus. The significance of this factor is higher in North America. Also, we take a look at aircraft orders in other regions of the world.

**Key words:** Airbus, Boeing, aircraft producers, civil aviation, national interest

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## **1. Introduction**

Air transport is undoubtedly one of the most important sectors of today's world economy. It enables global distribution of valuable and perishable goods and supports movement of people. It is possible to transport almost anything between any two points in the world within 24 hours. What makes air transport even more important is its link to research and development. On one hand it is the preferred method of shipping for hi-tech goods and expensive technologies; on the other hand air transport itself is one of the most progressive and technologically equipped sectors of the world's economy.

The demand for air transport is determined by various factors: price, income, service attributes, quality and exchange rates (Holloway, 2008) to mention a few. The selection of airline to fly with depends on price, service attributes, quality, frequent flyer program and customer loyalty. Another important factor might be nationality: Many US citizens prefer flying with a US airline to using services of other airlines. Similarly, many Europeans would choose a European airline over foreign companies. The reasons for this behavior include national pride, confidence in domestic quality, desire to understand the language spoken by the crew etc.

The question of national identity and its importance in decision making also comes forward in aircraft ordering. However, this issue has been paid little attention by researchers yet. Therefore the main objective of the presented paper is to analyze the role of national/regional identity in aircraft ordering by airlines and other customers. We focus on the two major aircraft manufacturers of today: Airbus and Boeing. We anticipate existence of a strong relation between national/regional identity of the client and the

aircraft manufacturer chosen. It is expected that American customers have a strong propensity to order Boeing aircraft, whereas European customers have a strong propensity to order Airbus models.

The paper consists of six sections. After a brief introduction we present a summary of the world's major aircraft manufacturers and compare the main characteristics of the models produced. The third section describes the data sources used and the fourth section analyzes the methodology of our research. The results of the research are presented in section 5 – we analyze total aircraft orders, orders for narrow-body aircraft, wide-body aircraft, orders for all currently produced models and compare orders for the A350-XWB and B787 “Dreamliner.” The last section summarizes the research and elaborates Airbus/Boeing order matrixes by world region.

## **2. World's major aircraft manufacturers**

The most important aircraft manufacturers of today are Boeing Commercial Airplanes (Renton, WA) and Airbus S.A.S. based in French city of Toulouse. These are the only companies offering wide variety of aircraft ranging from 110-passenger short-haul Boeing 737-600 to 850-passenger long-haul Airbus A380. Owing to high capital intensity of aircraft development and production there are currently no other countries in the world able to compete successfully with Airbus and Boeing. However, there are some companies specializing in production of regional jets. This group includes Bombardier (Canada) and Embraer (Brazil), recently joined by ACAC (China), Sukhoi (Russia) and Mitsubishi Aircraft Corporation (Japan). Other notable civil aircraft producers are Antonov (Ukraine), Tupolev, Ilyushin (Russia) and ATR (France, Italy).

According to official statistics of Boeing there were 19,000 commercial airliners in service in 2007; the prognosis for 2027 is 36,000 aircraft (Boeing, 2008, p.3). Predictions of other institutions are similar: Rolls-Royce expects the 2026-fleet size to be 39,000 (Rolls-Royce, 2007, p. 25), JADC 35,500 (JADC, 2007, p. 4) and Airbus 33,000 aircraft (Airbus, 2007, p. 7). Another study, named CONSAVE 2050 develops various scenarios until the year 2050. According to these, the number of commercial airliners in service in 2050 will be between 23,400 and 105,600 (Berghof and Schmitt, 2005, p. 10).

From 19,000 commercial airliners in service in 2007, more than 16,000 were Boeings or Airbuses. It is therefore adequate to label aircraft market as highly duopolistic. This is the reason why the presented paper focuses entirely on Airbus and Boeing.

### *2.1. Boeing*

Boeing is the worldwide leader in civil aircraft production. This fact can be explained primarily on historic grounds – it has been on the market for decades longer than its main rival, Airbus. The history of the company began in 1916, the year when William E. Boeing performed his first flight on a self-made aircraft. Over the next couple of decades Boeing's name was used by airlines as well as aircraft producers. A very

important milestone in Boeing's history was the end of the 1950s marked by inauguration of the first American commercial jet airliner – 707. Thus, the era of Boeing has begun. Ten years later, the company introduced its most famous product – the 747 Jumbo Jet. More than 1400 747s have been delivered until today. Another iconic product is the 737, with over 8.000 pieces sold being the most ordered commercial airliner ever ([www.boeing.com](http://www.boeing.com)).

Boeing as we know it today was established in 1996 after merging with another U.S. aircraft producer McDonnell Douglas. Apart for Airbus and Boeing models, the MD-11, MD-80, MD-90 and MD-95 in final phases of development were the most important products on the commercial aircraft market of the 90s. The merger of Boeing and McDonnell Douglas has therefore led to duopolization of the market.

Today, production lines of Boeing manufacture 4 aircraft models in multiple variants: the 737, 747, 767 and 777. Boeing 787 Dreamliner is in final stages of the development process – with 840 orders even before the first test flight the aircraft is considered the fastest selling commercial airliner ever. As of August 1<sup>st</sup> 2009 manufacturer's backlog counts 3,469 aircraft ([www.boeing.com](http://www.boeing.com)).

## *2.2. Airbus*

Airbus, as a consortium of European aerospace manufacturers was established in 1970. France's Aerospatiale and Germany's Deutsche Airbus each took a 50 per cent stake. The aim of the consortium was to create a European aircraft manufacturer that would be able to compete successfully with US producers that dominated the market since World War II. The international cooperation led to the development of the world's first wide-body twin-engine jet airliner Airbus A300.<sup>1</sup> Later in the 1970s Spain's CASA and United Kingdom's Aerospace joined the consortium.

Owing to the fact that consortium model has multiple disadvantages in the areas of cost management, logistics and employee commitment, in 2001 Airbus was transformed into a joint stock company. The majority owner is the European Aeronautic Defence and Space Company (EADS). Today Airbus has assembly halls in three countries in Europe – Germany, France, Spain – and has recently opened a new plant in China as a part of its strategy of penetrating this Asian market.

Currently production lines of Airbus manufacture 4 aircraft models – the A320, A330, A340 and A380 Superjumbo, the largest commercial airliner ever produced able to seat 853 passengers. Another airliner – the A350XWB – is currently under development with first test flight planned for 2011 and first delivery to customer expected in 2013. As of August 1<sup>st</sup> 2009 Airbus's backlog counts 3,529 aircraft ([www.airbus.com](http://www.airbus.com)).

Table 1 presents total orders and deliveries of all currently marketed Airbus and Boeing models as of October 31<sup>st</sup> 2009.

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<sup>1</sup> Boeing 747 was the world's first wide-body airliner, however, it has 4 engines.

*Table 1: Orders and deliveries of Airbus and Boeing aircraft as of 10/31/2009*

<b>Model</b>	<b>A320</b>	<b>A330</b>	<b>A340</b>	<b>A350</b>	<b>A380</b>	<b>B737</b>	<b>B747</b>	<b>B767</b>	<b>B777</b>	<b>B787</b>
<b>Orders</b>	6414	1031	384	493	200	8300	1523	1036	1116	840
<b>Deliveries</b>	4046	647	370	0	20	6199	1416	980	816	0

Source: [www.airbus.com](http://www.airbus.com) and [www.boeing.com](http://www.boeing.com).

It is obvious that the vast majority of orders (more than 70 per cent) are orders for the Boeing 737 and Airbus A320 aircraft. These are currently the only Western-made single-aisle commercial airliners on the market. Flexibility and cost advantages are some of the reasons of their high popularity and market dominance. They may be efficiently used to serve practically any intra-continental city pair and are thus the preferred aircraft model for low-fare airlines. Ryanair, for example, the largest European airline by scheduled passengers carried, has entirely based its operating model on Boeing 737s. The Shanghai-based Spring Airlines operates an all-A320 fleet. Although the first variants of these aircraft were originally introduced decades ago (the B737 in year 1967 and the A320 in 1988) they are still popular and manufacturers periodically introduce new, more efficient and ecologic variants. Boeing currently markets the B737-900 and the B737-900ER. After introducing the A320 in 1988, Airbus added the A321 in 1994, the A319 in 1996 and commenced production of the A318 in 2003.<sup>2</sup>

The other end of the market is dominated by the Boeing 747 and Airbus A380 – long-haul high-capacity icons of the modern air transport. While the Boeing 747 Jumbo Jet was first introduced in 1969, the Airbus A380’s maiden commercial flight took place in October 2007. Both models can be considered direct competitors, although their technical specifications are considerably different. Maximum capacity of the A380 in all economy class configuration is 853, which exceeds maximum capacity of the Boeing 747 by 50 per cent (550 passengers). The A380 dominates in all other technical specifications – such as wingspan, maximum takeoff weight, tail height, fuel consumption – as well. To compete with its rival Boeing has announced a new 747, dubbed 747-8I; however, as it has only been able to secure 20 orders from 1 customer so far (Lufthansa), the future of the project is doubtful. Airbus has two hundred A380s on order backlog, as of October 31<sup>st</sup> 2009. While this number lags behind expectations as well, high growth of Middle Eastern and East Asian markets is expected to increase customers’ interest in the A380 in the years to come.<sup>3</sup>

Both B747 and A380 are typical intercontinental airliners, but they have also been used on some high-density short-haul routes. Singapore Airlines utilizes the A380 on the high-profit Singapore-Hong Kong route (1,594 mi.). The shortest regular A380 route to date is Sydney-Auckland (1,340 mi.) operated by Emirates. No airline operates the A380 in its maximum 850-passenger configuration; they generally seat 300-400 passengers less.

<sup>2</sup> The A318, A319, A320 and A321 are considered variants of the A320.

<sup>3</sup> The A380’s largest customer – Emirates Airlines – with 58 Superjumbos on order has already indicated possible interest in more aircraft.

The A330, A340, B767 and B777 are typical examples of modern wide-body long-range aircraft. The 767 and 777 have been in production since 1982 and 1995. The A330 and A340 entered service in 1993. The best performer from this group is generally considered to be the Boeing 777 – it has the most orders and is also the world’s longest-range commercial airliner (the -200LR variant). Many airlines that base their model on long- and ultra-long-haul operations own large fleets of the B777 – Emirates or Singapore Airlines to mention a few.

Another pair of directly competing products is the Boeing 787 Dreamliner and the Airbus A350XWB. The first 787 Dreamliner should perform its first flight in December 2009 while the A350XWB is expected to emerge from the development phase in 2013. As of October 31<sup>st</sup> 2009, the 787 order book counts 840 aircraft compared to 493 orders for the A350. Both models boast to be equipped with the most advanced technology. The most commonly cited advantages of the new models are as follows:

- a fuselage made of composite materials;
- a new more cost efficient all-composite design of wings;
- a flight range exceeding 8,000 nautical miles – this is sufficient for direct flights from Europe to any other inhabited place on Earth except for the Pacific;
- at least 20 per cent higher fuel efficiency compared to the direct predecessors;
- a new more comfortable cabin atmosphere.

Due to these and other specifics both models are often considered aircraft of the new generation.

### **3. Data sources**

An analysis of the role of national and regional identity in aircraft ordering requires access to complete order list data. As we mentioned before, our research focuses exclusively on Airbus and Boeing, as they are the only complex commercial airliner manufacturers of today. Out of this reason all the data used originates in official statistics of Airbus and Boeing.

Boeing’s website [www.boeing.com](http://www.boeing.com) contains a section “Orders and deliveries,” which gives viewers access to an extensive database of all Boeing and McDonnell Douglas aircraft orders since 1958. The user interface is very simple and apart from featuring a variety of standard reports it enables users to create their own criteria to personalize output. It is possible to sort orders and deliveries by year, model, region, airline and many other parameters. This research is based on chronological list of orders of all models from January 1<sup>st</sup> 1989 until June 30<sup>th</sup> 2009.<sup>4</sup>

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<sup>4</sup> Boeing orders between 01/01/1990 and 06/30/2009 include the following aircraft:

*McDonnell Douglas 11*: MD-11, MD-11-ER, MD-11-F.

*McDonnell Douglas 80*: MD-80-81, MD-80-82, MD-80-82T, MD-80-83, MD-80-87, MD-80-88.

The statistics of Boeing place each customer into one of twelve world regions: Africa, Caribbean, Central America and Mexico, Central Asia, East Asia Europe, Middle East, North America, Oceania, South America, South Asia or Southeast Asia. Some customers who desired to stay in anonymity are labeled as “unidentified.”

The online statistics of Airbus are a bit less complex compared to Boeing. The user interface options include sorting by customer name and aircraft model; however they do not enable sorting by date of order. There is also a report sorting orders by model and date of order, but this one does not include name of the customers. To overcome this shortcoming our research is based on a complete list of Airbus orders from 1974 until June 30<sup>th</sup> 2009. Although this period is 15 years longer than the period used for Boeing, the 1974-1988 data includes orders for mere 956 aircraft, which is only 10.3 per cent of the total orders.<sup>5</sup> The inaccuracy that arises from the different time lengths of the datasets used is therefore insignificant.

Another possibility was to extend the time series of Boeing orders back to 1974; this has been dismissed due to the following reasons:

- the bipolar world order that existed before 1989 adds significant distortions to the factors of national and regional identity and potentially changes their roles in aircraft ordering;
- while Airbus sold only 956 aircraft between 1974 and 1988, Boeing (including McDonnell Douglas) booked orders for 5,435 airliners in the same period. This represents 34 per cent of total Boeing orders. It is therefore obvious that while Boeing was already a mature established manufacturer in the period in question, Airbus was not yet fully competitive.

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*McDonnell Douglas 90:* MD-90-30, MD-90-30ER, MD-90-30T.

*Boeing 707:* B707-E6A (11 pcs. ordered in 1990 by the US Army).

*Boeing 717:* B717-200.

*Boeing 737:* B737-300, B737-400, B737-500, B737-600, B737-700, B737-700BBJ, B737-700C, B737-800, B737-800BBJ, B737-900, B737-900BBJ, B737-900ER.

*Boeing 747:* B747-200F, B747-300M, B747-400, B747-400D, B747-400ER, B747-400M, B747-400F, B747-400ERF, B747-8, B747-8F.

*Boeing 757:* B757-200, B757-200PF, B757-300.

*Boeing 767:* B767-200, B767-200ER, B767-300, B767-300ER, B767-300F, B767-400ER.

*Boeing 777:* B777-200, B777-200ER, B777-200LR, B777-300, B777-300ER, B777F.

*Boeing 787:* B787-3, B787-8, B787-9.

<sup>5</sup> Airbus orders include the following aircraft:

*A300:* A300.

*A310:* A310.

*A320:* A318, A319, A320, A321.

*A330:* A330-200, A330-200F, A330-300.

*A340:* A340-200, A340-300, A340-500, A340-600.

*A350:* A350-800, A350-900, A350-1000.

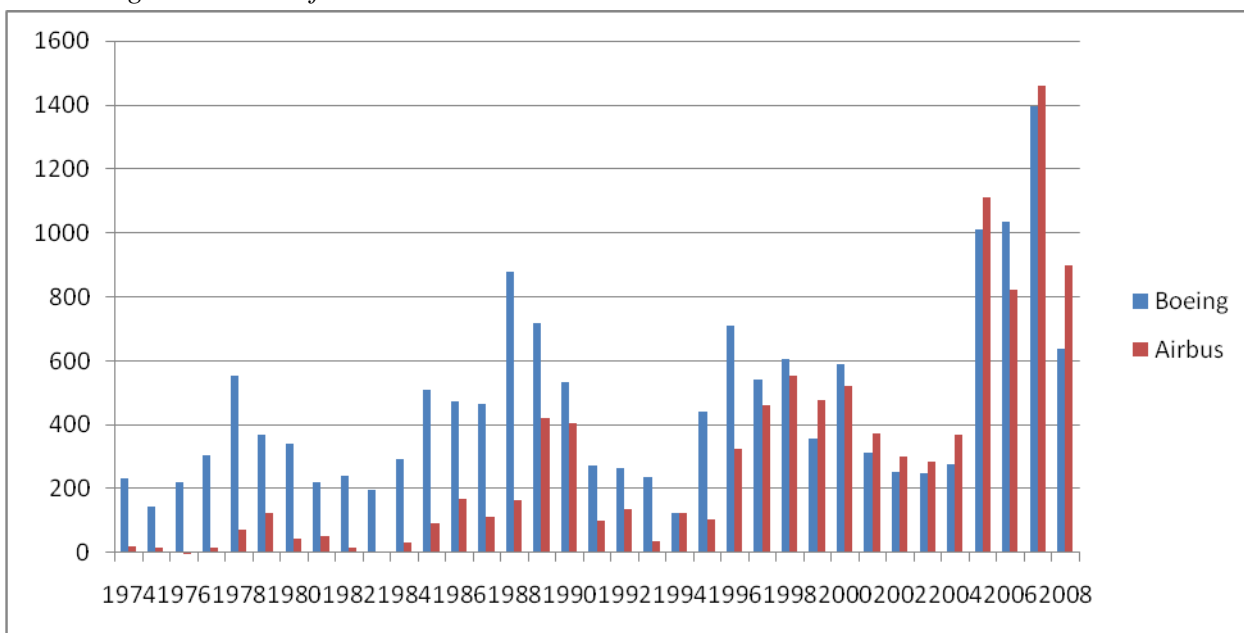
*A380:* A380.

- Boeing secured orders for 10,649 aircraft between 01/01/89 and 06/30/09. Airbus sold 9,283 aircraft during its whole existence until 06/30/09. Both datasets we propose to use are thus of a similar size.

While Boeing distinguishes between 12 world regions, Airbus follows a different methodology, cutting the number of regions down to 6: Europe, North America, Asia-Pacific, Middle East, Latin America and Caribbean, and Africa. There is also a group of „undisclosed.“

Figure 1 represents a comparison of the aircraft orders of Boeing and Airbus between 1974 and 2008.

Figure 1: Aircraft orders 1974-2008



Source: [www.airbus.com](http://www.airbus.com) and [www.boeing.com](http://www.boeing.com). Airbus aircraft orders exclude cancellations.

It becomes obvious that it took Airbus 15-20 years to approach the number of annual orders of Boeing aircraft. It took 25 years to surpass its main rival for the first time (1999). The reasons behind this long period are various: aircraft manufacturing is a highly capital-intensive sector, research and development are costly and time-consuming, relations between airlines and aircraft manufacturers tend to be long term, which handicaps new entrants etc.

#### 4. Methodology

As evidenced in the previous section Airbus and Boeing use different approaches to classify customers into world regions. While Boeing uses a 12-region methodology, Airbus only distinguishes between 6 world regions. Therefore our first task is to set a standard classification of world regions. Table 2 shows the approach chosen: each



country on the Airbus and Boeing order lists is allocated into one of the eight world regions used for this research.

*Table 2: World regions*

<b>REGION</b>	<b>COUNTRIES</b>
Europe	Austria, Belgium, Bosnia and Herzegovina, Croatia, Cyprus, Czech republic, Denmark, Faroe islands, Finland, France, Germany, Gibraltar, Greece, Hungary, Iceland, Ireland, Italy, Luxemburg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom
North America	Canada, United States
Community of Independent States	Azerbaijan, Kazakhstan, Russia, Turkmenistan, Ukraine, Uzbekistan
Asia	Bangladesh, Bhutan, Brunei, China, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam
Middle East	Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, Yemen
Latin America and the Caribbean	Argentina, Bermudas, Brazil, Chile, Colombia, Ecuador, Guadalupe, Jamaica, Mexico, Panama, Peru, Salvador
Pacific	Australia, Fiji, French Polynesia, Nauru, New Caledonia, New Zealand, Papua-New Guinea
Africa	Algeria, Angola, Cote d'Ivoire, Egypt, Ethiopia, Kenya, Libya, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Reunion, Senegal, Somalia, South Africa, Sudan, Tunisia, Zimbabwe
Undisclosed	Nationality not made public.

Two regions of the utmost importance for our research are Europe and North America. North America obviously includes the United States of America and Canada. Preparing a list of European countries is a bit more problematic though. Out of historical reasons we consider it sensible to exclude countries of the Community of Independent States (ex-Soviet countries) from Europe and classify them as a separate region. There is also a question of Turkey – although in datasets of both Airbus and Boeing it is considered a European country, owing to its close relations with the USA and uncertain future of its EU-integration efforts we decided to place in the Middle Eastern region. All in all, we propose an eight-region system and an additional category of those who didn't wish to make their identity public.

As we already made clear in section 3 this research is based on orders of all Boeing aircraft between 01/01/1989 and 06/30/2009 and orders of all Airbus aircraft

throughout its whole existence (1974) until 06/30/2009. We have proved different lengths of time series will not have significant impacts on the results.

In total 19,932 aircraft were ordered in the period in question. To minimize impacts of potentially biased government decisions we have to exclude 51 Boeing aircraft from our dataset – those were ordered by the US, Peruvian, Chilean and Kuwaiti Army and some other governmental entities. After this adjustment our dataset counts 19,881 commercial airliners.

Following sections of the paper present an analysis of Airbus and Boeing aircraft orders by world regions. We construct A/B ratio – computed as number of Airbus aircraft orders divided by number of Boeing aircraft orders – and compare its values in different world regions. The A/B ratio value will be greater than 1 when the number of Airbus aircraft orders is higher than the number of Boeing aircraft orders. Conversely, A/B is smaller than 1 when Boeing orders exceed Airbus orders. While analyzing the orders we will focus on Europe and North America because they are the home regions of the manufacturers studied. It will also be interesting to see the behavior of customers in other regions, especially those with clear cultural and historical ties to either Europe or North America. For example, taking into account the history of the regions we expect African and Latin American customers to prefer Airbus aircraft. On the other hand, clients from the Pacific are expected to have closer ties with Boeing.

In addition to analyzing total orders in all world regions we will compare the data for 5 largest network carriers (by number of passengers carried) in both Europe and North America. Those are American Airlines, Delta Airlines, United Airlines, US Airways and Northwest Airlines; and Lufthansa, Air France, British Airways, KLM Dutch and Iberia.<sup>6</sup> Low-fare airlines (e.g., Southwest Airlines or Ryanair) were excluded from the comparison due to some special characteristics of their operating models. Low-fare airlines tend to base their aircraft fleet on a single aircraft model, be it the B737 or A320. Thus, Southwest Airlines operates hundreds of B737 and it is difficult to see them order a different aircraft model in the future.

## **5. Results**

The results are presented in 5 sections: total orders for all models, orders for narrow-body aircraft, orders for wide-body aircraft, total orders for all current models and total orders for the A350XWB and the B787.

### ***Total orders for all models***

The total number of Airbus and Boeing commercial airliners ordered in the period studied reaches 19,881. The regional division of the orders is presented in table 2 and figure 3.

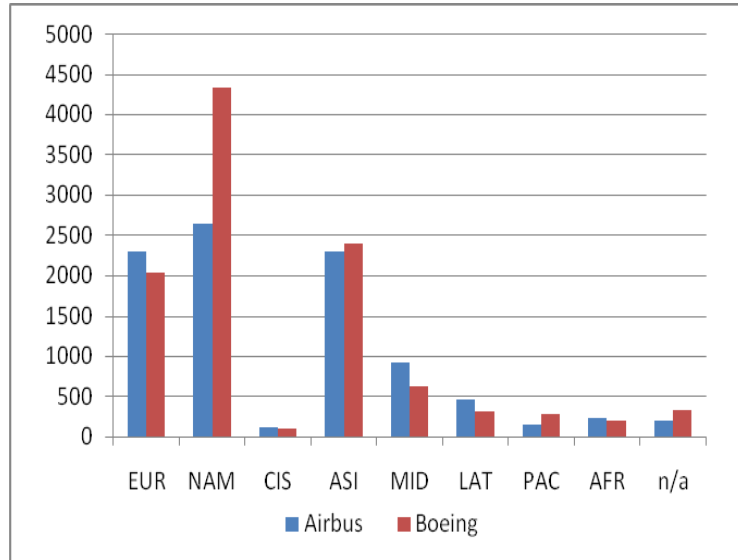
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<sup>6</sup> Air France and KLM merged in 2004. However, their orders are listed separately.

More than 35 per cent of the aircraft (6,960 pcs.) were ordered by North-American clients. This confirms the position of North America as the most developed and mature market in the world. The region is followed by Asia (4,701 pcs.) and Europe (4,325 pcs.). The lowest number of aircraft ordered can be observed in the Community of Independent States (212 pcs.), Africa (418 pcs.) and the Pacific (432 pcs.).

*Table 3 and Figure 2: Total orders for all models*

Region	A	B	A/B
EUR	2292	2032	1.13
NAM	2635	4325	0.61
CIS	110	102	1.08
ASI	2303	2398	0.96
MID	910	627	1.45
LAT	460	318	1.45
PAC	153	279	0.55
AFR	228	190	1.20
n/a	192	327	0.59
$\Sigma$	9283	10598	0.88



A single look at regional A/B ratios reveals a strong orientation of North American clients on buying models of the regional manufacturer – Boeing. For every 100 Boeing aircraft ordered only 61 Airbus aircraft are ordered. Higher level of Boeing preference can only be noticed on a relatively small aviation market of the Pacific (100:55).

On the other hand, Airbus aircraft are preferred in the Middle East and Latin America and the Caribbean (both regions with an A/B ratio of 145:100). Also, Airbus is a market leader in Africa (120:100), Community of Independent States (108:100) and Europe. However, the market share of Airbus in Europe is disappointing, with A/B ratio of only 113:100. As we shall see later, the reasons for this surprisingly low ratio can be found on the single-aisle aircraft market.

From the data available we conclude that the role of national/regional identity in aircraft ordering is 1.85 times higher in North America than in Europe. The reasons for this include the following:

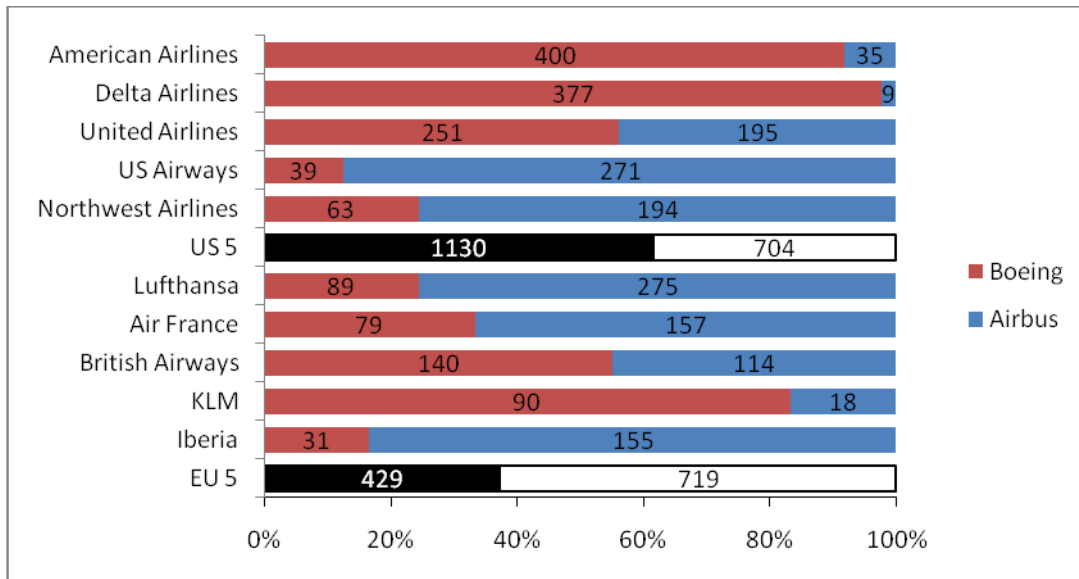
- While European aviation market consists of dozens of separate markets, North America as a region comprises only two countries – USA and Canada. Thus, even in a hypothetical case of the same propensity to buy domestic aircraft in both regions, purchases of Boeing aircraft by North American customers will still be exceeding Airbus purchases by European clients. Hungarian, Polish or other European customers might not consider

Airbus a domestic producer. European identity is weak and it is subordinated to national identities.<sup>7</sup>

- Longer historical tradition of Boeing compared to Airbus. Although Airbus has been on the market for 35 years now, it is still disadvantaged by clients promoting continuity.
- There is a group of American passengers who are not willing to fly on an Airbus aircraft. This group is considerably larger than the number of European passengers refusing to use Boeing aircraft.
- Airbus aircraft are generally more expensive than Boeing aircraft.

Figure 3 shows the number and share of orders for Airbus and Boeing aircraft by 5 largest network airlines from North America and Europe.

*Figure 3: Total orders for all models – selected airlines*



The data needs to be analyzed carefully keeping in mind that we use only a narrow sample of airlines. Moreover, inclusion of low fare carriers (such as Ryanair and Southwest) into the analysis would change the results greatly; we have explained the reasons for excluding them in part 4 of this text. All in all, the chart supports the claim that regional identity plays an important role in aircraft ordering in Europe and North America.

As seen in table 3 the orders for Airbus aircraft have outnumbered the orders for Boeing aircraft in Europe, Africa, Latin America and the Caribbean and the Middle East. African and Latin American countries have a rich history of being under a long rule of

<sup>7</sup> After conducting a thorough analysis of the propensity to buy Airbus aircraft by European clients we come to a surprising conclusion: While the overall A/B ratio in Europe is 1.13, the A/B ratio for the four countries participating in Airbus joint venture (France, Germany, Spain and United Kingdom) is 1.45. The rest of Europe has an A/B ratio of 0.89, which means they prefer Boeing! Each of the mentioned groups has approximately a 50-percent share on total European orders.

colonizers from Europe, and the influence of European culture and politics has remained strong ever since. Moreover, a significant part of local airlines is co-owned by European shareholders. Along with China, the Middle East has recently been the fastest growing aviation market in the world and therefore it will be very interesting to see future development of aircraft orders in the region. The A/B ratio in the Community of Independent States is close to 1.00, with a slight preference for Airbus. We assume this preference might have been caused by different lengths of Airbus and Boeing time series used in our research in combination with a relatively low number of aircraft ordered.

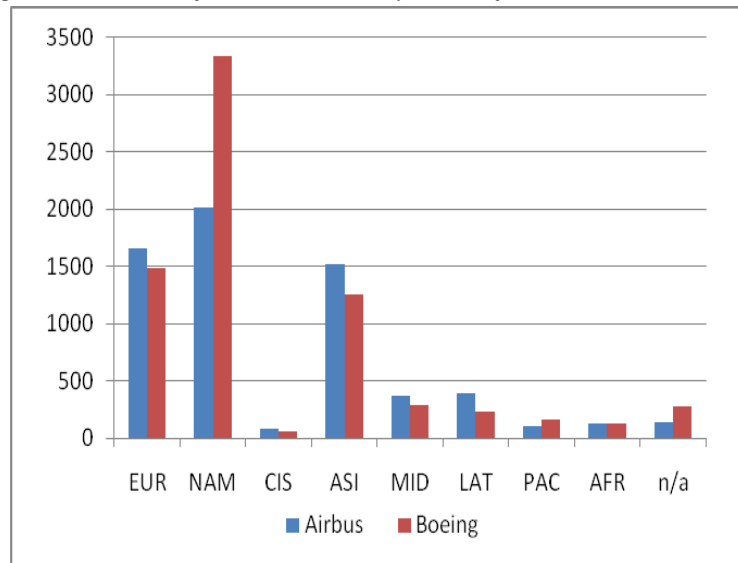
Boeing aircraft have been preferred in North America, the Pacific and with a small margin in Asia as well. The Pacific has traditionally been a zone of influence of the United States, therefore Boeing’s large market share in the region is understandable. The situation in Asia is more complicated – out of 599 aircraft ordered in Japan in period in question more than 80 per cent are Boeing models. Conversely, Airbus is a clear market leader in China. Moreover, the European manufacturer has recently opened a new assembly hall in Chinese city of Tianjin which is supposed to give Airbus a competitive advantage in Asia. We therefore expect Boeing to start losing its market share in Asia in the near future.

#### ***Orders for narrow-body aircraft***

Table 4 and figure 4 show total orders for narrow-body aircraft.

*Table 4 and Figure 4: Orders for narrow-body aircraft*

<b>Region</b>	<b>A</b>	<b>B</b>	<b>A/B</b>
EUR	1649	1482	1.11
NAM	2005	3333	0.60
CIS	82	57	1.44
ASI	1520	1249	1.22
MID	371	288	1.29
LAT	385	229	1.68
PAC	100	155	0.65
AFR	123	124	0.99
n/a	133	272	0.49
$\Sigma$	6368	7189	0.89



Narrow-body (or single-aisle) aircraft include the Airbus A320, Boeing 737 and out-of-production models Boeing 717, Boeing 757, McDonnell Douglas MD-80 and McDonnell Douglas MD-90. Narrow-body aircraft orders represented 70 per cent of total commercial aircraft orders in the focus period. The strongest market is North America thanks to the highly developed domestic aviation network of the USA.

The results of our research are similar to the results of the total aircraft orders section. The only significant differences can be seen in Asia and Africa. While Airbus is the leader on the Asian narrow-body aircraft market, Boeing rules the regional wide-body aircraft market. The A/B ratio in Africa is virtually equal to 1.00, implying thus no preference. The propensity of European clients to order narrow-body Airbus aircraft is surprisingly small – the logic behind this fact was explained in the previous section.

*Figure 5: Orders for narrow-body aircraft – selected airlines*

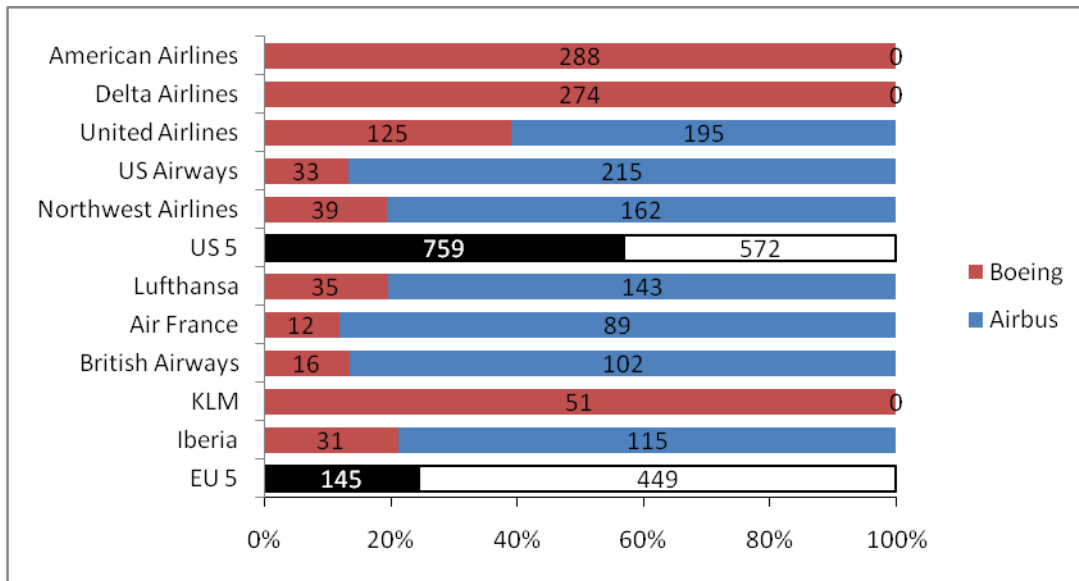


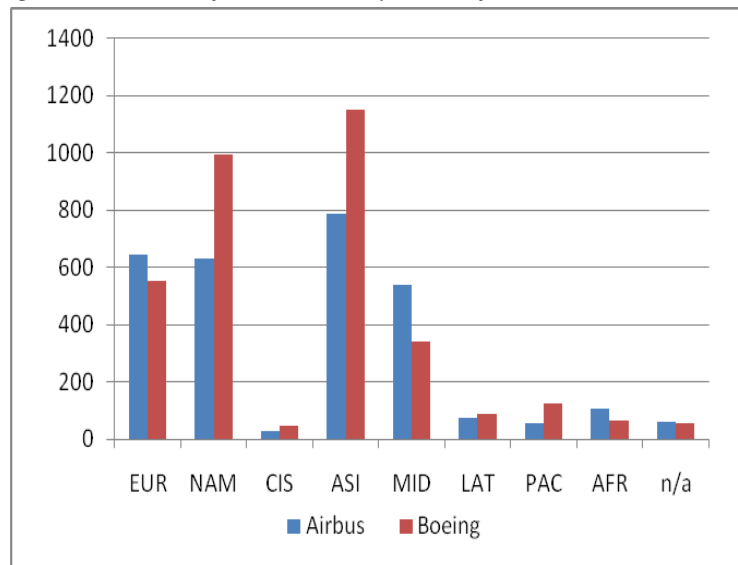
Figure 5 depicts orders for narrow-body aircraft by selected North American and European airlines. The preference for domestic manufacturer is obvious: American airlines prefer Boeing aircraft, while European airlines favor Airbus. An important feature of the narrow-body aircraft market is that some companies operate a single-model (all-Boeing or all-Airbus) fleet. In addition to cost savings as a typical reason for this, the selection of single-aisle aircraft is currently limited to the A320 and B737; it is therefore not surprising that airlines purchase a large number of aircraft of the same model rather than combining aircraft of different models. A special case are low-fare airlines, which base their operating model on fleet harmonization – this lowers the pilot training and maintenance costs. The higher the number of aircraft ordered the better financial conditions can be secured. For example Southwest Airlines ordered 519 aircraft in the focus period, all of which were Boeing 737s. WestJet ordered 84 737s, Ryanair 338 737s, Norwegian 42 737s etc. EasyJet purchased 271 aircraft – the first 44 of those were 737s, then it switched to Airbus A320.

#### ***Orders for wide-body aircraft***

Wide-body (or twin-aisle) aircraft include the Airbus 300, 310, 330, 340, 350 and 380, the Boeing 747, 767, 777, 787 and McDonnell Douglas MD-11. The distribution of wide-body aircraft orders can be seen in table 5 and figure 6.

Table 5 and Figure 6: Orders for wide-body aircraft

Region	A	B	A/B
EUR	643	550	1.17
NAM	630	992	0.64
CIS	28	45	0.62
ASI	783	1149	0.68
MID	539	339	1.59
LAT	75	89	0.84
PAC	53	124	0.43
AFR	105	66	1.59
n/a	59	55	1.07
$\Sigma$	2915	3409	0.86



Compared to orders for narrow-body aircraft, the wide-body aircraft market is approximately two times smaller. This has been caused by different technical specifications and different use of twin-aisle airliners:

- Higher capacity – the higher the capacity the fewer aircraft are needed. A twin-aisle airliner is able to transport on average twice as many passengers as a single-aisle airliner. Moreover, economic viability of twin-aisle aircraft is limited by size of the market – they can only be effectively operated on routes where demand exceeds the number of available seats on single-aisle aircraft.
- Longer range – although there are also short- and medium-range variants (such as Boeing 787-3) the vast majority of wide-body aircraft are used for long and ultra long flights. Obviously, the demand for long flights is smaller than the demand for short and regional transportation; therefore wide-body aircraft are needed less than their narrow-body counterparts.
- Higher price – list prices of wide-body aircraft are generally several times higher than the prices of narrow-body airliners. While a new Boeing 737-600 cost approximately 52 million USD in 2008, the price of the cheapest twin-aisle model, a 767-200ER started at 128 million USD. The price of a double-deck aircraft (the B747 and A380) is 2 to 3 times higher than that.

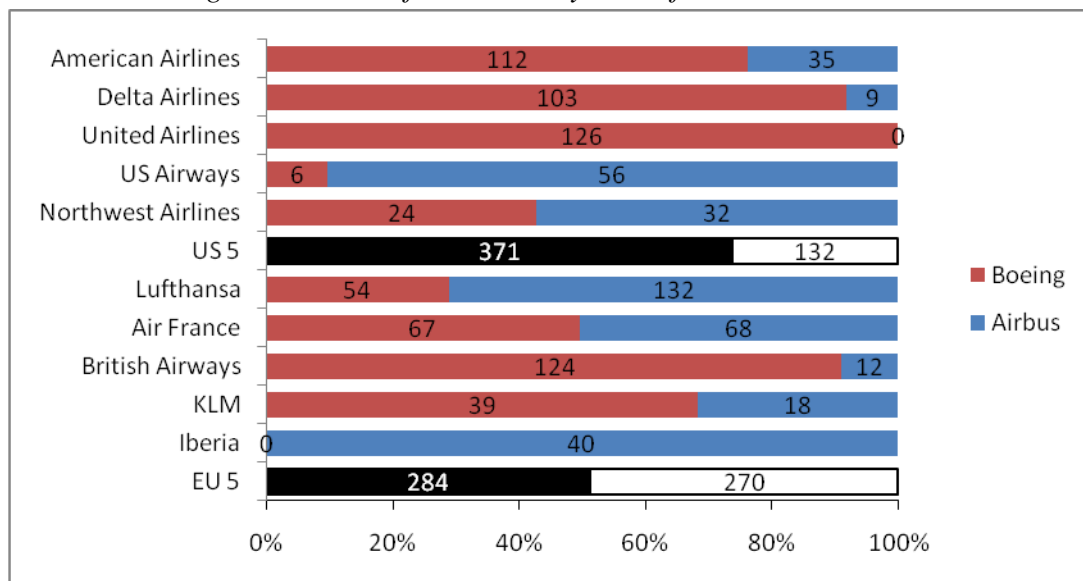
The propensity of European clients to buy wide-body Airbus models is higher than their propensity to prefer Airbus to Boeing on the market for narrow-body aircraft. A prominent reason for this is the absence of low-fare airlines on the wide-body market. As we have already mentioned in the previous section low-fare airlines follow a strategy of fleet harmonization – they generally operate an all-narrow-body fleet of either A320s or B737s. While Boeing has been very successful with European low-fare airlines, the wide-

body market has no significant presence of low-fare customers. The A/B ratio of 1.17 in Europe is higher compared to 1.11 on the narrow-body market. The position of Airbus wide-body models is stronger in North America as well (0.64 compared to 0.60).

In the majority of other regions there is a strong contrast between wide-body and narrow-body orders: in the CIS the A/B ratios are 0.62 and 1.44, in Asia 0.68 and 1.22, in the Middle East 1.59 and 1.29, in Latin America 0.84 and 1.68, in the Pacific 0.43 and 0.65, and in Africa 1.59 and 0.99. The region of special interest is Asia owing to a large number of aircraft ordered. While Boeing dominates the wide-body market, Airbus is the leader in narrow-body aircraft sales. Due to the recent establishment of an A320 assembly hall in Chinese city of Tianjin we expect Airbus to strengthen its position in the region.

It is interesting to examine aircraft orders in Asia in more detail. After analyzing the data available we come to the conclusion that while in the majority of countries the market is evenly split between Airbus and Boeing, Japan is a major exception. Being the biggest wide-body aircraft customer in the region Japan shows strong preference towards Boeing models – out of 391 wide-body aircraft ordered only 35 are Airbus models (i.e. less than 10 per cent). If Japan was excluded from the region, the A/B ratio in Asia would increase significantly, from 0.68 to 0.94.

*Figure 7: Orders for wide-body aircraft – selected airlines*



The only region in the world where Airbus dominates both single- and twin-aisle markets is the Middle East. In other parts of the world the big differences between A/B ratios on narrow-body and wide-body markets can be attributed to the low number of aircraft ordered. For example customers from the Community of Independent States ordered only 212 aircraft in the period in question – the dataset is small and a single new order can alter the A/B ratio substantially. Similarly, although clients from Latin America



and the Caribbean ordered a total of 778 aircraft, merely 164 of those are twin-aisle aircraft, causing thus the same statistical problem as in the CIS.

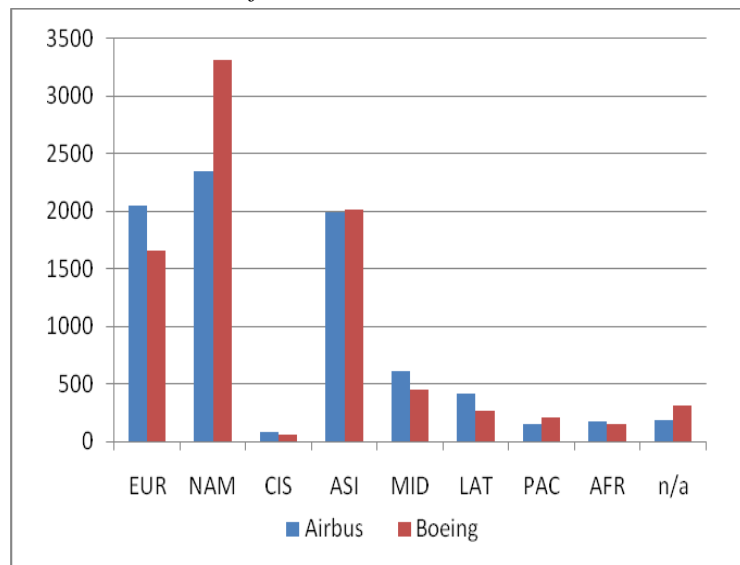
Boeing is the clear winner in orders for wide-body aircraft among 10 selected European and American large network carriers (Fig. 7).

**Total orders for all current models**

The list of Western-designed commercial airliners which are currently in production includes the Boeing 737, 747, 767, 777, the Airbus A320, A330, A340 and A380. The newest models – the Boeing 787 Dreamliner and Airbus A350XWB have not been included in this section as they are not certified as of November 30<sup>th</sup> 2009. We will focus on them later.

*Table 6 and Figure 8: Total orders for all current models*

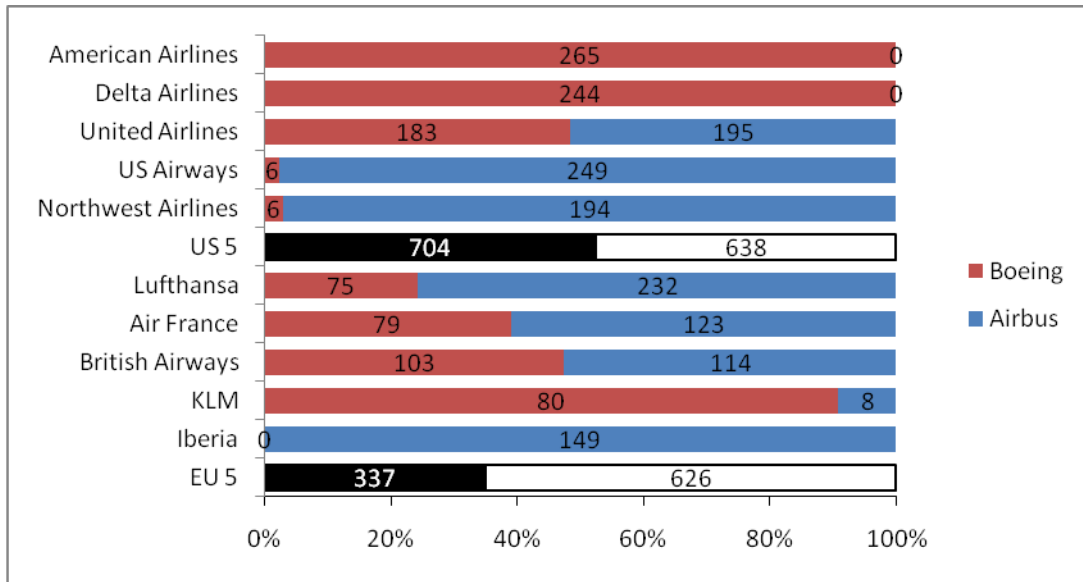
Region	A	B	A/B
EUR	2046	1649	1.24
NAM	2339	3307	0.71
CIS	82	61	1.34
ASI	1982	2003	0.99
MID	610	448	1.36
LAT	417	267	1.56
PAC	146	209	0.70
AFR	174	154	1.13
n/a	178	310	0.57
$\Sigma$	7974	8408	0.95



After comparing the distribution of orders for all current models (table 6) with distribution of orders for all models (table 3) we observe that the results are almost identical. The A/B ratio differences reach only a few hundredths and virtually in every region the difference is in favor of Airbus. Such a result was anticipated – orders for all current models don't include older aircraft from times when Airbus was not yet a respected company. Thus, better market position of Airbus in table 6 is understandable.

An example of Airbus' success in orders for recent aircraft models can be seen in figure 9.

Figure 9: Total orders for all current models – selected airlines

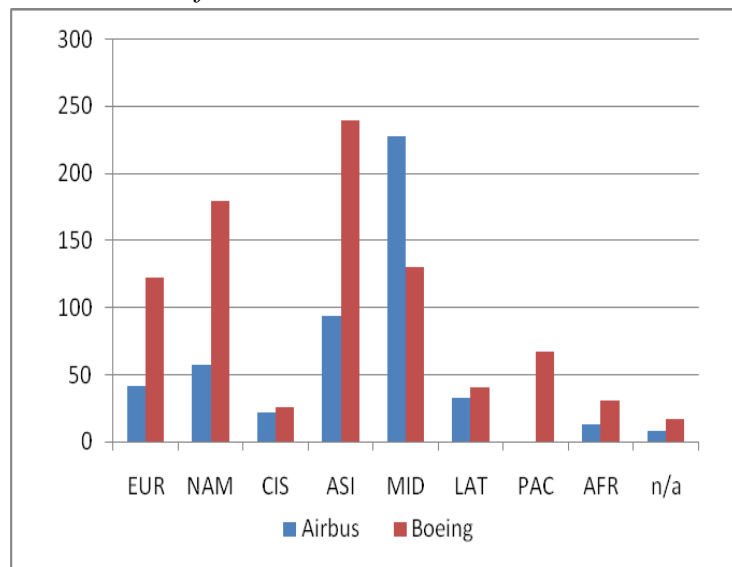


**Total orders for the A350XWB and the B787**

The Airbus A350XWB (extra-wide body) and Boeing 787 Dreamliner are often referred to as aircraft of new generation. As of November 30<sup>th</sup> 2009 they are not certified. The first deliveries are scheduled for 2010 (B787) and 2013 (A350).

Table 7 and Figure 10: Total orders for the A350XWB and the B787

Region	A	B	A/B
EUR	41	122	0.34
NAM	57	179	0.32
CIS	22	26	0.85
ASI	93	239	0.39
MID	227	130	1.75
LAT	32	40	0.80
PAC	0	67	0.00
AFR	13	30	0.43
n/a	8	17	0.47
$\Sigma$	493	850	0.58

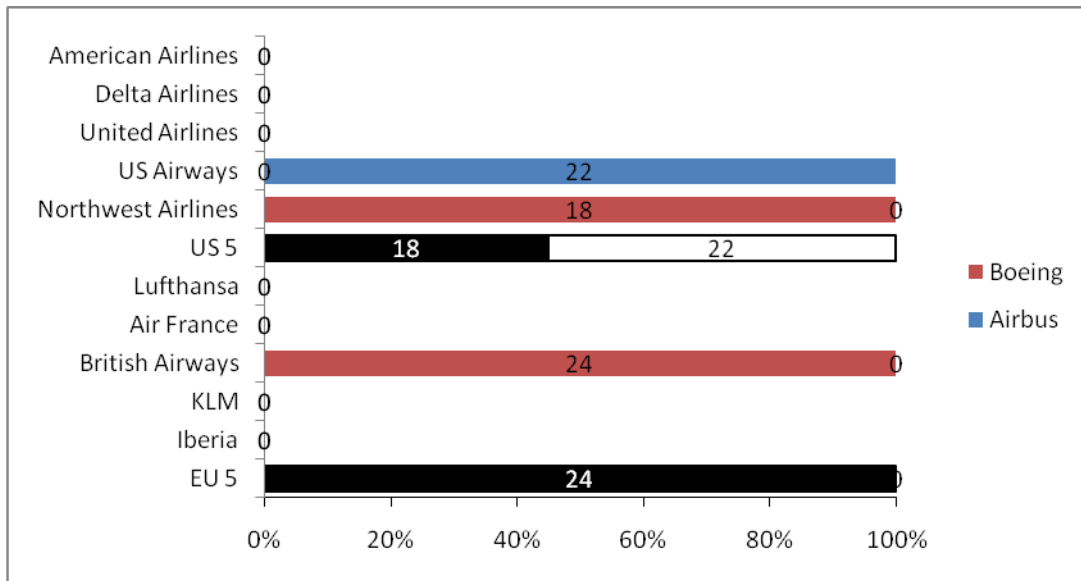


As these projects are very recent and their commercial production hasn't entirely begun yet the dataset used in this section is necessarily small. The number of anticipated future orders is several times higher than current 1,343 pieces. Moreover, development of the Boeing 787 began three years earlier than the development of the A350. It is therefore logical that Boeing has more aircraft on order than Airbus. Due to all the facts mentioned,

we abstain from analyzing total orders for the A350XWB and the B787. However, to maintain the complexity of this paper we present them in table 7 and figure 10.

Currently the Dreamliner dominates in all world regions with a sole exception of the Middle East. As noted multiple times throughout the paper Middle Eastern clients are known for their strong preference towards Airbus. Conversely, the region with strong preference for Boeing is the Pacific.

*Figure 11: Total orders for the A350XWB and the B787 – selected airlines*



## 6. Conclusions

The main goal of our paper was to analyze impacts of the factor of national/regional identity on aircraft ordering by airlines and other corporate clients. We expected that American customers have a strong propensity to order Boeing aircraft, whereas European customers have a strong propensity to order Airbus models. After a thorough data analysis we come to the conclusion that our expectations were correct. Not surprisingly, the propensity of American clients to order Boeing aircraft is higher than the propensity of European clients to order Airbus aircraft – the A/B ratio in Europe is 1.13 while in North America it is 0.61 (therefore, the B/A ratio equals 1.64). From among the other regions Airbus dominates in the Middle East while Boeing is preferred in the Pacific.

For additional testing of our conclusions we excluded lessors, investment entities and small airlines from the dataset, limiting thus our database to 101 large and medium-sized airlines.

Table 8: Total orders for Boeing and Airbus aircraft by world region  
(101 selected airlines)

Region	n	$\Sigma$	$\Sigma A$	%A	$\Sigma B$	%B	maxA	maxB	max $\Delta$	avgA	avgB
EUR	30	2777	1465	52.8	1312	47.2	275	338	-338	48.83	43.73
NAM	12	3326	812	24.4	2514	75.6	271	519	-519	67.67	209.50
ASI	24	3178	1265	39.8	1913	60.2	152	223	-191	52.71	79.71
MID	11	917	574	62.6	343	37.4	179	61	120	52.18	31.18
AFR	9	309	176	57.0	133	43.0	52	29	39	19.56	14.78
PAC	5	369	117	31.7	252	68.3	110	158	-52	23.40	50.40
LAT	6	502	223	44.4	279	55.6	151	127	143	37.17	46.50
CIS	4	128	61	47.7	67	52.3	58	32	26	15.25	16.75
$\Sigma$	<b>101</b>	<b>11506</b>	<b>4693</b>	<b>40.8</b>	<b>6813</b>	<b>59.2</b>	<b>275</b>	<b>519</b>	<b>-519</b>	<b>46.47</b>	<b>67.46</b>

Key:  $n$  – number of airlines in region,  $\Sigma$  – total orders,  $\Sigma A$  – total Airbus orders, %A – share of Airbus orders on total orders,  $\Sigma B$  – total Boeing orders, %B – share of Boeing orders on total orders, maxA – largest Airbus order, maxB – largest Boeing order, max $\Delta$  – biggest difference between maxA and maxB, avgA – average number of Airbus aircraft ordered by a company, avgB – average number of Boeing aircraft ordered by a company.<sup>8</sup>

Applying our approach to 101 selected airlines (table 8) we obtain similar results as when analyzing the whole database. The most noticeable difference can be observed in North America – the A/B ratio drops significantly from 0.61 to 0.32. This indicates larger US airlines strongly prefer Boeing while smaller airlines and institutional investors are more or less impartial.

In Europe the results are the same in both datasets.

<sup>8</sup> Airlines studied:

*Europe:* Adria Airways, Aegean Airlines, Aer Lingus, Air Berlin, Air Europa, Air France, Air Malta, Alitalia, Austrian Airlines, British Airways, Croatia Airlines, ČSA, Cyprus Airways, easyJet, Finnair, Iberia, Icelandair, KLM - Royal Dutch Airlines, Lauda Air, LOT Polish Airlines, Lufthansa, Norwegian Air Shuttle AS, Olympic Airlines, Ryanair, SAS, Spanair, TAP - Portugal, Tarom, Virgin Atlantic Airways, Wizz Air.

*North America:* Air Canada, AirTran Airways, Alaska Airlines, American Airlines, Continental Airlines, Delta Air Lines, Hawaiian Airlines, Northwest Airlines, Southwest Airlines, United Airlines, US Airways, WestJet.

*Asia:* Air China, Air India, All Nippon Airways, Asiana Airlines, Cathay Pacific Airways, China Airlines, China Eastern Airlines, China Northern Airlines, China Southern Airlines, EVA Air, Garuda Indonesia, Hainan, JAL, Kingfisher Airlines, Korean Air, Malaysia Airlines, Pakistan International Airlines, Philippine Airlines, Shanghai Airlines, Shenzhen Airlines, Singapore Airlines, Thai Airways International, Turkish Airlines, Xiamen Airlines.

*Middle East:* El Al Israel Airlines, Emirates, Etihad Airways, Gulf Air, Kuwait Airways, Oman Air, Qatar Airways, Royal Air Maroc, Royal Jordanian, Saudi Arabian Airlines, Yemenia-Yemen Airways.

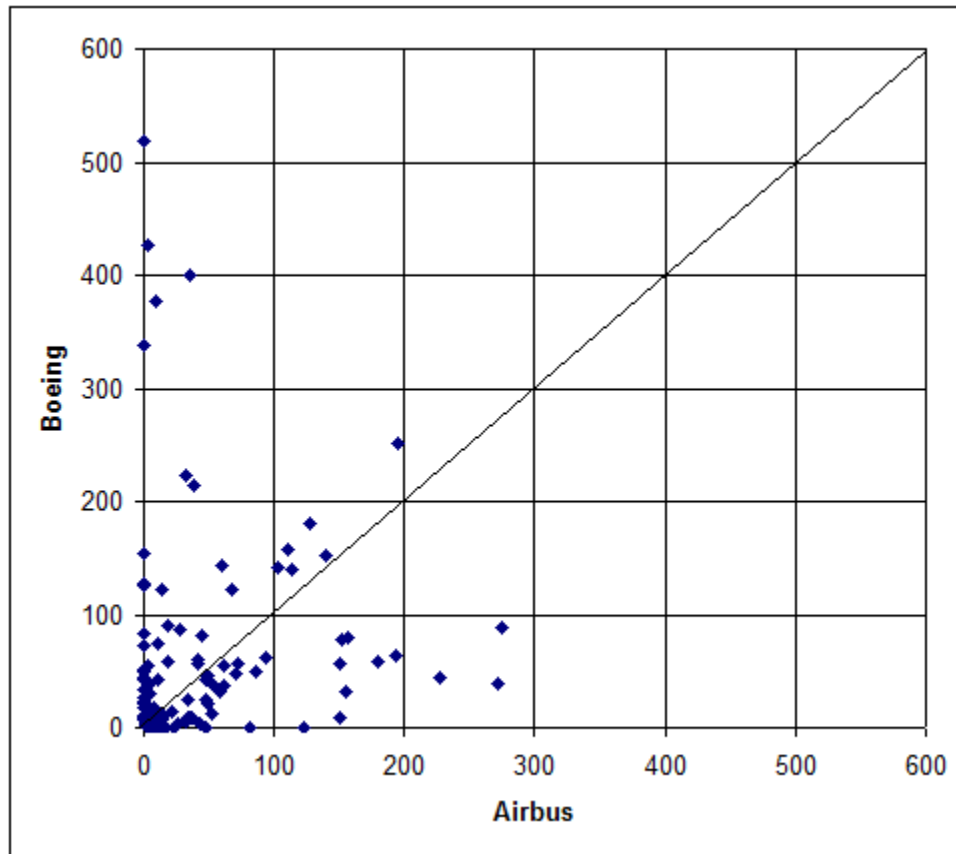
*Africa:* Afriqiyah Airways, Air Algerie, Air Mauritius, Arik Air, Egyptair, Ethiopian Airlines, Kenya Airways, South African Airways, Tunis Air.

*Pacific:* Air New Zealand, Air Niugini, Air Pacific, Qantas, Virgin Blue Airlines.

*Latin America and the Caribbean:* Aerolineas Argentinas, Aeromexico, COPA Airlines, GOL Airlines, LAN Airlines, TAM.

*Community of Independent States:* Aeroflot, Aerosvit, Azerbaijan Airlines, Turkmenistan Airlines.

Figure 12: Airbus/Boeing order matrix (101 selected airlines)

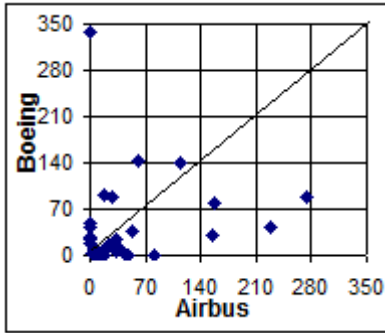


There is a big difference in market positions of Airbus and Boeing (table 8 and fig. 12). An analysis of the Airbus/Boeing order matrix reveals the number and position of points on the main axes is significantly different. There are relatively few points on the Airbus axis and all of them are close to zero; on the other hand there are many points on the Boeing axis and some of them take high values. This means Boeing is more successful in gaining exclusive clients – those who purchase all the aircraft from one manufacturer. From among the selected 101 airlines Boeing was the exclusive aircraft supplier for 21 airlines with 1,798 pieces ordered; Airbus had exclusivity with 11 airlines that ordered 356 aircraft. This is also obvious from regional Airbus/Boeing order matrixes (fig. 13).

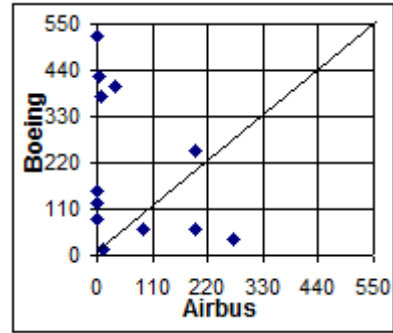
While Boeing is more successful in gaining exclusive clients, a typical client of Airbus prefers fleet-diversification.

Figure 13: Airbus/Boeing order matrix by world region (101 selected airlines)

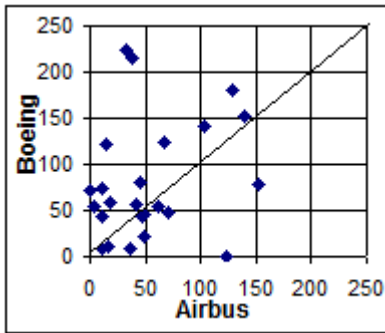
13a – EUROPE



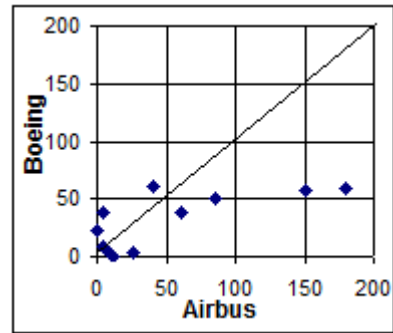
13b – NORTH AMERICA



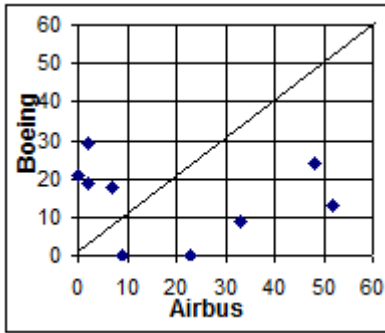
13c – ASIA



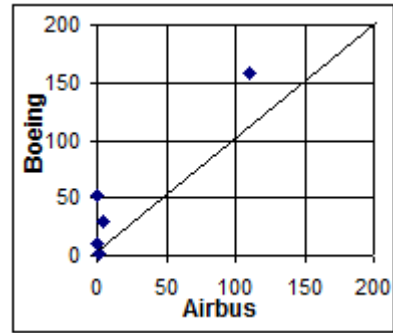
13d – MIDDLE EAST



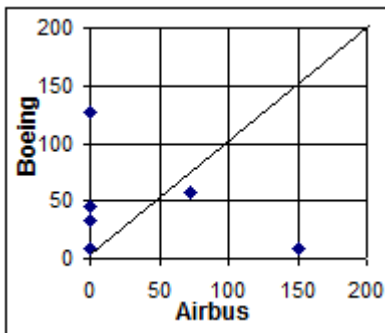
13e – AFRICA



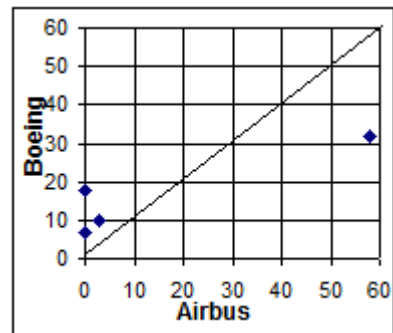
13f – PACIFIC



13g – LATIN AMERICA AND THE CARIBBEAN



13h – COMMUNITY OF INDEPENDENT STATES



To summarize, our research comes to the following conclusions:

- Clients from North America prefer Boeing aircraft.
- Clients from Europe prefer Airbus aircraft.
- The propensity of North American clients to buy Boeing aircraft is 1.85 times higher than the propensity of European clients to buy Airbus aircraft.
- If we divide Europe into two sub-regions, where the first region consists of countries participating in EADS (France, Germany, Spain and United Kingdom) and the second region includes all the other European countries, the first group will strongly prefer Airbus models ( $A/B = 1.45$ ) while the second group prefers Boeing ( $A/B = 0.89$ ).
- A very important group of clients are low-fare airlines – their operating model is generally based on fleet harmonization, i.e. they operate all-Airbus (usually all-A320) or all-Boeing (all-B737) fleet.
- The region with the highest preference for Airbus aircraft is the Middle East.
- The region with the highest preference for Boeing aircraft is the Pacific.

It will be very interesting to carry on with our research and focus on future trends in aircraft ordering. On one hand accelerating forces of globalization and liberalization will decrease the importance of the factor of national/regional identity in aircraft ordering. On the other hand economic crises and political interests can lead to a renaissance of protectionism. We also have to take into account that both Airbus and Boeing receive millions of dollars from public budgets and they create thousands of jobs; therefore the factor of supporting one's own economy by buying domestic will always be there.

There is one last thing to mention about the future of aircraft manufacturing: the role of China. Today the only really global producers of modern single- and twin-aisle aircraft are Airbus and Boeing. China will most likely enter this market soon. It has already invested heavily in the ARJ21 regional jet. An Airbus-320-class airliner called Comac C919 is currently under development and should take off for its first flight in 2015. More aircraft projects will likely follow and the duopoly of Airbus and Boeing might become history.

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