



Global Commercial Aerospace Industry

Aircraft order backlog analysis

July 2016

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Background

Recent industry dialogue regarding the robustness of the commercial aerospace sector has in part focused on the risk of an economic downturn and the potential impact it might have on the historically high levels of aircraft backlog.

One perspective is that some of the backlog is at risk because the industry has experienced boom and bust cycles on average about every eight years, and that the current cycle has run its course. Also, some believe that the production cycle and output is unsustainable at current levels because global airlines cannot absorb the output, which may lead to potential airline price wars. An alternative perspective is that the commercial aerospace sector has largely outgrown past boom/bust cycles due to sustained growth in travel demand, airline capacity discipline, industry consolidation, backlog concentration in fast growing economies, improved airline financial performance and aircraft affordability.

This analysis of the global commercial aircraft backlog is to assess what part of the backlog, if any, is potentially at risk of cancellation or deferral based on an analysis of air carrier credit risk and other factors, and to help inform industry dialogue on this matter.

Executive summary

The global commercial aerospace industry's operating profits and margins have increased in 2014 and 2015 and are expected to improve further in 2016. This provides for higher affordability by airline customers to purchase new aircraft, due to:

- Increased revenue passenger kilometers (RPKs) and capacity utilization
- Improved airline operating cost structure, including significantly lower fuel prices

The recent up-cycle of aircraft orders and production has resulted in a backlog increase from 6,913 units in 2009 to 13,467 units in 2015, or 9.6 years of aircraft production backlog at current production rates. The commercial aircraft backlog is at an all-time high, driven by:

- 6.6 percent and 6.7 percent year-on-year (YoY) growth in passenger traffic in 2014 and 2015 respectively
- Replacement of obsolete equipment

233 airlines or leasing companies are customers in the order backlog for the 5 largest commercial aircraft OEMs, of which information for 215* of them was available and included in this study. Viewed historically, the aircraft order backlog appears to have stabilized at a “new norm” of 6 to 10 years, compared to average backlogs of 3 to 5 years in the last cycle.

Aircraft additions to the global fleet, net of retirements, generally match the growth in air transportation travel demand, as measured by RPK growth.

*Represents more than 85 percent of total commercial aircraft backlog; excludes airline customers undisclosed by OEMs and airline customers for which information was not available

Source: Deloitte analysis, IATA, UBS, Airbus, Boeing, Bombardier, Flightglobal

What we included

Of the unit backlog, 36 percent were from airlines and leasing companies rated by credit agencies. The remaining backlog for airlines/leasing companies not possessing a credit rating total 8,614 units, representing 64 percent of total unit backlog, as follows:

- 11.5 percent of unit backlog were for government-owned airlines or state-owned enterprises
- 52.5 percent of unit backlog were for private airlines, smaller leasing companies and unidentified customers, all with no credit ratings

In summary, 13.0 percent of total aircraft unit backlog and 11.6 percent of total backlog dollar value is potentially vulnerable to deferral or cancellation in the event of a sustained economic recession.

- The definition of vulnerable is an airline/leasing company with a credit rating BB or lower; or where there is no credit rating, an airline/leasing company that has been in business for 10 or less years, and has an order backlog equivalent or more than its current fleet capacity
- To put this in perspective, in a highly unlikely event of an immediate full 13.0 percent reduction in backlog, years of backlog would only be reduced from 9.6 to 8.4 years, equating to 11,716 units of backlog, about a level achieved for the first time in 2013
- A benchmark: the 2008/2009 recession saw global unit backlog decrease 5.4 percent (or 395 units) and backlog value decline 6.9 percent

Global Commercial Aircraft backlog – a deep dive

Global commercial airlines can afford new aircraft because industry profits have experienced a secular increase since 2010, with further improvements expected

- This growth was driven primarily by industry consolidation, growth in RPKs, and airline capacity discipline
- Also, this was partly due more recently to low fuel prices, more efficient cost structure, and additional sources of revenue, e.g., checked bags, food and premium seating

Global commercial aerospace industry operating profit and margin: 2004 to 2016F

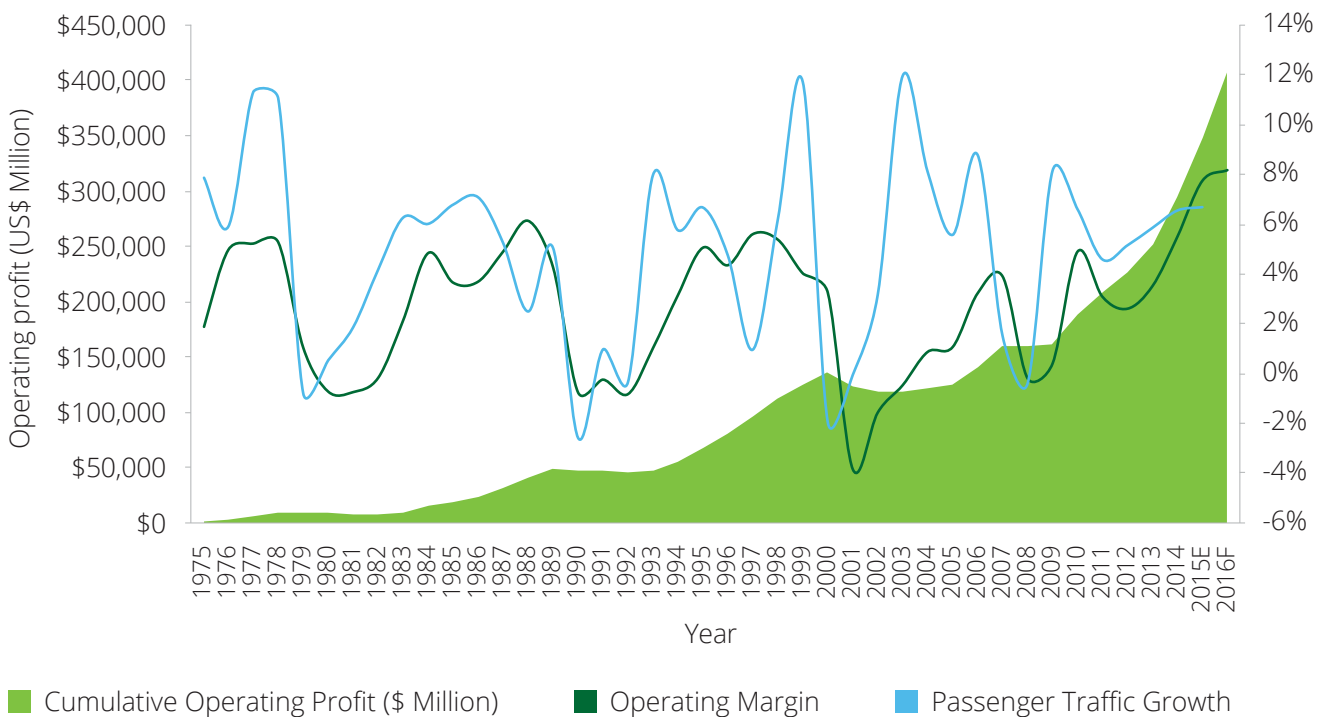


Source: IATA, ICAO, Airlines.org, MIT, RITA, BTS, and Deloitte analysis

Global airline industry's cumulative operating profits are currently at record levels, starting even before the occurrence of low oil prices in 2015

- Cumulative profitability has greatly improved the balance sheets of airlines and made recapitalization of fleets more affordable
- Profitability increased despite airfares dropping 46 percent on a CPI-adjusted basis since 1990

Global airline industry – cumulative operating profits: 1975 to 2016F

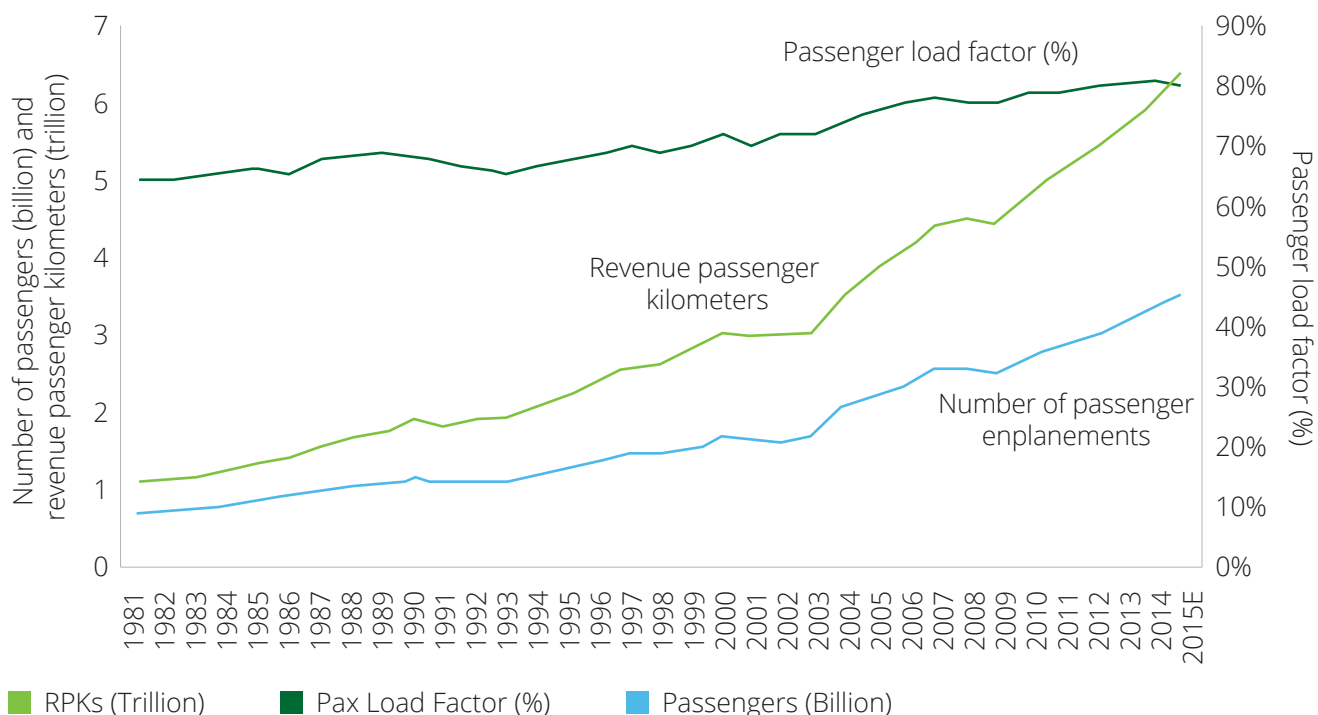


Note: Cumulative operating profit is shown on primary Y-axis while operating margin and passenger traffic growth shown on secondary Y-axis
 Source: Deloitte analysis, IATA, ICAO, Airlines for America, EIU, World Bank

Travel demand is increasing at a CAGR of 5.4 percent (2005 to 2015), much of it due to global demographics and wealth creation in Asia and the Middle East

- 900 million to 3+ billion passenger enplanements annually from 1981 to 2015
- 1 trillion to 6+ trillion annual revenue passenger kilometers (RPKs) over same period
- Load factors at an all-time high
- Of the global population of 7 billion people, it is estimated that only 6 percent flew on an airplane last year, representing additional untapped and addressable market demand

Global airline traffic: 1981 to 2015E

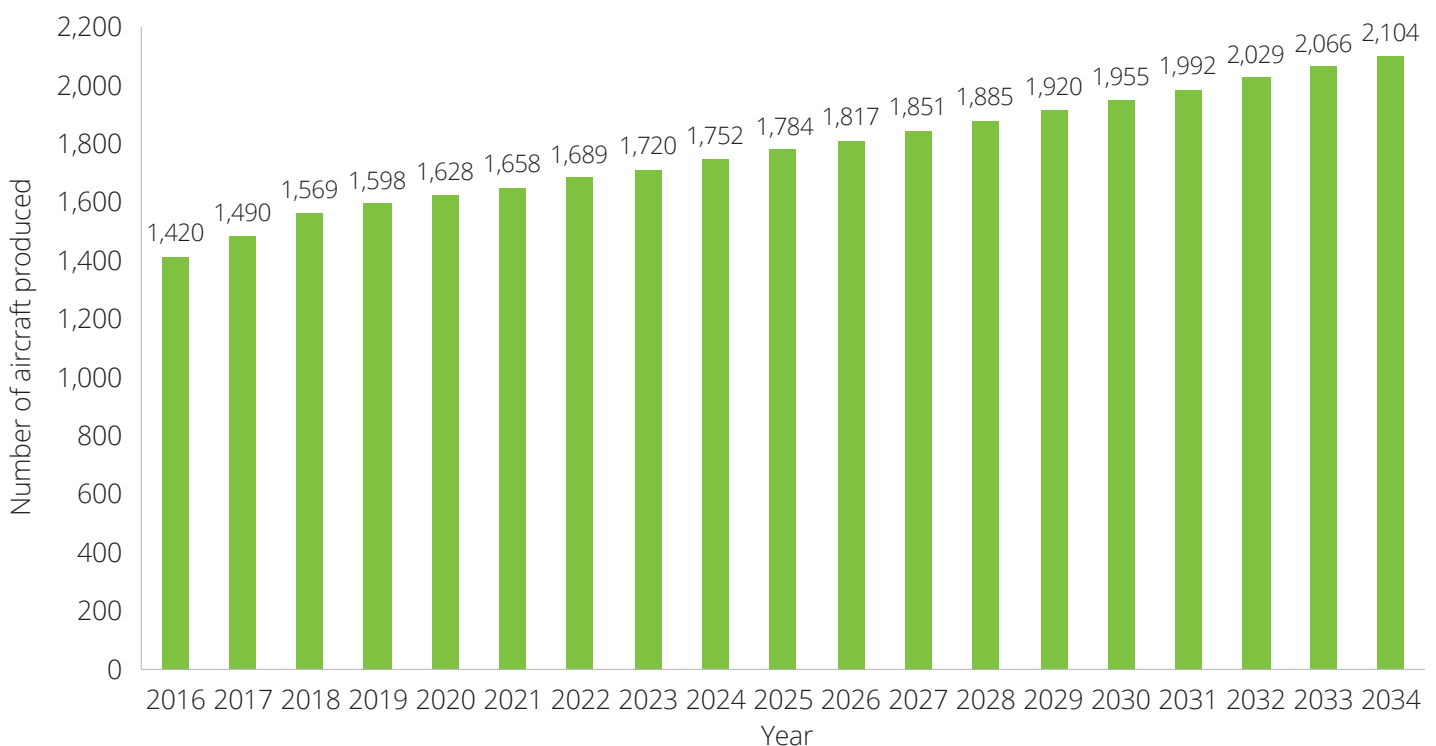


Source: Deloitte analysis, IATA, ICAO, Air & Space Smithsonian

A composite industry production forecast shows an estimated 34,000 commercial aircraft to be produced by 2034, mostly to service this increase in travel demand

- Some of the production demand service replacements needed for obsolete equipment
- Expected CAGR for gross aircraft additions is estimated to be 3.1 percent through 2021
- However, market forecasts for commercial aircraft keep increasing each year, which now total an estimated 34,000 aircraft delivered by 2034
- As was the case in the last 5 years, OEMs are expected to increase forecasted production levels again in the next few years

Forecasted production levels of commercial aircraft: 2016 to 2034



Source: Deloitte analysis, Airbus, Boeing

Net additions of global airline capacity generally matches the increase in travel demand, demonstrating a demand and supply balance

- Aircraft retirements plus new aircraft introductions equate to a 5.7 percent YoY increase in global seat capacity in 2015
- Demand for travel as measured by RPKs has experienced a CAGR of 5.3 percent over the 2005 to 2015 period
- Many industry analysts have observed that this match of supply and demand still leaves room for additions to global seat capacity in excess of RPK growth, as most flights are still running at record high load factors, 80.6 percent in 2015, with many flights sold out

Net additions to commercial aircraft fleet: 2005 to 2014

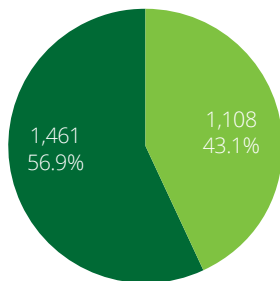


Source: Deloitte analysis, OAG, IATA, ICAO, Boeing

The nature of the backlog has shifted, with composition becoming more global and diverse with more customers, reflecting a changing airline industry

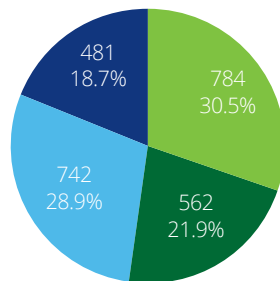
- The commercial aircraft backlog in 2004 comprised 2,569 aircraft from 2 OEMs, with 49 major customers, representing 4.2 years of backlog at the then production rate
- By the end of 2015, the backlog had grown to 13,467 aircraft from 5 OEM's with 233 major airline/leasing company customers, equating to 9.6 years of backlog, worth \$1.9 trillion at list prices

2004 Backlog by OEM



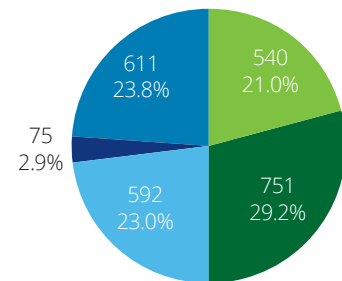
Airbus Boeing

2004 Backlog by customer group



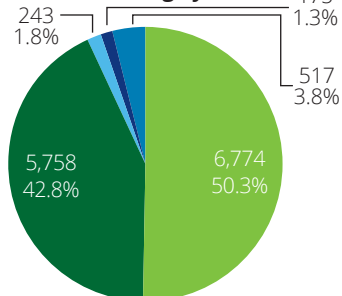
FSC LCC
Leasing Co. Other*

2004 Backlog by region



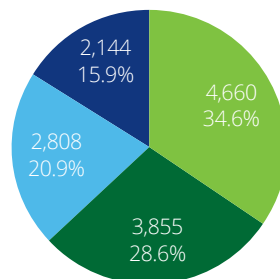
Europe North America
APAC Africa
Other*

2015 Backlog by OEM



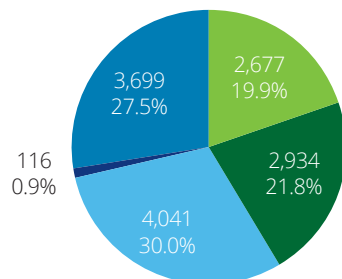
Airbus Boeing
Bombardier C Series Irkut MS-21
COMAC C919

2015 Backlog by customer group



FSC LCC
Leasing Co. Other*

2015 Backlog by region



Europe North America
APAC Africa
Other*

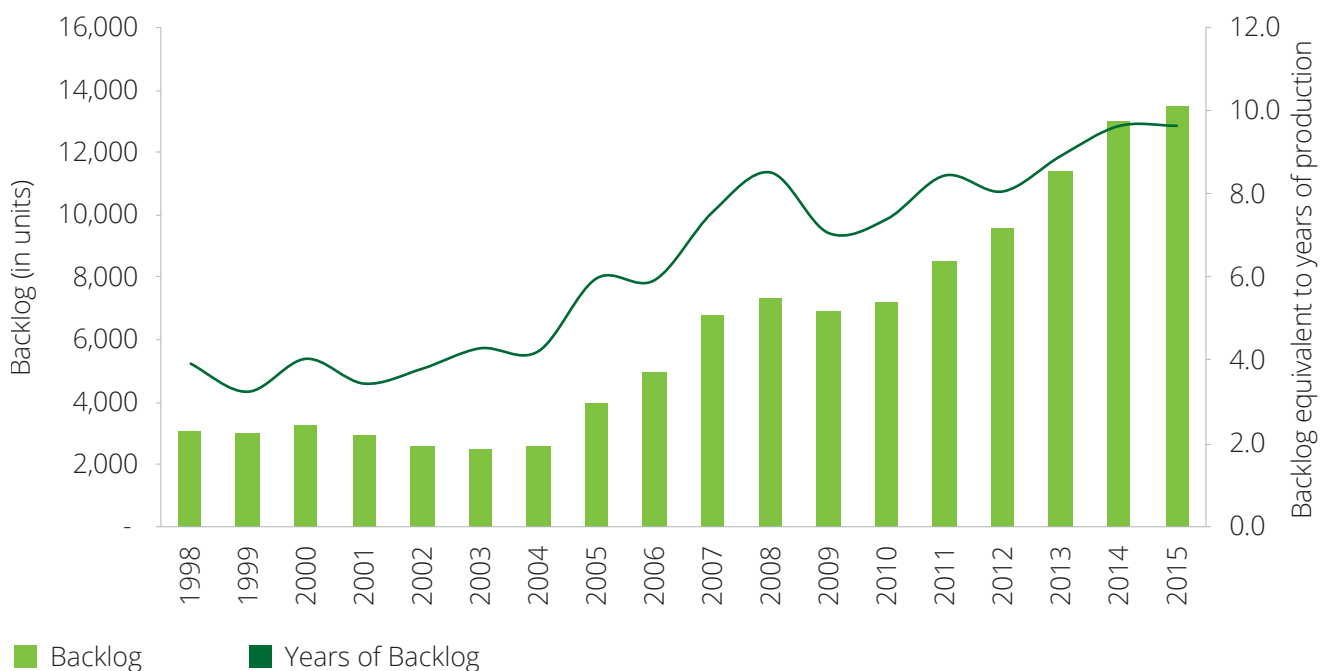
Note: Other regions include Middle East, South America, Central America and undisclosed; other customers include cargo, charter, very small private airlines and undisclosed customers

Source: Deloitte analysis, UBS, Airbus, Boeing, Bombardier, Flightglobal

The size of the backlog appears to have permanently shifted upwards, with the “new normal” years of backlog being in the 6 to 10 year range

- The prior “normal” level of backlog was in the 2 to 5 year range during the 1998 to 2008 period, with dips experienced after the 2001 and 2008 recessions
- The 2001 to 2004 dip was partly due to backlog reliance on U.S. and European carriers which experienced severe financial stress, impacting aircraft affordability
- The global economic downturn of 2008 to 2009 experienced only a marginal dip, a 5.4 percent drop in unit backlog, as orders diversified with more Asia-Pacific customers who continued growing

Global airline industry – backlog: 1998 to 2015

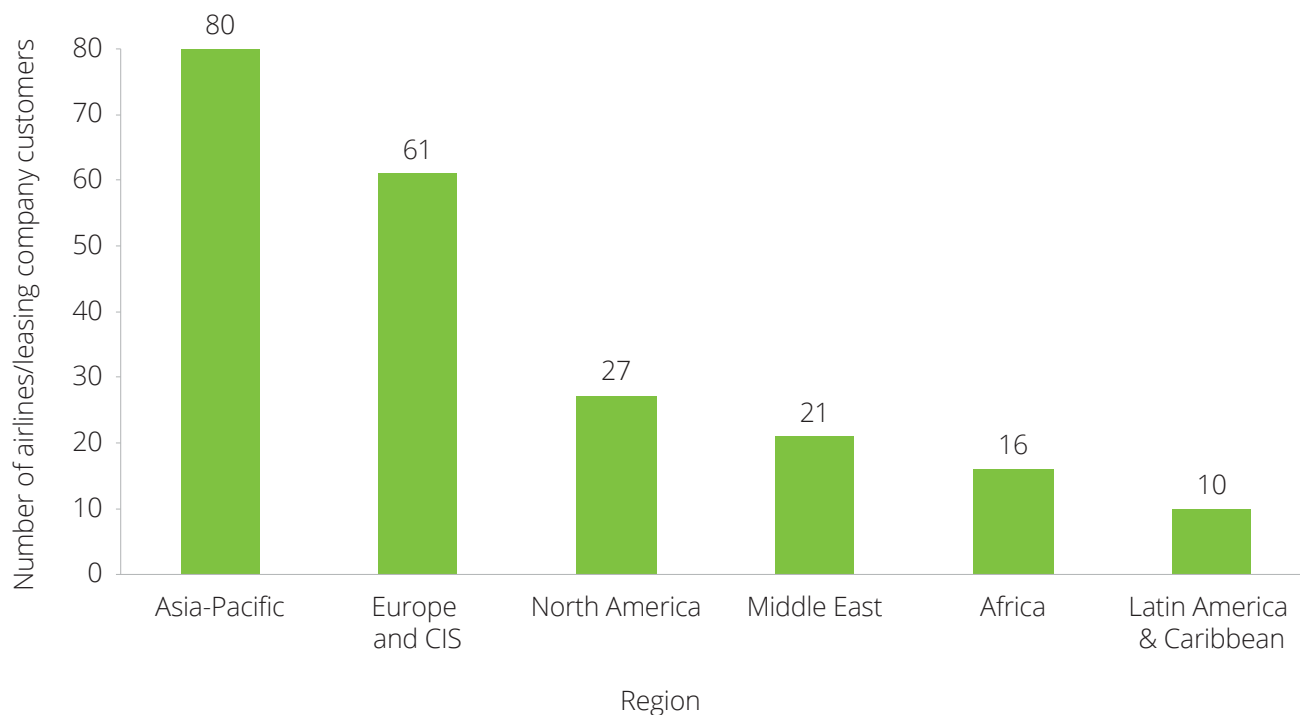


Note: Order backlog for Bombardier C Series, COMAC C919, and Irkut MS-21 included from 2009, 2010, and 2013 onwards, respectively

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal

The backlog of 215 airline/leasing company customers has shifted east with 80 in Asia-Pacific, followed by Europe and CIS (61) and North America (27)

Global airline industry – Breakup by region



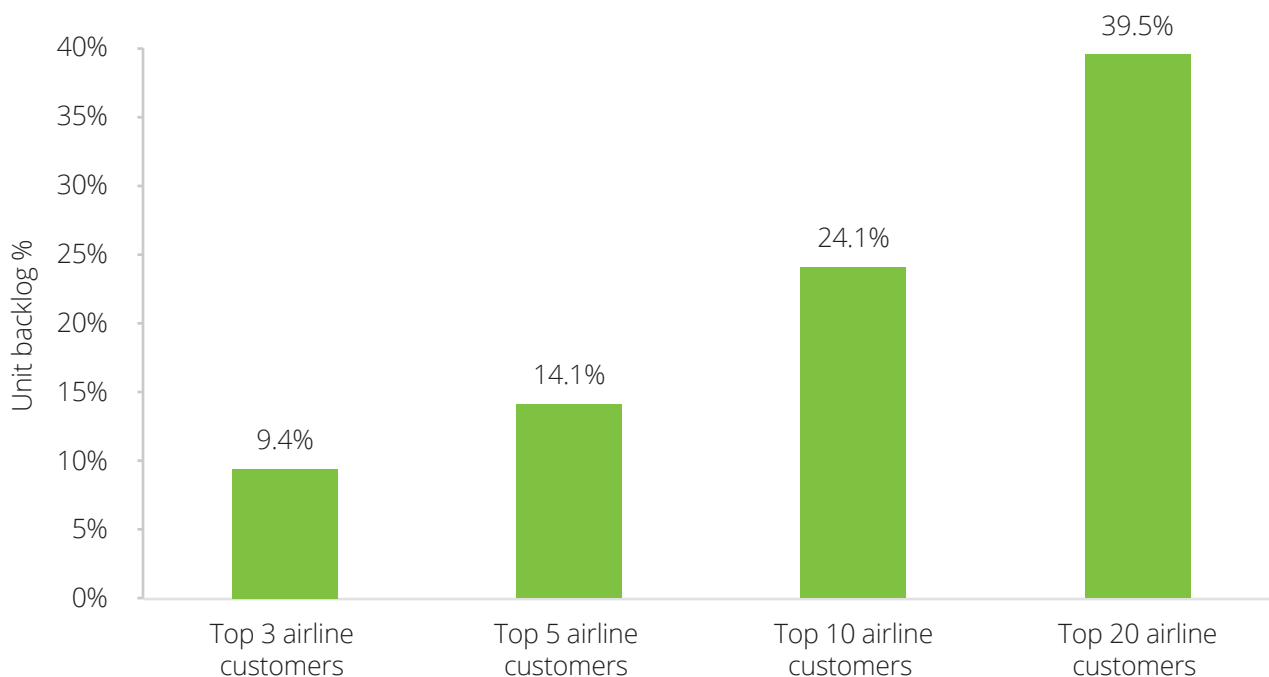
Note: Number of airlines/leasing co. for the regional split are the major disclosed customers representing more than 85 percent of the total backlog

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal

The top three OEM customers with the highest number of aircraft in backlog, represent 9.4 percent of total global backlog

- Global fleet of in-service commercial aircraft, excluding regionals, is 19,020* aircraft
- Aircraft in backlog as a percentage of in-service aircraft is 70.8 percent
- The aircraft backlog spread among 233 disclosed customers is quite diverse, although the top 10 customers represent 24.1 percent of the unit backlog, and 10 percent of customers represent almost 40 percent of backlog, suggesting some level of concentration

Degree of aircraft backlog concentration in 2015



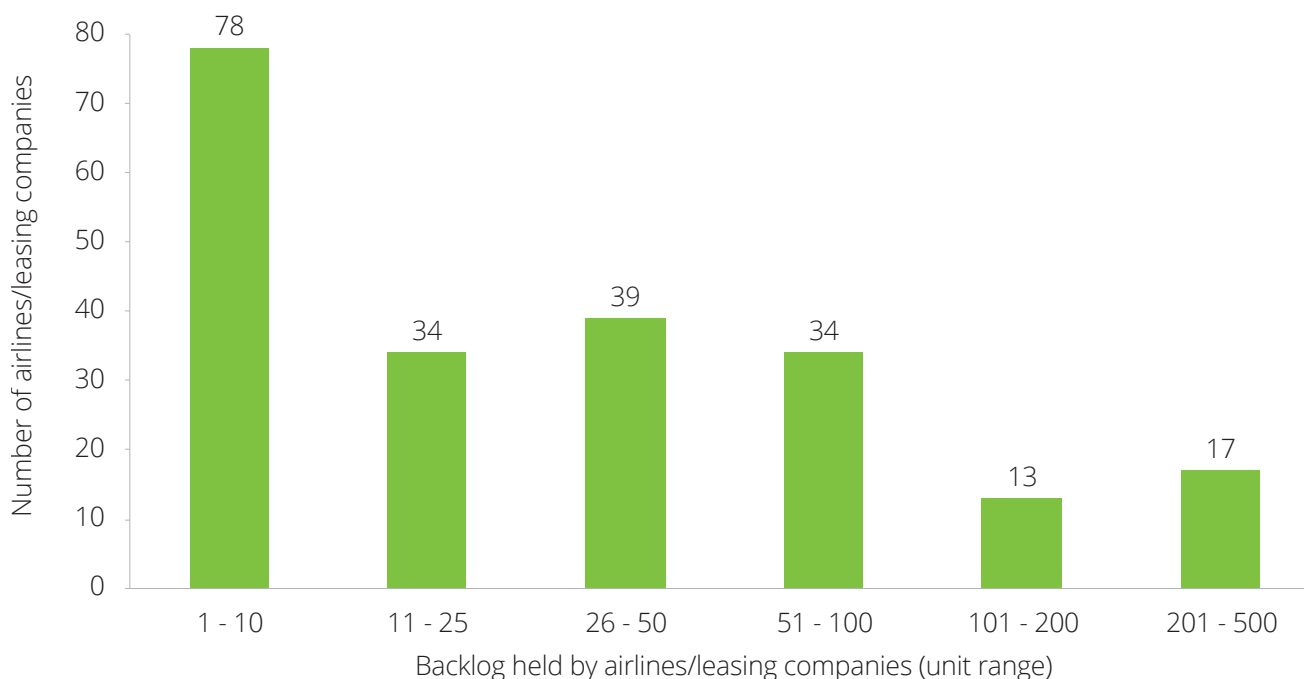
Note: *Fleet size as of December 2014

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier

Out of the backlog of 215 airline/leasing company customers analyzed, 78 customers hold backlog in the range of 1 to 10 units

- Backlog has many customers with small orders on the books
- However, there also appears to be high level of concentration as 17 customers hold backlog in the range of 201 to 500 units (total of 4,757 backlog units)

Unit backlog by unit range



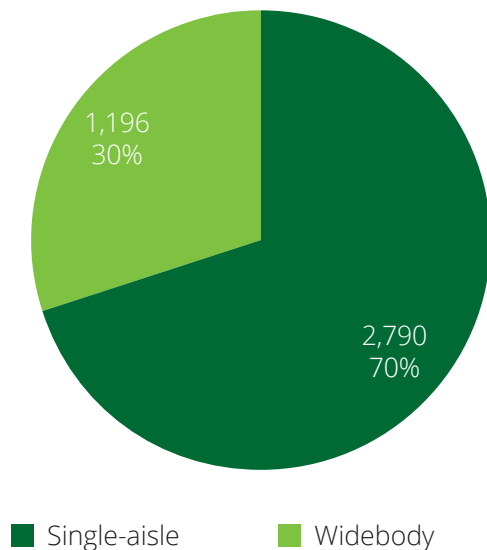
Note: Number of airlines/leasing co. are the major disclosed customers representing more than 85 percent of the total backlog

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal

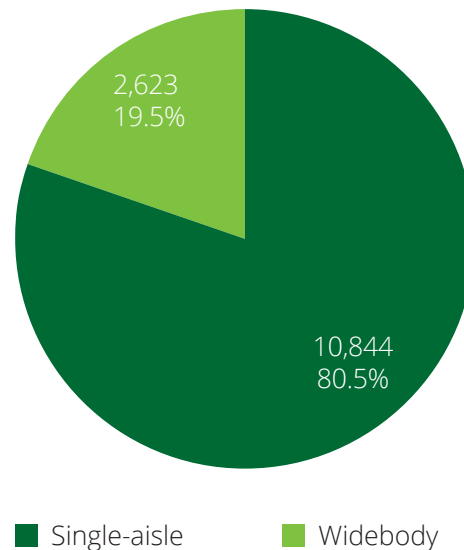
There has been a shift in the single-aisle and wide-body aircraft backlog mix over the last 10 years

- In 2005, single-aisle aircraft accounted for 70.0 percent of the total backlog
- In 2015, the contribution of single-aisle aircraft increased to 80.5 percent of the total backlog of 13,467 units

2005 Backlog by type of aircraft
(number of units and backlog %)



2015 Backlog by type of aircraft
(number of units and backlog %)

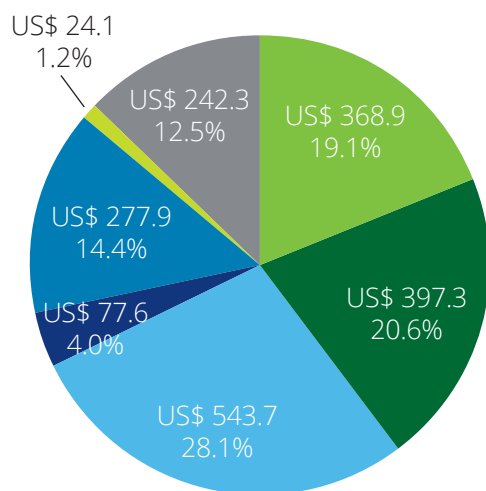


Source: Airbus, Boeing, Flightglobal, Deloitte analysis

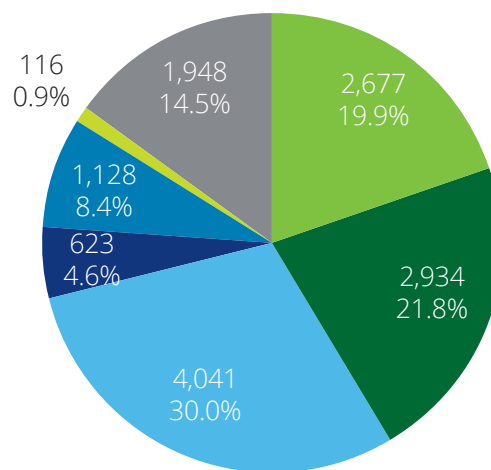
Regionally, Asia-Pacific customers by backlog dollar value equates to \$543.7 billion with 4,041 units, which is 30.0 percent of the total backlog

- Asia-Pacific is the largest customer region, due to above average RPK growth and travel demand
- North America accounted for \$397.3 billion (20.6 percent) of the total backlog
- Europe and CIS held backlog worth \$368.9 billion (19.1 percent)

**Backlog dollar value by region
(US\$ billion)**



**Unit backlog by region
(number of units and backlog %)**

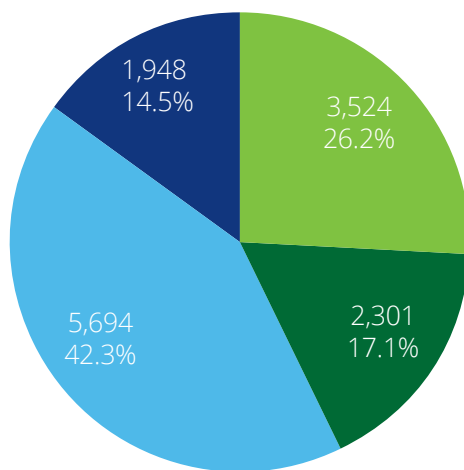


Note: *Includes airline customers undisclosed by OEMs and airline customers for which information was not available
Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

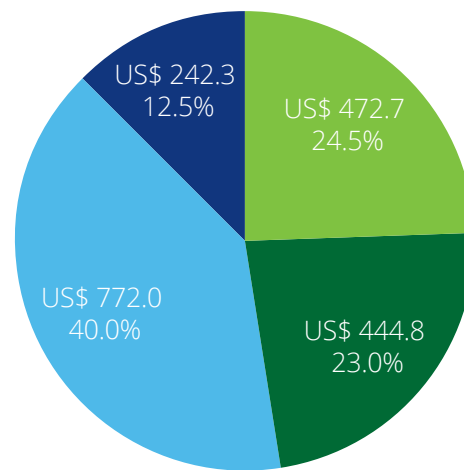
Types of customers have shifted, with private airlines, leasing companies and governments becoming more prominent

- Unit backlog held by state-owned or government-owned airlines, accounted for about 17.1 percent of the total airline industry
- Leasing companies continue to grow, with private and public leasing companies holding 20.9 percent of the global commercial aircraft backlog

**Overall unit backlog—by airline ownership
(number of units and backlog %)**



**Overall backlog value—by airline ownership
(US\$ billion)**



■ Private Airline/Leasing Co. ■ SOE ■ Public Airline/Leasing Co. ■ Undisclosed*

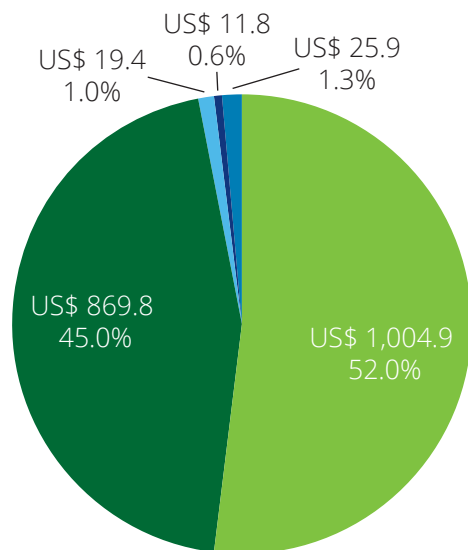
Note: *Includes airline customers undisclosed by OEMs and airline customers for which information was not available

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal

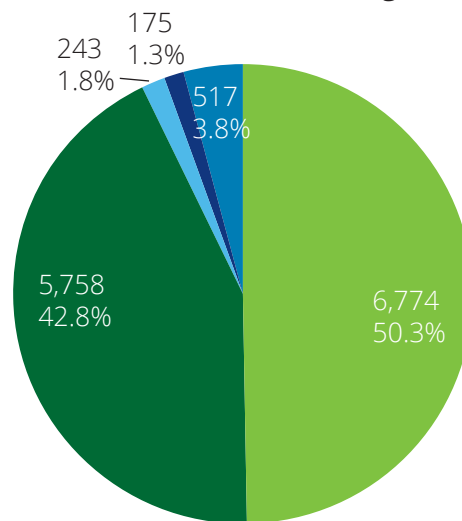
Other commercial aircraft OEMs besides Airbus and Boeing are becoming a factor, although this duopoly still has a commanding market-share of backlog

- Airbus and Boeing together account for 97.0 percent of the backlog dollar value
- This duopoly accounts for 93.1 percent of the unit backlog

Overall backlog value by OEM (US\$ billion)



Overall unit backlog unit by OEM (number of units and backlog %)



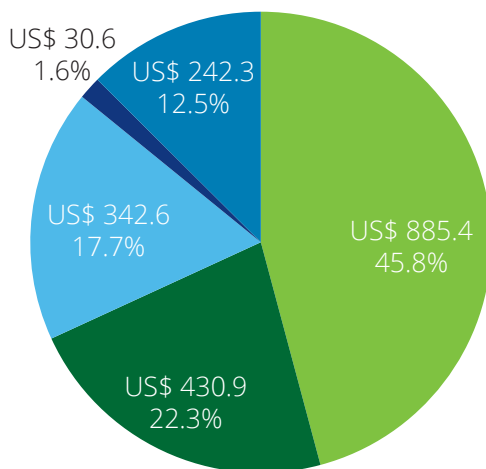
■ Airbus
 ■ Boeing
 ■ Bombardier C Series
 ■ Irkut MS-21
 ■ COMAC C919

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

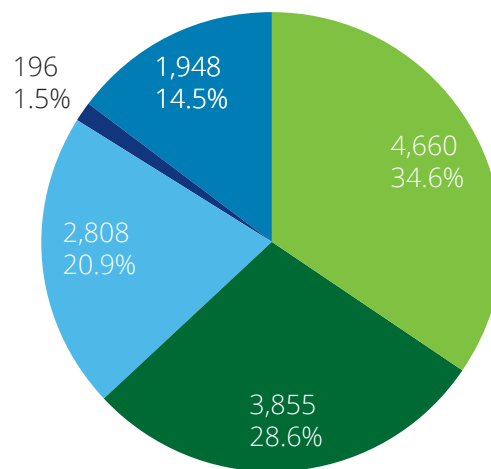
Backlog customer type has shifted towards Low-Cost Carriers (LCC), although Full-Service Carriers (FSC) hold a significant portion of the backlog value

- 22.3 percent of backlog value is held by LCC airlines, followed by leasing companies at 17.7 percent
- FSC airlines still hold a commanding lead with 45.8 percent of the backlog value

Overall backlog dollar value by type of customer (US\$ billion)



Overall unit backlog by type of customer (number of units and backlog %)



■ FSC ■ LCC ■ Other ■ Leasing Company ■ Undisclosed*

Note: *Includes airline/leasing co. customers undisclosed by OEMs and customers for which information was not available

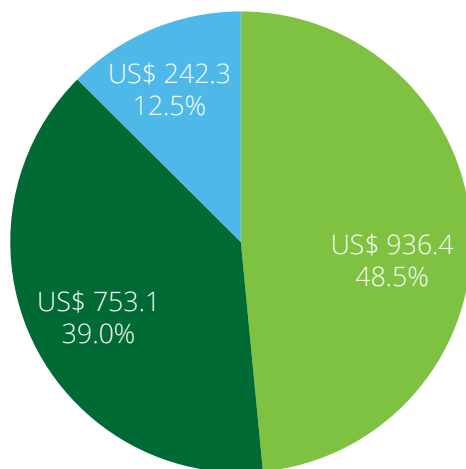
Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

Aircraft order backlog –
a detailed analysis of
creditworthiness

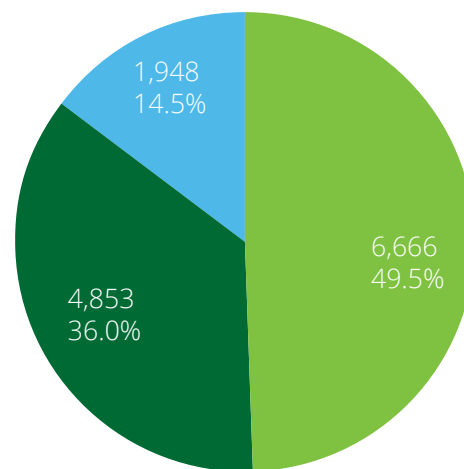
Airlines/leasing companies having a credit rating hold a backlog value of \$753.1 billion or 39.0 percent of the backlog value

- Typically these are public registered companies rated by Moody's, S&P, Fitch, Egan-Jones and other credit rating agencies
- In terms of backlog units, airlines/leasing customers that have credit ratings available hold 36.0 percent or 4,853 units in backlog

Overall backlog dollar value by availability of credit rating (US\$ billion)



Overall unit backlog by availability of credit rating (number of units and backlog %)



■ Airlines/Leasing Co. unrated
 ■ Airlines/Leasing Co. with credit rating
 ■ Customer undisclosed

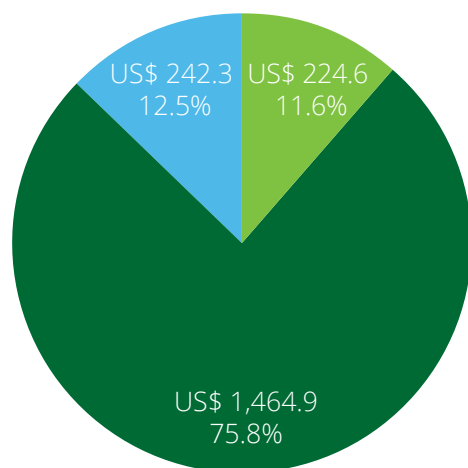
Note: *Includes airline/leasing co. customers undisclosed by OEMs and customers for which information was not available

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

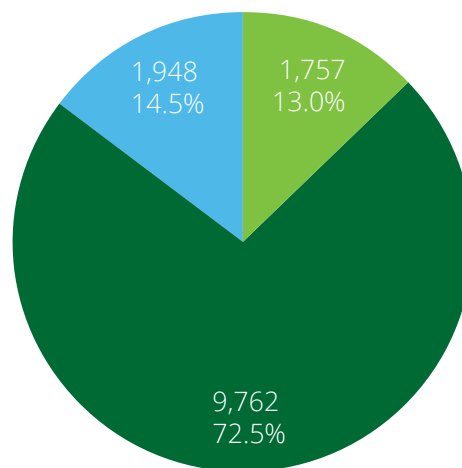
In summary, some 1,757 aircraft (13.0 percent) or US\$224.6 billion (11.6 percent) of the total global backlog value is estimated to be held by vulnerable customers

- Our definition of “vulnerable” is an airline/leasing company with a credit rating of BB or lower; or where there is no credit rating, a customer that has been in business for 10 or less years, and has an order backlog equivalent or more to its current fleet capacity
- To put this in perspective, in a highly unlikely event of an immediate full 13.0 percent reduction in backlog, years of backlog would only be reduced from 9.6 to 8.4 years, equating to 11,716 units of backlog, about a level achieved for the first time in 2013
- As a benchmark, in the 2008/2009 global economic downturn, global unit backlog only decreased 5.4 percent (395 units) and backlog value declined 6.9 percent

Overall backlog value by stability of customers (US\$ billion)



Overall unit backlog by stability of customers (number of units and backlog %)



■ Stable ■ Vulnerable ■ Undisclosed*

Note: *Includes airline/leasing co. customers undisclosed by OEMs and customers for which information was not available

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

A snapshot of the overall vulnerable backlog suggests much of it belongs to smaller customers, with very few having less favorable credit

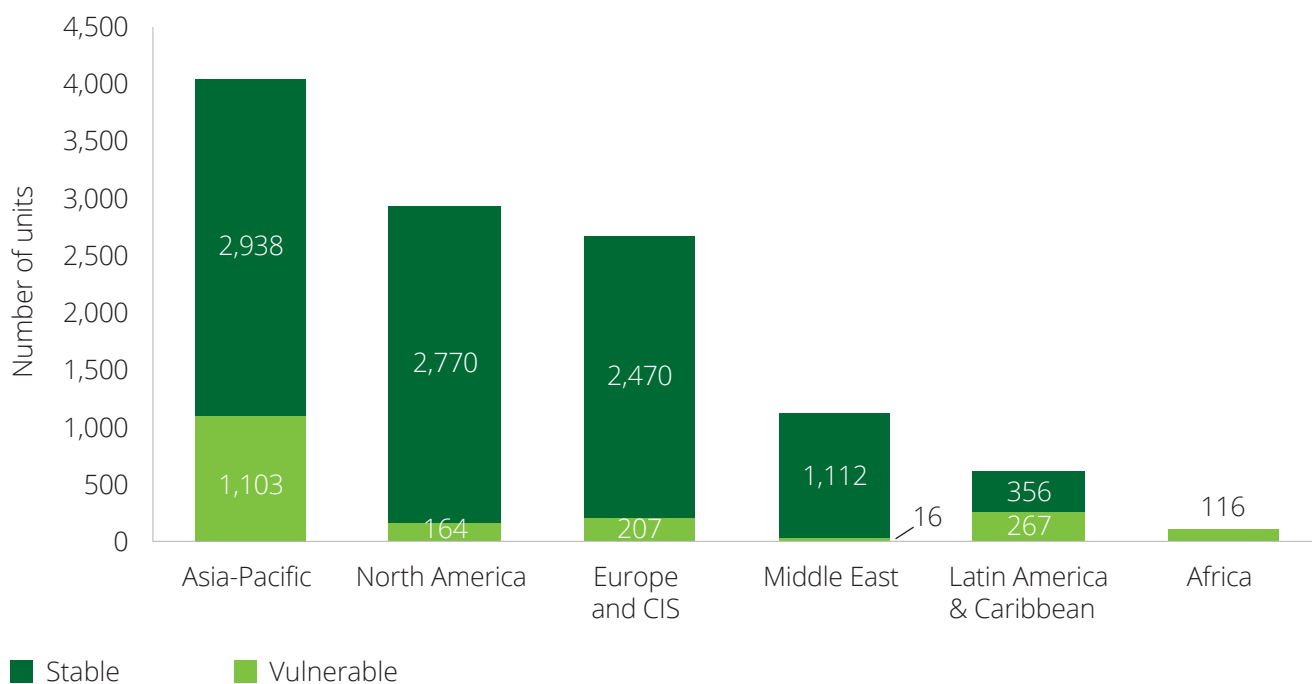
- Out of the total vulnerable unit backlog of 13.0 percent (1,757 units), 7.7 percent is for customers in business for less than 10 years and a backlog to in-service ratio more than 100 percent
- The balance at 5.3 percent (716 units) of the vulnerable backlog is composed of customers rated BB or lower, non-operational airlines, bankrupt airlines and airlines yet to start operations

	No. of airlines	Unit backlog	Unit backlog as a percent of total	No. of airlines vulnerable	Unit backlog vulnerable	Unit backlog vulnerable as a percent of total
Airlines in business for less than 10 years and backlog to in-service ratio more than 100 percent	19	1,508	11.2%	17	1,041	7.7%
State-owned airlines rated BB or lower	3	188	1.4%	3	188	1.4%
Non-state-owned airlines rated BB or lower	6	377	2.8%	6	377	2.8%
Non-operational, bankrupt and airlines yet to start operations	9	151	1.1%	9	151	1.1%
Total	37	2,224	16.5%	35	1,757	13.0%

By region, Asia-Pacific had 1,103 units (27.3 percent) defined as vulnerable, due to relatively younger airlines, predominance of LCCs and aggressive growth plans

- North America and Europe and CIS had more stable backlog, with vulnerable backlog at 5.6 percent and 7.7 percent respectively, primarily due to airline market maturity and capacity discipline
- For North America, the majority of the backlog (2,770 units or 94.4 percent) was with stable and generally higher credit rated airlines
- For Middle East, only 1.4 percent (16 units) of the unit backlog was held by airlines/leasing companies that were vulnerable

Unit backlog by region and creditworthiness



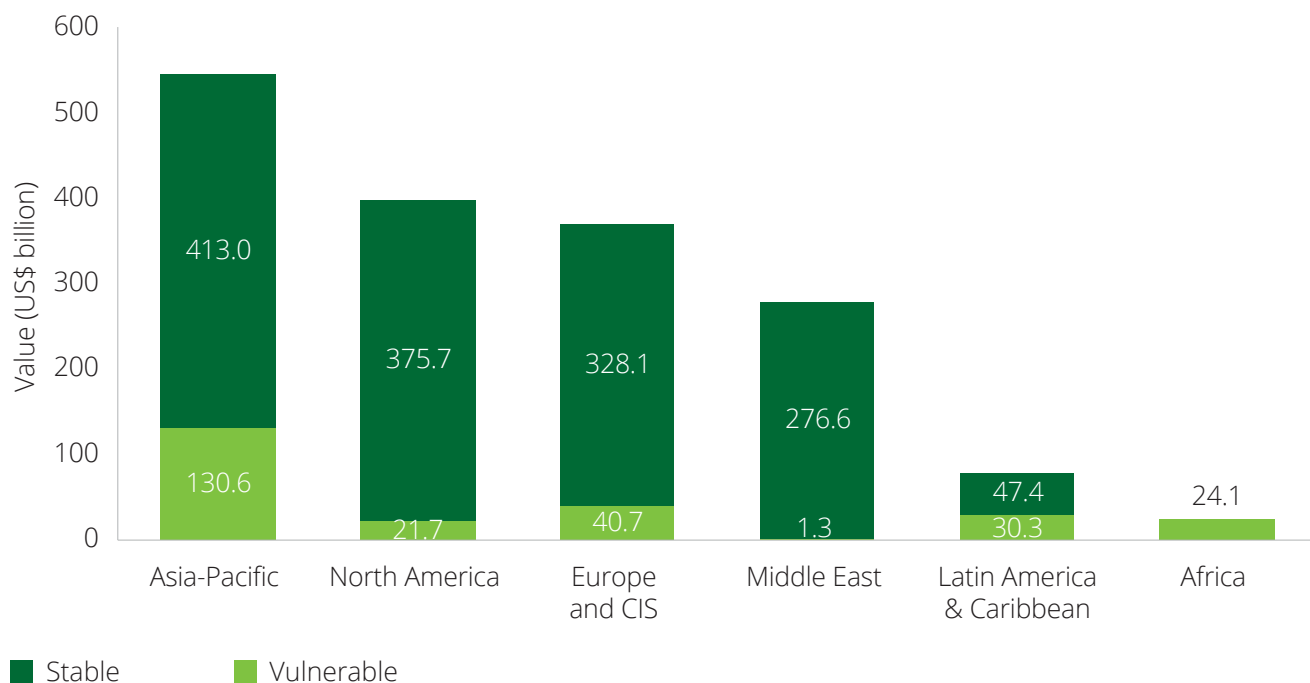
Note: Base units exclude airline/leasing co. customers undisclosed by OEMs and customers for which information was not available; hence, total units will not add up to industry backlog of 13,467 units

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

Also by region, backlog value for Asia-Pacific vulnerable customers is 24.0 percent, whereas North America's vulnerable airline backlog is only 5.5 percent

- Europe and CIS region's backlog value comprised \$40.7 billion (11.0 percent) held by airlines/leasing companies that are vulnerable
- The Middle East has virtually no vulnerable backlog

Overall backlog value by region and risk (US\$ billion)



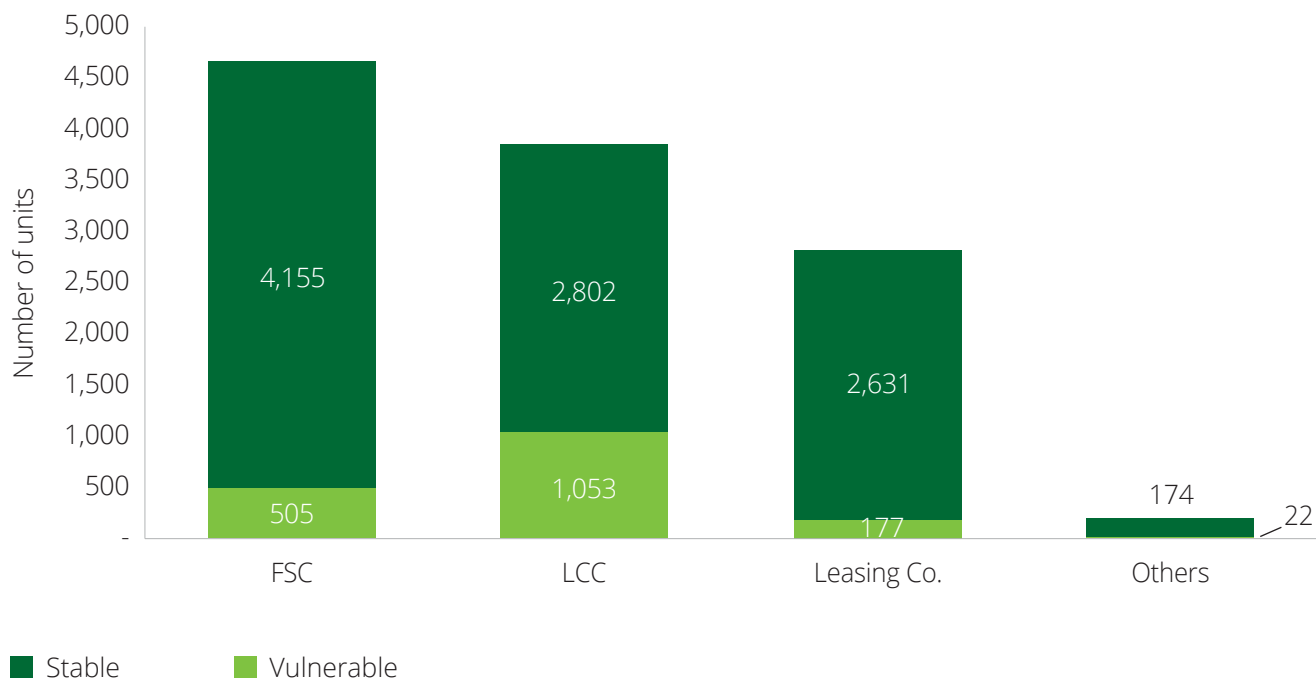
Note: Base value excludes airline/leasing co. customers undisclosed by OEMs and customers for which information was not available; hence, total value will not add up to industry backlog of \$1.9 trillion

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

By customer type, FSCs & LCCs accounted for 40.5 percent and 33.5 percent of the total unit backlog respectively

- Leasing companies held 24.4 percent of the total commercial aircraft backlog
- For leasing companies, only 6.3 percent of the unit backlog is attributable to vulnerable customers
- Out of the total unit backlog attributed to FSCs, 10.8 percent is held by vulnerable customers
- However, for LCCs, vulnerable backlog was much higher, accounting for 27.3 percent

Overall backlog unit by type of customer and risk



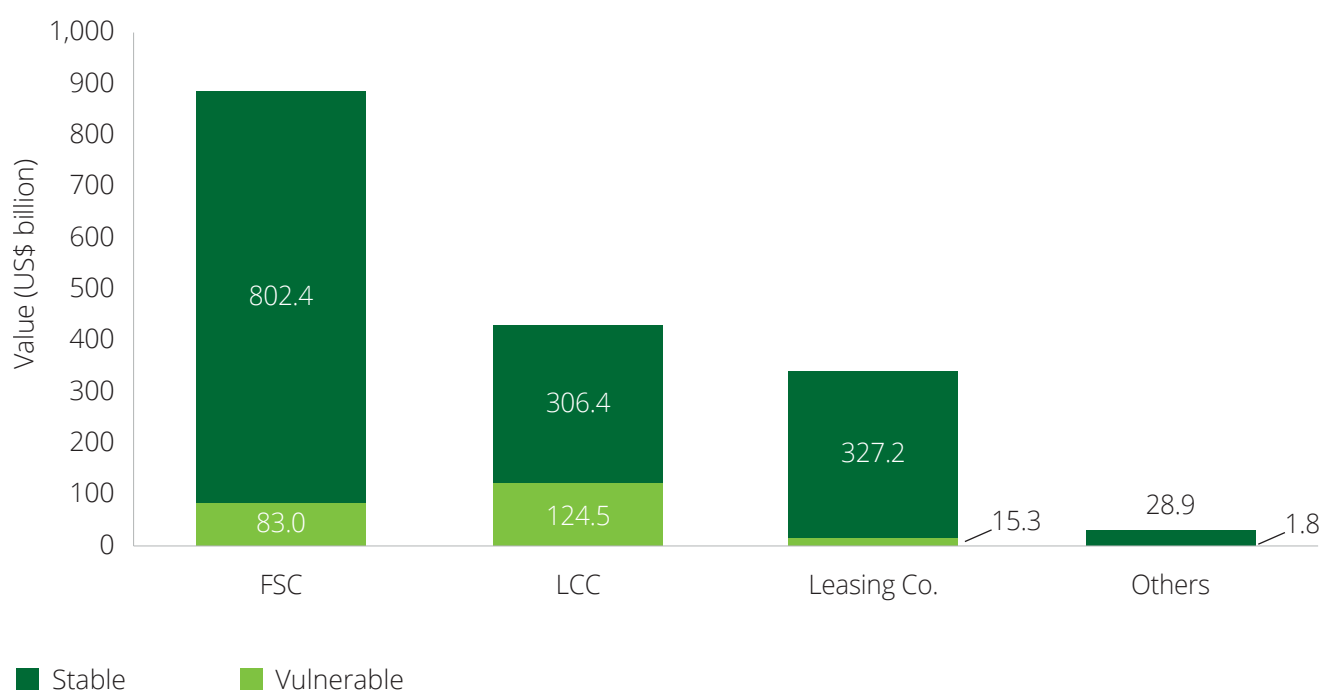
Note: Base units exclude airline/leasing co. customers undisclosed by OEMs and customers for which information was not available; hence, total units will not add up to industry backlog of 13,467 units

Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

In terms of backlog value, FSCs accounted for about half of the total backlog value, followed by LCCs, which accounted for 25.5 percent of backlog value

- Backlog dollar value attributable to the vulnerable customers accounted for only 9.4 percent of the total FSC backlog dollar value, with majority of the backlog value being stable
- On the other hand, 28.9 percent of the LCC backlog dollar value was for vulnerable customers

Overall backlog value by type of customer and creditworthiness (US\$ billion)



Note: Base value excludes airline/leasing co. customers undisclosed by OEMs and customers for which information was not available; hence, total value will not add up to industry backlog of \$1.9 trillion

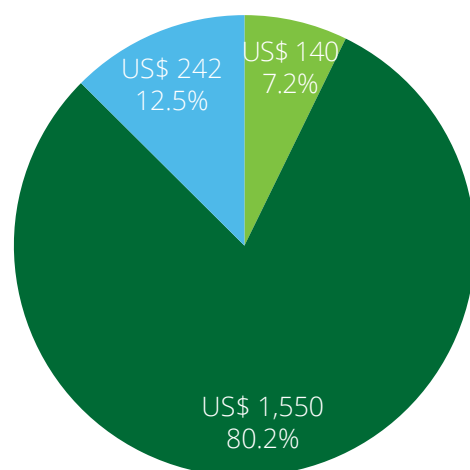
Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

Sensitivity analysis

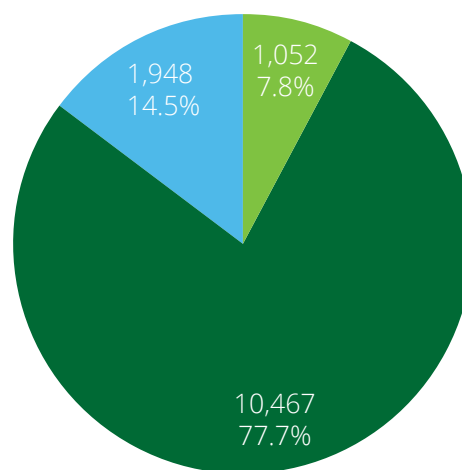
A sensitivity analysis using a more restrictive definition of a vulnerable customer results in 7.2 percent backlog dollar value at risk in a recession

- In this scenario, a modified definition of “vulnerable” is applied to an airline/leasing company with a credit rating of BB or lower, or where there is no credit rating; a customer that has been in business for 5 or less years, and has an order backlog of more than 25 aircraft
- Under this classification there are likely 1,052 aircraft (7.8 percent) or US\$139.9 billion (7.2 percent) of the total global backlog value held by vulnerable customers
- In this scenario, a highly unlikely and immediate full 7.8 percent reduction in backlog would reduce backlog years from 9.6 to 8.9 years, equating to 12,417 units of backlog

Overall backlog value by stability of customers (US\$ billion)



Overall unit backlog by stability of customers (number of units and backlog %)



■ Stable ■ Vulnerable ■ Undisclosed*

Note: *Includes airline/leasing co. customers undisclosed by OEMs and customers for which information was not available
Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, Flightglobal, Capital IQ, and Bloomberg

Methodology

Customer categorization – Methodology

- For the purpose of the analysis, the listed metrics for 215¹ airlines/leasing companies (for which information was available) was analyzed to categorize commercial aircraft backlog as stable or vulnerable:
 - Type of airline: Public, Private or State-owned enterprise (SOE)
 - Credit ratings
 - In-service fleet size
 - Aircraft backlog units
 - Backlog to in-service fleet ratio percent²
- Criteria to classify airlines/leasing companies as stable or vulnerable:
 - For airlines/leasing companies rated by credit agencies (including SOEs), airlines/leasing companies with credit rating BB or lower have been classified as vulnerable; ratings BB and above are categorized as stable
 - For non-rated airlines/leasing companies, a Public/Private (Non-SOE) airline which is less than 10 years in business and has a backlog to in-service fleet ratio of above 100 percent, has been classified as vulnerable
 - All other public and private airlines/leasing companies have been classified as stable. State-owned or government-owned airlines that are not credit rated are classified as stable as they are less likely to experience deferrals or cancellations due to financial stress
- Backlog value is calculated at list prices, and backlog units are calculated at the current rate of aircraft production

Source: Deloitte analysis

Note: 1) Includes major disclosed airline customers, representing more than 85 percent of the total backlog

2) Backlog to in-service fleet ratio is defined as "Current order backlog / In-service fleet"

Backlog data is sourced from Airbus and Boeing websites, hence, not likely that there is double counting of units between airlines and leasing companies

Caveats

- The analysis has not assessed each individual OEM's backlog, nor individual airline/leasing company customers, nor have comments on the creditworthiness or vulnerability thereof in backlog.
- Information on 215 of the 233 customers of OEMs was available for analysis, and the analysis offers observations attributable to the entire backlog, including the 18 other customers not assessed. This extrapolation might not be valid.
- The definition of vulnerable is based on criteria which may not be valid or agreed by others that offer financing to purchase aircraft.
- For customers with a credit rating, those with higher than BB may indeed have vulnerability in a severe economic recession to deferrals and cancellations, even though this analysis assumes not. Conversely, customers with BB or lower ratings could indeed have stability in their orders, although for this analysis it is assumed not.
- For non-credit rated customers in business 10 or less years, and have orders in backlog double their current fleet, it is assumed they are a vulnerable customer, absent specific credit ratings indicating otherwise. This definition may not be valid.
 - Customers that have orders in backlog that are double their current fleet size may indeed be creditworthy, even though they do not have a public credit rating by one of the agencies.
 - Customers that have been in business 10 years or less may indeed be creditworthy.
- Government and state-owned enterprises may indeed have orders in backlog subject to deferral or cancellation, even though for this analysis it is assumed that they are not vulnerable.

Source: Deloitte analysis

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