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FIELD_LAB Pairs Trade

Pairs Trade Strategy and Valuation Dynamics of Boeing and Airbus in the Aerospace
Industry.

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Abstract

This study investigates the use of pairs trade strategy in the aerospace industry, concentrating on a comparison between Boeing and Airbus. It combines theoretical concepts with practical implementations, employing multiple financial instruments to create a comprehensive trading strategy. The study seeks to balance risk and return in a highly competitive market by giving insights into the two industry leaders' organizational structures, financial health, and market dynamics. The project is a realistic application of financial analysis, risk management, and strategic valuation. Where the Discounted Cash Flow method, the multiples analysis and the dividend discount model are used to find the fair value of both stocks.

Keywords: Trading, Financial Markets, Valuation, Corporate Finance, Aerospace Industry, Boeing, Airbus, Risk Management, Hedge Funds

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Introduction

This research initiative is dedicated to a detailed examination of the aerospace and defense sector, with a specific emphasis on industry leaders Airbus and Boeing. Employing rigorous methodologies such as a Porter's Five Forces analysis and a SWOT analysis, this study aims to unravel the complexities inherent in the aerospace industry.

The financial health of both Airbus and Boeing will be subjected to meticulous scrutiny, encompassing critical metrics including liquidity, solvency, profitability (analyzed through a detailed ROE decomposition utilizing Du Pont analysis), and the cash conversion cycle. Subsequently, the project endeavors to establish the fair value of stocks through the implementation of a Discounted Cash Flow (DCF) model. Additionally, a comparative analysis will be conducted, utilizing four key ratios to provide a holistic evaluation of the financial standing of these industry giants. Taking a strategic leap, a pairs trading strategy, a manifestation of statistical arbitrage, will be applied to explore the correlation between Airbus and Boeing stocks. This tactical approach seeks to identify potential investment opportunities by capitalizing on the relationship between these industry frontrunners. To fortify risk management, the pairs trade will undergo a comprehensive analysis, leveraging tools such as Value at Risk (VaR) and alternative risk measures including Conditional Value at Risk (CVaR), stress tests, and drawdown assessments.

The synthesis of these analyses will culminate in the identification of a winning stock, derived from a comprehensive evaluation encompassing financial health, market dynamics, and strategic positioning within the aerospace industry. This initiative aspires to furnish investors with discerning insights and well-informed recommendations, bridging the divide between theoretical concepts and pragmatic applications in the dynamic and technologically advanced aerospace sector.

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Company Overview

Boeing (BA)

Boeing (BA) Nowadays and product lines

Since its foundation in 1916 and until now, Boeing has been able to strengthen its commercial and productive base, becoming one of the biggest players on the aerospace industry. Today The company is divided into three main divisions: Commercial Airplanes, Defense, Space, and Security, and Boeing Global Services. Also, the company's organizational structure has functional divisions that work together in different areas. These divisions specialize in technological advancements, security, economics, quality control, efficiency enhancement, advanced design and production techniques, engineering and program administration, and technological innovation and implementation. Interconnected functional areas ensure the smooth operations and innovation of Boeing across its varied portfolio (The Boeing Company: General Information, n.d.).

- ❖ **Commercial:** Responsible for producing commercial jetliners such as the 737 and 747 families. Furthermore, Boeing is constantly innovating new aircraft, such as the 737 MAX, 777X, and 787-10 Dreamliner. The cargo sector may show the company's influence, with Boeing aircraft handling over 90% of all cargo worldwide ("The Boeing Company: General Information" n.d.).

There were 371 Boeing aircraft delivered as of September 30, 2023, (“Commercial Airplanes - Boeing” 2023). The figures 1.11 show that the Boeing 737 is the most popular plane, with 286 aircraft being delivered. The Boeing 747 has 73 deliveries, followed closely by the Boeing 767, which has 17 deliveries. This distribution exemplifies the diverse requirements of the aviation industry, comprising a blend of passenger travel, freight transportation, and commercial operations that drives Boeings deliveries.

- ❖ **Defense, Space, and Security (BDS):** Satellites, military aircraft, and human spaceflight are some solutions provided by Boeing. The AH-64 Apache helicopter, the 702 family of satellites, and the KC-46 aerial refueling aircraft are some products offered by BDS. The goal of BDS is to better utilize information technology and enhance aircraft capabilities (“The Boeing Company: General Information” n.d.).
- ❖ **Boeing Global Services:** Provides a full range of support services to clients in the commercial, defense, and space sectors. Boeing Global Services has experience in supply chain management, engineering, digital analytics, and training assistance and guarantees continuous support, preserving the effectiveness of commercial aircraft and offering mission assurance to countries all over the world (“The Boeing Company: General Information” n.d.).

Boeing (BA) Key Clients

According to company information, in 2022, Boeings business mix contributed to enterprise revenue in the following percentages. Commercial aircraft was the biggest business segment,

making up 39% of enterprise sales. The defense, space, and security sector was the second largest, accounting for 35% of enterprise revenue. Global Services was the third-largest revenue generator, accounting for 26% of the total enterprise earnings (“DEFENSE, SPACE & SECURITY OVERVIEW” 2023).

In terms of commercial planes, the American market is the biggest market for Boeing. On a year-to-date basis (YTD), September 30, 2023, is the last date. Boeing has delivered 371 airplanes, of which 207 were acquired by the American market. The biggest players in this market were Southwest Airlines (69 units) and United (59 units). It is also worth mentioning that the Irish company Ryanair has received 40 units in the same time-lapse (“Commercial Airplanes - Boeing” 2023). Additionally, in the military, aerospace, and security industry, the biggest client is the US government, which accounts for 74% of the total revenue of the company in this industry line (“DEFENSE, SPACE & SECURITY OVERVIEW” 2023).

Airbus (AIR)

Airbus (AIR) Nowadays and product lines

Nowadays, Airbus SE, which is based in Toulouse, France, is a well-known European public company with shares listed in France, Germany, and Spain. Following a rebranding initiative, the corporation and its subsidiaries are now referred to as “the company” instead of “the group.” The part of Airbus that used to be called “Airbus Commercial Aircraft” is now just “Airbus.” Airbus SE is engaged in the development, production, delivery, and provision of aeronautical products, space systems, and associated services (“2022 Annual Report - Airbus” 2023). The company operates in various segments, including:

❖ **Airbus Commercial Aircraft:** Airbus Commercial Aircraft offers a wide range of passenger aircraft with seating capacities ranging from 100 to 850 passengers. All of these aircraft are designed for maximum comfort, efficiency, and innovation. By catering to varied needs, Airbus offers a pleasant experience for passengers, pilots, and crew, including those of VIPs, government officials, business travelers, and vacationers. The A320 Family is the most popular type of plane for single-aisle flights. The A220 Family is also popular, and the A330 Family is good for long-haul flights. The A350 marks Airbus peak in modern aviation, incorporating market criteria for size, range, revenue generating, passenger comfort and environmental sustainability (“Commercial Aircraft | Airbus” n.d.).

In the year 2022, Airbus delivered a total of 661 commercial aircraft, representing an increase of 8% in comparison to the previous year. The A321 family ranked as the most popular aircraft with 264 deliveries, followed by the A319 and A320 with combined deliveries of 252 and the A350 with 60 deliveries. Finally, the A220 family delivered 53 planes, while the A330 delivered 32 planes (“Airbus - 2022 Commercial Aircraft Highlights” 2023)

❖ **Airbus Helicopters:** The Airbus helicopter line provides effective helicopter solutions for a broad range of tasks, including those related to government, military, and regulatory compliance. Their helicopters, which are used in over 150 countries, do a lot of different things, like emergency services and dangerous missions. A diverse variety of rotary-wing aircraft is provided to specific customer requirements by Airbus, which prioritizes safe transportation and vertical flight activities (“Helicopters | Airbus” n.d.).

❖ **Airbus Defense and Space:** As a prime contractor for initiatives such as Europe Future Combat Air System (FCAS), the company creates novel solutions such as the Multi-Domain Combat Cloud (MDCC) and the Network for the Sky (NFTS). Its product portfolio includes the Eurofighter Typhoon combat aircraft, the A400M, C295, and CN235 airlifters, and the A330 Multi-Role Tanker Transport. Airbus also provides robust unmanned aerial systems (UAS) and secure, resilient communications capabilities for networks and systems (“Airbus Defence” n.d.). Airbus provides a diverse range of solutions to space exploration, including electronic components, scientific satellites, crewed spacecraft, and telecommunications relay platforms. The ArianeGroup, a joint venture between Airbus and Safran, is in charge of Europe's Ariane launcher projects, demonstrating Airbus' proficiency in up-to-date launch vehicles and space missions (“Airbus Space” n.d.).

Airbus (AIR) Key Clients

The revenue of Airbus in the year 2022 was approximately €58.8 billion, representing a rise of 13% in comparison to the previous year. The company's commercial aircraft business division contributed the most revenue, accounting for €41.4 billion, or 70% of the total revenue. The helicopter business segment generated revenues of €7 billion, accounting for 12% of the total revenue, while the defense and space business segment generated revenues of €10.3 billion, accounting for 18% of the total revenue (“Airbus Reports Full-Year (FY) 2022 Results” 2023).

In 1995, Airbus established a distinct section devoted to the management of aircraft lessors. The notable lessors working with Airbus included large entities like General Electric Capital Aviation Services and the International Lease Finance Corporation, both of which were major customers of the company (“Market | Airbus” n.d.). In 2022, lessors got 28% of all deliveries. On the other hand,

23% of all aircraft were made for the European market, 22% for the “Americas,” and 21% for the Asia-Pacific market (“Airbus - 2022 Commercial Aircraft Highlights” 2023).

Aerospace Industry Analysis

Porter’s Five Forces Industry and Competition Analysis

Michael E. Porter created the Five Forces model in 1980. It is a popular way of looking at industries and making company strategies. This approach is based on the idea that a company's approach should be able to take advantage of new possibilities and take on new risks. According to Porter, there are five competing forces that shape every industry and market. Those forces affect the level of competition in a particular industry and, as a result, how profitable and attractive it is (Asad 2012). According to this approach, the goal of corporate strategy should be to manage these competitive factors in such a way that the organization's position improves. Porter identified five things that will help us understand the aerospace industry better:

Threat of New Entrants

New companies entering the aerospace industry do not pose a big threat for big players like Boeing and Airbus because of many reasons. Firstly, the aviation industry is highly complex and capital-intensive, requiring substantial financial resources and expertise for aircraft development and manufacturing. Established enterprises in the industry have made significant investments in research, development, and supply chain networks, thereby imposing significant barriers to entry (Robles 2022). Secondly, stringent safety and regulatory standards govern aerospace operations. Obtaining certifications and ensuring compliance with these standards are crucial, requiring in-depth industry knowledge. Established companies have a history of meeting these standards,

making it difficult for new entrants to navigate the regulatory complexities effectively (“Safety and Certification - Aerospace Industries Association” n.d.).

Furthermore, the aerospace industry benefits from strong brand recognition and customer loyalty. Companies with long-standing relationships with airlines and a reputation for delivering high-quality and reliable aircraft have a competitive advantage. Building such trust and gaining market dominance is a challenge for fresh players, as you can see most often on commercial aircraft (Hivelr Business Review 2023). Finally, the industry operates on extended product development cycles, involving years of design, testing, and certification before a new model is introduced, "The product lifecycles in aerospace is 10 years of development, and then three decades of product service. This means that the engineering and product data fidelity has to exist for that extended period" (Grasson 2012). Established players have the experience and infrastructure to manage these processes efficiently, putting new entrants at a disadvantage.

Supplier Bargaining Power

Supplier bargaining power in the aerospace industry is a critical aspect that has a substantial impact on company operations and profitability. This influence varies based on numerous factors. To begin with, the aerospace industry relies on a vast network of suppliers to supply a varied range of components and materials required for aircraft construction (Prakash 2023). These vendors play an important role in the aerospace supply chain, contributing things like avionics systems, engines, landing gear, and other critical components. Collaboration with various suppliers is essential, given the complexity and scope of aerospace manufacturing.

Buyer Bargaining Power

A buyer influence, especially in the aviation sector, has a significant impact on the business dynamics and plans of the aerospace industry. The buyers influence can have a significant impact on pricing, order numbers, and contract terms. Buyers have a considerable bargaining power in the industry due to several compelling factors. The aviation industry is, first of all, a fiercely

competitive and price-sensitive sector. Airlines regularly engage in intense discussions with aircraft manufacturers to secure the most affordable prices for fleet additions. Airlines, as significant clients, possess the capability to evaluate proposals from multiple manufacturers and pursue the most advantageous terms and pricing (Hivelr Business Review 2023).

Furthermore, the aviation sector has encountered numerous obstacles in recent times, such as financial woes, fluctuating fuel costs, and alterations in consumer preferences (Dube 2023). Airlines have increased their bargaining strength by focusing on cost efficiency and profitability during these obstacles. In line with their financial and operational objectives, airlines may opt to postpone or cancel purchases, engage in bargaining sessions, or request a higher level of financial support. Furthermore, the emergence of low-cost operators and the dominance of leasing firms has given airlines greater flexibility in managing their fleet. Lease companies have the ability to negotiate large orders and leasing agreements with manufacturers (“Aircraft Leasing: Proven Resilience - KPMG Ireland” 2022), which puts extra pressure on the aerospace players to offer competitive prices and attractive terms.

Threat of Substitutes

Substitutes are not a big problem for the aerospace industry, where companies like Boeing and Airbus operates. Substitutes, or other products or services that meet identical client needs, are limited in the commercial aircraft manufacturing industry. Air travel is the predominant mode of long-distance transportation, especially for international and transcontinental travel (Sheffield School of Aeronautics n.d.). Commercial airlines heavily rely on aircraft for their operations, and no other mode of transportation can match the speed, efficiency, and global reach of airplanes.

While railroads, ships, and vehicles can provide specialized types of travel, they are not realistic alternatives to substantial long-distance air travel on a large scale.

Industry Rivalry

The aviation industry is characterized by a significant degree of rivalry. Boeing and Airbus are engaged in fierce competition in order to secure their share of the market, especially in the commercial aircraft sector. These industry giants consistently push the boundaries of creativity, introducing fresh aircraft designs and competing for orders from airlines around the globe. The competitive landscape between Boeing and Airbus is shaped by factors such as pricing strategies, technological advancements, product excellence, and customer preferences (Kannan, 2020).

The aerospace industry is also known for its long product development cycles. Introducing new aircraft models to the market is a multi-year process, during which the competitive landscape can shift significantly. The timing of new products, the capacity to offer cutting-edge offerings, and the effectiveness of manufacturing procedures all contribute to gaining a distinct advantage in the market (Hussain et al. 2019). Any delays or setbacks in the development of new products can have a profound impact on a company's ability to compete effectively. Also, how the industry changes depends on how much people want to fly around the world, how the economy is doing, and geopolitical influence. These things outside can cause orders to fluctuate, cancel, or delay, making it harder to keep market share and make money.

SWOT Analysis

Airbus

Airbus exhibits notable strengths as a major player in the aerospace industry. The company's diverse product portfolio, encompassing aircraft, helicopters, and defense systems, positions it

strategically in various market segments. Airbus is recognized for its commitment to innovation and technology, leading to advancements in the aerospace field. This focus extends to environmentally friendly solutions, aligning with evolving industry demands.

With a robust global presence, Airbus operates in key countries and maintains strong relationships with a broad customer base, ranging from commercial airlines to governments and defense organizations. The company's skilled workforce contributes to its success, fostering a culture of innovation and continuous improvement.

Despite these strengths, Airbus faces challenges such as a complex supplier network, high research and development costs, and vulnerability to economic downturns inherent to the aerospace industry's cyclical nature. Intense competition, particularly from major players like Boeing, Bombardier, and Embraer, adds pressure on Airbus to innovate continuously.

Amidst challenges, Airbus identifies opportunities for growth. The increasing global demand for air travel, especially in emerging markets in Asia and Africa, presents a promising avenue. The company can capitalize on the growing emphasis on fuel efficiency and sustainability, aligning its focus with industry trends.

Furthermore, Airbus sees potential in expanding its services, delving into unmanned aerial vehicles (UAVs), and exploring opportunities in space exploration. These strategic moves could contribute to additional revenue streams and strengthen its position in the market. However, Airbus remains vigilant against potential threats. These include intense competition, economic downturns affecting the industry, stricter environmental regulations, supply chain disruptions, and the ever-present challenge of rapid technological advancements. The emergence of new competitors, particularly from technologically advanced nations like China and Russia, adds to the competitive landscape.

Boeing

Strengths

Boeing enjoys a robust and esteemed brand within the aerospace industry, marked by widespread recognition. The company's expansive product and service portfolio encompass commercial and military aircraft, satellites, and defense-related products. Demonstrating a commitment to innovation, Boeing possesses formidable research and development capabilities, consistently delivering cutting-edge products and technologies. With a significant global footprint, Boeing operates manufacturing facilities and conducts operations across numerous countries. Established and positive relationships with major customers, including airlines and governments, contribute to Boeing's competitive advantage.

Weaknesses

Boeing's dependence on the commercial airline industry exposes it to the inherent risks of economic downturns and shifts in consumer behavior. Intense competition within the aerospace sector, particularly from Airbus, presents a challenge to Boeing's market position. The company grapples with high debt levels, a consequence of substantial investments in new products and technologies. Safety concerns surrounding the 737 MAX aircraft pose a significant weakness and potential reputational risk.

Opportunities

The company can capitalize on the growing demand for commercial air travel, particularly in emerging markets. Opportunities for expansion into space exploration and tourism markets present avenues for diversification. The increasing demand for unmanned aerial vehicles (drones) in both

military and civilian applications offers a promising growth area. Mergers and acquisitions represent strategic opportunities for Boeing to enhance its market position and capabilities.

Threats

Economic downturns and changes in consumer behavior pose threats to the commercial airline industry, impacting Boeing's revenue streams. Fierce competition from Airbus and other aerospace companies challenges Boeing's market share. Government regulations and tariffs affecting international trade introduce external threats. Continued safety concerns and issues associated with the 737 MAX aircraft pose risks to Boeing's reputation and market standing.

Is There Collusion Between Boeing and Airbus?

No evidence exists that Airbus and Boeing conspired in the market. Both corporations have been involved in a long-running and complex trade dispute, which has led to many judgments and WTO rulings. The World Trade Organization has examined and ruled on numerous instances of government assistance and financial assistance for both Airbus and Boeing, demonstrating that they are engaged in competitive rather than cooperative behaviours. To end unfair help, the World Trade Organization conducted investigations into public assistance for both firms, concluding that certain aid supplied to Airbus and Boeing breached export subsidy regulations. Government loans for the Airbus A380 and several sources of US funding for Boeing are included in this (Reuters 2021).

Considering the absence of any collusion between Airbus and Boeing, it is evident that the market dynamics, market share, and positioning of both businesses are primarily influenced by their plans, capabilities, and market responses. The success and market share of both Airbus and Boeing are determined by their capacity to invent, respond to customer demands, and handle specific obstacles in the aerospace industry, which is characterized by a highly competitive environment. Moreover, the regional ecosystems in Europe and the United States, where these corporations are situated,

play a significant role in the formulation of their strategies and market positions. The legal frameworks, financial conditions, and technological advancements in these regions affect operational choices and aggressive strategies (Duddu 2020).

Geopolitical Effects

Because of restrictions on flying, changes to routes, and problems with getting supplies, the conflict between Russia and Ukraine in 2023 has had a big impact on the plane industry. Airlines are experiencing higher operational expenses due to airspace overflight restrictions, which has restricted air connections between Europe and Eastern Asia. The imposition of sanctions has led to the suspension of Airbus and Boeing aircraft deliveries to Russian customers, as well as the confiscation of leased aircraft. Russia's titanium, which is required for the manufacture of contemporary aircraft, is a major source of concern for the aerospace industry (Walton 2022). While European companies like Airbus continue to buy Russian titanium, Boeings contract with the Russian VSMPO-AVISMA, the main titanium supplier, has been suspended in 2022 (Lin 2022). Higher operational expenses, higher plane ticket prices and financial challenges for airlines and aerospace industries have been caused by the COVID-19 pandemic aftermath and the aforementioned issues.

As of September 29, 2023 (the date of valuation), there have been no actual hostilities, therefore the potential ramifications of an Israel-Palestine conflict for Boeing and Airbus remain speculative. Any further escalation in this region could have serious consequences for both companies. Any crisis in the Middle East could disrupt supply lines, decrease demand for commercial, increase military aircraft, and affect global oil prices, which could affect airline operations and aircraft orders. Given the regions geopolitical sensitivity, a confrontation could have broader political and economic ramifications, influencing the global aircraft sector, in which both Boeing and Airbus play major roles.

The present economic tensions between the United States and China have had distinct impacts on Boeing and Airbus. Boeing has had a hard time because of the strained relationships, but there are

signs that things might be getting better. Agreements were reached that may reduce Boeings market limits in China, including a plan to increase flights between the two nations, following a meeting between President Biden and President Xi Jinping (Gu and Lee 2023). The Chinese market has seen significant success for Airbus, which has secured significant orders from Chinese carriers. Among these agreements is a \$37 billion agreement for roughly 300 A320neo planes, the largest aircraft order from Chinese carriers since the pandemic began (Wenqian and Nan 2022). Airbus is also expanding its presence in the country, with plans to begin building the A321 aircraft at its Tianjin facility.

Company Valuation

The basic goal of every corporation, as is generally known in the corporate and financial world, is to increase shareholder value (Friedman 1970). This value is the present value of the company's future cash flows, appropriately discounted to reflect the inherent risk and opportunity cost connected with these cash flows.

The term 'market value' is used to describe the current value a firm's shares are trading at on the financial markets. This value is affected by supply and demand dynamics, investor sentiment, and market conditions. Short-term market swings, speculations, and market perceptions also influence market value, which often deviates from a company's fair value (Maverick 2022). On the other hand, 'fair value' takes into account a deeper examination of a firm's core attributes, such as financial performance, forecasting, sector trends, and financial considerations. It reflects the business genuine intrinsic worth and can be determined by several valuation methods such as discounted cash flow (DCF) analysis, price-to-earnings (P/E) ratios, or comparable company analysis (Hwang 2023). The fair value of a company is more accurate when underlying assets, earnings potential and overall financial health are considered.

The distinction between "market value" and "fair value" has significant implications for investors. If the fair value of the stock is greater than the market value, it may be undervalued. This condition

lets investors buy shares at a lower price than their intrinsic value, which could lead to capital gains when the market price eventually matches their fair value. In contrast, if the market value surpasses the fair value, it may indicate that the stock is overpriced. Investors must be careful when buying stocks because the market price may not be supported by the company's fundamentals. Overpriced companies are susceptible to price corrections, and investors may consider waiting for a more favorable market entry point or investigating alternative investing options (Maverick 2022).

Discounted Cash Flow (DCF) Analysis

According to the Corporate Finance Institute, a DCF model is a specialized financial modeling tool used to determine a company's value. DCF, or discounted cash flow, is the process of projecting a company's unlevered free cash flow into the future and then discounted it back to its current worth, known as the net present value (NPV) (CFI Team n.d.). In the context of this project, there will be applied the DCF model analysis for Boeing and Airbus. This is going to be done with the purpose of identifying the differences between the fair and market values of both companies. With the information obtained, it is possible to categorize both companies as undervalued and overvalued.

For both companies, all financial information regarding income statements, balance sheets, and cash flows was collected from Bloomberg. It is noteworthy to mention that the information obtained counts from the year 2015 until 2022, plus Q1 and Q2 of the present year, 2023. The selection of a timeframe spanning from 2015 to 2023 for the financial data on Boeing and Airbus is a matter of strategic importance. The time covers a significant period for examining the alterations and trends in the aerospace sector. This period covers diverse economic cycles, including expansion phases and obstacles, such as the repercussions of the COVID-19 health crisis on the aviation industry (Appendix 3, table 1-2).

Calculation and Forecast

According to the Boeing Report for fiscal year 2022 and the year 2021, no material part of the business is seasonal. Despite this affirmation, a thorough analysis of semestral data dating back to

2015 has been conducted for both companies. The purpose of looking at quarterly values was to see if there were any trends that could be used to make a more precise estimate for the second semester of 2023. The analysis revealed that there are, in fact, certain yearly patterns for the second semester in comparison to the first terms values. Notably, for Boeing and Airbus the values being close to 1 generally imply stable trends without major seasonal fluctuations (Appendix 3, table 3).

Revenue Growth

The aerospace industry's future growth forecast, which will be implemented by Boeing and Airbus as a shared driver, is projected to increase by 7.7% annually until 2025 and by 5.9% annually until 2030 (Appendix 3, table 4). It was feasible to arrive at these figures by referring to the report of the business research company on the aerospace market (The business Research Company 2021). The aerospace industry future forecasts are undergoing a positive transformation due to several key variables. Expanded commercial drone operations permits, as demonstrated by regulatory improvements such as the US Federal Aviation Administration's Operations Over People rule, promise to open new revenue streams for aircraft manufacturers worldwide (Federal Aviation Administration 2021). Furthermore, the incorporation of advanced materials such as graphene and carbon nanotubes are anticipated to enhance aircraft efficiency by reducing weight and fuel consumption, resulting in more environmentally-friendly and economically-sound flights(Andrew and Dhakal 2022). Finally, the widespread adoption of Virtual Reality (VR) technology in aircraft manufacturing, such as Boeings utilization of VR for design and testing, is anticipated to significantly enhance overall efficiency by expediting training, maintenance, and design processes (Davila Delgado et al. 2020).

Depreciation and Amortization

For Boeing and for Airbus, the ratio of Depreciation & Amortization to sales has been utilized to project future cashflow and is a crucial indicator of a company's cost structure, as it reflects the ratio of non-cash expenses to revenue. A 2.68% average percentage for Boeing spanning from 2015

to 2022 and a 4.18% for Airbus demonstrates a rather constant link between Depreciation & Amortization charges and sales throughout time for both companies, in which is possible to see higher percentages on Airbus but still not extreme values (Appendix 3, table 5). Continuity is critical for anticipating future financial performance since it implies consistent expense allocation and good asset management. In the future, using the average percentage as a starting point is a good way to predict what will happen, assuming that the current trend will continue.

EBITDA

In the aftermath of the challenging years marked by the Boeing 737 MAX incidents and the global COVID-19 pandemic, Boeing faced significant financial setbacks. In 2018, the company reported revenues of 101.127 billion USD, a benchmark that has not been achieved again until the forecasted year of 2027.

The subsequent years witnessed a decline in revenue, and the company struggled to recover to pre-crisis levels. The forecast for revenue growth indicates a return to the 2018 benchmark in 2027. However, given the extreme values and negative trends observed in the historical data for the years following 2018, it is crucial to carefully calculate and forecast the EBITDA margins.

For the EBITDA margin calculations from 2024 to 2026, and onward from 2027, a meticulous approach is adopted to ensure the reliability of the forecasts. To avoid the undue influence of

extreme values during the pandemic and the 737 MAX incidents, the median EBITDA margin for the years 2015-2022 is considered. This median value, 4.57%, is chosen over the average to mitigate the impact of outliers and provide a more stable representation of Boeing's historical performance.

Furthermore, for the period from 2027 onwards, where the company is anticipated to return to pre-crisis revenue levels, a median EBITDA margin of 11.32% from the pre-crisis period (2015-2018) is utilized. The rationale behind this decision is the belief that Boeing, having regained its pre-crisis revenue, will operate with the same level of efficiency as demonstrated in the years leading up to the crisis (Appendix 3, table 6).

For Airbus, the analysis of the EBITDA margin for Airbus was conducted utilizing historical data. The historical EBITDA margins range from 4.65% to 19.03%, indicating varying levels of performance. Using the historical average EBITDA margin of 10.86%, a consistent approach has been taken for the predicted years (2024-2030). The assumption is that the historical average reflects a realistic future projection, demonstrating confidence in Airbus capacity to maintain a constant EBITDA margin. Unlike Boeing, Airbus historical data does not show negative margins, which makes it easier to make predictions based on the stable historical average (Appendix 3, table 6).

Tax Rate

Boeing has been unable to establish an effective tax rate since 2019 due to its negative earnings before taxes (Appendix 2, table 9). As a result, a historical approach was not possible. Nonetheless, from the year 2024, when the company achieves profitability as per the forecast (see table Boeing forecast), a projection based on the sales data from the year 2022 was generated. The method

involved separating corporate taxes into regions based on the revenue generated in each location. The weighted average of corporate tax rates was calculated by combining tax information with sales percentages for each region, yielding a future tax rate of 22.03% for the future effective tax rate (Appendix 3, table 7). This approach permits a thorough examination of the numerous tax environments in which the organization operates, taking into account the implications of different tax environments. The rationale behind this approach stems from the understanding that corporation tax rates have a significant impact on future cash flows and, consequently, the overall valuation of the organization.

The effective tax rate is an essential component for estimating future cash flows in the calculation of Airbus discounted cash flow. The historical tax rate data from 2015 to 2022 shows a significant degree of volatility, with extreme values in 2019 being observed. In order to account for outliers, the median of historical Effective Tax Rate figures has been determined, yielding an estimate of 22.54% for the following year (Appendix 3, table 8). This decision suggests a preference for robustness because the median is less vulnerable to extreme values than the mean. The predicted tax rates for incoming years are rooted in these median levels, giving a more reliable foundation for estimating Airbus future financial performance.

Capital expenditures

The ratio of capital expenditures to sales has been used for Boeing and Airbus to project future cash flow and is a crucial indicator of a firm's commitment to long-term assets, reflecting the proportion of revenue devoted to capital expenditures. The average percentage of 2.12% for the period 2015 to 2022 for Boeing and 3.91% for Airbus for the same period, values that are over the time stable and do not have extreme values on both companies (Appendix 3, table 9). That average is going to be used as the value for the forecast period, supporting the assumption that the

investment strategy it's not going to change over the years. Since there are signs of recovery all along Boeing company and more advanced in Airbus, continue investing is important in the context of improving the processes and develop new technologies to keep the company improving revenues in the future.

Adjusted Net Working Capital.

For Boeing, the same process done in the EBITDA margin has been done in the adjusted net working capital to sales ratio, for the reason that there are some extreme values corresponding to the pandemic years and the recovery years. In resume, from 2024 until 2026, the total median (2015–2022) 6.973% (COVID-19 years). However, from 2027 onwards, the median from 2015 until 2018 was used, giving a value of 4.54%. This conclusion is based on the observation of a declining trend that began in 2020, resulting in a decrease of nearly 15 percentage points per year. When sales return to pre-COVID-19 levels, the ratio reverts to pre-COVID-19 levels. The assumption in the computation is essential because it takes into account the unusual influence of the years of the Pandemic. The decision to revert to the pre-pandemic median from 2015 to 2018 demonstrates an acknowledgement that the extreme figures may not accurately reflect the company's regular operational performance (Appendix 3. Table 10).

Across the period 2015–2022, Airbus net working capital ranges from -13,006 million to -2,651 million. On average, net working capital is calculated to be -10.96% of revenues. This value will be employed to project the company's DCF in the future, based on the premise that, even during the COVID-19 and post-pandemic eras, there are no extreme or out-of-trend values. Allowing for the interpretation that Airbus will continue to experience negative net working capital in the long run. In this scenario, the negative Net Working Capital indicates a planned financial strategy rather

than a financial risk, demonstrating Airbus ability to manage the intricacies of its industry and manufacturing processes. The extended production cycle causes Airbus to incur substantial upfront expenses before generating revenue from its customers.

Net Debt to EV Ratio

It is critical to understand a company's capital structure in order to perform a discounted cash flow assessment. A higher ratio of Net Debt to EV may indicate an elevated level of financial risk and interest payments, thereby affecting the company's cost of capital and, consequently, the discount rate utilized in the DCF model. Boeing's ratio has gone from a negative value in 2015 to a 27.2% value in 2022. In previous years, Boeings negative ratios indicated a higher percentage of cash and equivalents to debt. The ratio began to increase in 2018, indicating a growing dependence on debt to fund operations. From the peak of 2020 the company is in a downward trend. In response, there is an assumption that Boeing will continue this trend by maintaining a target net debt to enterprise value (EV) ratio of 20%.

Over the same period, Airbus has shown a more consistent pattern, with its ratio ranging from -1.08% to 5.91%, excluding an extreme value of 27.36% in 2016, due to an increase in long term debt. For this reason, the Net Debt/EV target is set at 5%, expecting that the company will continue to have the same structure in the following years (Appendix 3. Table 11).

DCF– Boeing

The average ratio of Boeing net debt to EV from 2010 to 2022 was 12.7%, and its historical equity beta is 1.48 (Yahoo Finance 2023b). The company's debt beta is estimated to be 0.1 ((Schaefer & Strebulaev, 2009)), resulting in an unlevered beta of 1.30 (Appendix 3, table 17). The target equity beta of the company is 1.61 if Boeings target net debt-to-enterprise value ratio is 20%, as estimated.

According to (Fernandez, García de Santos, and Fernandez Acin 2022), a market risk premium of 5.6% has been assumed, and the U.S. 10-Year Treasury Yield has been deemed as a proxy for the risk-free rate, currently at 4.57% as of September 29th, 2023. This yields a cost of debt of 5.13% and a cost of equity of 13.57%. By combining these figures with the projected future effective tax rate and the target Net Debt-to-Enterprise Value ratio, a weighted average cost of capital of 11.65% is obtained.

The calculated WACC of 11.65% was utilized to discount future cash flows by utilizing the discounted free cash flow valuation framework. Free cash flows were forecasted and discounted individually for the third and final quarter of 2023 as H2 and for years 2024 to 2030. The long-term revenue growth assumption is set at 2%, that correspond to the long-term inflation target. Being the two companies in their mature phase, it is expected that they grew at this level. Moreover, it is possible to see a certain degree of correlation between inflation and the revenue growth of Boeing and Airbus (Appendix 3, table 16). The terminal value accounting for free cash flows from 2031 onwards was computed and discounted. The aggregate value of all future projected cash flows for Boeing, discounted at a WACC of 11.65%, amounts to \$66,042.20 million, which is the estimated enterprise worth of the company. When subtracted the amount of net debt from the company's books, \$21,028.20 million in equity is obtained and a target price of \$34.47 for each share. Boeing stock is overvalued by 456% through the discounted cash flow valuation method, according to its closing share price on September 29, 2023, of \$191.68 (Appendix 3, table 12).

DCF Sensitivity Analysis

In the concluding phase, the analysis explored the sensitivity of the share price target with regard to two critical assumptions in the model: the revenue growth rate and the risk-free rate. A 1% change in the revenue growth rate was considered. Regarding the risk-free rate, an optimistic view involved utilizing the pre-pandemic value of 1.55% for the U.S. 10-Year Treasury Yield. Conversely, for a pessimistic scenario, the risk-free rate was set to the high observed before the 2007-2008 financial crisis, standing at 5.26%. A comprehensive breakdown of these scenarios and their respective impacts on the share price target can be found in the (Appendix 3, tables 12-15).

DCF – Airbus

The ratio of Airbus net debt to enterprise value from 2010 to 2022 was 5.54%, and its historical equity beta was 1.64 (Yahoo Finance 2023a). The company's debt beta is estimated to be 0.05 (Schaefer & Strebulaev, 2009), which results in an unlevered beta of 1.55 (Appendix 3, table 17). The target equity beta for the company is 1.63 if Airbus' target net debt-to-enterprise value ratio is 5%, as estimated. The U.S. 10-Year Treasury Yield was used as a proxy for the risk-free rate, which is 4.573% as of September 29th, 2023, according to the assumption of a market risk premium of 5.60% (Fernandez, García de Santos, and Fernandez Acin 2022). The summation of these numbers with the projected future effective tax rate and the target Net Debt-to-Enterprise Value yields a weighted-average cost of capital of 14.32%

To discount future cash flows using the discounted free cash flow valuation framework, the calculated WACC was 14.32%. The third and final quarter of 2023, taken as H2, and the years 2024 to 2030, were analyzed and discounted separately. The terminal value accounting for free cash flows from 2031 onwards was computed and discounted under the 2% long-term revenue

growth assumption (as explained above). The total value of all Airbus' future projected cash flows, discounted at a WACC of 14.32%, equals €45,435.83 million, which is the estimated enterprise worth of the company. When subtracted the net debt from the company's books, €42,825.83 million in equity is obtained and a target price of €54.21 for each share. Airbus stock is overvalued by 134.24% through the discounted cash flow valuation method, according to its closing share price on the valuation date of €126.98 (Appendix 3, table 14).

Comparables / Similar – Boeing

On this project, the multiples method was also used to value Boeing Co, diverging from the discounted free cash flow model by comparing Boeing against industry counterparts rather than solely on its historical data. The primary step involved identifying comparable companies on the sector in which it was chosen, which can be seen in industry (Appendix 3, table 18). From the initial list of peers, the similars that were most akin to Boeing, in terms of Market Cap, D/V, Unlevered Beta and EPS growth were chosen. On these metrics the most similar companies were Spirit AeroSystems Holdings, Textron Inc, Safran SA, and Airbus SE industry (Appendix 3, table 19). After the selection of the similars, various multiples were calculated for Boeing, including the Price-to-Earnings (P/E), Enterprise Value-to-Sales (EV/Sales), Enterprise Value-to-EBITDA (EV/EBITDA), and Price-to-Book (P/B) ratios. For Boeing multiples, it just makes sense to see the values obtained on the Enterprise Value-to-Sales (EV/Sales) because, because of Boeing's high levels of debt and today's financial situation, all other valuations are negative.

Enterprise Value-to-Sales (EV/Sales). When contrasted with the broader set of comparable companies, Boeing's share price appeared overvalued by 76%. However, when benchmarked against the selected similar companies, the valuation was closer to Boeing's actual share price as

of September 29, 2023 (\$191.68), showing an overvaluation of 50%. A Sensitivity analysis was also conducted for the multiple chosen, using the lowest and highest multiples from the similar companies to provide a range of price targets. The analysis revealed that Boeing's actual share price was within this calculated range, suggesting a balanced valuation relative to the industry (Appendix 3, table 20).

Comparables / Similar – Airbus

It was conducted a valuation of Airbus SE using the multiples method mirroring the one used on Boeing. This method benchmarks Airbus against similar companies in the market, rather than relying exclusively on Airbus's historical data. The initial and most critical step involved selecting a set of comparable companies industry (Appendix 3, table 21). The companies selected as similars to Airbus included Boeing (BA), Spirit AeroSystems Holdings Inc (SPR US), MTU Aero Engines AG (MTX GR), and Bombardier Inc (BBD/B CN) industry (Appendix 3, table 22). Upon selecting the comparable companies, the team calculated four different multiples: Price-to-Earnings (P/E), Enterprise Value-to-Sales (EV/Sales), Enterprise Value-to-EBITDA (EV/EBITDA), and Price-to-Book (P/B) ratios, in which the P/E multiple is not going to be taken in count for the similars negative value, due to the high negative value for Boeing.

When taking into account all companies comparable to Airbus, we find that the company's share price is in general overvalued with EV/EBITDA, EV/Sales, and P/B ratio multiples. On the other hand, considering only the most similar companies which were selected, there are found values that are more reflective of Airbus's actual share price close of \$126.98 as of September 29, 2023. When measured by EV/EBITDA, the company is overvalued for 6.5%. Similarly, the EV/Sales ratio suggests an overvaluation with a price target of \$119.89, this time when compared with all

the sector the prices is closer to market. The P/B ratio indicates that Airbus is trading above the book value of its assets with a price target of \$43.84, signifying an overvaluation of 190%. A sensitivity analysis was done based on the minimum and maximum values of these multiples from similar companies. This gave a range of possible valuations for Airbus. A pessimistic \$66.91 to an optimistic \$230.61 was the price range for EV/EBITDA. According to the EV/Sales ratio, the price range was from \$80.69 to \$166.08. Considering the high variability and uncertainty in book value estimations, the P/B ratio ranged dramatically from -\$144.44 to \$557.12 industry (Appendix 3, table 23).

Additionally, a regression was run with all the comparable companies. The regression was run with P/E as the dependent variable and the log of market capitalization, Debt-to-Enterprise Value, and levered beta as independent variables. When Airbus earnings per share are multiplied by the P/E of 1.88 a negative price target is obtained. Also, in this case the influence of Boeing is still very strong industry (Appendix 3, table 24)..

The industry in which Airbus operates typically shows robust valuations due to its capital-intensive nature and long-term growth prospects in global aerospace and defense sectors. The average price target using the applicable multiples is \$94.32; hence we conclude Airbus's stock price is slightly overvalued by approximately 34.63% industry.

Dividend Discount Model – Airbus

Airbus pays out yearly dividends, which are assumed to be paid out on April 30th each year for the sake of investigation. The dividend growth model utilized in the investigation provides estimates of both short- and long-term dividend growth rates. During the short term, the average annual dividend growth rate of 16.40% from 2011 to 2023 is used for the dividend growth from 2024 until

2030. Under this prediction, it is assumed that the company will continue to have the same payout strategy that had in the last years, being a mature firm with consistent earnings. The median annual dividend growth rate of 10.56% from 2011 to 2023 is taken into account over the long run. This approach assumes that the company will maintain a solid payout ratio, being mature and so able to generate solid earnings and invest less in the firm. The terminal value is calculated using the long-run rate for years after 2030. It's important to know that the early years (before 2011) and the lack of dividends in 2010 were not included in the calculations. Furthermore, the year 2021 is absent, implying that no information regarding the forthcoming dividend is available for that year.

Dividend growth rates are then utilized to forecast future dividends, and discounted cash flows are calculated to arrive at a terminal value. A price target of \$67.58 is set based on the total of discounted dividends and the terminal value. Compared to the closing price of Airbus stock on September 29, 2023, which was \$126.98, the computed valuation suggests a 87.89% overvaluation.

A sensitivity analysis was conducted on the price target, considering variations in long-term annual dividend growth rates. If the annual dividend growth rate were to increase by 1 percentage point, the corresponding price target would rise to €84.31. Conversely, a 1 percentage point decrease in the growth rate would result in a lower price target of €57.14 industry (Appendix 3, table 25).

Boeing DDM

The analysis of a Dividend Discount Model (DDM) for Boeing is precluded by the company's suspension of dividend payments in 2020, coinciding with the onset of the COVID-19 pandemic. Despite the forecasted return to profitability in 2024 based on the Discounted Cash Flow (DCF) model, the prudent decision has been made to delay the resumption of dividend payouts.

This cautious approach stems from the recognition of the financial challenges the company faced in recent years, including the impact of the pandemic and other adverse events. Rather than immediately reinstating dividends, the focus is on fortifying the company's financial health. The intention is to allow time for a more solid foundation, ensuring that financial metrics and stability are robust enough to sustain consistent dividend payments in the long term.

Pairs Trade NPV

The objective of this analysis is to establish a correlation between discounted cash flow (DCF) calculations and the pair trade strategy, elucidating the net present value (NPV) of the pairs trade and its sensitivity to a pivotal driver – industry growth. The methodology involves employing DCF-derived fair values for the stocks, adhering to the pair value rationale (shorting the most overvalued and longing the less overvalued). Subsequently, the determination of the number of stocks bought/sold culminates in an assessment of the theoretical NPV of the strategy, based on a notional of €1,000,000.

In the base scenario, assuming an EUR/USD conversion rate of 1.0586 to convert Boeing's price into euros, the fair values of the stocks are ascertained through DCF calculations. This results in values of €36.49 (indicating a 456% overvaluation, prompting a short position) for Boeing and €54.21 (reflecting a 134% overvaluation, warranting a long position) for Airbus. With a notional value set at €1 million, the calculation of the number of shares bought/sold enables the determination of a theoretical NPV for the portfolio, resulting in €247,073.13. This figure suggests a notably low NPV, primarily attributed to the overpriced nature of the stocks (Appendix 6, Table 1). In exploring the sensitivity of NPV to changes in revenue forecasting within the DCF, considering variations of plus or minus 3% annually, the analysis reveals a remarkable stability in NPV. This indicates a low sensitivity to fluctuations in revenue growth, underscoring the resilience of the strategy to changes in this key parameter (Appendix 6, Table 2-3).

Conclusion

From a hedge fund perspective, a comprehensive evaluation of Airbus and Boeing indicates that Airbus holds a more favorable financial position and overall health in the aerospace industry. Airbus has demonstrated robust liquidity patterns over time, ensuring its ability to meet short-term obligations efficiently. This contrasts with Boeing, which, while maintaining stability, shows limitations in quickly converting assets into cash. In terms of solvency, Airbus adopts a judicious balance between debt and equity management, maintaining stability in its financial structure. Conversely, Boeing has experienced fluctuations, particularly with a surge in long-term debt between specific periods. Notably, Airbus has proven to be more resilient and efficient in navigating industry challenges, such as aircraft incidents and the impact of the COVID-19 pandemic. The company has not only recovered but has also returned to profitability, showcasing its adeptness in overcoming sector-wide crises.

Additionally, Airbus demonstrates superior efficiency, particularly in its cash conversion cycle, reflecting a streamlined process of converting sales to cash and enhancing overall financial agility. The Discounted Cash Flow (DCF) research found a significant gap between Boeing and Airbus in the market valuation arena, contributing to Airbus's position as the strategic winner. Boeing's stock had a 456% overvaluation as of September 29, 2023, with a DCF-derived target share price of \$34.47, which was much lower than its market trading price. Boeing's enterprise value was estimated to be \$66,042.20 million, indicating a significant gap between market perception and underlying value. Airbus' stock, on the other hand, was overvalued, albeit to a smaller amount. Airbus' enterprise worth was evaluated at €45,435.83 million using a weighted-average cost of capital of 14.32%, resulting in an intrinsic share price of €54.21. However, based on the valuation date's closing share price at €126.98, Airbus's stock was overvalued by 134.24%. While this number suggests an overestimation, it's still significantly lower than Boeing's, indicating a more reasonable market estimation of Airbus. The comparatives using financial multiples further affirmed this perspective, showing Airbus's overvaluation against an industry average price target

to be around 34.63% while for Boeing it was 50% just taking in count one multiple. These valuation discrepancies clearly illustrate why Airbus emerges as the preferable investment choice in the aerospace sector: while both companies are overvalued, Airbus's market valuation is comparatively closer to its fundamental value, indicating a more grounded approach to its financial assessment.

The trading strategy employed paints a compelling picture of Airbus as the market leader over Boeing. Our signal construction, which is integral to the strategy, dictates that going long the spread involves buying Airbus and shorting Boeing. In contrast, going short the spread involves the opposite positions. Over a period spanning 14 years, our strategy executed a total of 3,408 positions. The breakdown of these positions consisted of 785 long positions, 1,917 instances where no position was taken, and 706 short positions. This distribution of positions indicates a tendency for Airbus to be undervalued more frequently relative to Boeing, which, conversely, was more often overvalued. This pattern is further substantiated by the total returns over the same timeframe, with Airbus yielding an impressive 1049% return, significantly surpassing Boeing's return of 338%. The predominance of long positions in Airbus and the substantial return difference reflect Airbus's consistent undervaluation compared to Boeing, suggesting a more attractive valuation and financial performance. Hence, in the context of our hedge fund strategy, Airbus emerges not only as the strategic winner due to its sound financial and market valuations but also as the preferred investment choice, demonstrating a greater propensity for undervaluation and a higher return on investment.

Boeing			
Approach	estimate	pessimistic	optimistic
DCF	34,47	22,02	96,09
Multiples - EV/Sales	128,13	47,45	268,07
Average	81,3	34,735	182,08
	191,68		
	-58%		

Airbus			
Approach	estimate	pessimistic	optimistic
DCF	54,21	48,41	76,32
DDM	67,58	57,14	84,31
Multiples - P/E	19,29	-76,70	51,20
Multiples - P/B	43,84	-144,44	557,12
Multiples - EV/EBITDA	119,23	66,91	230,61
Multiples - EV/Sales	119,89	80,69	166,08
Average	70,67	5,34	194,27
	126,98		
	-44,34%		

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APPENDIX

Appendix 1: Corporate Structures, Historical Backgrounds of Boeing and Airbus and the Aerospace Industry

Further Analysis 1 - History Boeing

One of the largest commercial jet transport manufacturers in America is the Boeing Company, which also provides military aircraft, helicopter, spacecraft, and missile. It was originated in 1916, whereby, William E. Boeing launched Aero Products Company that eventually changed and became known as Boeing Airplane Company after some years. Over the years, Boeing has played an integral part in the history of aviation (Amir and Stanley 2023a).

Boeing's journey has been marked by strategic acquisitions, such as the merger with McDonnell Douglas Corporation in 1997 and the acquisition of the aerospace and defense units of Rockwell International Corporation in 1996 (Proctor 2022). Despite its noteworthy accomplishments, the company encountered numerous obstacles, including manufacturing issues with the 787 Dreamliner and the temporary suspension of all 787s worldwide in 2013 due to concerns about battery fires. The aerospace industry, however, continued to be a pioneering force, constantly shaping the future of flight with inventive ideas and technological advancements. (Amir and Stanley 2023a).

At the close of the year 2022, Boeing disposed the square footage that stood at eighty-seven (87) million square feet spanning the operations, warehouses, offices, among many others. About 88% of the property is hosted by the U.S.; the remaining percentages are in China, Australia, Canada, UK, India, and Germany. Among the more than 156,000 Boeings employees, about 13 per cent worked abroad. (“Today, Tomorrow and Beyond The Boeing Company 2022 Annual Report” 2023)

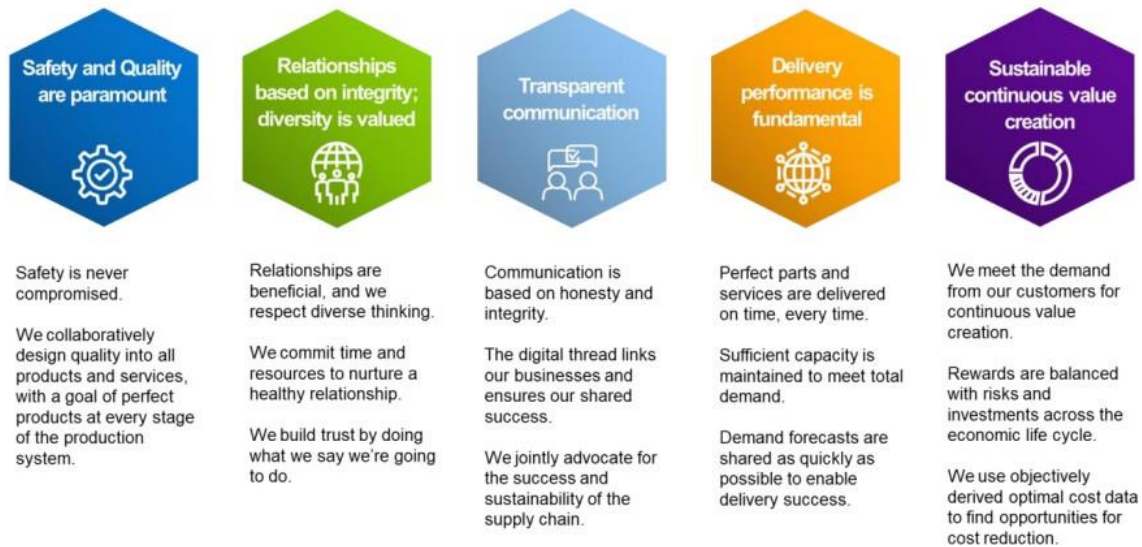
Table 1 – Boeing Divisions Source: (“Today, Tomorrow and Beyond The Boeing Company 2022 Annual Report” 2023)

<i>(Square feet in thousands)</i>	Owned	Leased	Government Owned	Total
Commercial Airplanes	39,586	6,673		46,259
Defense, Space & Security	22,643	5,090		27,733
Global Services	1,201	7,591		8,792
Other ⁽¹⁾	1,821	2,476	315	4,612
Total	65,251	21,830	315	87,396

⁽¹⁾ Other includes sites used for corporate offices, enterprise research and development and common internal services.

Table 2 – *The Boeing Supply Chain Principles*

The Boeing Supply Chain Principles:



Source:("The Boeing Supply Chain Principles" 2021)

Further Analysis 2 - Boeing (BA) Raw Material and supply chain

Boeing's manufacturing processes underwent a major transformation after the launch of the 787 Dreamliner in 2009. The conventional approach included Boeing would provide each of its partners that made various aircraft components with completely comprehensive designs. Following that, these partners would ship individual components to Boeing for final assembly, testing, and validation. But the 787-model required teamwork. Boeing worked closely with vendors to create, examine, and approve their own parts. This change required improved coordination and communication among supply chain participants to ensure the smooth integration of purchase orders, component schedules, and scheduled delivery times. This inventive approach gave suppliers more power, reducing expenses, boosting production, and accelerating the flight-plane delivery (Ross 2020).

To boost supplier performance, superiority, delivery, and efficiency, Boeing is focusing on enhancing the supply chain. The plan calls for enhancing collaborations, reaffirming commitments, and ongoing progress. Boeing has implemented fundamental values that prioritize safety, quality, integrity, diversity, open communication, delivery performance, and long-term value generation in order to foster cooperative relationships with suppliers (“The Boeing Supply Chain Principles” 2021). These concepts are meant to forge closer bonds, achieve flawless quality, punctual delivery, and enhance cost performance throughout the supply chain.

Following Boeing 2022 financial report, Boeing purchases a large number of equipment and major components from sole-source vendors in the USA and other regions of the world. The organization adheres to a rigorous certification and performance evaluation procedure to mitigate the dangers associated with relying on outside sources. Boeing may struggle to fulfill its contractual obligations if its suppliers or subcontractors violate terms that could have a negative impact on schedules and program or contract viability. To continue operating, Boeing requires reliable and affordable energy supplies, primarily electricity. Furthermore, the timely arrival of vital components like titanium, aluminum, and composites is crucial for the success of Boeings aircraft designs. Subassemblies and components are produced using these materials. It can take a while to certify new sources for these materials. Boeing stopped buying titanium from Russia due to the conflict between Russia and Ukraine. However, since alternate sources and inventory were used, this relocation did not interfere with business as usual (“Today, Tomorrow and Beyond The Boeing Company 2022 Annual Report” 2023).

Further Analysis 3 - *Boeing (BA) Ownership Structure and Corporate Governance*

Boeing as public company which is quoted on the NYSE, where institutional investors hold a majority ownership of BA through almost the 61.67% of the outstanding shares that they control. By the end of 2022, the three biggest investors are:

- ❖ The Vanguard Group - 7.72% - 46,029,863 (SEC 2023b)
- ❖ Newport Trust Company - 7.43% - 44,267,963 (SEC 2023c)
- ❖ BlackRock, Inc. - 5.6% - 33,268,254 (SEC 2023a)

Boeing works under a strong corporate governance system that is guided by changing principles that emphasize the interests of shareholders. The Board of Directors, which consists of 10 to 14 members, ensures that the company's strategic goals are met through diversified experience, independence, and alignment. A thorough examination procedure is used to pick directors, with an emphasis on skills in aerospace, engineering, finance, and allied sectors. The board must have at least 75% of its members meet the NYSE independence criteria. This process is overseen by the Governance & Public Policy Committee, which aligns candidates with the company's long-term goals (Boeing 2023).

CEO performance evaluation and succession planning are critical board functions. Internal talent is developed, and emergency succession plans are reviewed annually. Six standing committees, each with its own mandate, assist the board in its oversight duties. Directors are expected to attend all meetings and participate in ongoing education. Executive sessions, excluding management, are held regularly to ensure confidentiality. Directors have access to management and can hire independent advisors at the expense of the company. Furthermore, director compensation is designed to be aligned with long-term shareholder interests. It contains shares or stock-equivalent units, which create a stake in the company's performance (Boeing 2023).

Airbus

Further Analysis 4 - *History Airbus*

The company known as Airbus Industrie was founded as a consortium in 1970. Later on, it became one of the leading European manufacturers that produced short-, medium-range, and very capacious jetliners. France, Germany, and UK collaborated to form this consortium due to the existing gap in the demand for small body aircraft for air cargo services. Today, Airbus has become one of the leading commercial aircraft manufacturers in the world, rivaling with the giant American company, Boeing (Amir and Stanley 2023b). The Airbus A300, the consortiums first aircraft, was released on October 28, 1972. Airbus initially encountered difficulties in achieving its projected success. Airbus set out to create superior and more innovative models after the success of the A300, as demand for their first aircraft increased. Over 400 orders were placed upon the launch of the Airbus A320, which became its flagship product. This model took to the skies for the first time on February 22nd, 1987, marking a turning point in Airbus growth (Durgut 2021).

The European Aeronautical Defense and Space Company NV (EADS) was established in 2000, and Airbus operated under its supervision from 2000 to 2014. Until 2006, EADS controlled 80% of Airbus, while the remaining 20% belonged to a British aerospace company called BAE Systems. Following that, EADS acquired BAE Systems 20% stake in Airbus. (Petrescu et al. 2017). Over the years, Airbus has gone through a lot of changes and name changes, most recently in 2014, 2015, and 2017.

The distribution of Airbus workforce is heavily concentrated in a handful of nations, with France and Germany occupying the leading positions, accounting for more than 93,000 of the total personnel of Airbus (134,267). Furthermore, significant Airbus workforces have been recorded in the United Kingdom, Spain, Canada, and the United States, all of which are key markets for Airbus

aircraft. This specialized personnel placement aligns with the company's business strategy of catering to significant aviation markets while maintaining close proximity to key clients. Furthermore, the commercial aircraft segment has the highest concentration of its personnel (79,134 employees) and is the largest.

Table 3 – Airbus Workforce

WORKFORCE				
	2022	2021	2020	2019
Total number of employees ☒	134,267	126,495	131,349	134,931
By business segment ☒				
Commercial aircraft activities	79,134	73,560	78,487	80,985
Airbus Helicopters	20,803	20,126	20,026	20,024
Airbus Defence and Space	34,330	32,809	32,836	33,922
% Part time employees	3.99%	4.34	4.36	4.43
By contract type				
Unlimited	131,307	122,950	128,151	130,591
Limited contract > 3 months	2,960	3,156	3,198	4,340
By geographic area ☒				
France	48,238	45,931	48,231	49,143
Germany	44,898	42,972	45,568	45,638
Spain	12,899	11,881	11,828	12,637
UK	9,858	9,368	9,846	11,109
US	3,751	3,150	2,980	3,151
Canada	4,287	3,788	3,634	3,668
China	762	698	613	653
Other countries	9,574	8,707	8,649	8,932

Source: (“2022 Annual Report - Airbus” 2023)

Further Analysis 4 - Airbus (AIR) Raw Material and supply chain

The same as extended families, for Airbus partnerships and suppliers determine a success of the company on the industry. Approximately 80 percent of the company's production is done through the use of outsourcing with more than twelve thousand such companies across the globe. Airbus has a diverse group of suppliers with a total value amounting to about €49.6 billion that constitute almost 73% of its total revenue. Macrostructures, equipment and systems, materials and components, propulsion, cabin procurement, and specialized IT and services are some of the direct procurement providers. The other purchase category is known as indirect procurement that

comprises of building materials, machineries, engineering services, consultant support, information technology equipment and office supplies (Be An Airbus Supplier, n/a).

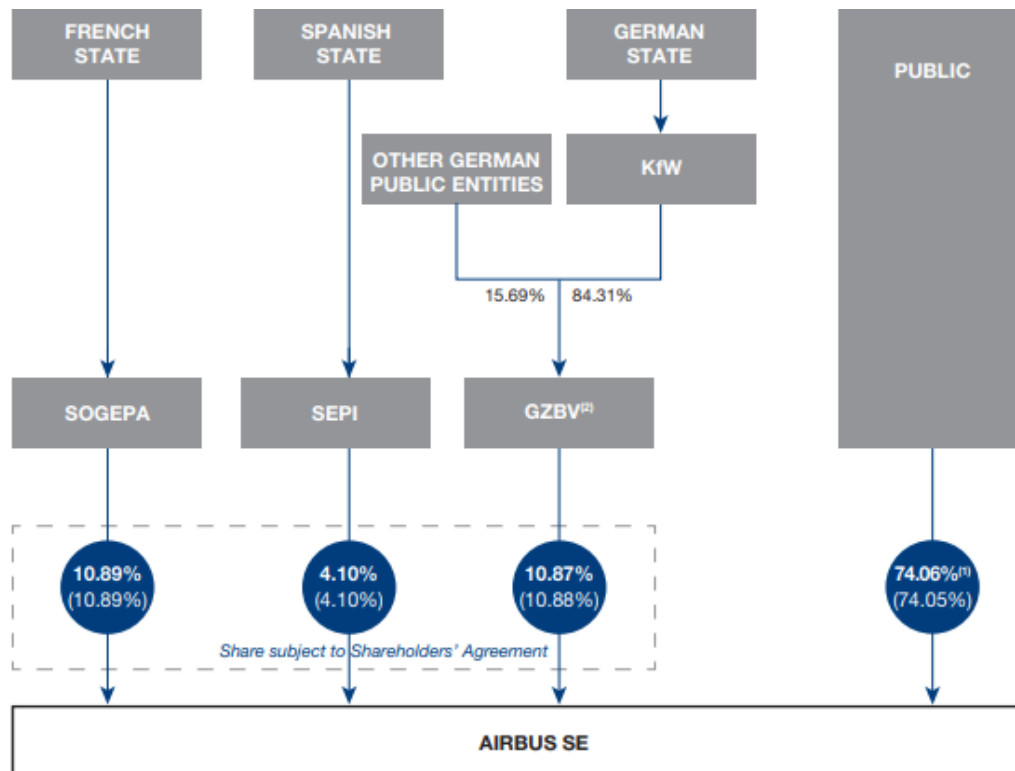
When it comes to putting things together and getting them out, Airbus has twelve final assembly lines spread out over five global locations, which represents continuous production. The headquarters located in Toulouse, France, is equipped with two A320 Family aircrafts and one each of A330 and A350 wide body final assembly lines. The A350 production line in Toulouse is notable for its eco-friendly layout, which includes natural light and a solar roof that accounts for 55% of the facility power. Four production lines belonging to the A320 family are situated in Hamburg, Germany. These lines incorporate innovative technologies and efficient processes that were developed with the involvement of employees, utilizing Design Thinking principles. Tianjin, China, makes A320 Family planes and gives them to Asian airlines. Mobile, Alabama, USA, makes A320 Family planes and single-aisle A220 planes for customers in North America (“Production - Airbus” n.d.).

As previously mentioned for Boeing, Airbus may encounter challenges in fulfilling its contractual obligations if its suppliers or subcontractors fail to adhere to the requirements, thereby jeopardizing schedules, program outcomes, or contract viability. Airbus survival depends on reliable and affordable energy sources, particularly electricity. Also, it's important to get titanium, aluminum, and composites as soon as possible to make Airbus' aircraft designs work. Since the start of the war in Ukraine, this has been a problem because of sanctions against Russia, the main supplier of energy and titanium (Hansens et al. 2023). Subassemblies and components are made from these materials, which underscores the importance of their consistent and timely availability for Airbus production processes.

Further Analysis 5 - Airbus (AIR) Ownership Structure and Corporate Governance

Airbus ownership structure is currently dispersed among numerous stakeholders, each with specific interests. Moreover, a quarter of the approximately 800 million shares are under government control. The French government owns 10.89% of the corporation, thanks to the holding company SOGEPA. Similarly, the German government has a 10.87% ownership through the holding firm GZBV, while the Spanish government has a 4.10% share through the holding company SEPI. Furthermore, 0.2% of the shares are designated as treasury shares. As a result, the remaining 74.06%, or almost 590 million shares, are freely traded and controlled by outside investors. American investors own a major share of these. The majority of the big private shareholders are large investment groups situated in the United States, with others in London. This diverse ownership structure reflects Airbus' global appeal and investor interest, with large shares held by both governments and private companies (Mitchell, 2023).

Table 4 – Airbus Ownership Structure



Source:(“Airbus SE / Report of the Board of Directors 2022” 2023)

The board of directors of the company is composed of a maximum of twelve individuals. These individuals are responsible for managing, directing, and executing the company and its business activities, as described in the job description. The Board Rules provide a detailed description of the Boards decision-making obligations, supplementing their legal and association-defined tasks (Airbus n.d.). The CEO is in charge of day-to-day management, and he makes decisions with the help of the Executive Committee. Without Board approval, the CEO is not able to engage in transactions that fall under the Boards core responsibilities.

Following the Corporate Governance page on Airbus webpage, there are 3 different committees that are defined like this:

- ❖ **Audit Committee:** This committee approves yearly financial statements, quarterly financial statements, and half-year financial statements. The board receives guidance regarding the selection of external auditors and ensures that audit efforts are appropriately directed.
- ❖ **The Remuneration, Nomination, and Governance Committee:** provides guidance to the Board regarding crucial appointments, such as those to the Executive Committee. It also provides recommendations on remuneration strategies and long-term remuneration plans. Typically, periodic evaluations of the Company corporate governance are a component of its duties.
- ❖ **The Ethics, Compliance, and Sustainability Committee:** helps the Board keep Airbus committed to ethical business, integrity, and sustainability. It oversees the Company's ethical and compliance program, which makes sure that internal rules, procedures, and controls are effective. It also looks at Airbus sustainability strategy to make sure it matches the Company goals.

Table 5 - Airbus R&D Expenses

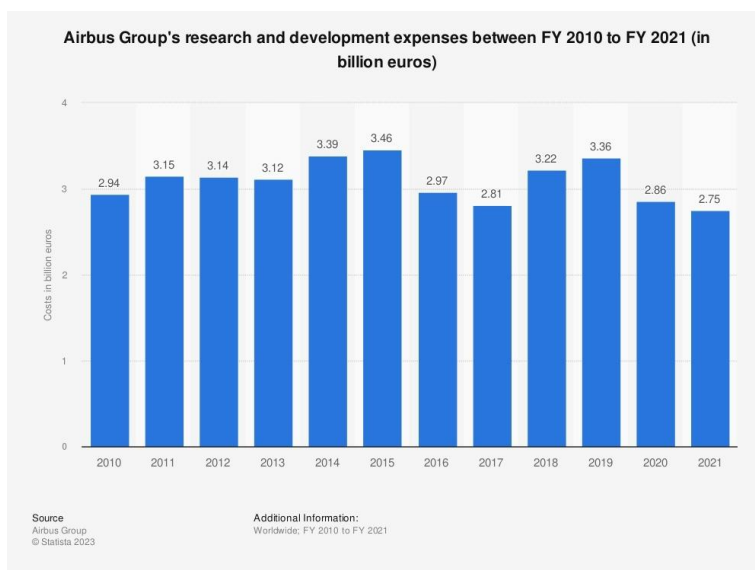


Table 6 - Airbus and Boeing Revenues by Region in 2021

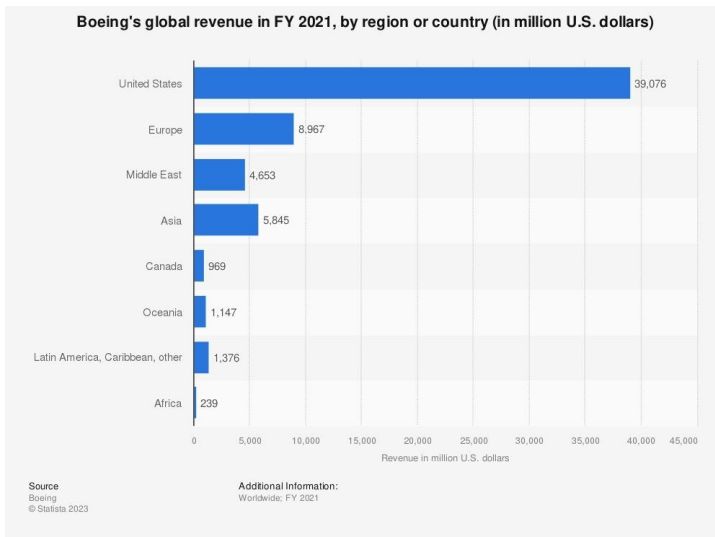
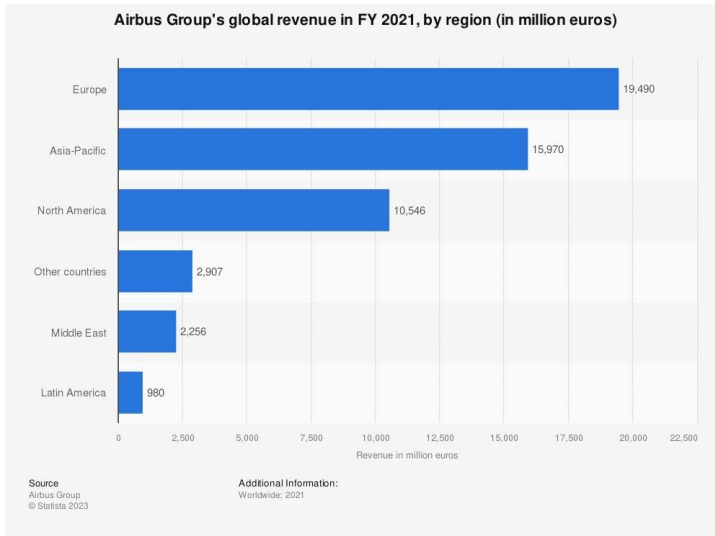
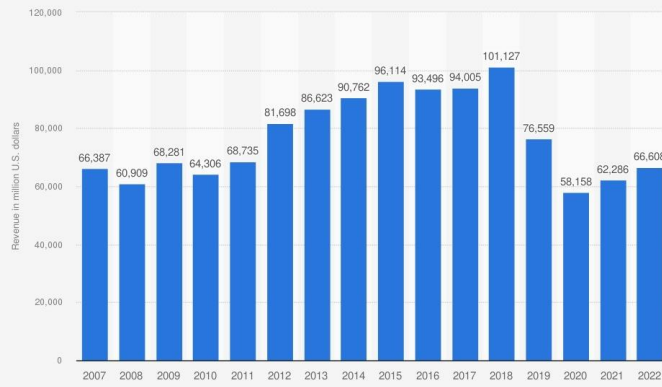


Table 7 - Airbus and Boeing Worldwide Revenue

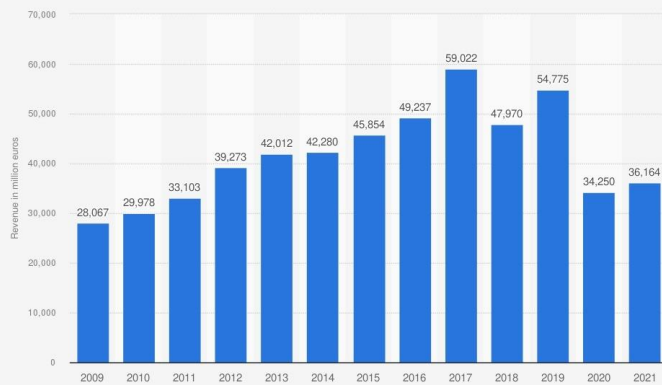
Boeing's worldwide revenue from FY 2007 to FY 2022 (in million U.S. dollars)



Source
Boeing
© Statista 2023

Additional Information:
Worldwide; FY 2007 to FY 2022

Airbus Division's revenue from FY 2009 to FY 2021 (in million euros)



Source
Airbus Group
© Statista 2023

Additional Information:
Worldwide; Airbus Group; FY 2009 to FY 2021

Table 8 - *Airbus and Boeing Employees*

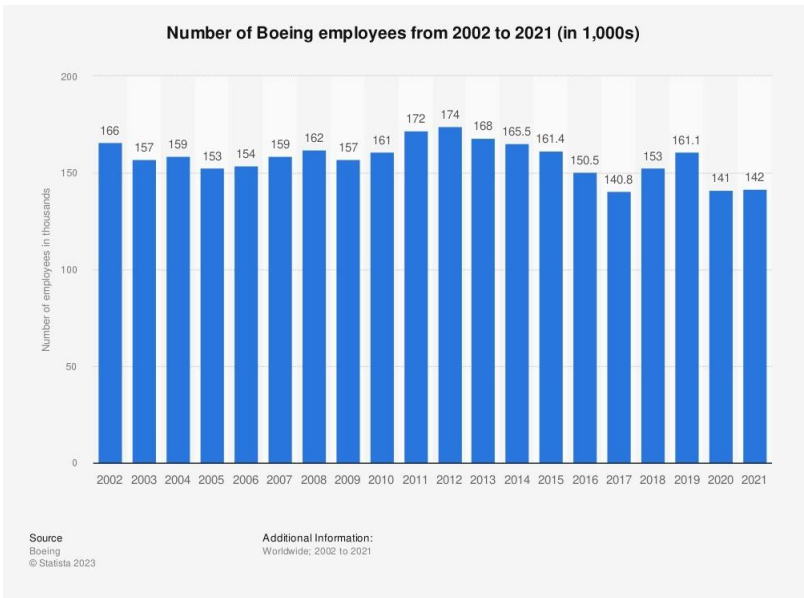
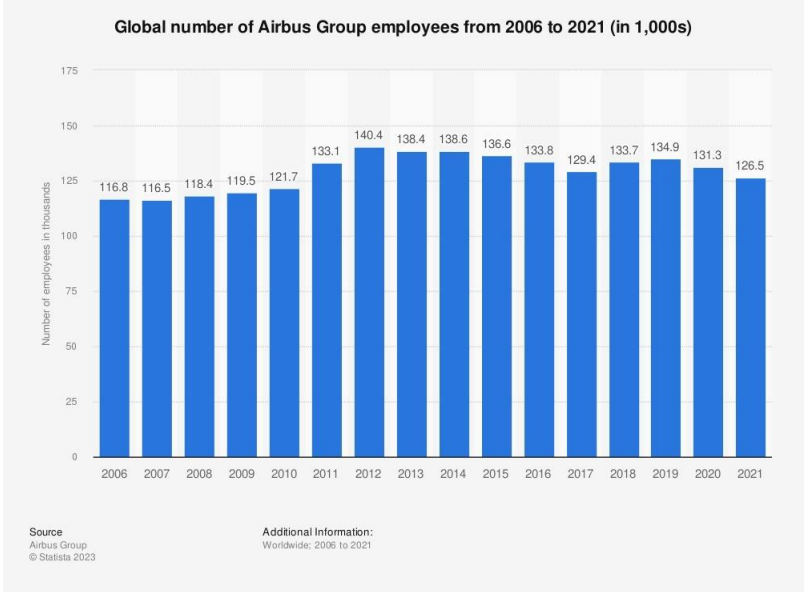


Table 9 - Airbus and Boeing Aircraft Deliveries

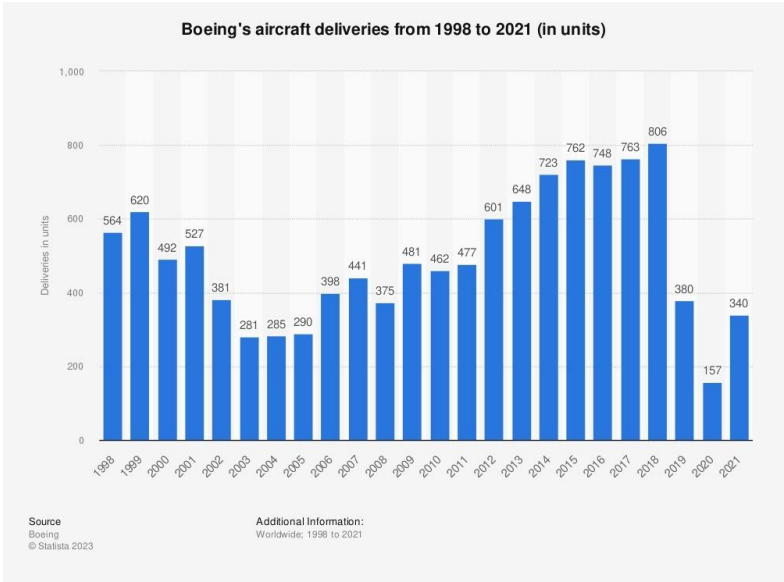
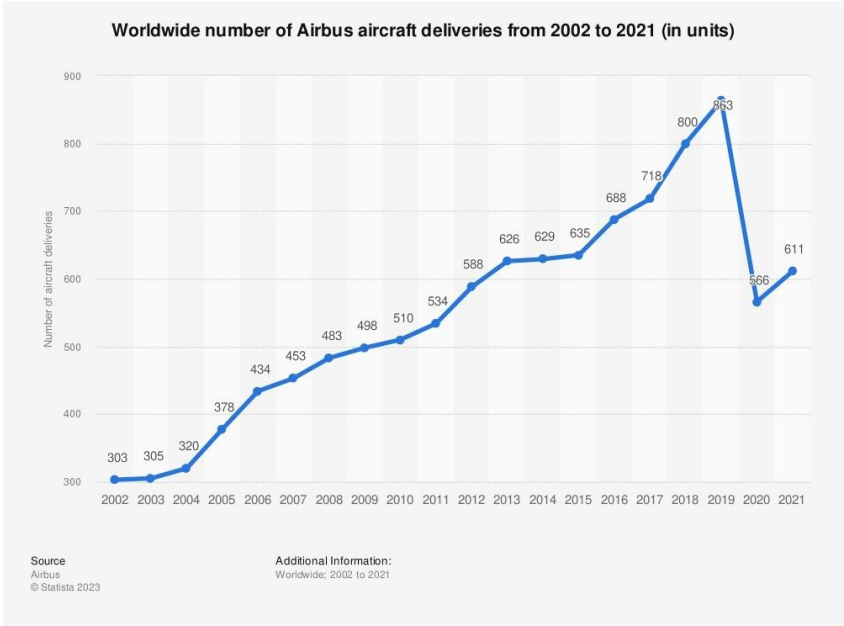


Table 10 - *Leading Aerospace and Defense Manufacturers*

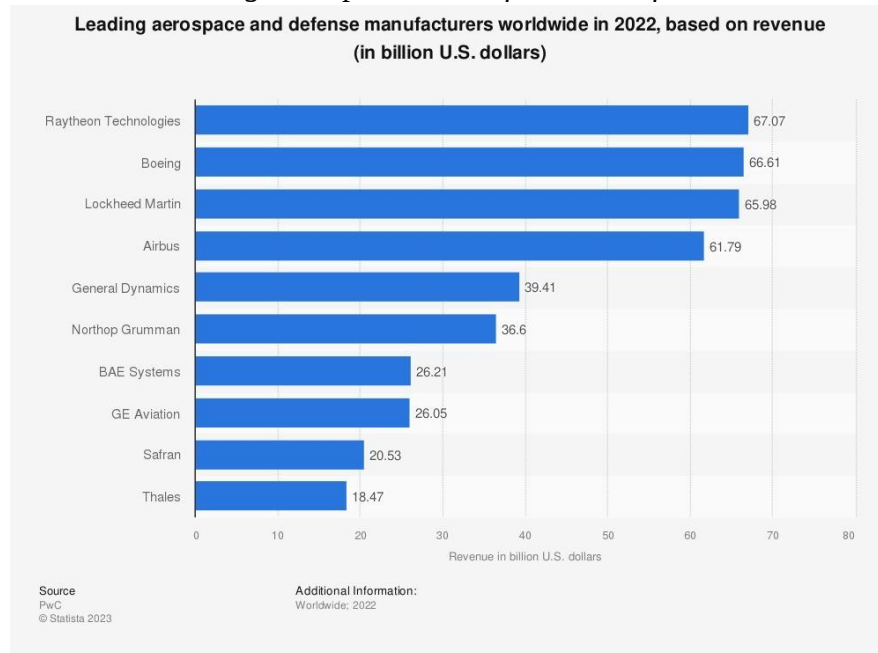


Table 11 - *Size of Aircraft Fleet by Region*

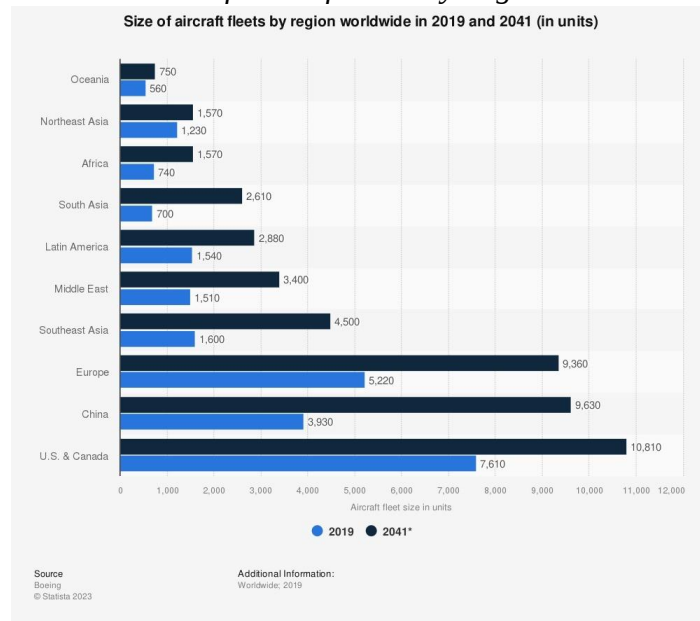


Table 12 - Number of Gross Orders for Airbus and Boeing

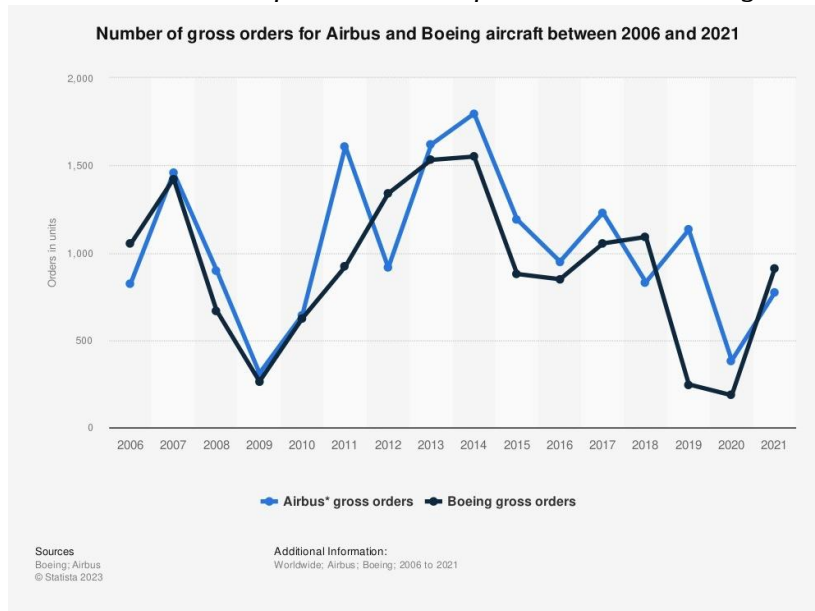


Table 13 - Orders and Deliveries for Airbus and Boeing

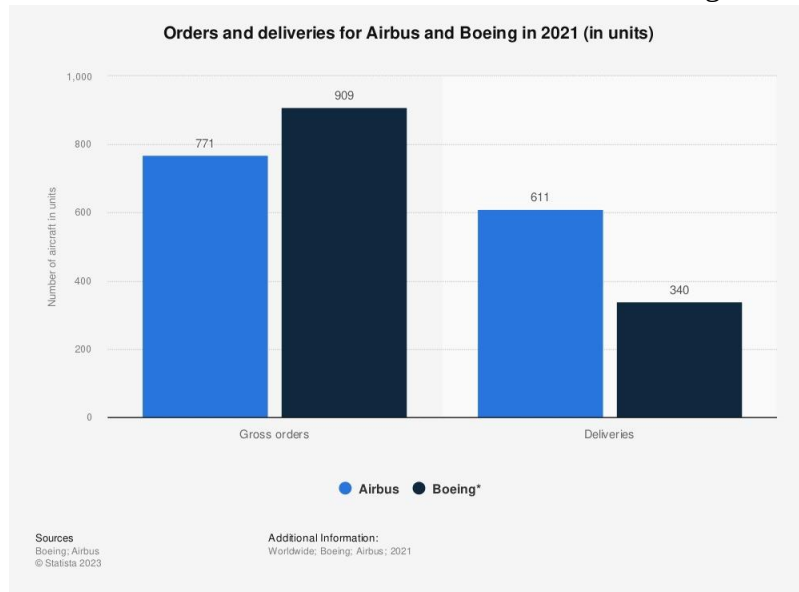


Table 14 - Commercial Most Ordered Planes for Boeing

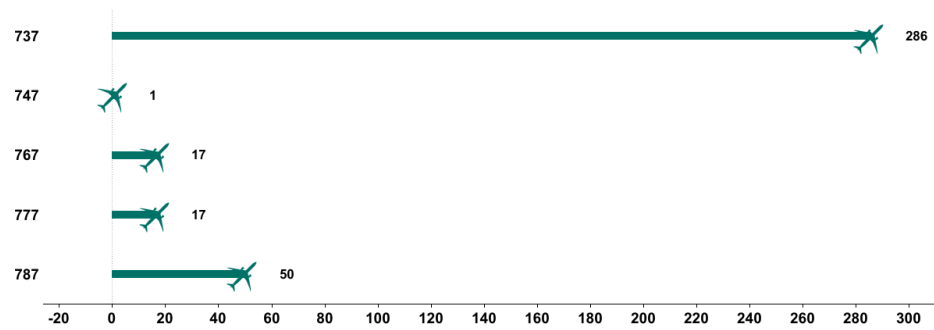


Figure 1 : "Commercial Airplanes - Boeing", 2023

Table 15 - Airbus Revenues by Segment

By Business Segment	Revenues		
(Amounts in millions of Euro)	FY 2022	FY 2021	Change
Airbus	41,428	36,164	+15%
Airbus Helicopters	7,048	6,509	+8%
Airbus Defence and Space	11,259	10,186	+11%
Eliminations	-972	-710	-
Total	58,763	52,149	+13%

Table 1 : ("Airbus Reports Full-Year (FY) 2022 Results" 2023)

Table 16 - *Airbus Historical Biggest Clients*

Airline	Historic Orders	Historic Deliveries	Operating
IndiGo	830	342	268
AirAsia Malaysia	592	230	212
easyJet	548	383	332
Lufthansa	521	424	272
China Eastern Airlines	507	402	441
Wizz Air	490	195	171
Delta Air Lines	481	263	415
China Southern Airlines	411	311	371
JetBlue Airways	378	230	230
Frontier Airlines	356	135	121

Table 2: (Ahlgren, 2023)

Table 17 - *Airbus Deliveries per Program*

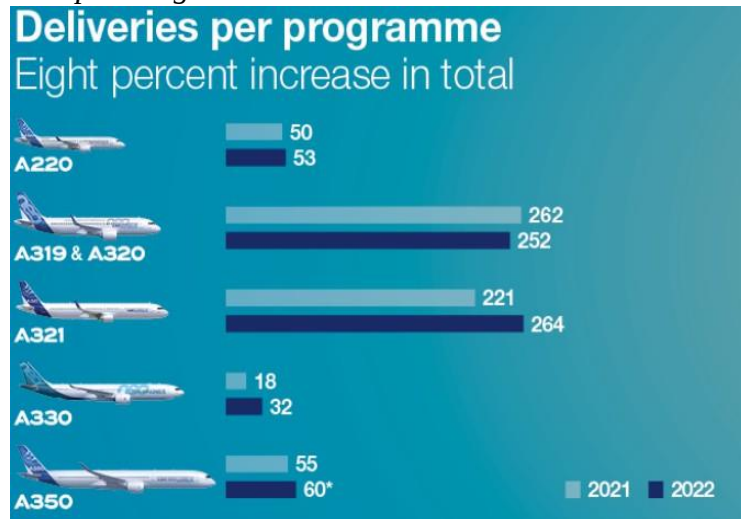


Figure 2 : "Airbus - 2022 Commercial Aircraft Highlights", 2023

Table 18 - Aerospace Supplychain

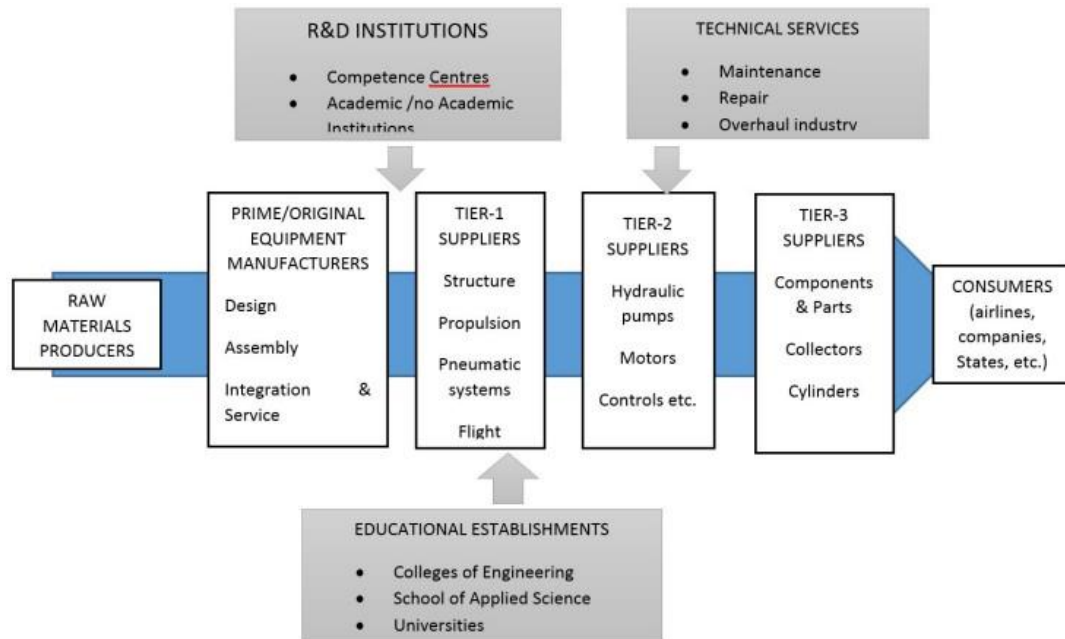


Figure 3: Mocenco, 2015

Appendix 2: Valuation Models and Calculations

Table 1 - Forecasted Cash Flow of Boeing

	Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
	Q1 - Q2 2023	Q3 - Q4 2023	2023	2024	2025	2026	2027	2028	2029	2030
	30/06/2023	31/12/2023	31/12/2023	31/12/2024	31/12/2025	31/12/2026	31/12/2027	31/12/2028	31/12/2029	31/12/2030
Revenue	37.672,00	39.377,45	77.049,45	82.982,26	89.371,90	94.644,84	100.228,88	106.142,39	112.404,79	119.036,67
Revenue growth			-	7,70%	7,70%	5,90%	5,90%	5,90%	5,90%	5,90%
EBITDA	664,00	706,8066716	1.370,81	3.792,29	4.084,30	4.325,27	11.345,91	12.015,32	12.724,22	13.474,95
EBITDA margin	1,76%	1,79%	1,78%	4,57%	4,57%	4,57%	11,32%	11,32%	11,32%	11,32%
Depreciation And Amortization	913	963,8745559	1876,874556	2.223,92	2.395,17	2.536,48	2.686,13	2.844,62	3.012,45	3.190,18
D&A / Revenue	2,42%	2,45%	2,44%	2,68%	2,68%	2,68%	2,68%	2,68%	2,68%	2,68%
EBIT	-249,00	-257,07	-506,07	1.568,36	1.689,13	1.788,79	8.659,78	9.170,70	9.711,77	10.284,77
Income Tax Expenses (Benefits)	-322	-322,00	-644	345,5107582	372,1150865	394,0698766	1907,748569	2020,305734	2139,503772	2265,734495
Effective Tax Rate				22,03%	22,03%	22,03%	22,03%	22,03%	22,03%	22,03%
NOPLAT	73,00	64,93	137,93	1.222,85	1.317,01	1.394,72	6.752,03	7.150,40	7.572,27	8.019,03
Capital Expenditures	764	699,5381003	1463,5381	1759,223971	1894,684217	2006,470586	2124,852351	2250,218639	2382,981539	2523,57745
CAPEX / Revenue	2,03%	1,78%	1,90%	2,12%	2,12%	2,12%	2,12%	2,12%	2,12%	2,12%
Adjusted Net working capital	12.691,00	28.022,65	28.022,65	5.786,61	6.232,18	6.599,88	4.553,03	4.821,66	5.106,14	5.407,40
Adj. NWC / Revenue	34%	36%	36,37%	6,97%	6,97%	6,97%	4,54%	4,54%	4,54%	4,54%
Increases in Adjusted Net working capital		15.331,65	-	-22.236,04	445,57	367,70	-2.046,85	268,63	284,48	301,26
Free Cash Flow		-15.002,38		23.923,59	1.371,93	1.557,03	9.360,16	7.476,17	7.917,26	8.384,38

Source: Developed by the group

Table 2 - Forecasted Cash Flow of Airbus

	Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
	Q1 - Q2 2023	Q3 - Q4 2023	2023	2024	2025	2026	2027	2028	2029	2030
	30/06/2023	31/12/2023	31/12/2023	31/12/2024	31/12/2025	31/12/2026	31/12/2027	31/12/2028	31/12/2029	31/12/2030
Revenue	27.663,00	37.142,66	64.805,66	70.443,75	76.572,85	81.855,85	87.503,90	93.541,67	99.996,04	106.895,77
Revenue growth				8,70%	8,70%	6,90%	6,90%	6,90%	6,90%	6,90%
EBITDA	2.929,00	3874,5003	6.803,50	7.650,19	8315,76	8889,54	9502,92	10158,63	10859,57	11608,88
EBITDA margin	10,59%	10,43%	10,50%	10,86%	10,86%	10,86%	10,86%	10,86%	10,86%	10,86%
Depreciation And Amortization	1.042,00	1.042,00	2.084,00	2944,55	3200,72	3421,57	3657,66	3910,04	4179,83	4468,24
D&A / Revenue	3,77%	3,28%	3,22%	4,18%	4,18%	4,18%	4,18%	4,18%	4,18%	4,18%
EBIT	1.887,00	2.832,50	4.719,50	4.705,64	5.115,03	5.467,97	5.845,26	6.248,58	6.679,74	7.140,64
Income Tax Expense	537	754,16718	1291,1672	1060,65	1152,93	1232,48	1317,52	1408,43	1505,61	1609,50
Effective Tax Rate	28,46%	26,63%	27,36%	22,54%	22,54%	22,54%	22,54%	22,54%	22,54%	22,54%
NOPLAT	1.350,00	2.078,33	3.428,33	3.644,99	3.962,10	4.235,49	4.527,74	4.840,15	5.174,12	5.531,14
Capital Expenditures	1.090,00	1.599,02	2.689,02	2754,35	2993,98	3200,56	3421,40	3657,48	3909,85	4179,62
CAPEX / Revenue	3,940%	4,31%	4,15%	3,91%	3,91%	3,91%	3,91%	3,91%	3,91%	3,91%
Adjusted Net working capital	-2.806,00	-8.693,06	-8.693,06	-7720,63	-8392,33	-8971,40	-9590,43	-10252,17	-10959,57	-11715,78
Adj. NWC / Revenue	-10,14%	-13,41%	-13,41%	-10,96%	-10,96%	-10,96%	-10,96%	-10,96%	-10,96%	-10,96%
Increases in Adjusted Net working capital		-5.887,06		972,42	-671,70	-579,07	-619,03	-661,74	-707,40	-756,21
Free Cash Flow		7.408,37		2.862,77	4.840,55	5.035,57	5.383,03	5.754,45	6.151,51	6.575,97

Source: Developed by the group

Table 3 - Boeing and Airbus Seasonality Factors

Boeing seasonality factors

Sales Revenue Turnover	EBITDA to Revenue	Depreciation and Amortization to Sales	Capital Expenditure to Sales	Working Capital to Sales	Effective Tax Rate
1.05	1.02	1.01	0.88	1.08	1.07

Airbus seasonality factors

Sales Revenue Turnover	EBITDA to Revenue	Depreciation and Amortization to Sales	Capital Expenditure to Sales	Working Capital to Sales	Effective Tax Rate
1.34	0.99	0.87	1.09	1.32	0.94

Source: Developed by the group

Table 4 - *Boeing and Airbus Revenue Forecast*

Year	Growth Rate (%)
2023	7.7%
2024	7.7%
2025	7.7%
2026	5.9%
2027	5.9%
2028	5.9%
2029	5.9%
2030	5.9%

Source: Developed by the group with data from (The business Research Company 2021)

Table 5 - *Boeing and Airbus Historical Depreciation & Amortization*

Boeing

Year	Depreciation and Amortization (in million units)	Percentage of Sales
2015	1,833	1.91%
2016	1,889	2.00%
2017	2,047	2.19%
2018	2,114	2.09%
2019	2,271	2.97%
2020	2,246	3.86%
2021	2,144	3.44%
2022	1,979	2.97%
Avg.	-	2.68%

Airbus

Year	Depreciation and Amortization (in million units)	Percentage of Sales
2015	2,466	3.83%
2016	2,294	3.45%
2017	2,298	3.44%
2018	2,444	3.84%
2019	2,927	4.15%
2020	2,831	5.67%
2021	2,325	4.46%
2022	1,716	4.62%
Avg.	-	4.18%

Source: Developed by the group.

Table 6 - *Boeing and Airbus Historical EBITDA and EBITDA Margin*

Boeing

Year	EBITDA (in millions)	EBITDA Margin
2015	9,277	9,65%
2016	9,498	10,04%
2017	11,757	12,59%
2018	14,026	13,87%
2019	-395	-0,52%
2020	-10,723	-18,44%
2021	-1,035	-1,66%
2022	-1,574	-2,36%
Avg.	-	2,90%
Median (2015-2018)	-	11,32%
Median (2015-2022)	-	4,57%

Airbus

Year	EBITDA (in millions)	EBITDA Margin
2015	6,528	10.13%
2016	4,552	6.84%
2017	12,708	19.03%
2018	7,492	11.76%
2019	4,266	6.05%

Year	EBITDA (in millions)	EBITDA Margin
2020	2,321	4.65%
2021	7,667	14.70%
2022	8,041	13.68%
Avg.	-	10.86%

Source: Developed by the group

Table 7 - Boeing Calculation of Tax Rate

Regions	Revenues <i>in mil \$</i>	%	Tax %
<i>United States</i>	\$ 39.234	58,90%	21,00%
<i>Asia</i>	\$ 8.393	12,60%	24,52%
<i>Europe</i>	\$ 7.916	11,88%	23,68%
<i>Middle East</i>	\$ 5.047	7,58%	15,18%
<i>Canada</i>	\$ 1.612	2,42%	25,00%
<i>Oceania</i>	\$ 1.576	2,37%	29,72%
<i>Africa</i>	\$ 418	0,63%	27,27%
<i>Latin America, Caribbean</i>	\$ 2.412	3,62%	31,12%
	\$ 66.608	100,00%	22,03%

Source: Developed by the group

Table 8 - Airbus Historical Tax Rate

Year	Effective Tax Rate
2015	20.06%
2016	22.54%
2017	38.21%
2018	29.73%
2019	224.53%
2020	-
2021	16.97%
2022	18.50%
Median	22.54%

Source: Developed by the Group

Table 9 - Boeing and Airbus Historical CAPEX

Boeing

Year	Capex (in millions)	Capex as % of Revenue
2015	2,450.00	2.55%
2016	2,613.00	2.76%
2017	1,739.00	1.86%
2018	1,722.00	1.70%
2019	1,834.00	2.40%
2020	1,303.00	2.24%
2021	980.00	1.57%
2022	1,222.00	1.83%
Avg.	-	2.12%

Airbus

Year	Capital Expenditures (in millions)	Capex as a Percentage of Sales
2015	2,924	4.54%
2016	3,060	4.60%
2017	2,558	3.83%
2018	2,285	3.59%
2019	2,340	3.32%
2020	1,759	3.52%
2021	1,928	3.70%
2022	2,464	4.19%
Avg.	-	3.91%

Source: Developed by the group

Table 10 - Boeing and Airbus Historical Adjusted Net Working Capital

Boeing

Year	Net Working Capital (in millions)	NWC as % of Sales
2015	7,754.00	8.07%
2016	3,937.00	4.16%
2017	4,597.00	4.92%
2018	3,508.00	3.47%

Year	Net Working Capital (in millions)	NWC as % of Sales
2019	4,501.00	5.88%
2020	28,303.00	48.67%
2021	19,918.00	31.98%
2022	10,047.00	15.08%
Avg.	-	15.28%
Median (2015-2018)	-	4.54%
Median (2015-2022)	-	6.97%

Airbus

Year	Net Working Capital (in millions)	Net Working Capital as a Percentage of Sales
2015	-4,565	-7.08%
2016	-7,497	-11.26%
2017	-9,765	-14.63%
2018	-9,263	-14.54%
2019	-13,006	-18.45%
2020	-4,631	-9.28%
2021	-4,130	-7.92%
2022	-2,651	-4.51%
Avg.	-	-10.96%

Source: Developed by the Group

Table 11 - *Net Debt to EV Ratio*

Boeing

	2015	2016	2017	2018	2019	2020	2021	2022
Net Debt	-1.391,00	1.094,00	2.304,00	6.210,00	17.817,00	55.831,00	50.050,00	42.387,00
Market Capitalization	96.380	96.080	175.640	183.060	183.370	120.840	118.560	113.520
Net Debt / (Net Debt + Equity)	-1,5%	1,1%	1,3%	3,3%	8,9%	31,6%	29,7%	27,2%

airbus

	2015	2016	2017	2018	2019	2020	2021	2022
Net Debt	2.535,00	19.333,00	-	820,00	352,00	834,00	5.436,00	4.999,00
Market Capitalization	53.130	51.330	76.750	74.500	114.340	86.540	99.960	93.300
Net Debt / (Net Debt + Equity)	4,6%	27,4%	-1,1%	0,5%	0,7%	5,9%	4,8%	1,6%

Source: Developed by the group

Table 12 - DCF for Boeing

Net Debt / (Net Debt + Equity) _2015-2022	12,70%
Beta_e_historical	1,48
Beta_d	0,1
Beta_u	1,30
Net Debt / (Net Debt + Equity) _target	20%
Beta_e_target	1,61
Risk-free rate	4,57%
Market risk premium	5,60%
Tax rate	22,03%
Cost of debt	5,13%
Cost of equity	13,57%
After-tax WACC	11,65%
Long-term growth	2%
Valuation date	1/10/2023

Discounted Free Cash Flow		-14594,59	20844,18	1070,57	1088,20	5858,98	4191,26	3975,28	3770,48
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Sum (dFCF)	26.204,32
Terminal Value	39.837,88
Enterprise Value	66.042,20
Net Debt	45.014,00
Equity Value	21.028,20
# common shares outstanding	610,00
\$boeing_Target (date)	34,47
\$boeing_Close (29/09/2023)	191,68
\$Boeing Overvaluation/(Undervaluation)	456%

Source: Developed by the group

Table 13 - Sensitivity Analysis DCF Boeing

Boeing Sensitivity Analysis		revenue growth		
risk-free rate		-1,0%	0,0%	1,0%
	1,55%	79,79	87,74	96,09
	4,57%	29,50	34,47	39,73
	5,26%	22,02	26,56	31,32

Source: Developed by the group

Table 14 - DCF for Airbus

Net Debt / (Net Debt + Equity)_2010-2021	5,54%
Beta_e_historical	1,64
Beta_d	0,05
Beta_u	1,55
Net Debt / (Net Debt + Equity)_target	5%
Beta_e_target	1,63
Risk-free rate	4,573%
Market risk premium	5,60%
Tax rate	23,22%
Cost of debt	4,89%
Cost of equity	14,88%
After-tax WACC	14,32%
Long-term growth	2%
Valuation date	1/10/2023

Discounted Free Cash Flow		7164,55		2331,76	3464,05	3119,70	2889,85	2676,93	2479,69	2296,99
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Sum (dFCF)	26423,51
Terminal Value	19012,31
Enterprise Value	45435,83
Net Debt	2610
Equity Value	42825,83
# common shares outstanding	790
\$airbus_Target (date)	54,21 €
\$airbus_Close (date)	126,98
\$Airbus Overvaluation/(Undervaluation)	134,24%

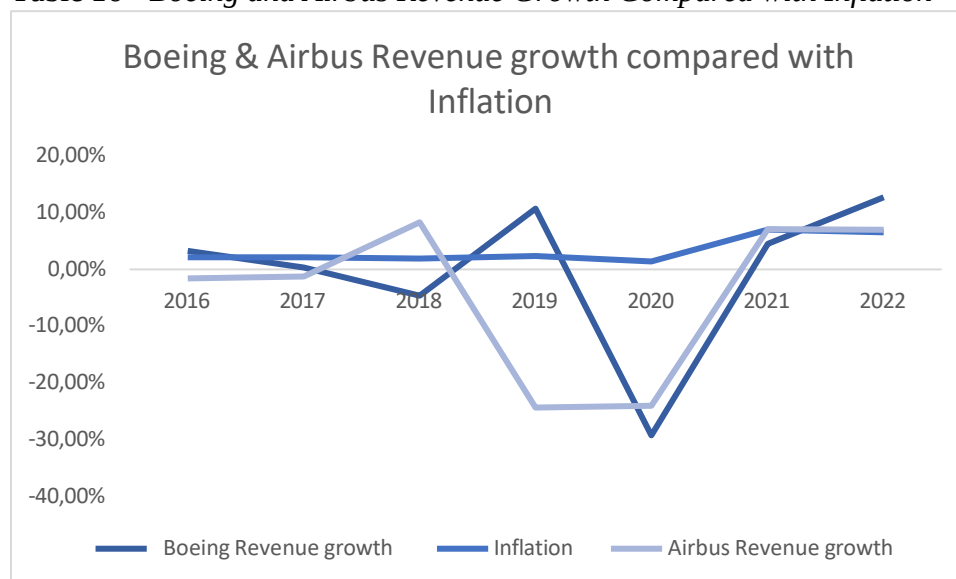
Source: Developed by the group

Table 15 - Sensitivity Analysis DCF Airbus

Airbus Sensitivity Analysis		revenue growth			
		-1,0%	0,0%	1,0%	
risk-free rate	1,55%	67,04	71,54	76,32	
	4,57%	51,02	54,21	57,60	
	5,26%	48,41	51,40	54,55	

Source: Developed by the group

Table 16 - Boeing and Airbus Revenue Growth Compared with Inflation



Source: Developed by the group

Table 17 - Beta_d by Rating and Maturity

By Rating	A and above	BBB	BB	B	CCC
Avg. Beta	< 0.05	0.10	0.17	0.26	0.31
By Maturity	(BBB and above)	1–5 Year	5–10 Year	10–15 Year	> 15 Year
Avg. Beta		0.01	0.06	0.07	0.14

Source: S. Schaefer and I. Strebulaev, “Risk in Capital Structure Arbitrage,” Stanford GSB working paper, 2009.

*Note that these are average debt betas across industries. We would expect debt betas to be lower (higher) for industries that are less (more) exposed to market risk. One simple way to approximate this difference is to scale the debt betas in Table 12.3 by the relative asset beta for the industry (see Figure 12.4 on page 425).

Source: Schaefer & Strebulaev, 2009

Table 18 - Comparables for Boeing

Ticker		Name	Mkt Cap	Net Debt	Currency Adjusted Enterprise Total Debt	Total Debt to Unlevered Be	EPS	EV/EBITDA	P/E	P/B	EV/Sal	Bk. per share					
SPR US	Similar	Spirit AeroSystems Holdi	1,693.37	3,534.40	5,237.47	3,962.30	0.75	0.83	-13%	9.81	-	1.81	13.67	0.88	-	8.16	
TXT US	Similar	Textron Inc.	15,477.24	1,557.00	17,034.24	3,182.00	0.23	1.11	-4%	9.46	16.84	2.17	1.16	-	-	-	
EMBR3 BZ		Embraer SA	2,525.63	1,190.10	3,963.70	3,274.20	0.74	0.16	-1%	6.96	65.42	0.99	0.74	-	-	3.47	
BDX CN		Boeing Co.	3,475.74	5,025.00	8,647.74	5,980.00	0.73	0.71	-18%	6.79	5.36	-	1.46	1.10	-	33.88	
MTX GR		MTU Aero Engines AG	9,741.67	798.64	10,540.31	1,302.00	0.16	0.72	-3%	9.06	27.23	3.42	1.53	-	-	52.85	
SAF FP	Similar	Safran SA	67,178.77	263.00	93,517.23	6,957.00	0.11	1.17	-44%	13.31	20.08	5.60	2.63	-	-	-	
AIR FP	Similar	Airbus SE	106,165.50	6,687.41	93,517.23	10,983.00	0.18	0.94	0%	10.03	24.99	6.57	1.41	-	-	20.46	
RRR LN		Rolls-Royce Holdings PL	22,660.00	3,584.70	5,955.00	5,955.00	0.35	1.00	-11%	9.46	-	6.38	-	1.30	1.47	-	
		Boeing	116,324.80	38,900.00	154,534.06	57,001.00	0.34	1.30	-23%	25.79	-	40.80	-	7.06	1.92	-	27.67
Average (no Boeing)			28,615.49	1,165.68	24,200.11	5,199.44	0.41	0.80	-37%	9.36	18.97	3.71	1.37	-	-	6.95	
Average Similar			47,630.22	318.25	40,616.31	6,271.08	0.32	1.03	- 0.17	10.65	15.03	7.00	1.52	-	-	6.15	

Source: Developed by the group with Bloomberg information

Table 19 – *Similar for Boeing*

Boeing Similar	
Mkt Cap	Airbus
D/V	Textron
Beta_u	Safran
EPS Growth	Spirit AeroSystems

Source: Developed by the group

Table 20 – *EV/SALES Calculation and sensitivity Analysis*

		EV/SALES BA Valuation	
		ALL AVG	SIMILAR AVG
BA SALES		77.049	77.049
BA EV		105.183	117.059
BA EQUITY		66.283	78.159
BA #share		610	610
PRICE		108,66	128,13
\$BA_Close (as of 30/09/2023)		191,68	191,68
\$BA Overvaluation/(Undervaluation)		76%	50%
SENSITIVITY ANALYSIS BASED ON SIMILARS MIN AND MAX VALUES			
	Similar Avg	Similar Min	Similar Max
EV/Sales	1,52	0,88	2,63
Price	128,13	47,45	268,07
	<i>Pessimistic</i>		<i>Optimistic</i>

Source: Developed by the group

Table 21 - *Comparables for Airbus*

Ticker	Name	Mkt Cap	Net Debt	Currency Adjusted Enterprise Total Debt	Total Debt to Unlevered Bet	EPS - \$ A	EV/ EBITD	P/E	PIB	EV/ Sales	Bk per share
SFR US	Similar	1599,37	3.594,40	5.297,47	3.962,30	0,75	0,89	-18%	9,81	-	1,81
TXR US		15.477,24	1.557,00	17.034,24	3.182,00	0,23	1,11	-4%	9,46	16,84	2,17
EMBR3 B2		2.525,63	1.190,10	3.963,70	3.274,20	0,74	-	-1%	6,96	65,42	0,99
BDB CN	Similar	3.475,74	5.025,00	8.847,74	5.980,00	0,73	0,71	-18%	6,79	5,36	-
MTX GR	Similar	9.741,67	798,64	10.540,31	1.302,00	0,16	0,72	-8%	9,06	27,23	3,42
SAF FP		67.178,77	263,00	-	6.957,00	0,11	1,17	-44%	13,31	20,08	5,60
BA	Similar	116.924,80	38.900,00	154.534,06	57.001,00	0,34	1,30	-23%	25,79	40,80	-
RH LN		22.660,00	3.584,70	-	5.955,00	0,35	1,00	-11%	9,46	6,38	-
AIR FP		106.165,50	-	99.517,23	10.983,00	0,18	0,94	0,08%	10,03	24,99	6,57
Average (no Airbus)		29.960,40	6.864,10	33.369,59		0,43	0,84		11,33	10,74	2,00
Average Similar		32.960,40	12.079,51	44.804,90	17.061,33	0,49	0,91	-	12,86	10,26	2,14

Source: Developed by the group with Bloomberg information

Table 22 - *Similar for Airbus*

Airbus Similar	
Mkt Cap	Boeing
D/V	MTU Aero Engines AG
Beta_u	Spirit AeroSystems Holdings In
EPS Growth	Bombardier Inc

Source: Developed by the group

Table 23 – Multiples Calculation for Airbus

	EV/EBITDA AIR Valuation	
	ALL AVG	SIMILAR AVG
AIR EBITDA	6.803,50	6.803,50
AIR EV	77.077,62	87.503,22
AIR EQUITY	83.765,03	94.190,63
AIR #share	790,00	790,00
PRICE	106,03	119,2286467
Airbus (as of 30/09/2023)	126,98	126,98
\$AIR Overvaluation/(Underv.	20%	6,5%

SENSITIVITY ANALYSIS BASED ON SIMILARS MIN AND MAX VALUES

	Similar Avg	Similar Min	Similar Max
EV/EBITDA	12,86	6,79	25,79
Price	119,23	66,91	230,61
	<i>Pessimistic</i>		<i>Optimistic</i>

	EV/SALES Valuation	
	ALL AVG	SIMILAR AVG
AIR SALES	64.806	64.806
AIR EV	92.582	88.024
AIR EQUITY	99.270	94.711
AIR #share	790	790
PRICE	125,66	119,89
\$AIR_Close (as of 30/09/2023)	126,98	126,98
\$AIR Overvaluation/(Undervaluation)	1%	6%

SENSITIVITY ANALYSIS BASED ON SIMILARS MIN AND MAX VALUES

	Similar Avg	Similar Min	Similar Max
EV/SALES	1,36	0,88	1,92
Price	119,89	80,69	166,08
	<i>Pessimistic</i>		<i>Optimistic</i>

	Book value AIR Valuation	
	ALL AVG	SIMILAR AVG
Price/Book value	2,00	2,14
Book value per share of Airbus	20,46	20,46
PRICE	41,00	43,8385567
\$Air_Close (as of 19/10/2022)	126,98	126,98
\$Air Overvaluation/(Undervaluation)	210%	190%

SENSITIVITY ANALYSIS BASED ON SIMILARS MIN AND MAX VAL			
	Similar Avg	Similar Min	Similar Max
Book Value	2,14	-7,06	27,23
Price	43,84	-144,44	557,12
	<i>Pessimistic</i>		<i>Optimistic</i>

Source: Developed by the group

Table 24 - P/E multiple Regression for Airbus

Regression Statistics		Adjusted PE multiple for Airbus:	
Multiple R	0,949348		-7,649
R Square	0,9012615		Airbus EPS (ttm) 1,88
Adjusted R Squar	0,7696103		PRICE TARGET -14,38
Standard Error	14,651362		
Observations	8		

ANOVA						
	df	SS	MS	F	Significance F	
Regression	4	5878,165408	1469,541352	6,845825	0,072970432	
Residual	3	643,987269	214,662423			
Total	7	6522,152677				

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	131,39964	30,13626525	4,360183377	0,022298	35,49259679	227,30669
ln(mkt cap)	-11,977804	7,341011333	-1,631628622	0,201258	-35,3401786	11,38457
D/V	-96,60661	35,132057	-2,749813641	0,070753	-208,4124945	15,199275
B-e	-69,588537	18,4627391	-3,769133938	0,032685	-128,3452124	-10,831861
EPS (5y growth)	-51,518849	53,53406517	-0,962356373	0,406862	-221,8881367	118,85044

Source: Developed by the group

Table 25 - Dividend Discount Model and Sensitivity Analysis for Airbus

[illegible]

Source: Developed by the group

Appendix 3: Pair Trade NPV

Table 1 - Base scenario NPV

Base Scenario		EUR/USD	1,0586
Price Boeing	202,91 €		
Price Airbus	126,98 €		
Value Boeing	36,49 €	456% short	
Value Airbus	54,21 €	134% long	
Notional	1.000.000,00 €		
Shares Boeing sold	4928		
Shares Airbus bought	7875		
Theoretical NPV portfolio	247.073,13 €		

Source: Developed by the group.

Table 2 - Revenue Increase Scenario

Industry Revenues Increase	3%	EUR/USD	1,0586
Price Boeing	202,91 €		
Price Airbus	126,98 €		
Value Boeing	53,88 €	277% short	
Value Airbus	64,94 €	96% long	
Notional	1.000.000,00 €		
Shares Boeing sold	4928		
Shares Airbus bought	7875		
Theoretical NPV portfolio	245.872,38 €		

Source: Developed by the group.

Table 3 - Revenue Decrease Scenario

Industry Revenues Decrease	-3%	EUR/USD	1,0586
Price Boeing	202,91 €		
Price Airbus	126,98 €		
Value Boeing	21,45 €	846% Short	
Value Airbus	45,16 €	181% Long	
Notional	1.000.000,00 €		
Shares Boeing sold	4928		
Shares Airbus bought	7875		
Theoretical NPV portfolio	249.949,56 €		

Source: Developed by the group.