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A Note on Strategic Trade Applications and Public Support Selection in the Aerospace industry: Which Subsidy for Airliner Manufacturers?

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Abstract

Policy makers and academics have long analyzed a duopoly in the commercial airliners manufacturers industry between Airbus and Boeing. Particular attention has been paid to the structure and performance of the industry, as well as the crucial role of subsidies in the context of strategic trade theory and applications, leading to one of the longest World Trade Organization cases. This analysis is becoming increasingly topical as both competitors experience significant backlogs with indications that their capacity does not meet demand, public discussion on subsidies is increasing and new contenders in the long haul market are becoming visible. The modeling method developed compares and evaluates government support in the forms of capacity enhancement with the relevant support of per unit cost on the performance of the domestic firm. The results are compatible with the stylized evidence, revealing that the capacity enhancement mechanism is inferior in boosting the domestic firm's performance.

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1. Introduction

There has been a long-standing competition between European airline manufacturer Airbus and US Boeing in the market for medium and long haul aircraft. This has spurred a number of academic, legal and policy works over several decades.

Disputes over subsidies have been at the centerpiece of this duopoly competition with several milestones realized within the World Trade Organization (WTO) and a corresponding set of literature. The competition modeling and impact of subsidies has been analyzed through WTO institutional bodies (Carbaugh and Olienyk, 2004, Hamilton, 2024, Kugler, 2018, Lester, 2012), as well as academic scholars. Research towards a comprehensive analysis of the airliners competitive framework and the impact of subsidies have taken place (Brander and Spencer, 1985, Carbaugh and Olienyk, 2004, Irwin and Pavcnik, 2004, Klepper, 1990, Neven et al, 1995, Shetna, 2024, Witting, 2010) with relevant studies examining developments and qualitative implications. The level of complexity of the theme becomes evident by factors such as the latest agreement regarding subsidies of a bilateral nature (Brunsden et al, 2021, EU, 2021, USTR, 2021, USTR, 2022, Beresnevicius, 2020), the rise of other competitors that are government dependent (Spray, 2024, Reuters, 2023, Persinos, 2024) and also the significance of substantial backlogs and capacity challenges that result in production shortages in meeting orders and demand. The role of the interactions with defense markets of multi product firms add another layer of complexity, challenging comprehensive analytical frameworks and approaches.

The subsidization factor has been dominant throughout the analysis but is in itself of a multidimensional and complex nature, as there are many different methods and approaches to defining and measuring it. Dominant to this debate is the subsidy in the form of RnD support for launching new aircraft, though there is the challenge of distinguishing between per unit production subsidy and RnD capacity subsidization that is not always clarified in terms of its impact on the relevant analysis.

This paper aims to close this gap by modeling and comparing relevant differences in efficiency between per unit production subsidy and capacity enhancement support provided by the public sectors in an oligopolistic, strategic trade framework. The hypothesis examined is that government support in the form of capacity enhancements has a lesser impact on the performance of the domestic firm over the alternative of public support in the form of per unit production cost subsidy.

The rest of this paper is structured as follows. A background description of the key performance metrics evolution with a focus on Boeing and Airbus is presented next, followed by the role of the public sector and subsidies. The relevant literature with respect to the economic analysis is then presented, followed by a model aiming to address relevant gaps in the form of comparing public support in the form of enhancements to capacity of domestic firms with per unit cost support. The paper closes with a section on discussion and future research agenda and conclusions.

2. Background to Strategic Trade Applications in the Commercial Airliners Industry

This Section describes some key characteristics with regards to the performance and competitive framework in the medium/large commercial airliners industry with a focus on Boeing and Airbus. In three subsections, descriptions on backlog and deliveries metrics are presented, along with the role of the public support and subsidies, as well as key literature approaches and analysis.

2.1 Background to Boeing and Airbus Key Performance Evolution

Boeing and Airbus have been competing as a duopoly in the commercial airliners market with their fleets dominating the relevant medium and long haul segments. In the past few years, Airbus has experienced significant performance leadership over Boeing in a decades-long duopoly competitive environment characterized by significant rows over governmental support on behalf of its domestic supplier. Deliveries of aircraft, sales and keeping up with planned backlog management altogether have seen Airbus outperforming Boeing. However, both companies have experienced shortages in supplying their products

and maintaining low levels in their respective backlogs. Thus, while Airbus has outperformed Boeing, both manufacturers appear to have difficulties matching their production runs with their sales and backlog (Beresnevicious, 2020a, Leggett, 2024, Mcmillan, 2024). As Table 1 illustrates, since 2019 Airbus has been outperforming Boeing in terms of aircraft delivery, while net orders remain significantly high for both manufacturers.

Boeing has been suffering from employee strikes and safety of aircraft issues with its Boeing 737Max, with a growing backlog, while steadily falling behind Airbus in terms of deliveries of aircraft as Table 1 reveals (Hemmerdinger, 2025 and Leggett, 2024). Airbus on the other hand, also faces significant challenges in terms of delivering aircraft and closing on an over 8,000 aircraft backlog in 2024 with the head of Airbus stating "We have more demand than the ability to supply" (Guillaume Faury quoted in Hanvey 2024).

Table 1: Orders and Deliveries of Aircraft

	Airbus		**Boeing**	
	Net Orders	**Deliveries**	**Net Orders**	**Deliveries**
2024	826	766	377	348
2023	2,094	735	1,314	528
2022	820	661	774	480
2021	507	609	479	340
2020	268	566	-471	157
2019	768	863	54	380
2018	747	800	893	806
2017	1,109	718	912	763

Source: Hemmerdinger (2025).
Note: Time series data for deliveries and orders can be obtained from Boeing (2025) and Airbus (2025).

This may appear as a mixed blessing, as on the one hand, capacity challenges may provide an opening for new entrants into the market, such as the Chinese firm, Comac (Reuters, 2023, Persinos, 2024), while on the other hand they may be seen as 'locking-up' current and future demand into their backlogs.

2.2 Public Support and the Subsidies Factor

Crucial to this framework is the role of subsidies, both tin terms of the historic performance path of the two competitors, but potentially, also in potential barriers to publicly owned/supported new entrants. Subsidies have had a substantial impact upon the industry, with a prominent example coming from an analysis undertaken by a WTO institution examining their effect initially on a claim against Airbus, followed by a claim against Boeing, both of which are in favor of anti-competitive practices as the example below reveals.

"The panel found that the effects of the pre- A350XWB LA/MSF subsidies continued to be a genuine and substantial cause of the present-day market presence of A320, A330, and A380 families. If those subsidies had not existed, Airbus would not be selling those products today. In respect of the 'product effects', the panel found that the A350XWB could not have been launched at the end of 2006 and marketed in the absence of the LA/MSF pro-gramme. The panel found that, as in the original proceeding, the US experienced significant lost sales under Article 6.3(c) and the challenged LA/MSF subsidies continue to be a genuine and substantial cause of serious prejudice to the US." (Kugler, 2018).

The subsidies and tariffs framework becomes enhanced and topical as the US new administration rhetoric is considering trade subsidization a central policy theme (Hamilton, 2024, Spray, 2024).

The subsidies debate has been one of the longest disputes examined in various episodes under World Trade Organization institutional framework, but also its predecessor and other bodies. Starting from an early milestone in 1992, the two parties agreed an Agreement on Trade in Large Civil Aircraft (TLCA). This agreement provided a framework for public support for both industries set at a maximum of 33% of total development costs. Furthermore, loans were at a centerpiece of the agreement, as preferential loan policies and loan forgiveness in case of no-launch of new aircraft for Airbus led to the agreement that public support had to cover government costs. Other provisions related to precise indirect public support percentages, though a precise definition of what constitutes indirect aid was hard to come by (Wittig, 2010). This is another thorny issue, as amongst other indirect support, economies of scope and scale in multiproduct industries may be perceived as instrumenting and steering relevant public demand for specific defence projects to enhance cost advantages for commercial products.

TLCA effectively came to a halt when in 2004 the US government filed a case with WTO against Airbus/EU, which was reciprocated by the EU filling a case against the US/Boeing on the grounds of inappropriate with WTO subsidies. This sparked a sequence of milestones, with institutional bodies formed to examine the cases of each trade rival, while countermeasures were determined, tariffs set in place and re-examination processes evolved (Airbus, 2025).

During this period, foreign direct investments were undertaken by Airbus with facilities set up in the US, such as in Mobile, US (also China), for alleviating domestic support arguments, while debt issues for the competitors rose and various tariff and subsidy mechanisms evolved (Beresnevicious, 2020a, 2020b, Pandey, 2020). A cooperative agreement was reached between the EU and the US in 2021 formalizing collaboration and contact to address relevant issues on a continuous basis (EU, 2021). Since then, though Airbus officials have stated their commitment to public support for new technology development aid and the use of mechanisms such as repayable government loans in the form of new models launch aid (Thompson, 2023).

2.3 Economic Approaches to the Airbus-Boeing Competitive Framework

Economic analysis has taken note of the subsidization sequel since the early days, as well as the policy and performance implications of the industrial structure.

Industrial organization analysis with the use of cost and demand functions to model competition in the commercial manufacturers industry has been used extensively in the literature with applications to Boeing and Airbus. Brander and Spencer (1985) in a seminal paper applied a simple, yet comprehensive model to examine the dilemma faced by firms engaged in the commercial airliners market and the catalytic impact on the outcome of the game of the government intervention in support of its domestic industry. Brander and Spencer (1985) provide a simple, yet comprehensive approach to the catalytic role of public subsidy in the duopoly dilemmas. Though the setting ignores the military-commercial market interactions, as the relevant firms supply both markets, nonetheless it depicts the strategic role of government subsidies for development and entry in new markets.

Strategic trade framework may arguably lead to a ‘neo-mercantilistic’ approach whereby governments compete in collusion with domestic decreasing costs industries. In the presence though of national security considerations, whereby autonomy in systems may be a priority over cost, such public support for domestic producers is justified on the grounds of public policy security preferences.

Klepper (1990) follows a similar, yet more detailed approach in modeling the relevant competition through specific cost functions and market conditions. Klepper again ignores the multiproduct nature insofar as the defence markets are concerned yet reaches conclusive results insofar as subsidies play a crucial role in the performance of firms and development of products.

Challenges associated with new product developments in multiproduct oligopolies arise in the form of ‘canibalization’ of markets, as a rising scope of new products creates substitutes for existing markets (Neven et al, 1995), with this factor playing a crucial role in the case of Airbus launching its A380 airliner.

Irwin and Pavcnik (2004) identify th elaunch of A380 as having a more profound negative impact through canibalization of existing Airbus markets on the impact of its rival Boeing 747. More recently, Shetna (2024) provides a useful case study approach with modelling simulations based on WTO scenarios.

However, despite the different nature of subsidies as they evolve following the trade disputes and agenda, there has been little attention at comparisons of different forms of public support on the performance of the two rivals, or indeed in the industry altogether (including development of contestability through new entrant implications).

The novelty in the model in this paper rests primarily with the form of RnD support employed and its comparison with the per unit subsidization with regards to competitiveness gains.

In the model employed in this paper, fixed costs associated with RnD are assumed to impact upon the shape and positioning of cost curves. This is compatible with traditional approaches whereby production costs options in the long run range from low-fixed cost steep cost schedules to smoother, high fixed cost total cost functions. The next section examines how interactions of different types of public support impact upon cost curves and performance of competitors in such a duopolistic framework.

3. The Model

Two single product firms with constant marginal cost curves are assumed to compete 'a la Cournot' in a framework intended to capture ceteris paribus the impact of different approaches of public support to its domestic industry. The two firms are symmetric in their cost functions and also face a duopolist commercial/non captive market. The asymmetry rests with the type of support each receives from its respective public sector. Thus, we assume firm 1 to be on the receiving side of per unit subsidy, while firm 2 to be on the receiving side of production process support, analogous to RnD enhancement for more efficient production technology. This is expected to be more realistic than assuming a net injection of funds in the form of fixed costs savings. Solving such a model results in obtaining equilibrium conditions for output q1 and q2, subject to the equilibrium values for the two types of subsidization, allowing a comparative analysis.

Starting from a model of oligopoly, where two firms compete 'a la Cournot' with symmetric and constant marginal costs, with one of them receiving a per unit subsidy by its domestic public sector we have

$$P = a - b(q1 + q2) \tag{1}$$

where,
P is the price
α is the autonomous demand
b is the demand curve slope
q1 and q2 the quantities supplied by firms 1 and 2, respectively

$$C1 = F + (c - s)q1 \tag{2}$$

where,
C1 is the total cost for firm 1
F is the fixed cost for firm 1
c is the (constant) average cost
s is the per unit subsidy

$$C2 = F + cq2 \tag{3}$$

where,
C1 is the total cost for firm 2

$$\Pi i = qip - Ci \tag{4}$$

For i = 1, 2
Πi is the profit of firm i

The equilibrium solutions for q1 and q2 point at how the firm with the subsidy s (for s>0) becomes the market leader,

$$q1 = 1/3\,(a - c + 2s\,)/b \tag{6}$$

$$q2 = 1/3\,(a - c - s\,)/b \tag{7}$$

However, let us assume that the cost coefficient is not a constant 'c', but depends in an inverse manner on a capacity parameter, directly related to fixed costs and for simplicity assumed to be 1/F, where F=fixed costs. Then we have,

$$C1 = F + \left[\left(\frac{1}{F}\right) - s\right] q1 \tag{8}$$

To compare with the case whereby the public sector supports capacity building by the firm, rather than a per unit subsidy, we introduce a capacity augmentation term that has a beneficial impact upon the variable costs, but does not appear as a 'fixed cost' as it is not incurred by the firm itself. Thus, we have,

$$C2 = F + \left[\left(\frac{1}{F+g}\right)\right] q2 \tag{9}$$

where,
g is the capacity-enhancing public support for firm 2

For the case of cost equation (9), the firm still pays its fixed cost, but because it benefits from a capacity of F+g, its marginal cost has declined accordingly. Note that the two cost functions of equations (8) and (9) are equal when s = g = 0 and also when g = F and the value of 's' is half of the fixed cost (F). In the latter case, it would require for the relevant public sector of firm 1 to provide support that doubles its capacity (assuming linear and constant production returns to fixed assets), while the relevant to firm 2 public sector would subsidize each unit by half the fixed costs.

Solving the model's new profit functions for the equilibrium values of q1 and q2 we obtain the relevant outputs as follows

$$q1 = \frac{aF^2 + agF - F + 2sF^2 - 2g + 2gsF}{3bF(F+g)} \tag{10}$$

$$q2 = \frac{aF^2 + agF - F - sF^2 + g - 2gsF}{3bF(F+g)} \tag{11}$$

Comparing the two values of equations (10) and (11) reveal that for values of s, F, g equal, or greater than one, q1 is greater than q2. This shows that public support for capacity building under constant costs is far less effective than per unit subsidization as a firm performance enhancement mechanism. Direct per unit subsidization thus will determine a market leader, rather than capacity enhancement.

The implications of this result highlight the attractiveness of direct per unit subsidization by the public sectors, as opposed to the indirect mechanism of capacity development. An extension of this finding shows that R&D support for production processes makes a feeble impact on competitiveness compared to direct subsidies. The European policies of subsidy per unit in the aerospace industry have had a beneficial impact on the competitiveness of the industries in commercial markets compared to lump sum support that may be directed to capacity enhancements, assuming symmetric cost technologies.

This result is compatible with the phenomenon of extensive efforts into sales by the two main competitors, rather than meeting production targets via focusing on enhancing capacity. Though this may not result in a causal explanation of the backlog amassing, it may go some way into explaining absence of incentives in mitigating against it. This result is also compatible with subsidy patterns benefiting price reducing support, rather than investments into capacity enhancement. On the other hand, the latter are more noticeable and high-profile, in comparison.

4. Discussion

There has been an extensive dispute over subsidies in a historic duopoly between Airbus and Boeing in the commercial airliners market. Performance of companies, strategic trade and game theoretical analysis have been the focus of policy makers, WTO institutions and academics providing invaluable knowledge and understanding in industrial matters and government economic policies.

In this framework, there has been significant analysis involving theoretical and applied contributions in the form of economic industrial models and evaluations of subsidy effects, impacts and retaliatory actions. Textbook theory in international trade provides a benchmark assessment in comparing tariffs with quotas (applicable also in cases of retaliation mechanisms), though there is less emphasis on comparing different forms of subsidies and public support.

This may be partly due to the complexity surrounding the factors that would impact upon such comparisons. The analysis in this paper aims at this gap in literature by developing and applying a theoretical framework to compare the impact of subsidies affecting the per unit cost with public support that enhances capacity of the targeted/domestic firm.

The results reveal that public support targeting the per unit cost has a stronger impact compared to enhancement of capacity. This appears consistent with the amassing of significant and growing backlog by the two rivals, Boeing and Airbus, that seem to focus more on obtaining orders and enhancing sales, rather than fulfilling the capacity necessary to meet them.

Beyond this, the practice of expanding the order book, but lacking behind in production would appear on the first instance to have a mixed impact upon threat of entry and contestability. On the one hand, there is a lock-in effect on the buyers through the backlog enhancement agreements with the two rivals, while on the other hand, there is clear opportunities for new entrants associated with perceived shortages of supply.

This is an area for further research that would also enhance the role of international political aspects, as the new entrant threats originate from publicly owned firms from countries like China and Russia.

Moreover, the analysis makes a comparison ‘ceteris paribus’ of capacity enhancement government support with per unit cost government support. The approach taken may well be extended in future research to take into account an augmented multi-stage modelling mechanism with potential complexities and calibrations.

5. Conclusions

This paper builds on a long-standing analysis of the duopoly in the commercial airliners industry between Boeing and Airbus. Academics and government officials have focused on the structure and performance of the relevant firms and the implications of public policy and subsidies on the competition between them within a strategic theory framework. The case for subsidization and its implications, in particular, has been one of the longest standing open cases within the World Trade Organization. Moreover, this analysis is becoming increasingly relevant as:

1. Both competitors are shown to experience significant backlogs with indications that their capacity does not meet demand.
2. Public discussion on subsidies and trade restrictions is increasing on a global level.
3. New companies and models in the long haul market are becoming visible.

The modeling method developed compares and evaluates government support in the forms of capacity enhancement with the relevant support of per unit cost on the performance of the domestic firm.

The results of the analysis are compatible with the stylized evidence, revealing that the capacity enhancement mechanism is inferior in boosting the domestic firm's performance when compared to per unit cost subsidy. This supports a firm strategy of boosting sales, rather than enhancing capacity. This result goes some way into explaining the persistence of backlog s for the two manufacturers, but may also provide a mechanism preventing new entries from emerging international players. Finally, the paper examines relevant further research potential.

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