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How Political Were Airbus and Boeing Sales in the 1970s and 1980s?[*]

Tobias A. Jopp / Mark Spoerer[+]

Abstract: When, in the second half of the 1960s, governments and aircraft manufacturers in Western Europe discussed a possible joint project called "Airbus", the markets for civil jet aircraft were dominated by two US firms, Boeing and McDonnell Douglas. After a disappointing start, Airbus Industrie, founded in 1970, had become a serious competitor only a decade later. Since the early 2000s, Airbus and Boeing have been competing head-to-head for market leadership for jet aircraft with more than 100 seats. Boeing has persistently complained about Airbus receiving loans on favourable terms and other subsidies from European governments, and that the latter would use political pressure to make operators buy Airbus aircraft. Based on a record of all wide-body jets delivered between 1969 and 1989 and a dataset built thereupon on all airlines having acquired a brand-new wide-body, we subject the latter reproach to an empirical test by asking for the political determinants of Airbus and Boeing sales. We find suggestive evidence for airlines' ownership status and their home countries' former colonial ties to as well as trade relations with and development aid flows from the Airbus consortium member countries and the US to have mattered.

Keywords: Airbus, Boeing, aircraft deliveries, nonmarket environment, political sale, subsidies

JEL classification: N42, N44, N72, N74, F23, H25, L93

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1. Introduction

In the first three decades of its existence, civil aviation was almost entirely determined by military and therefore political interests. Owing to the legendary Douglas DC-3, the new means of transport gained a certain degree of reliability and, above all, economic viability in the mid-1930s making the operation of airplanes lucrative for business purposes. Although, after the Second World War, civil aviation profited worldwide from the sale of thousands of phased-out US military transporters, it remained a highly political and highly regulated industry – in- and particularly outside the United States (e.g., Hickie 1991: 191; McGuire 1997: 28-33; Lawrence/Thornton 2005: 7-19; and Bowen 2010: 12-18).[1] Until the 1980s, almost every national flag carrier outside North America was still firmly in the hands of the state. Nearly all airlines placed their scheduled flight business in the hands of a cartel, the International Air Transport Association (IATA) (Bowen 2010: 21, 54). Even within the United States, regional monopolies regulated air traffic business into the 1970s. The two large and privately owned American international carriers, Pan American World Airways (Pan Am) and Trans World Airlines (TWA), were allowed to operate only a few domestic routes, whereas airlines with names such as Eastern, Western, Southern or Northwest Orient Airlines (the latter with route rights to East Asia) shared most of the domestic market with companies still existing today such as American Airlines (AA), Delta Airlines (DA), and United Airlines (UA) (Bowen 2010: 18-22).

With politics still playing an important role in civil aviation, the Airbus consortium was a child of its time when it was founded in 1970. France wanted to put a stop to the increasing dominance of US aircraft manufacturers with her Concorde, Mercure and now Airbus projects. As a junior partner, Germany saw its opportunity to revive its long-standing aircraft industry and return to the market for large civil aircraft. The US manufacturers initially gave the Airbus project just as little a chance as they had given the Concorde and the Mercure (Hayward 1975: 354; McGuire 1997: 37-39; Thornton 1995: 45-66; Andres 1996; Kirchner 1998; and Raabe 2020). However, when Airbus' first major sales successes emerged

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[1] We refer to the C-47 and the C-54 and their civilian versions DC-3 and DC-4.

in the late 1970s – in late 1977 Eastern Airlines received its first A300s (on a leasing basis)[2] – accusations of unsound practices became more outspoken. On the one hand, the Americans pointed to the large loans on favourable conditions and other, more direct subsidies the Airbus consortium received from its member states' governments; and on the other hand, they accused the Europeans of exerting direct political influence on the sale of their new aircraft. The Europeans reacted with counter-reproaches and referred to the cross-subsidisation of US civil aircraft production by military orders. Years of litigation before the World Trade Organization (WTO) followed suit (Baldwin/Krugman 1988: 51; Hickie 1991: 191-193; and McGuire 1997: 48-90).[3]

The mutual accusations of political influence on sales are the subject of our article. We are interested in the extent to which the accusations were justified and, if so, for which manufacturers and periods this applies. Since we do not have access to the relevant source material at Airbus or Boeing, we use an indirect empirical approach based on mass data on jet deliveries. As Airbus started with two wide-body jets, the A300 and the A310,[4] we limit ourselves to this market segment. We created a database that covers the years 1969 to 1989 and contains not only all wide-body aircraft delivered by Airbus, Boeing, Lockheed and McDonnell Douglas in that period, but also a number of political variables on the characteristics of the ordering airlines and of their respective countries of origin. We proceed by briefly discussing the economic and political environment of the market for wide-body aircraft in the 1970s and 1980s in Section Two. We turn to our main methodological concern, namely, how to measure "political sales" in a mass data setting, in Section Three and introduce our data set in Section Four. Section Five is devoted to the empirical analysis centring on logit regressions asking for the determinants of airlines' decisions to buy Airbus and Boeing aircraft; the regressions are performed for the entire period 1974-1989 as well as for the sub-periods 1974-1979 and 1980-1989 and separately for Airbus and Boeing sales. Finally, Section Six serves to establish a lower-bound guesstimate of the absolute and relative number of political sales by Airbus and by Boeing.

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[2] On the importance of Eastern Airlines as a customer for Airbus, cf. Bugos (1996: 394) and McGuire (1997: 52-54).

[3] On the subsidy dispute after the 1992 trade agreement between the EC and the US, cf. specifically Pavcnik (2002); Carbaugh/Olienyk (2004); Maennig /Wittig (2010); and Olienyk/Carbaugh (2011).

[4] Airbus' first narrow-body, the A320, went into service in March 1988.

2. The economic and political environment of the wide-body aircraft market from the late 1960s to the 1980s

Three major trends dominated the investigation period. Firstly, after the first oil price crisis, economic efficiency, especially fuel costs per passenger kilometre, was deemed crucial for the success or failure of an aircraft model. Secondly, as worldwide prosperity increased, so did the demand for passenger and cargo flights, making wide-bodies profitable in the first place. Thirdly, a slow but steady deregulation of the air transport markets took place, starting in the United States.

Deregulation in the United States mainly affected rights to flight routes. Before the Airline Deregulation Act signed by US President Jimmy Carter end of October 1978 came into force, new routes had been subject to a lengthy approval procedure by the Civil Aeronautics Board (CAB). The rest of Western civil aviation was essentially subject to the IATA, a cartel of almost all major international airlines, which fixed prices and quality for each individual route until the 1990s (McGuire 1997: 42-44; and Bowen 2010: 93).

Most IATA members outside North America were national flag carriers under public ownership over the 1970s and 1980s. One big exception is British Airways (BA), which was privatised under the Thatcher government in 1984.[5] It is not surprising that publicly-owned flag carriers opted for national aircraft types if existing. For years, Air France flew the Caravelle twin-jet (1959-1981) on its short- and medium-haul routes. Air Inter, the other state-owned French airline, was the only airline to use the Mercure twin-jet (1974-1995), built by Dassault. Moreover, Air France was the A300's launch customer (1974-1997), and Air Inter also relied entirely on Airbus aircraft to replace the Mercure (McIntyre 1992: 13-27; Béteille 1995; Dienel/Lyth 1998: 18-49; and Bowen 2010: 112).[6] BA, created in 1974 by the merger of British European Airways (BEA) and British Overseas Airways Corporation (BOAC), relied almost entirely on national turboprop and jet aircraft for short- and medium-haul routes and partly also on long-haul routes.[7] Air France and BA were also the only airlines to buy the prestigious, but enormously fuel-thirsty Concorde which they operated between

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[5]   Air Canada and Japan Airlines switched to private ownership in the second half of the 1980s, too.

[6]   For an overview of the most important characteristics of the jet aircraft types mentioned here, cf. Table A.1 in the Appendix.

[7]   On short- and medium-haul routes: Vickers Viscount, Vickers Vanguard, Hawker-Siddeley Trident, and BAC 1/11; on long-haul routes: Vickers VC-10.

1976 and 2003 despite rising kerosene prices and maintenance costs (Dienel/Lyth 1998: 50-84).

Medium-sized privately-owned airlines existed in addition to the national flag carriers. The French Union de Transport Aériens (UTA) was majority-owned by Chargeurs Réunis, one of Europe's largest shipping groups. Following from the French aviation authorities' (strict) regulation, UTA served long-haul routes not covered by Air France, primarily to Africa, Asia, Australia and Oceania. With the exception of two Caravelles operating in Oceania, UTA flew exclusively US aircraft, mainly DC-8, DC-10 and B747 freighters. Due to declining profit margins, the majority of shares in the company were sold to Air France in 1990 (McGuire 1997: 28-33; and Dienel/Lyth 199: 18-49). British Caledonian Airways (BCal), created in 1970/72 by a merger of two private airlines supported by the British government, served mainly long-haul routes to South America and Africa, besides a couple of European routes. In short- and medium-haul traffic BCal relied entirely on the British BAC 1/11 and in long-haul traffic on the Boeing B707 and later the DC-10.[8] After economic difficulties, the company was sold in 1987 to BA. Ten A320s ordered by BCal in 1983 were then taken over by BA in 1988 making them the first Airbuses in the BA fleet (Dienel/Lyth 1998: 50-84).

Another example for the conflicts between economic and political motives in the aviation business of the 1960sis the case of the Vickers VC-10 of which only 40 civil aircraft were built. The launch customer BOAC had to buy a second batch of this model due to pressure from the British government, although the company would have preferred to buy more aircraft of the more economical B707. With BUA (later BCal), another British company opted for the model. The only non-British customers came from the Commonwealth: Ghana Airways, Nigeria Airways (cancelled) and East African Airways (based in Kenya) with a total of eight actually built aircraft. Later, used VC-10s were leased or sold to Laker Airways (UK), Air Malawi and Gulf Air. The latter is based in Bahrain, the only non-Commonwealth airline ever flying the VC-10. However, Bahrain was a British protectorate until 1971.

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[8] Initially, BCal had taken over two VC-10s of its predecessor company British United Airways (BUA), but phased out those aircraft soon thereafter.

Illustration 1
The British Vickers VC-10 was elegant and popular with passengers because of the large cabin windows, but economically inferior to the B707 and the DC-8 (40 delivered between 1964 and 1970).
Photo: British Caledonian Airways

This brief overview suggests that if state-owned airlines had the chance to acquire aircraft manufactured in their own country they would have taken it; and, as the VC-10 example adds, if they had not shown a sufficient motivation to voluntarily acquire them, they would have been pressed by the government. In the United States, where state-owned airlines have been unknown ever since, European aircraft manufacturers saw only few sales opportunities. The Caravelle was chosen only by UA, which bought 20 of them. The BAC 1/11 was somewhat more successful and was sold to Mohawk, AA, Braniff and Aloha. Contrasting with this, not a single French airline used the BAC 1/11, and no British airline ever the Caravelle.


Illustration 2
The French Sud Aviation Caravelle was the only commercially successful non-American passenger jet before the Airbus (282 delivered between 1959 and 1972).
Photo: United Airlines

From the airlines' point of view, political guidelines were undesirable as they might have interfered with economic efficiency arguments supposed to govern aircraft choice. The first oil price crisis in 1973-74 almost doubled the price of kerosene within a year, and at the heyday of the second oil price crisis in May 1981 the price of kerosene was almost ten times higher than at the beginning of 1973 (see Figure 1). Seemingly ever-increasing jet fuel prices led to the phasing-out of numerous less efficient aircraft types. Both the Boeing 720 and the Convair Coronado were sold to operators in the periphery or scrapped. The Concorde, which had been evaluated and leased by Braniff and Singapore Airlines, did not find any further customers beyond Air France and BA. After the second oil price crisis, Lockheed did not find new customers for its Tristar and ceased production in 1985 (Argiropoulos 1982; Majumdar 1987: 509-510).

Fig. 1: Index of monthly kerosene and jet fuel prices, Jan. 1960 to Dec. 1989 (1982 = 100)
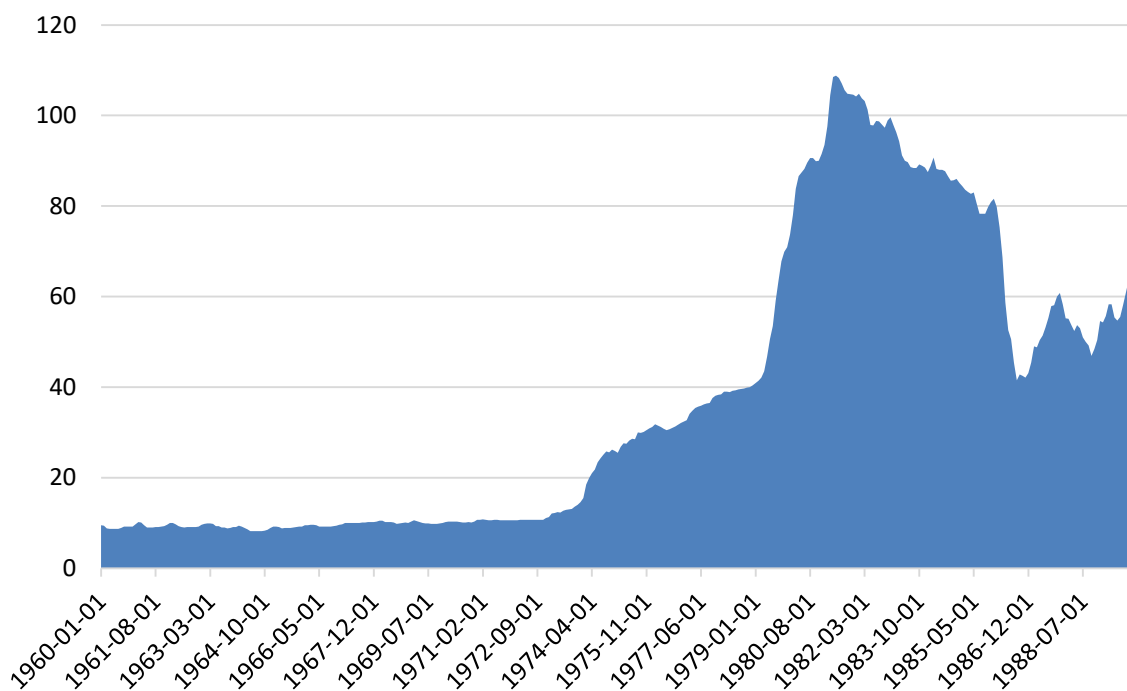

Sources: U.S. Bureau of Labor Statistics, Producer Price Index by Commodity for Fuels and Related Products and Power: Kerosene and Jet Fuels [WPU0572], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/WPU0572, July 29, 2020.

On the one hand, this development disadvantaged Airbus (and its competitors) in that potential customers had to record drastic slumps in profits and therefore were forced to delay the renewal of their fleets. Worldwide, the number of aircraft orders did indeed decrease, and so did the number of deliveries of wide-body aircraft, too (see Figure 2). On

the other hand, however, Airbus now benefited from the better efficiency of its A300, being the first twin-engine wide-body aircraft. Although the somewhat larger DC-10 and Tristar three-engine models had the advantage of being able to cross the Atlantic non-stop and at the shortest possible distance until 1985, they nevertheless had higher fuel consumption per passenger (DeSantis 2013).

Fig. 2: The market for wide-body jets between 1969 and 1989
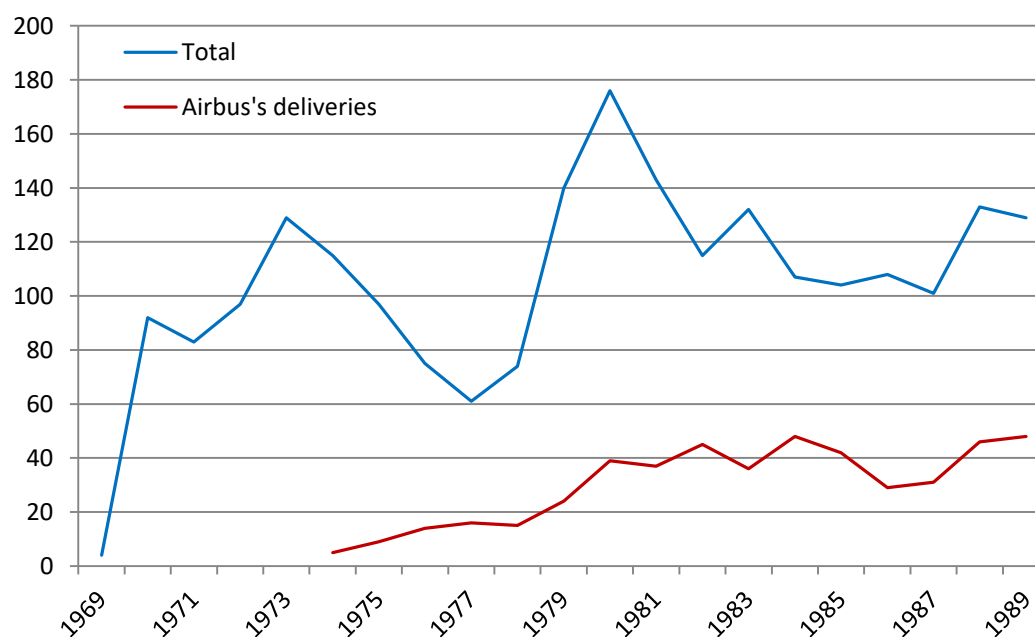
Notes: "Total" is the sum of all deliveries of Airbus A300/A310, Boeing B747/B767, Lockheed L-1011, and McDonnell Douglas DC-10 jets.

Sources: Our dataset; see Section 4.

In addition, the A300 occupied a market niche. On short- and medium-haul routes, the A300 with 250 seats in a typical three-class configuration was significantly larger than the largest variants of the B727, the B737 or the DC-9 (all single-aisle aircraft) and only slightly smaller than the DC-10 or the Tristar (approx. 300 seats each), but with one engine less. This cost advantage was reflected in market shares after the second oil price crisis (Figure 3). While deliveries of the two three-engine competitor models declined and their market share fluctuated by 5 and 10 percent respectively, Airbus was able to increase its market share significantly, although Boeing launched the comparatively small B767 in 1982.

Fig. 3: Aircraft manufacturers' market shares in the wide-body segment over 1969-1989
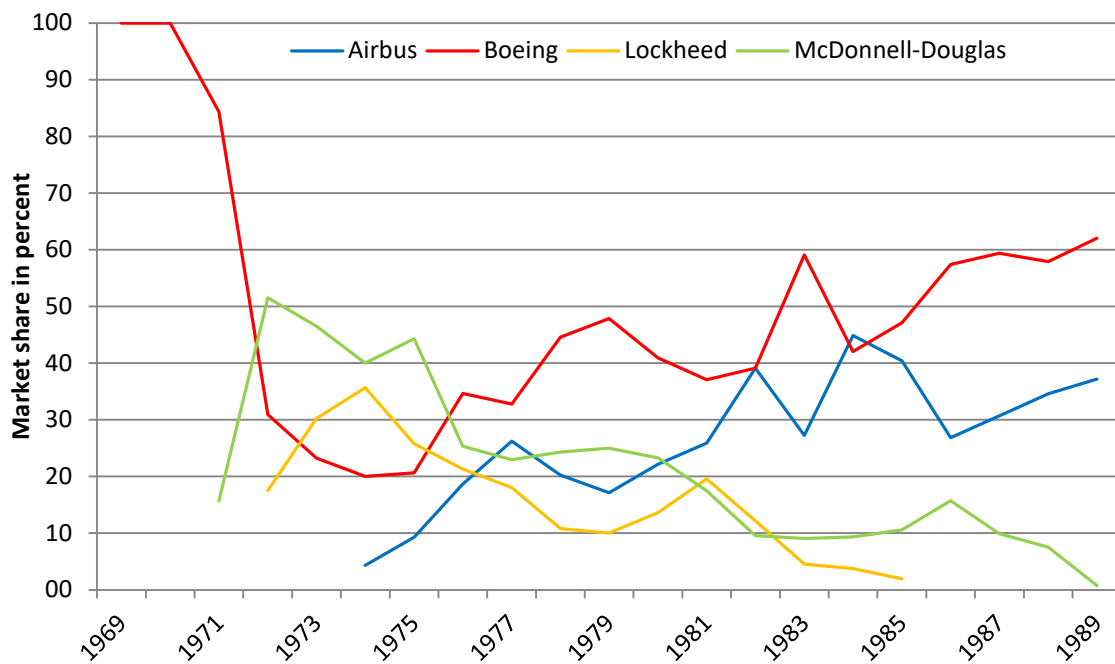
Notes: Based on deliveries per manufacturer.

Sources: Our dataset.

Illustration 3

Pan Am's order of 30 Airbus A300 and A310 aircraft were part of Airbus' final breakthrough on the US market in the early 1980s (561 and 255 delivered between 1974 and 2007).

Photo: Pan American

Illustration 4
Sloppy maintenance led to a fatal crash of an American Airlines McDonnell Douglas DC-10 and a subsequent two-month grounding in summer 1979, which had a serious impact on DC-10 sales (586 delivered between 1971 and 2001).
Photo: American Airlines

When AA, one of the three very large US domestic airlines, started using the A300 in spring 1988, Airbus had finally made its breakthrough on the US market.[9] Lockheed had already retired as a producer of civil aircraft three years earlier, while the DC-10, modernized as the MD-11, had little success. In fact, the market for large civil aircraft was now a duopoly between Airbus and Boeing.

3. A "political sale" – what it is and how to measure it

The factors having enabled Airbus to seriously compete with Boeing by 1989 have been intensely debated. Some authors emphasise that the A300/A310 was technologically superior to American aircraft and designed to fill a market niche not yet served. Irrespective of the subsidy/government support issue, airlines bought Airbus aircraft primarily for reasons of economic efficiency in air traffic (Majumdar 1987: 502-506; Sarathy 1993: 136).[10] Others stress that, to understand Airbus' rise, it is necessary to make a clear distinction between the "market" and the "nonmarket" environment within which commercial aircraft production takes place. Airbus' success owes at least as much to nonmarket strategies, or factors, as it does to market-related ones (Hickie 1991: 192; Sandholtz/Love 2001; and Crombez/Van Kerckhoven/Van Gestel 2011). Following Sandholtz and Love (2001: 150),

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[9] US customers of the A300/A310 according to our dataset (until 1989) and Wikipedia thereafter (year of first delivery in parentheses): Eastern Airlines 34 A300 in total (1977); Pan Am 12 A300 (1984) and 18 A310 (1985); Continental Airlines 3 A300 (1986); and American Airlines 35 A300 (1988).

[10] Related to this argument is the idea that Airbus' success fundamentally builds on organizational innovation, too (e.g., Kechidi 2013).

[n]onmarket strategies include subcontracting and, […], coproduction offers; investment in local training or maintenance facilities; strategic manipulation of forecasts; diplomatic pressure applied by institutions such as the European Commission (EC), European leaders and trade representatives; and lobbying and even bribery of airline officials.[11]

And Sandholtz and Love (2001: 152-153) more concretely on Airbus:

Since Airbus competes in a highly visible, important trade sector and is a consortium composed of nationally owned aerospace companies, it should be no surprise that diplomatic pressure, often at the highest levels, is utilized to improve Airbus' fortunes. For example, the French government has often linked inducements such as landing rights, technical assistance, and special trade agreements to the purchase of Airbus transports. Indeed, even in the early years of Airbus, Boeing executives and U.S. government officials repeatedly complained about Airbus's "government-to-government-type selling effort.[12]

Combining both views, we may distinguish sales deals along two lines, namely whether or not a deal materializes because economic efficiency considerations guided the buyer's choice in the first place (buyer's motivation); and whether or not it is government involvement facilitating the closing of the deal between seller and buyer (government intervention). Figure 4 is an attempt at establishing a simple (ex-post) classification of sales deals along these lines.

For the purpose of this investigation, we define a sales deal to be "political" if, and only if, intervention of the governments standing behind seller and buyer is consciously involved in the closing of a *specific* deal. This intervention can take two forms: It can take a moderate form in which a government promotes a domestic seller's success on the world market by granting direct or indirect subsidies (non-repayable grants, favourable credit terms, export finance) or by intermediating on its behalf through its relations to the potential customer's home government (Newhouse 1983: 59-66). Governments furnish their diplomatic channels to ease communication between both parties and may serve as (financial or legal) guarantors of the deal while economic efficiency considerations on the buyer's side prevail (Type B).[13] The less moderate form of government intervention is given if the seller's government exerts pressure on the buyer's government which passes the

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[11] For a related definition of a firm's or a business's "political behavior", cf. Boddewyn (1993: 85-86).

[12] For corruption in the aircraft business, cf. "Airbus's secret past", *The Economist*, June 12, 2003; and "Airbus agrees to pay a huge fine to settle a bribery case", *ibid.*, January 31, 2020.

[13] On the function as guarantor, cf. Newhouse (1983: 194).

pressure right on to the buyer itself. The seller's government might use diplomatic or financial leverage merely to support its domestic business or because it has a stake of its own in the game. Alternatively (or in addition) the pressure on the buyer might (partly) lead right back to genuine interests of its own government. The involvement of political pressure is equal to the buyer's motive of ensuring economic efficiency to have factually faded into the background (Type C).

Fig. 4: Political versus non-political sales

Economic efficiency guiding principle \ Governments involved	No	Yes
Yes	Type A sale "classic market deal"	Type B sale "intermediating governments"
No	Type D sale "corruption"	Type C sale "political pressure"

Sources: Authors' own depiction.

In contrast, sales of type A and D are closed without government intervention but could nonetheless involve other nonmarket strategies, with bribery probably being the most extreme strategy of all nonmarket-non-government-reliant strategies. All four types of sales, of course, reflect ideal types. In reality, there might well be a sales deal involving intermediating-only governments, but also a nonmarket strategy modifying the buyer's motivation to buy. The grey-shaded area in Figure 4 is supposed to indicate that there might be some overlap.

Note that (full) state ownership of the involved firms is not a necessary precondition for a sale to be political; it is a catalyst significantly raising the likelihood of a type C sale to happen though. State ownership of the buyer facilitates political pressure to find its way into

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the buyer's management and therefore decision-making process.[14] Also note that there is another latent motive to buy, namely taste (Irwin/Pavcnik 2004: 226). In its broadest sense, taste may, for example, include the phenomenon that countries, or for that matter: firms, have deeper trade relations with geographically or culturally close partners. In the same vein, states may feel more sympathetic with states that match their own political attitudes or agendas and may be, thus, more likely to establish trade relations with these countries.[15]

Classifying each and every sale or, respectively, order by drawing on material from the manufacturers', customers' and governments' archives would be the ideal way to work out an answer to our research question. However, the effort would be tremendous, and given the high incidence of proven and suspected corruption in the aircraft business, it is extremely unlikely that we could get access to the documents. Therefore, we go the cheaper, since indirect, statistical road which, however, has not yet been taken by researchers.[16] We seek insights into how far Airbus and Boeing sales might have been political from a bird's eye perspective. We therefore need to measure aspects of sales' (potential) political nature. We consider four aspects: 1) an airline's ownership status (fully state-owned vs. mixed public-private ownership vs. fully privately-owned);[17] 2) historical colonial ties of an airline's home country with France, Great Britain, and the United States;[18] the economic, economic-historical, and political science literatures have assembled evidence that past colonial relations do matter long after a colony gains its independence and that a mother country may well keep diplomatic and financial control, and thus leverage, to a degree (e.g., Grier 1999; Acemoglu/Johnsin/Robinson 2001; Lange 2004; Asongazoh 2010;

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[14] As Newhouse (1983: 30) puts it concretely, "[g]overnment of a good many of Europe's airlines and airplane manufacturers gives the Airbus consortium an apparent advantage."

[15] A nice example is the travel of French President Valéry Giscard d'Estaing through the Middle East in March 1980 during which he promoted, among others, Palestinians' right for self-determination. Middle Eastern states basically caught this to be an anti-Israeli sentiment. In the following, several Middle Eastern airlines (e.g. Emirates, Kuwait Airways, Saudia) turned to Airbus and placed highly welcomed orders (Newhouse 1983: 39-40). While these sales are certainly political, they were so in a very broad sense best put under the header of "(political) taste" (unless one could prove that Giscard d'Estaing said what he said for reasons of promoting domestic business in the first place). Our definition, however, is narrower.

[16] A non-statistical alternative would be to concentrate on a manageable number of case studies. But that would probably not add much to the existing literature.

[17] To motivate this aspect: Hickie (1991: 192), states that "[p]olitical pressures are also sometimes applied to such airlines [i.e., national airlines; the authors], and even to the airlines of client states, in order to make them buy particular aircraft."

[18] To motivate this aspect: Consider the case of jets built in Western Europe, especially the Vickers VC-10 discussed above.

Austin 2010; Lee/Schultz 2012; and Maseland 2018); 3) international trade relations between an airline's home country and the Airbus consortium member countries as well as the US; we consider trade structure as a measure of "trading partner taste" and bilateral trade position (net surplus or deficit) as a possible trigger for trade tensions and governments' countermeasures;[19] and, finally, 4) development aid flows from the Airbus consortium member countries as well as the US to an airline's home country; like financial flows from the former colonial master to its former colony; development aid flows provide leverage, but may also trigger a feeling of being obligated to the aiding country (e.g. Imbeau 1989; Lumsdaine 1993; Schraeder/Taylor/Hook 1998; Alesina/Dollar 2000; Berthélemy 2006).

Our main hypotheses are as follows:

- H1.1: Airbus (Boeing) sold significantly more (less) likely to state-owned airlines than to privately-owned ones;

- H2.1: Airlines from former French and British (US) colonies significantly more likely bought Airbus (Boeing) aircraft;

- H3.1: The larger the weight of the Airbus consortium member countries (the US) as trading partner(s) of a country, the more likely did an airline of that country buy Airbus (Boeing) aircraft.

- H4.1: The larger the development aid flows from the Airbus consortium member countries (the US) to a receiving country, the more likely did an airline of that country buy Airbus (Boeing) aircraft.

We will discuss the sources of our data on these aspects in the next section and the variables created from these data in Section Five.

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[19] To motivate this aspect: Sandholtz and Love (2001: 153-154), state that "Boeing currently has about 80 percent of the Japanese market, far above its global market share. In addition, the flag carrier, JAL [Japanese Airlines; the authors], has an all-Boeing fleet. The EC has pressured Japan to buy more Airbuses, complaining that JAL had never purchased Airbus offerings – and had purchased the 737-400 without even considering the A320 – and that ANA [All Nippon Airways; the authors] cancelled Airbus, but not Boeing, orders. The imbalance in Japanese aircraft orders is almost certainly tied to political factors, especially Japan's desire to avoid trade tensions with the United States. Purchasing Boeing planes is one way of reducing Japan's trade surplus." Note that Japan specifically had a large and persistent trade surplus with the US in the 1970s and 1980s, and that JAL and ANA were already then two of the most important non-American Boeing customers; cf. footnote 20.

4. Data

In a first step, we created a dataset on the level of the delivered aircraft covering all wide-body deliveries between 1969, when the B747 entered the scene, and 1989. We recorded 2,215 deliveries of wide-body jets to, overall, 145 different first customers – 131 passenger airlines, five cargo airlines and nine governmental/miscellaneous customers – from 77 countries.[20] Table 1 shows the composition of this baseline dataset by manufacturer, aircraft type, and airline; while the Airbus, Boeing, and McDonnell Douglas models have been produced beyond 1989, the Lockheed Tristar was exclusively delivered in the 1970s and up until 1985. The ten largest customers account for no less than 845 deliveries, equalling a share of 38.1 percent in total deliveries.[21] By definition, the first customer is the first the passenger airline, cargo airline or miscellaneous customer to use a particular, newly-manufactured aircraft.[22]

Tab. 1: Baseline wide-body aircraft dataset, 1969-1989

Manufacturer/Aircraft type	Observed over	No. of deliveries		No. of different customers per manufacturer/aircraft type[a]	
Airbus	1974-1989	484		67	
A300	*1974-1989*		*321*		*47*
A310	*1983-1989*		*163*		*30*
Boeing	1969-1989	1,036		91	
B747	*1969-1969*		*755*		*74*
B767	*1982-1989*		*281*		*35*
Lockheed L-1011 (Tristar)	1972-1985	249		20	
McDonnell-Douglas DC-10	1971-1989	446		52	
Total	1969-1989	2,215		145[b]	

Notes: [a] Customers include passenger airlines, cargo airlines, and miscellaneous users. [b] The sum total does not equal the sum over the sub-entities as the sub-entities involve double counts of customers.

Sources: Authors' own depiction.

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[20] This category includes military (e.g. US Air Force) as well as non-military governmental (e.g., Abu Dhabi Amiri Flight) customers and one miscellaneous customer (i.e., General Electric). In case of a merger, we counted the merged airlines and the newly created airline separately; so, for example, Germanair (first German A300 customer) and Bavaria Germanair (created by merger of Germanair and Bavaria Fluggesellschaft in 1977, and acquired by Hapag-Lloyd in 1979).

[21] These are (total wide-body deliveries in parentheses): American Airlines (121), Japan Airlines (101), Pan Am (86), United Airlines (84), Delta Airlines (83), All Nippon Airways (80), Lufthansa (78), Eastern Airlines (72), TWA (71), and Air France (69).

[22] In other words, focus is on the primary market for wide-bodies only, leaving the market for used aircraft aside.

We arrived at the numbers of 2,215 deliveries and 145 customers as a consequence of few adjustments we had to perform on the original data.[23] These adjustments concern the way a particular aircraft's first customer was recorded in our source. Starting from the various production lists showing, in total, 2,255 aircraft, we first eliminated all aircraft "not built" (37) and all aircraft built for test purposes only (3); all remaining aircraft entered our database.[24] As regards the clarification of the first customer, 55 deliveries posed a challenge as aircraft are concerned which were not taken up by the originally ordering airline, possibly for reasons of illiquidity, insolvency, or merger. While we do know the originally ordering airlines, we decided to select as first customer the effective first user.[25]

We have collected the following basic information per delivered aircraft from our main source: Manufacturer serial number (MSN), manufacturer, model family/type, version (e.g., A300B4), main aircraft purpose (passenger, cargo, miscellaneous), first customer, first registration, exact delivery date, first customer's home country, first customer's commercial purpose (passenger/cargo airline, or miscellaneous), and first customer's founding date.

We added further binary-coded variables on the airline- and on the home country-level (see Table 2 in the subsequent section). These include an airline's ownership status at the point in time of the delivery;[26] whether an airline's home country was member of the Airbus consortium or was the United States; an airline's home country's broad geographical location; whether an airline's home country has historical colonial ties to either France, Great Britain, or the USA;[27] and whether an airline's home country was a member of the British Commonwealth at the time of delivery.

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[23] Our principle sources were the production lists to be found at the internet sites www.planespotters.net (all manufacturers except for Lockheed) and www.airfleets.net (Lockheed).

[24] A modest number of 21 deliveries were recorded as leases (based on an explicit remark in the production list) and 2,139 deliveries as buys (based on the absence of any remark as to a potential lease).We assume that the actual number of leases must be larger than 21 though. For example, the deliveries of the A300 to Eastern Airlines, which in fact were based on a favourable leasing arrangement ("fly before you buy" (Lawrence/Thornton 2005: 65), were not equipped with such a remark.

[25] For example, the A300 with the Manufacturer Serial Number "9" was originally ordered by Air Siam but effectively delivered to Air France in July 1976. Of these 55 deliveries, another seven were highlighted as leases (five alone to Pan Am).

[26] We extracted that information from the airline histories as deposited in Wikipedia. For all but four airlines, ownership status remained constant throughout the observation period; Air Canada, British Airways, and Japan Airlines switched from state (via mixed) to private ownership in the 1980s, and Philippine Airlines switched from private to mixed ownership in 1976.

[27] We focused on the last colonial master and ties sustaining into the recent past. For the latter fact, we do not consider a country's former colonial ties to Spain or Germany.

In a second step, we created a dataset on the airline-level to perform logit regressions of an airline's binary choice to buy, or not to buy, Airbus or Boeing aircraft (see Table 3 in the subsequent section). For each of the 145 airlines, and separately for the periods 1974-1989, 1974-1979, and 1980-1989, we observed whether or not an airline had been Airbus or Boeing customer; and how many Airbus and Boeing aircraft it had possibly bought. On this level of aggregation, we added trade variables[28] and development aid variables[29] referring to an airline's home country to account for trade structure and trade position as well as financial leverage. We will discuss these variables in detail in the subsequent section.

5. Empirical analysis

Our analysis consists of two parts. We begin with a simple descriptive inquiry into the distribution of the aircraft deliveries' characteristics in our baseline dataset; to the best of our knowledge, a comparable statistical exercise has not yet been done in the literature. This is followed by an inferential exercise on the airline-level asking for the determinants of the decision to buy Airbus or Boeing wide-body aircraft in the observation period using logit regressions; such an exercise has not yet been attempted in the literature either.

To begin with, Table 2 shows the results of a number of statistical t-tests on differences in sample means regarding an airline's ownership status, the broad geographical location of its home country, and the presence of colonial ties of its home country to the manufacturer countries. For the observation period as a whole, we compare the sample of Airbus deliveries with the sample of all American manufacturers' deliveries, in general, and with Boeing deliveries, in particular. Is the reported difference in sample means statistically significant and positive (negative), this implies that the respective variable's mean in the Airbus sample is larger (smaller) than the mean in the American manufacturer sample. Since all displayed variables are 0-1-coded dummy variables, this is equal to saying that the

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[28] Our main source for international trade data – i.e., bilateral import and export flows – is the Correlates of War Project's Trade Data Set as described in Barbieri/Keshk (2016). Online: http://correlatesofwar.org, and Barbieri/Keshk/Pollins 2009).

[29] Our main source on development aid flows from is the OECD. We focused on what the OECD labels "total official development flows (ODF)". To be precise, we recorded total receipts of ODF for each receiving country in our dataset and ODF granted by the Airbus consortium member states and by the US to calculate the shares; see https://stats.oecd.org/Index.aspx?DataSetCode=BTDIXE. We considered direct aid flows between, for example, France and a receiving country here; total ODF includes these unilateral flows as well as flows channeled through supranational organizations.

proportion of deliveries exhibiting a specific characteristic is significantly higher (lower) in the Airbus sample.

Tab. 2: T-tests on differences in sample means on the aircraft-level for the period 1974-1989

Selected binary variables	Airbus vs. American manufacturers	Airbus vs. Boeing
Buyer's ownership		
Private ownership	−0.119*** (0.025)	−0.092*** (0.027)
Public ownership	0.123*** (0.026)	0.112*** (0.028)
Mixed ownership	−0.004 (0.763)	−0.020 (0.015)
Buyer's geographical origin		
Airbus member country	0.092*** (0.020)	0.085*** (0.021)
European	0.118*** (0.024)	0.121*** (0.025)
Central and South American / Caribbean	−0.018** (0.008)	−0.015* (0.009)
North American	−0.149*** (0.023)	−0.055** (0.024)
African	0.031*** (0.012)	0.024* (0.013)
Middle Eastern	0.039** (0.016)	0.030* (0.017)
Southern Asia	0.033*** (0.010)	0.034*** (0.010)
South Eastern Asia	0.063*** (0.016)	0.052*** (0.018)
Eastern Asia	−0.084*** (0.017)	−0.014*** (0.020)
Oceanic	−0.033*** (0.008)	−0.054*** (0.010)
Buyer's Colonial ties		
To Airbus member countries	0.026 (0.023)	−0.026 (0.025)
To US	0.006 (0.242)	0.005 (0.005)
Commonwealth member	−0.020** (0.020)	−0.061*** (0.022)
	N = 1,810	*N = 1,294*

Notes: t-test on equality of mean across groups. Unequal variance in the groups assumed. Reported are the differences in sample means and the standard errors in parentheses. Significance levels are as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Sources: Authors' own computations.

The tests' implications are as follows: 1) The proportion of deliveries to privately-owned airlines is larger in the American manufacturer samples, while the proportion of deliveries to state-owned airlines is larger in the Airbus sample; there is no statistically significant difference regarding deliveries to airlines with mixed ownership. 2) The proportion of deliveries to Airbus consortium member countries is larger in the Airbus sample. 3) The proportion of deliveries to airlines from Europe, Africa, the Middle East, Southern Asia, and South Eastern Asia (deliveries to the last three form the "Silk Road" deliveries; Newhouse 1983: 38; Lynn 1995: 160-189) is generally larger in the Airbus sample, and largest for

deliveries to airlines from Europe. 4) The proportion of deliveries to airlines from Central and South America and the Caribbean, North America, East Asia, and Oceania is generally larger in the American manufacturer samples; with the exception of Oceania, this distribution is less pronounced in the Boeing subsample. 5) There is no statistically significant difference in sample means when looking at colonial ties to Airbus member countries (when put together) or to the United States. 6) The proportion of deliveries to airlines from Commonwealth countries (including but not exhausted by former British colonies) is larger in the American manufacturer samples, and larger in the Boeing subsample compared to all American manufacturers.[30]

Suggestive as these results might be – they seem to clearly confirm our hypothesis H1.1 and reject H2.1 –, they should be interpreted with caution. For example, all US and most North American airlines were privately-owned; hence it is not clear whether ownership mattered or geographical origin. This results from the fact that the variables for which we reproduce the t-test results in Table 2 are not independent from each other. For this reason, we augment our univariate analyses summarized in Table 2 by a multivariate logit analysis. Logit regressions on the airline level stand at the core of our subsequent analysis because they allow simultaneously estimating key (political) variables' effect on the airlines' decision to buy or not to buy Airbus or Boeing aircraft at all.[31] We restrict ourselves to focus on the simple binary response here (buy or not) for the reason that coupling or weighting the decision to buy with the number of bought aircraft raises additional statistical challenges that we want to leave aside for the moment.[32] Table 3 shows six regressions arranged into three models; regressions are estimated separately for Airbus and Boeing – for the full

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[30] We also performed the t-tests year-by-year to bring in greater detail. Results are given in graphical form in the Appendix. See the notes to Figure A.1 for how to read our graphical presentation.

[31] On logit regression, see e.g. Feinstein/Thomas (2002: 384-418); and Wooldridge (2002: 453-481). Logit regression is in our view the least complex regression design we can possibly implement given our data structure. We can think of numerous ways to extend the framework, beginning with an extension of our wide-body dataset into the present, by including narrow-bodies and also the secondary market for aircraft, and, on the statistical side, by using more complex count and panel models to make better use of the information embedded in our data.

[32] For one, we would have to consider more complex count data models (without or with time dimension). Secondly, in our view the decisions to buy aircraft of different manufacturers are not statistically independent from one another. The more aircraft an airline buys from one manufacturer (in a given market segment and period), the more likely it supposedly is to not also buy aircraft from another manufacturer. In statistical terms, we are likely facing here what the literature calls competing risks (the event happening earlier alters the probability of the other event to occur; hence there is a joint probability distribution to consider). To be precise, this challenge already exists when looking, as we do, at the binary response in a given period. But we think this challenge's impact on results is negligible in our setting.

observation period (model 1), and the 1970s (model 2) and 1980s (model 3).[33] All models include a number of variables on airline characteristics (upper part) and variables on the characteristics of the airlines' home country (lower part). All variables except for the airlines' founding year and the trade and development aid variables are dummy variables. Since the trade and aid variables inevitably exhibit empty cells for the Airbus consortium member countries and the United States, their inclusion leads to all observations on airlines from the respective countries being dropped; our regressions are thus run on 102 (1974-1989 and 1980-1989) and 95 (1974-1979) observations only.[34] For each variable we report the estimated logit coefficient along with its statistical significance, the coefficient's (clustered robust) standard error in parentheses, and an estimate of the marginal effect in brackets. For reasons of interpretation, it is much more meaningful to look at the marginal effects than at the coefficients themselves.[35] The marginal effect can be interpreted as the change in the ex-post-probability of becoming an Airbus or Boeing customer given a pre-defined change in the explanatory variable; for dummy variables, marginal effects report the change when the variable's value switches from zero to one, and for continuously defined variables they are evaluated at the respective variable's sample mean. Note that double-digit coefficients indicate that the variable is a perfect predictor meaning that the variable does not exhibit variation. We kept these variables for the sake of illustration though. This "problem" is especially present in model 2 on Airbus, which leads to the marginal effects being corrupted.

Manufacturer relations variables:[36] Airlines not having ordered any Boeing (narrow- or wide-body) aircraft before 1974 (when A300 deliveries started) whatsoever – these are 57 airlines in our dataset – were more than 20 percent less likely than airlines having had long-standing relations with Boeing to order Airbus or Boeing wide-bodies during 1974-1989. When breaking down the analysis to sub-periods, the effect shows for Airbus in the period

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[33] The results on the mean comparison tests performed year-by-year (see the Appendix) suggest that it makes sense to make a cut between 1979 and 1980 rather than before or after. Note that some observed airlines were founded only after 1979. This is why the number of observations is lower in model 2.

[34] We additionally ran regressions on the full 145 observations under exclusion of these variables. For reasons of space, we do not display the results here, but make them available upon request.

[35] The influence of an explanatory variable on the dependent variable is not linear in a logit model. It also depends on the other explanatory variables' values. That is, a variable's influence critically depends on which point in the distribution it is measured at.

[36] These two dummy variables along with a third one which we dropped to avoid multicollinearity (*Boeing customer before 1969*) are supposed to capture path dependency effects. The dropped dummy variable constitutes the base case.

1980-1989 but not before; for Boeing it shows only in the 1970s, but not thereafter. It is also in the 1970s that airlines that had just established relations to Boeing between 1969 and 1973 (since they were buying narrow-bodies or the new B747 or a combination of both) – these are 31 airlines in our dataset – were also less likely to become (or remain) a Boeing wide-body customer between 1974 and 1979. On a substantive level, airlines that had exclusive relations with McDonnell Douglas before 1974 (or, for that matter, with Lockheed since 1972) had little incentive to switch to Boeing models. These airlines predominantly had operated a mix of DC-8 and DC-9 jets and at first found a reasonable wide-body extension in the DC-10, Tristar, or the A300/310. This changed in the 1980s, when the A300/310 obviously became significantly less(!) attractive to many of these airlines. This is a somewhat surprising observation as the common narrative attributes Lockheed's market exit and the insignificance of the DC-10 by the mid-1980s to the rise of Airbus in the first place. But it seems that the increasing attractiveness of Boeing aircraft, and very likely of the B767 twin-jet appearing in 1982, helped on an equal scale to bury its fellow American competitors.

Ilustration 5
The Boeing B767 became a serious competitor for the slightly larger DC-10 and Tristar tri-jets, all the more when ETOPS regulation was relaxed in the mid-1980s so that twin-engine jets could cross the North Atlantic and the North Pacific on fuel-efficient routes (up to now 1,190 delivered between 1982 and June 2020).
Photo: All Nippon Airways

Tab. 3: Determinants of an airline's decision to buy Airbus or Boeing wide-body aircraft in the period 1974 to 1989

Variables	Model 1: 1974-1989		Model 2: 1974-1979		Model 3: 1980-1989	
	Airbus	Boeing	Airbus	Boeing	Airbus	Boeing
Airline characteristics						
Boeing customer after 1969	+0.15 (0.90)	−1.31 (0.80)	−0.28 (0.50)	−1.49** (0.58)	−0.05 (0.97)	−0.24 (0.92)
	[+4.0 %]	[−25.8 %]	[−0.0 %]	[−24.8 %]	[−1.3 %]	[−5.3 %]
No Boeing customer pre-1974	−1.01*** (0.33)	−1.23* (0.63)	−1.81 (1.24)	−2.83* (1.50)	−0.95*** (0.20)	−0.37 (0.50)
	[−24.0 %]	[−21.3 %]	[−0.2 %]	[−50.0 %]	[−21.3 %]	[−8.2 %]
Foundation year	+0.03*** (0.01)	−0.01 (0.01)	+0.07** (0.03)	−0.01 (0.01)	+0.03** (0.01)	−0.00 (0.01)
	[+0.7 %]	[−0.2 %]	[+0.5 %]	[−0.2 %]	[+0.5 %]	[−0.1 %]
Cargo airline	−17.42*** (0.68)	+15.61*** (1.18)	−17.50 (.)	+3.49 (2.54)	−15.53*** (0.76)	+15.81*** (1.09)
	[−47.5 %]	[+24.0 %]	[−0.2 %]	[+65.1 %]	[−44.0 %]	[+40.0 %]
Governmental customer	−1.30** (0.61)	−0.14 (0.90)	−15.39*** (1.22)	+0.96 (0.99)	−1.69** (0.71)	−0.64*** (0.16)
	[−35.2 %]	[−2.4 %]	[−0.3 %]	[+31.9 %]	[−28.7 %]	[−15.2 %]
Full state ownership	+0.81 (0.71)	+0.59 (0.67)	−0.03 (0.84)	+0.89 (0.84)	+1.64** (0.76)	+0.22 (0.52)
	[+18.4 %]	[+10.3 %]	[−0.0 %]	[+18.2 %]	[+33.7 %]	[+5.0 %]
Mixed ownership	+1.17 (0.98)	+0.63 (0.83)	−16.39*** (0.73)	+2.59* (1.56)	+1.86** (0.94)	+0.76 (1.20)
	[+28.3 %]	[+8.8 %]	[−0.5 %]	[+56.9 %]	[+43.0 %]	[+24.7 %]
Switching ownership	−16.94*** (0.81)	+14.70*** (1.39)	−17.46 (.)	+16.67*** (0.81)	−15.45*** (0.85)	+15.99*** (1.31)
	[−47.3 %]	[+26.0 %]	[−0.1 %]	[+77.6 %]	[−44.0 %]	[+41.1 %]
Home country characteristics						
Former French colony	−2.25** (1.01)	+0.01 (0.95)	−18.11*** (1.90)	+2.21* (1.51)	−2.04** (0.90)	−1.45*** (0.30)
	[−36.5 %]	[+0.2 %]	[−0.6 %]	[+55.5 %]	[−32.9 %]	[−34.6 %]
Former British colony	−0.96*** (0.32)	−0.77* (0.40)	−1.00 (0.77)	−1.06*** (0.36)	−0.79** (0.32)	+0.12 (0.48)
	[−22.0 %]	[−13.3 %]	[−0.1 %]	[−20.6 %]	[−17.7 %]	[+2.6 %]

Tab. 3 continued

Variables	Model 1: 1974-1989		Model 2: 1974-1979		Model 3: 1980-1989	
	Airbus	Boeing	Airbus	Boeing	Airbus	Boeing
Former US colony	+17.04*** (1.06)	+13.52*** (1.72)	+35.99*** (1.81)	+14.39*** (2.69)	+15.95*** (1.40)	+14.60*** (2.71)
	[+64.8 %]	[+23.1 %]	[+99.9 %]	[+74.1 %]	[+67.0 %]	[+35.1 %]
Roosevelt Corollary	−0.71** (0.36)	−1.96** (1.97)	−0.28 (1.15)	−2.31*** (0.22)	−1.19*** (0.30)	−0.64 (0.54)
	[−15.5 %]	[−42.4 %]	[−0.1 %]	[−30.0 %]	[−23.2 %]	[−15.2 %]
Average import share "Airbus"	+0.05 (0.04)	+0.01 (0.03)	−0.04 (0.07)	+0.02 (0.04)	+0.07* (0.4)	+0.04 (0.03)
	[+0.9 %]	[+0.2 %]	[−0.0 %]	[+0.3 %]	[+1.4 %]	[+0.8 %]
Average export share "Airbus"	−0.03 (0.04)	+0.00 (0.02)	+0.04 (0.06)	−0.01 (0.04)	−0.06 (0.04)	−0.05 (0.03)
	[−0.6 %]	[+0.0 %]	[+0.3 %]	[−0.5 %]	[−1.1 %]	[−1.0 %]
Average import share USA	+0.02 (0.02)	+0.04 (0.03)	+0.05 (0.08)	+0.09*** (0.02)	+0.03 (0.03)	−0.04* (0.02)
	[+0.4 %]	[+0.7 %]	[+0.3 %]	[+1.6 %]	[+0.7 %]	[−0.9 %]
Average export share USA	−0.02 (0.02)	−0.02 (0.01)	−0.03 (0.05)	−0.05*** (0.02)	−0.03 (0.02)	+0.03** (0.01)
	[−0.4 %]	[−0.3 %]	[−0.1 %]	[−1.0 %]	[−0.5 %]	[+0.6 %]
Average trade surplus "Airbus"	+0.00 (0.00)	+0.00** (0.00)	−0.00 (0.00)	+0.00 (0.00)	+0.00** (0.00)	+0.00** (0.00)
	[+0.00 %]	[+0.0 %]	[−0.0 %]	[+0.0 %]	[+0.0 %]	[+0.0 %]
Average trade surplus USA	−0.00 (0.00)	−0.00* (0.00)	+0.00 (0.00)	+0.00 (0.00)	−0.00 (0.00)	−0.00** (0.00)
	[−0.0 %]	[−0.0 %]	[+0.0 %]	[+0.0 %]	[−0.0 %]	[−0.0 %]
Average aid share "Airbus"	+0.01 (0.03)	+0.00 (0.03)	−0.01 (0.07)	−0.04 (0.03)	+0.00 (0.01)	−0.02* (0.01)
	[+0.0 %]	[+0.0 %]	[−0.1 %]	[−0.0 %]	[+0.1 %]	[−0.4 %]
Average aid share US	−0.02 (0.02)	−0.00 (0.01)	−0.01 (0.03)	+0.03* (0.01)	−0.02 (0.03)	+0.01 (0.02)
	[−0.4 %]	[−0.0 %]	[−0.0 %]	[+0.3 %]	[−0.4 %]	[+0.1 %]
Constant	−68.99** (27.05)	+23.03 (29.99)	−135.88** (57.86)	+22.32 (23.28)	−56.05** (25.37)	+11.48 (24.50)
No. of obs.	102	102	95	95	102	102
Log pseudolikelihood	−58.0	−56.1	−23.9	−40.2	−56.8	−60.7
Pseudo R-squared	0.18	0.16	0.30	0.34	0.19	0.14

Notes: The dependent variables are "airline has bought Airbus wide-body aircraft in the defined period" (if yes, then 1; 0 otherwise) and "airline has bought Boeing wide-body aircraft in the defined period" (if yes, then 1; 0 otherwise). Maximum-likelihood estimates of logit regression coefficients are given. Clustered robust standard errors are in parentheses (clustered is on geographical location). Marginal effects are given in brackets. In case of a dummy variable, the marginal effect is given for the step from 0 to 1. In case of a continuous variable, the marginal effect is evaluated at the variable's mean.

Sources: Authors' own estimations.

Foundation year: Consistent across all models is the effect that the younger an airline, the significantly more likely it was to buy Airbus; there is no significant effect, however, from the perspective of Boeing.[37] Together with the variables discussed before, this finding points to the importance of path dependency in the airline business and does match with the common narrative. Newly founded airlines compiled their fleets from the scratch and were not locked-in by earlier decisions in favour of another producer.

Customer nature variables:[38] Pure cargo airlines did not buy the A300/310 at all in the period under investigation. The A300 freighter was considerably less attractive than the larger freighter versions of the DC-10 and especially the B747 with its nose cargo door. In the whole period under consideration, governmental customers were neither particularly attached to Airbus nor to Boeing wide-bodies (in the 1980s). Apparently they had a tendency for the DC-10 and the Tristar. This result is very possibly driven by the KC-10 freighter based on the DC-10-30CF delivered in large numbers to the US Air Force between 1981 and 1990.

Ownership variables:[39] Contrary to our original expectation, which was reinforced by the mean comparison test shown in Table 2, an airline's ownership status was not a prime determinant of the decision to go for Airbus wide-body aircraft rather than for the others – at least not in the 1970s and from the bird's eye perspective on the entire observation period. That said, state-owned airlines (and such with mixed ownership) were indeed significantly more likely than privately-owned airlines to buy Airbus jets in the 1980s.[40] Finally, a note on the switching ownership variable is necessary. Since our design allows for only one observation per airline per model, we faced the challenge to assign ownership status to Air Canada, BA, JAL, and Philippine Airlines, which switched ownership during the observation period (see footnote 25). We solved the issue somewhat imperfectly by introducing a fourth ownership dummy. The implication of this variable's coefficients is clear: these airlines (with the exception of Philippine Airlines) bought no Airbus wide-bodies at all (at the time).

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[37] The marginal effects shown in Table 3 are evaluated at the mean foundation year of (rounded) 1951.

[38] We dropped the third dummy – passenger airline – to avoid multicollinearity. The dropped dummy variable constitutes the base case.

[39] We dropped the fourth dummy – private ownership – to avoid multicollinearity. The dropped dummy variable constitutes the base case.

[40] Note once again that two prime state-owned customers of Airbus – Air France and Lufthansa – are not accounted for in the regressions as they drop out due to the definition of the trade and aid variables.

Colony variables:[41] Contrary to our original hypothesis, home countries' former colonial ties significantly reduced the likelihood for airlines to buy Airbus. Airlines from former French colonies were significantly less likely to order Airbus aircraft throughout the whole period. Our results suggest that Boeing directly benefited from this in the 1970s while likewise seeing the likelihood to be bought decreasing significantly in the 1980s. Turning to airlines from former British colonies, they were significantly less likely to buy Airbus and Boeing jets alike.[42] However, looking into the sub-periods, such airlines were not more or less likely to buy Airbus (but less likely to turn to Boeing) than airlines the home country of which was a former colony in the 1970s. To state it clearly, that was good for Airbus. What seems to have been bad for Airbus sales was Great Britain re-entering the Airbus consortium in 1979. This is because, in the 1980s, airlines from former British colonies showed a statistically significant tendency to avoid buying Airbus aircraft. Given the British government's general lack of support for the Airbus project, this might not surprise. This lack much owes to the fact that the Lockheed Tristar was exclusively equipped with Rolls-Royce turbofan engines manufactured in England. BA flew the Tristar as did a couple of airlines based in the Commonwealth. Thus, what was good for Lockheed was good for Rolls Royce.

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[41] We dropped the fourth dummy – airline's home country never had been a colony of any of the three countries – to avoid multicollinearity. The dropped dummy variable constitutes the base case.

[42] We also ran regressions substituting the *former British colony* variable for a *Commonwealth membership* variable which, however, does not change the results. Results are available upon request.

Finally, having been an airline from a former US colony – in our dataset that is Philippine Airlines only – boosted both Airbus and Boeing sales. However, since the United States has no extensive history as colonizer, we thought it appropriate to also account for a somewhat looser concept of political influence in the geographical neighbourhood. We refer here to the 1904 Roosevelt-Corollary – a fundamental change to the Monroe-Doctrine of 1823 – which stated that the United States are supposed to actively intervene into conflicts in Latin America if necessary to restore order (Mitchener/Weidenmier 2005). In contrast to our expectations, airlines from Latin America were significantly less likely than airlines from the rest of the world to buy Boeing (and also Airbus) aircraft when looking at the full observation period. For Boeing, this effect prevails in the 1970s, but vanishes in the 1980s; from the perspective of Airbus, this effect sets in the 1980s.[43] To conclude, there indeed seems to be a colonial story in the data, but one which stands in contrast to the literature.

Trade variables:[44] We find some evidence that trade structure plays a role in determining the decision to buy aircraft. While there is no effect whatsoever in the regressions on the full period, trade structure matters especially in the sub-period regressions on the decision to buy Boeing wide-bodies. In the 1970s, airlines from countries with large imports from but small exports to the United States were more likely to buy Boeing; this relation turned upside down in the 1980s. More important for our prime focus, though, are the variables on the average net trade surplus. The effects observable for Boeing are somewhat counterintuitive as they imply that airlines from countries which exhibited large surpluses with the Airbus consortium member countries were more likely to buy Boeing and such with a large surplus with the United States were less likely to buy Boeing (in the 1980s, and overall). For Airbus, results suggest in line with our expectations on the effect that in the 1980s airlines from countries exhibiting a large average trade surplus with the Airbus consortium member countries were more likely to buy Airbus at all. This leaves room for the interpretation that such countries intended to buy Airbus in order to reduce a high surplus so as to avoid trade tensions (like with Japan and the US in the observation period; see footnote 19).

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[43] The variables takes the value 1 for all airlines from Latin America in our dataset, and zero otherwise.

[44] The trade structure variables equal the average share in a country's imports and exports for the respective period to which the regressions refer. The same goes for the net trade surplus.

Aid variables:[45] Our evidence on development aid flows as potential governmental leverage to boost Airbus or Boeing sales is very limited. We do not find an effect holding for the entire observation period. However, there is a statistically significant relationship between the US' share in aid a country received and the likelihood of an airline to buy Boeing in the 1970s. We also find indirect evidence for the 1980s. The higher the Airbus consortium member countries' share in the development aid a country received, the lower was the likelihood to buy Boeing whereas the effect on Airbus own sales is not clear.

6. How many sales were political? Establishing a bottom-line

Based on our evidence from logit regressions, we want to establish a bottom-line, or lower bound estimate, for the absolute and relative number of Airbus's and Boeing's political sales. This exercise can only be a crude approximation to the true number as we solely rely on patterns in mass data and not on detailed (archival) information on individual sales. The figures we offer in the following should be understood as figures on sales that are especially suspicious of having been political sales; we are aware that there certainly is a decent margin of error involved.

Our reasoning is as follows: As we do not want to overstretch our methodology, we decided to start from a rather narrow focus when it comes to selecting deliveries being our prime suspects for having been political. We therefore restrict ourselves to selecting from deliveries to state-owned airlines; as we outlined above, state-ownership is not a necessary precondition for a sale to be political, but the likelihood for those sales selected by us to have truly been political (as proven by archival research) might rise when sticking to that restriction. For illustration, Figure 5 shows the absolute and relative frequency of deliveries to state-owned airlines for Airbus and Boeing per year. Until 1981, the proportion of such deliveries is generally quite high for both; after 1981, however, the proportion for Boeing falls visibly faster than that for Airbus, as mirrored in the regression results.

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[45] The variables are defined to be the period average joint share of the Airbus consortium member countries and the average share of the United States in a country's receipts of total official development aid. The cells for all donor countries but the five manufacturer countries show a zero; for the latter, the variable is not defined.

Fig. 5: Deliveries of Boeing and Airbus wide-bodies to state-owned airlines

(a) Absolute number of manufacturer's deliveries

(b) Proportion in manufacturer's total deliveries (in %)
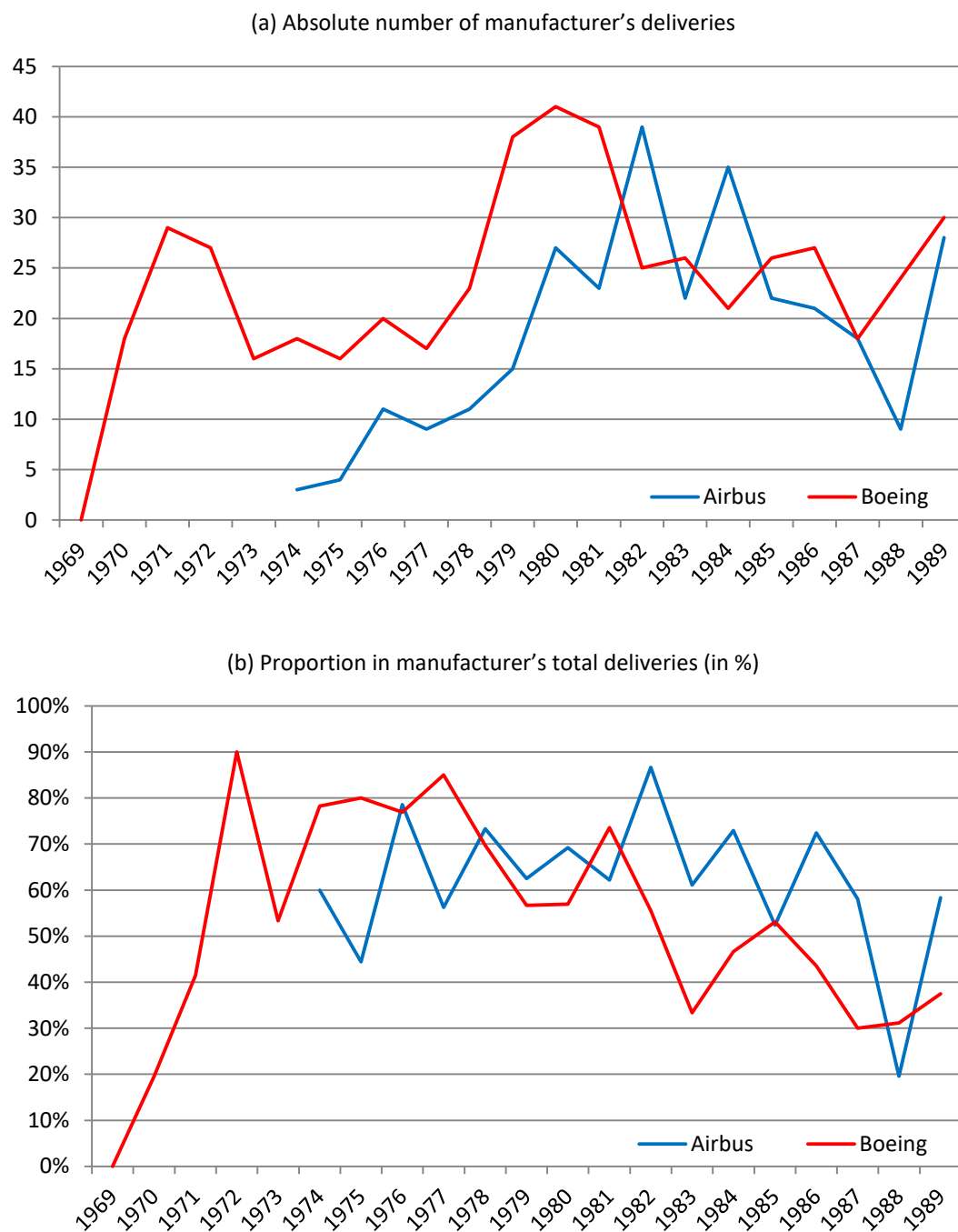
Sources: Authors' dataset.

Fig. 6: Suspected share of political sales in manufacturers' own wide-body deliveries by category

(a) Airbus (in %)

(b) Boeing (in %)
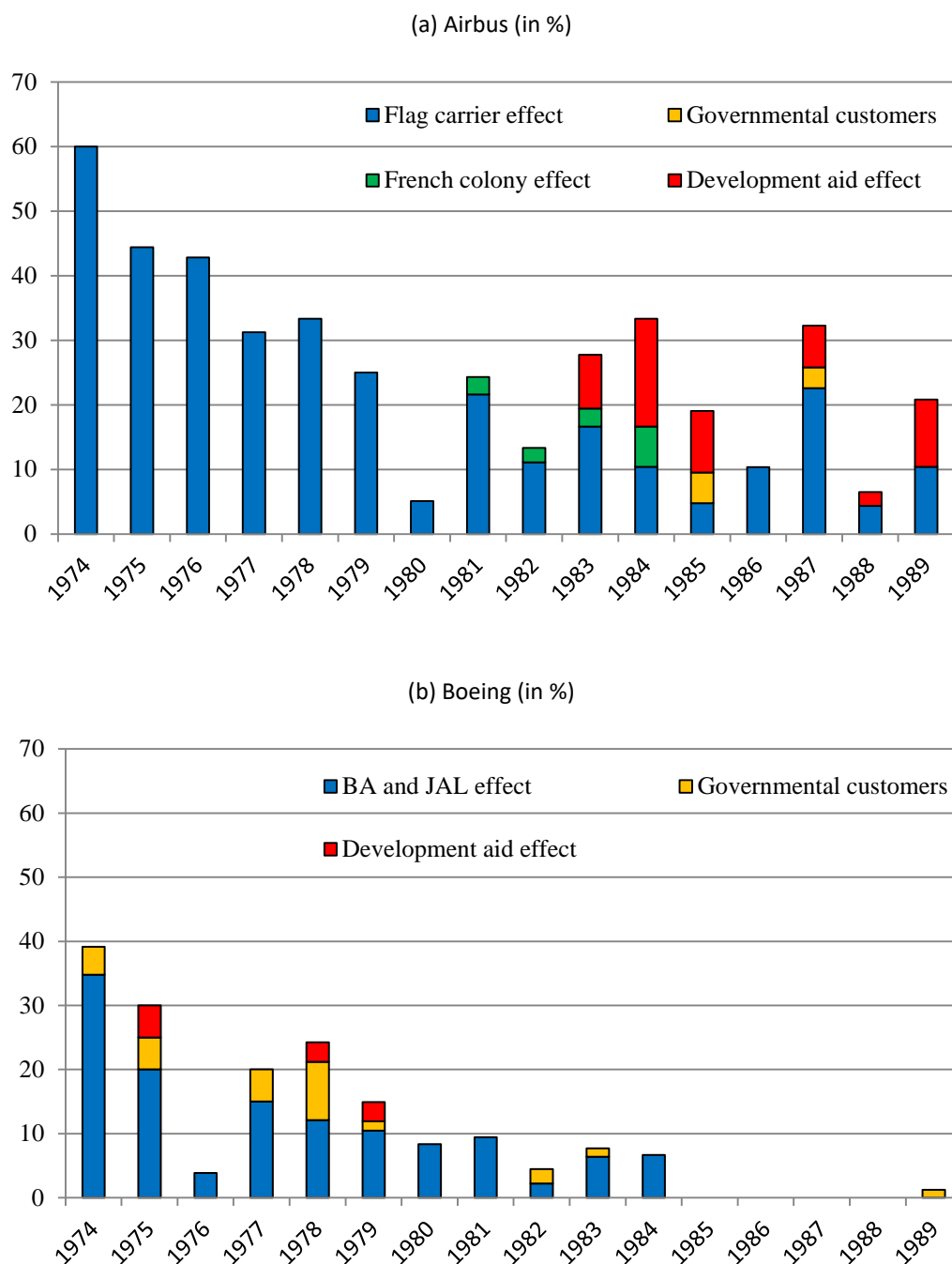
Sources: Authors' depiction.

Figures 6 and 7 report our guesstimates of political sales. Figure 6 gives the number relative to Airbus's and Boeing's deliveries by several categories. For Airbus, we counted the following deliveries in, step-by-step, avoiding any double counts: First, all deliveries to the "Airbus flag carriers" Air France, Iberia, and Lufthansa over 1974-1989 as the baseline; second, all deliveries to governmental customers over 1974-1989; third, all deliveries to

state-owned airlines from French colonies over 1974-1989 as, given the significantly reduced motivation of airlines from former colonies to buy Airbus (see above), the sales that actually occurred are especially suspicious to us for being politically forced; and, fourth, all deliveries to state-owned airlines over 1980-1989 the home country of which received at least the mean share of development aid plus one standard deviation from the Airbus consortium member countries (see above).[46] We did not include deliveries associated with a large average trade surplus (above subsample mean plus one standard deviation) in the 1980s (see above) because the airlines from the relevant countries were privately-owned. As is evident, the share of political sales in all Airbus deliveries was initially quite high and then settled somewhere between ten and thirty percent after 1980.

With regard to Boeing, we counted the following deliveries in: First; all deliveries by British Airways and Japan Airlines (as included in the variable *switching ownership*) over 1974-1984, thus, until these two airlines switched from state-owned to privately-owned (BA) and, respectively, mixed ownership (JAL);[47] second, all deliveries to governmental customers over 1974-1989; and, third, all deliveries to airlines in the 1970s, the home country of which received more than the subsample mean plus one standard deviation of development aid by the United States (see above). For neither Airbus nor Boeing, we included deliveries to Philippine airlines as the only former US colony in our dataset because the airline had pretty much benefited both equally with orders. It is evident that the share of political sales in all Boeing deliveries generally ranged below the proportion observed for Airbus; that the composition of sales is more diverse in the 1970s and not in the 1980s like it is for Airbus; and that the proportion is generally zero, or close to it (see 1989) after 1984.

Figure 7 additionally reports the absolute number of deliveries selected (dashed line) along with the absolute number of Airbus and Boeing deliveries for comparison (straight line). For both manufacturers we arrive at a modest number of between two and eleven deliveries per year which are highly suspicious of having been political sales. While the

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[46] The mean share in the 1980s subsample is 10.6 percent and the standard deviation is 14.9 percent. According to this principle, all deliveries to Emirates, Kuwait Airways, Singapore Airlines, Thai Airways, and Turkish Airlines are included.

[47] We did not consider Air Canada here for the reason that there likely is a neighbourhood effect involved. British Airways' lacking support for Airbus and its attraction to the Americans and Japan Airlines' buys to help reduce the Japanese trade surplus with the United States seem to be a baseline of political sales that should be considered like the sales to Air France, Iberia, and Lufthansa on Airbus' side.

number of deliveries, on the whole, exhibits a positive trend for both Airbus and Boeing, there is no such general increase in political sales.

Fig. 7: Suspected absolute number of political sales compared to manufacturers' own wide-body deliveries
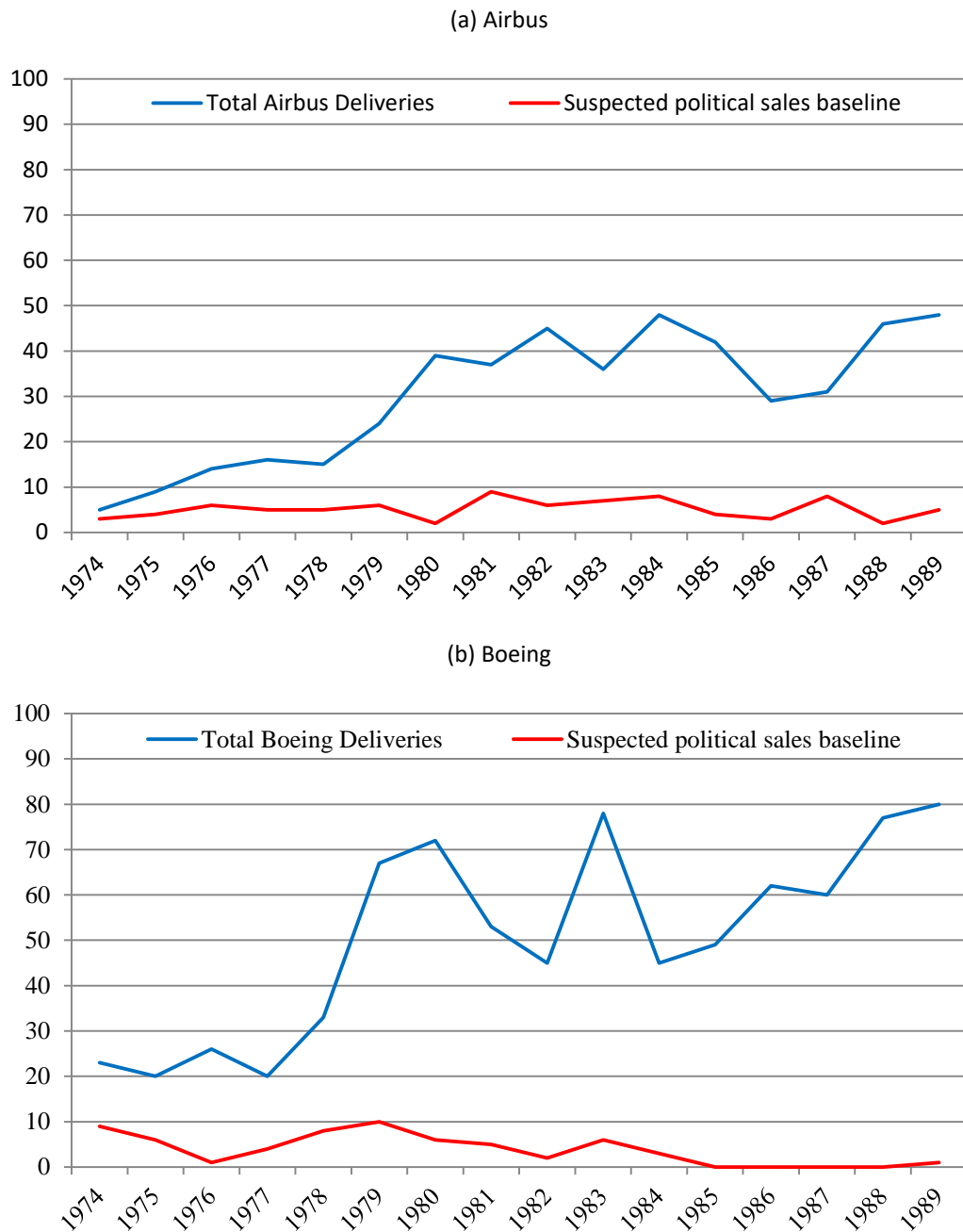
(a) Airbus

(b) Boeing

Sources: Authors' depiction.

Fig. 8: Percent share of Airbus's and Boeing's political sales in total wide-body deliveries
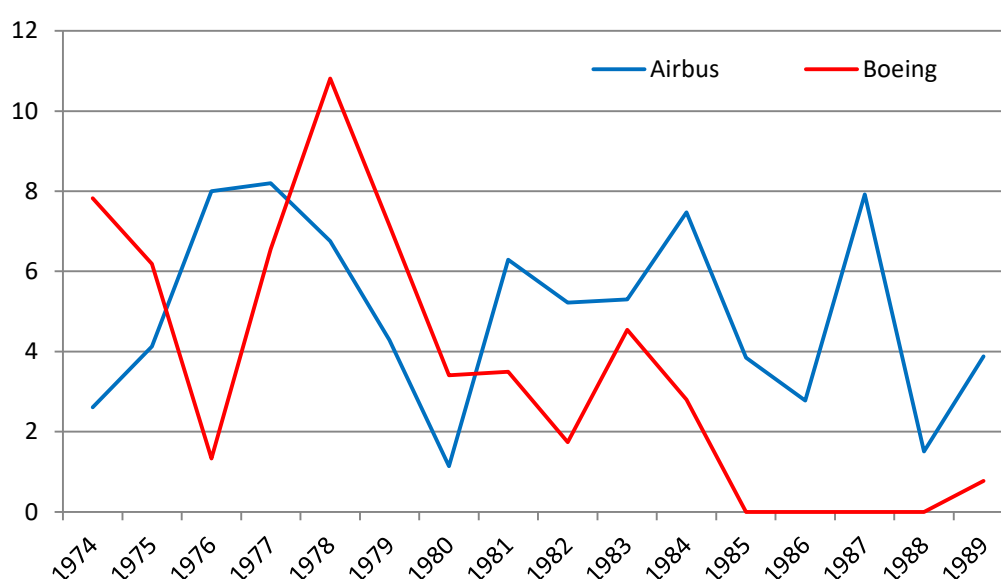
Sources: Authors' depiction.

Finally, Figure 8 shows the proportion of both manufacturers' political sales in total wide-body jet deliveries between 1974 and 1989 – that is, also including the deliveries by Lockheed and McDonnell Douglas. In fact, the proportion never exceeded eleven percent (Boeing 1978). It is more volatile for Boeing than for Airbus; and Airbus had more political sales than Boeing in the first half of the 1980s. Both manufacturers more or less equalled one another in closing (alleged) political sales in the 1970s. However, Airbus kept up generating a baseline of political sales in the 1980s which we do not find for Boeing. Although our graphical evidence is based on a somewhat elusive concept and is therefore to be taken with caution, the broad message regarding the 1980s certainly matches Boeing's critique of Airbus having benefited to a greater extent from political sales as defined in this article.

To conclude, we want to highlight six findings. First, it is worth stressing that our analysis revises the traditional picture that it was Airbus' rise leading to the marginalisation of the Tristar and the DC-10 in the first place; in light of our statistical evidence, Boeing played an equal part in it. Second, concerning our hypothesis H1.1 – that Airbus was significantly more likely to sell to state-owned airlines than to privately-owned –, our evidence is rather weak; in breadth, Airbus more likely sold to state-owned airlines in the 1980s, but this result does not hold for the 1970s and in our model for the full period. Third, while there apparently is a colonial story not yet told, it runs in the opposite direction of

what we originally expected; so far, our hypothesis H2.1 cannot be accepted in the form we stated it. Fourth, as concerns trade relations, we do find some indirect evidence in favour of our hypothesis that trading partner taste as well as the potential of trade tensions for the inclination to buy aircraft as a countermeasure mattered to some degree (H3.1). Fifth, likewise development aid may indeed be taken as workable leverage in the hand of the aircraft manufacturer countries. Sixth, further research has, of course, to harden our statistical evidence on the incidence of political sales in a more narrow sense. So far, our bottom-line guesstimate seems to suggest a rather moderate extent when looking at the pure scale – i.e., the proportion of political sales in total wide-body deliveries.

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Appendix

Fig. A.1: Mean comparison tests for selected binary variables by year – Airbus vs. American manufacturers (plotted on the left) and Airbus vs. Boeing (plotted on the right)
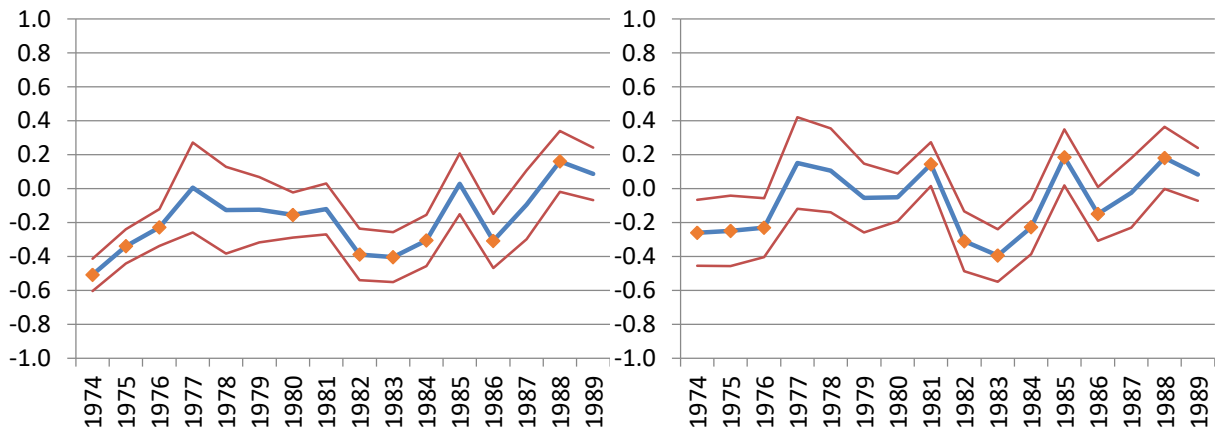
(1) Delivery to state-owned airline

(2) Delivery to airline from an Airbus member country

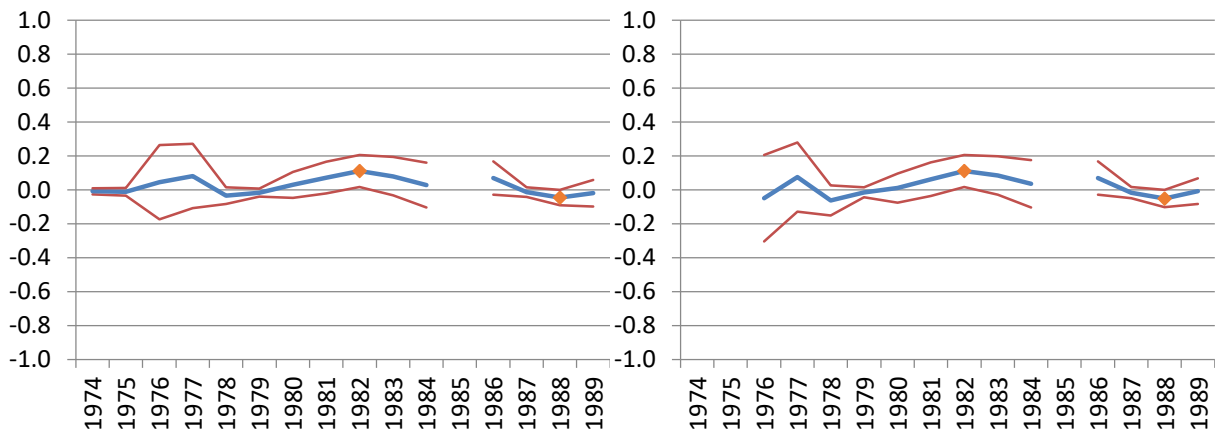## (3) Delivery to European airline
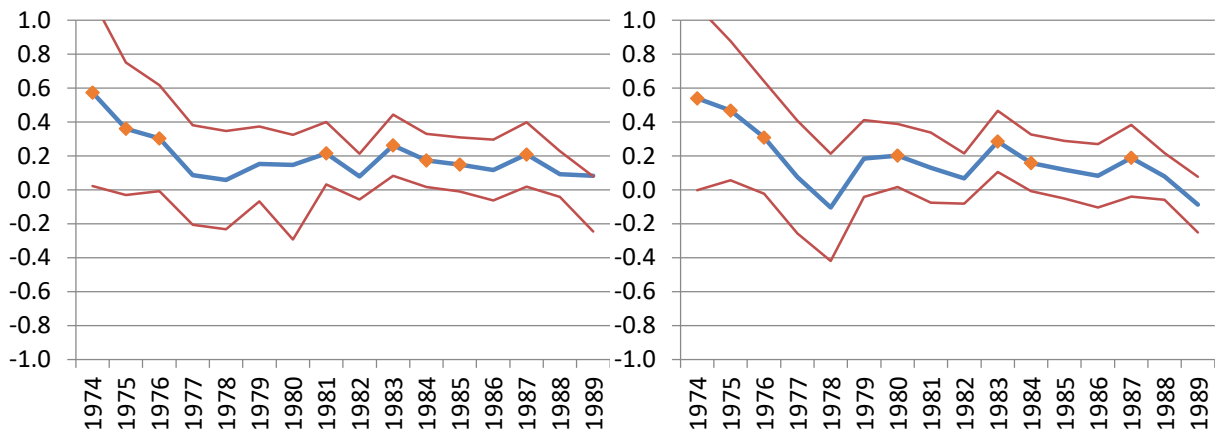
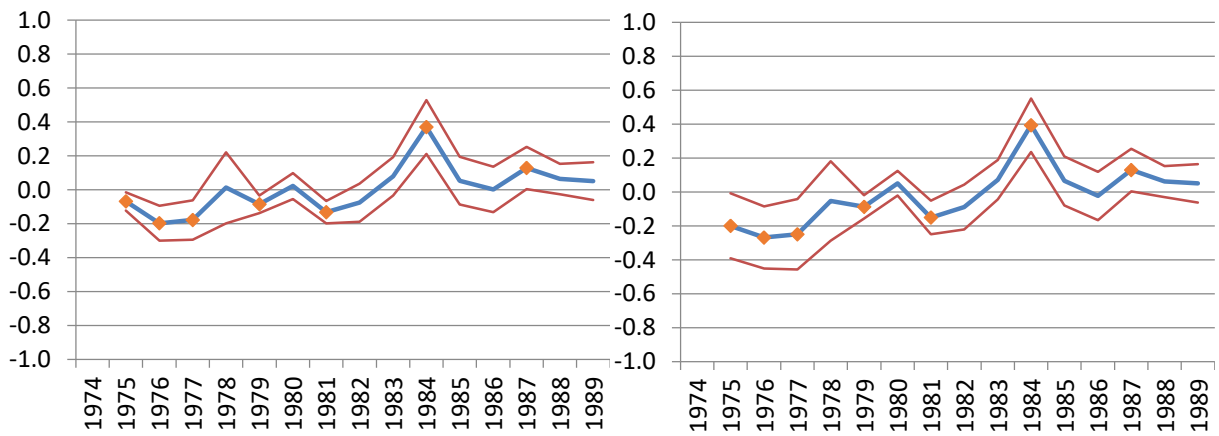## (4) Delivery to Central and South American airline
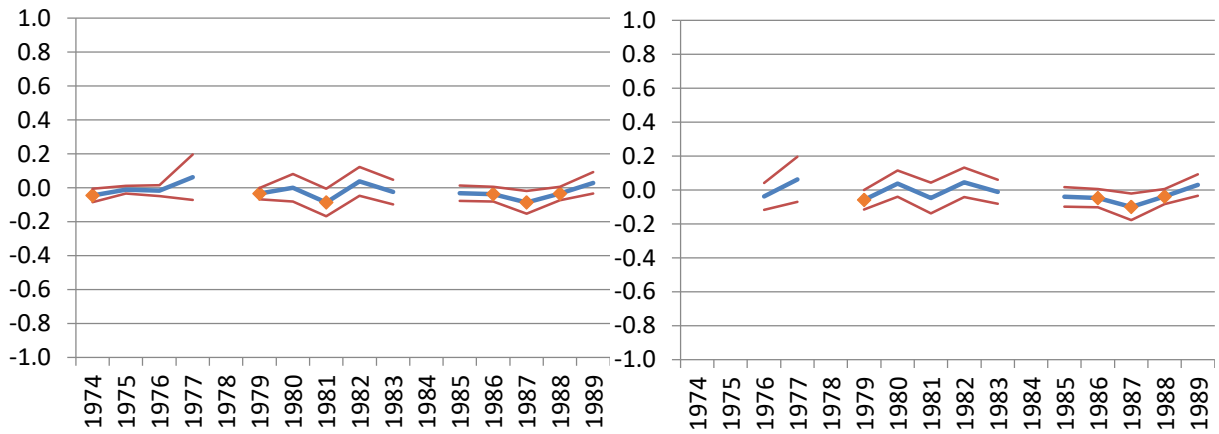
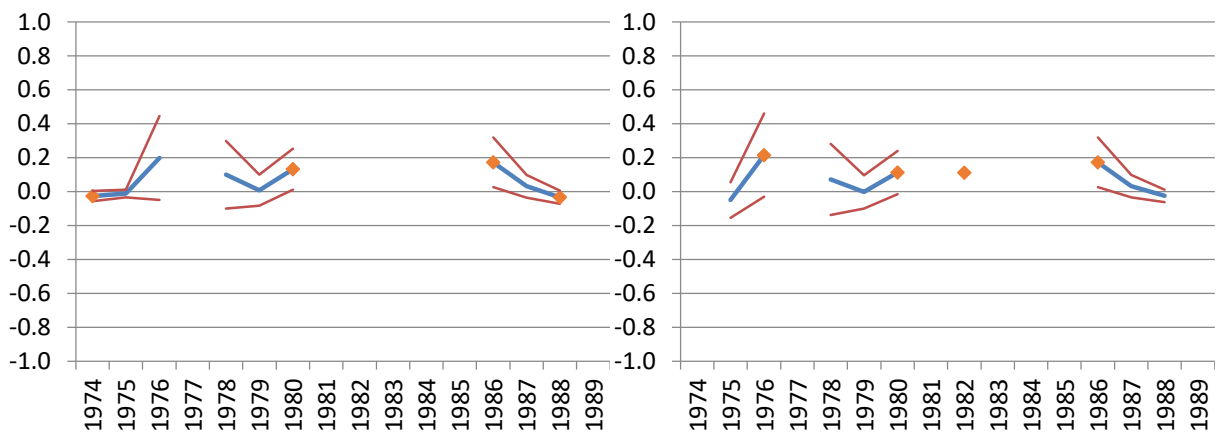## (5) Delivery to North American airline
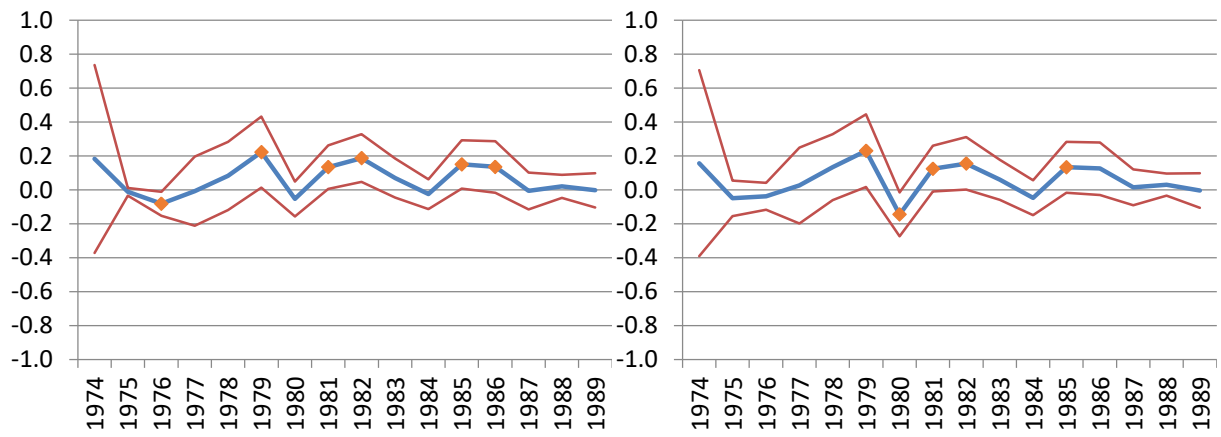
(6) Delivery to African airline
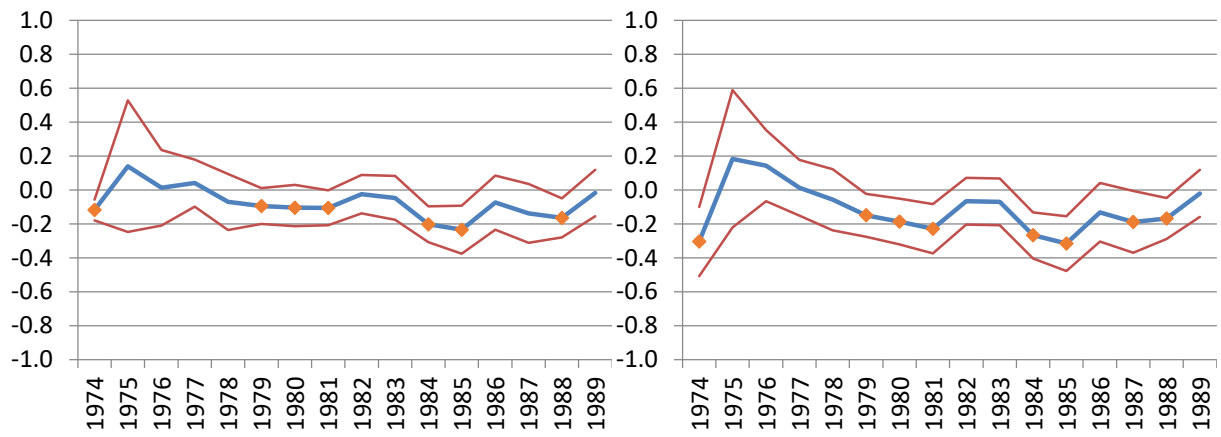

(7) Delivery to Middle Eastern airline

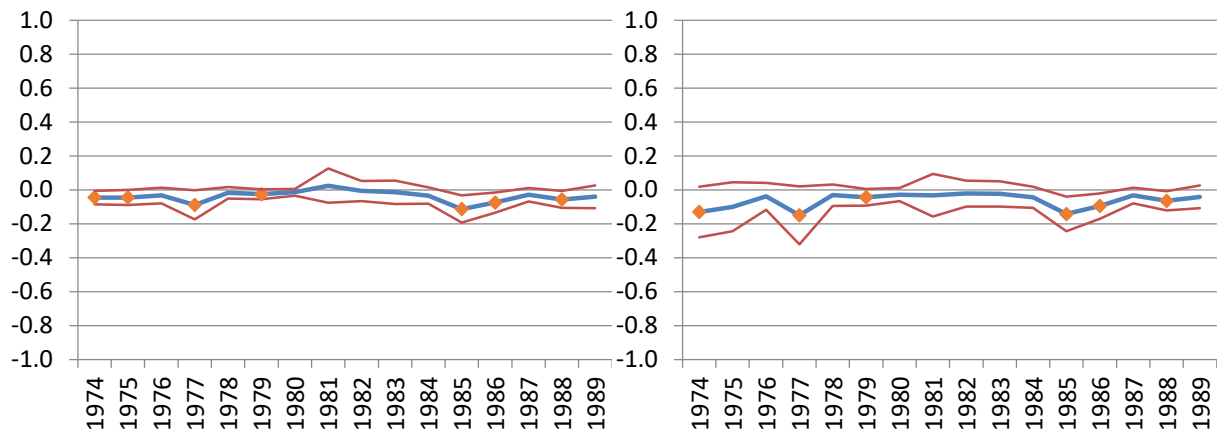## (8) Delivery to Southern Asian airline
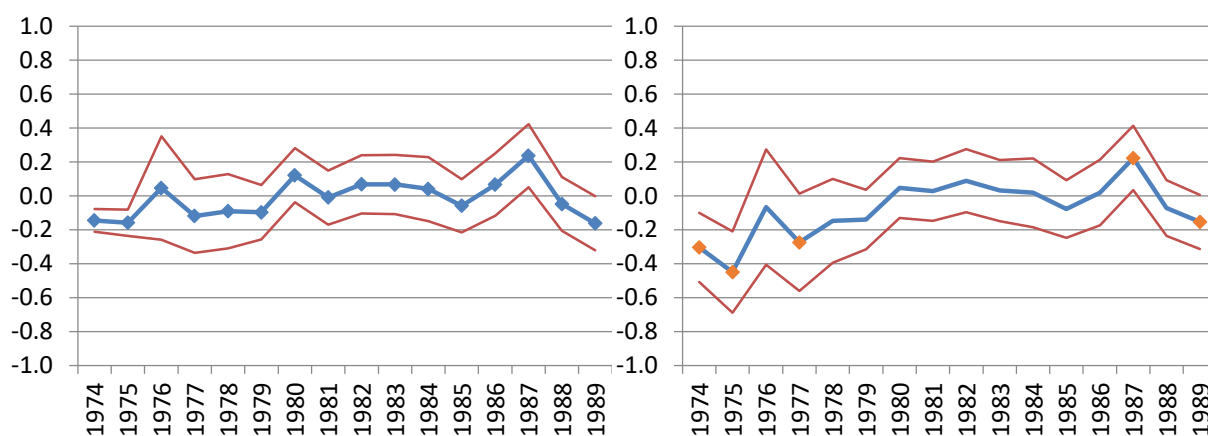
(9) Delivery to South Eastern Asian airline

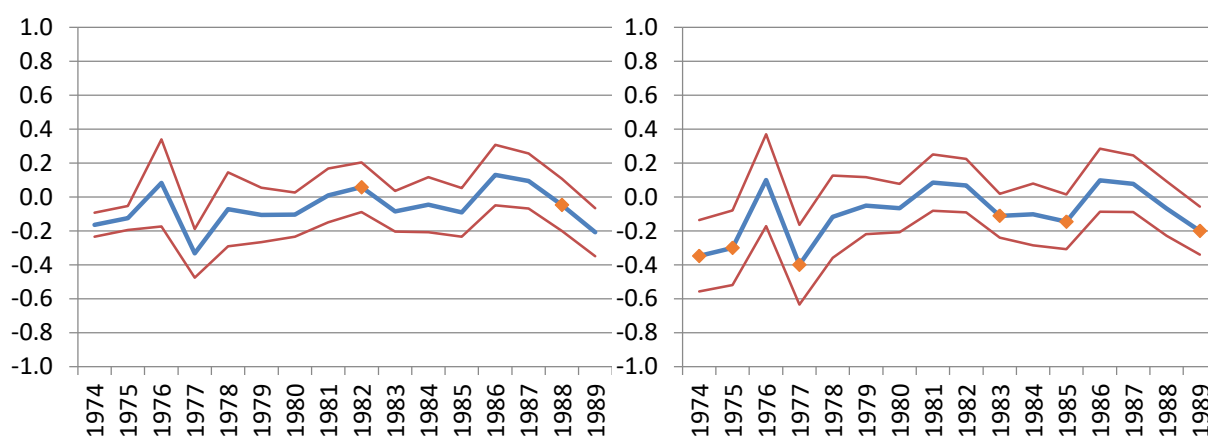(10) Delivery to Eastern Asian airline

(11) Delivery to Oceanic airline

(12) Delivery to airline from a country with former colonial ties to Airbus member states

(13) Delivery to airline from a Commonwealth country

Notes: The blue line reports the difference in mean between the Airbus and the American manufacturer samples. A difference of greater than (smaller than) zero implies that the mean in the Airbus (American manufacturer) sample is larger than the mean in the American manufacturer (Airbus) sample. Differences statistically significant on the ten percent level or better are marked by a dot. The red lines report the upper and lower 95-percent confidence intervals.

Sources: Authors' own calculations.

Tab. A.1: Non-Soviet jet aircraft types entering airline service until 1987

A	B	C	D	E	F	G	H
Aircraft type	Country	Inauguration to end of production	Aisles	Engines and position	max. seats	max. range (km)	Total built
DeHavilland Comet	UK	1952-1964	1	4 w(ings)	60-119	2,400-6,900	114
Sud Aviation Caravelle	F	1959-1972	1	2 r(ear)	80-140	1,500-3,600	282
Boeing B-707	US	1958-1982	1	4 w	179-219	8,000-9,300	763
Douglas DC-8	US	1959-1972	1	4 w	177-259	5,900-10,800	556
Boeing B-720	US	1960-1967	1	4 w	165	5,800-6,700	154
Convair Coronado	US	1960-1965	1	4 w	100-149	4,400-5,800	102
Vickers VC-10	UK	1964-1970	1	4 r	135-176	9,800-11,500	40
Boeing B-727	US	1964-1984	1	3 r	131-189	3,100-4,000	1,832
Hawker-Siddeley Trident	UK	1964-1978	1	3 r	103-180	2,800-4,600	117
British Aerospace BAC 1/11	UK	1965-1981	1	2 r	79-119	2,000-3,500	244
McDonnell Douglas DC-9/MD-80	US	1965-1999	1	2 r	90-172	2,300-3,800	2,167
Boeing B-737	US	1968-today	1	2 w	124-189	3,400-10,200	10,580[a]
Boeing B-747	US	1970-today	2	4 w	400-660	9,800-15,400	1,556[a]
McDonnell Douglas DC-10/MD-11	US	1971-2001	2	2 w + 1 r	380-410	10,000-13,400	586
Lockheed Tristar	US	1972-1984	2	2 w + 1 r	315-400	7,700-9,900	250
Airbus A300	F/D	1974-2007	2	2 w	345	3,400-7,000	561
Dassault Mercure	F	1974-1975	1	2 w	150	1,700	11
Aérospatiale/British Aerospace Concorde	F/UK	1976-1979	1	4 w	92, 100	6,700	20
Boeing 767	US	1982-today	2	2 w	290-375	6,000-12,300	1,190[a]
Boeing 757	US	1983-2004	1	2 w	221-295	5,400-7,300	1,050
Airbus A310	F/D	1983-1998	2	2 w	280	5,600-9,600	255

Notes: [a] As of late June 2020. A: Shown are all Western-built passenger jets used for major routes, thus Fokker F-28/F-100, Canadair or Embraer regional jets are not included. Included are all civil variants of a specific type even if produced after 1989. B: Country/countries of main producer(s): D – Germany, F – France, UK – United Kingdom, US – United States. C: Ranked according to first regular passenger flight. D: Wide-body aircraft have got two aisles by definition.

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