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Andreas Knorr/Jörg Bellmann/Rahel Schomaker

International Trade Rules and Aircraft Manufacturing: Will the World Trade Organization Resolve the Airbus-Boeing Dispute?

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Contents

1. Introduction 1

2. Strategic Trade Policy 2

2.1 Imperfect Competition and Strategic Trade Policy 2

2.2 The Brander-Spencer-Model 4

2.3 Critical Assessment of the Strategic Trade Policy 7

3. The Economics of the Civil Aircraft Industry 9

4. WTO Trade Disputes in the Aircraft Sector 12

4.1 Dispute Settlement in the WTO 12

4.2 The Boeing-Airbus Subsidy Dispute 15

4.3 The Bombardier-Embraer Subsidy Dispute 18

5. Will the WTO Resolve the Airbus-Boeing Dispute? 21

5.1 Trends in the Aircraft Industry 21

5.2 Aerospace Supply Chains 24

6. Conclusion 30

7. References 35

1. Introduction

The WTO subsidy dispute[1] between the US aircraft manufacturer Boeing and its European competitor Airbus has dragged on half a decade now. Politically, the case is widely considered to be the trickiest one in the history of the organization. Recent news about massive new commitments by several European governments to the tune of €3.3 billion (US$ 4.2 billion) for the planned Airbus A350XWB – due to enter service in 2013 as a direct competitor to Boeing's B787 and B777 aircraft families – have only added fuel to the fire. In short, France confirmed to contribute up to €1.4 billion (US$1.8 billion) for the A350XWB program, complemented by Germany's €1.12 billion (US$1.42 billion), the UK's €400 million (£340 million or US$508 million) and Spain's €332 million (US$422 million).

The WTO panel has published its final report in the US complaint – the trade dispute comprises two legally separate cases – on 30 June 2010. The case filed against Boeing by the European Communities[2] in return will remain pending for a while, however. Interim findings are not expected for release before September 2010.

In this paper, we will analyse the implications of increasingly globalized supply chains in the civil aircraft industry – with complex international networks of suppliers providing for an ever larger share of the value added – for this and similar trade disputes. Essentially, we argue that state aid programs which follow the theoretical rationale of the strategic trade policy approach have lost most of their effectiveness for lack of truly 'national (!) champions'.

This paper is organized as follows. Firstly, we will sketch the (often simplistic and politically naive) economics of the strategic trade policy concept against the backdrop of the rapidly changing business models

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1 A preliminary version of this paper was presented at the 13th Annual Conference of the Air Transport Research Society (ATRS) in Abu Dhabi (UAE) on 29 June 2009.

2 Prior to December 2009, the name "European Communities" was officially used in the WTO in dispute settlement cases before it was replaced by "European Union". In our paper we refer to the former term because it was used in all WTO documents cited in this paper.

in civil aircraft manufacturing. Secondly, after providing an overview of the WTO's dispute settlement procedures we will assess the economic merit – or demerit – of the arguments of the parties involved in the current trade conflict. This includes an in-depth analysis of the earlier, pertinent WTO decision in a very similar dispute between Canada and Brazil over the legality of subsidies for regional jet aircraft.

2. Strategic Trade Policy

2.1 Imperfect Competition and Strategic Trade Policy

Traditional trade theory states that all countries stand to benefit from the cross-border exchange of goods, i.e. free trade is considered a positive sum game. Opportunities for cross-border trade arise from productivity differences, or from differences in relative factor endowments, between countries, which, in turn, are translated into comparative advantages and disadvantages. In short, "a country has a comparative advantage in producing a good if the opportunity cost of producing that good in terms of other goods is lower in that country than it is in other countries" (Krugman/Obstfeld 2003, p. 12). Countries can benefit from trade relations if each of them produces and exports the specific good where it possesses comparative advantages. This, in turn, results in a trade pattern of perfect specialization (e.g. cloth or vine). To sum up, differences between countries in their resource endowments or technologies are the only determinants of international trade and, in this scenario, each individual country and the world as a whole gain from free international trade.

In its simplest form, the standard model takes for granted that national economies are characterized by constant economies of scale and perfect competition. These rigid assumptions were fundamentally challenged by the exponents of a new theory of international trade which quickly gained wide acceptance among trade theorists from the late 1970ies: the strategic trade policy approach. Assuming imperfect competition as the crucial feature of most markets for manufactured goods, its particular focus is on industries which are characterized by a combination of high yet surmountable barriers to entry in combina-

tion with substantial (increasing) economies of scale.[3] In these industries in which solely a small number of producers can (co-)exist, trade patterns are shaped by comparative advantage plus economies of scale and may be strongly influenced – and even reversed – by credible government interventions in favour of domestic producers (see Krugman 1987, pp. 132-134; Krugman/Obstfeld 2003, pp. 120-131).

Static economies of scale typically emerge from high fixed costs in the production process and/or in research and development. As a result, an increase in output leads to falling average costs. Dynamic economies of scale by contrast describe cost-reducing learning curve effects which occur over the life-cycle of a production run; e.g. the amount of man years required for the first type of a new aircraft are a multiple of the input required for, say, serial number 500 or higher of the same type (see Siebert 1988, p. 552; Monopolkommission 1992, pp. 376-377; Kösters 1994, p. 119).

Because of the barriers to market entry, which typically result from very high set-up costs (capital requirements) in combination with economies of scale, established large or experienced firms will make above-average profits on their investments. Therefore, the identification of scenarios when it is economically beneficial for governments to provide protectionist support to local producers to secure these excess earnings – rents – takes center stage in the strategic trade policy concept. In the simplest case, a subsidy provided to a domestic firm can shift profits from the foreign rival – which, as a result, may be forced to exit the market – to the domestic firm, assuming that the rent shifted to the domestic competitor will normally be higher than the subsidy provided. Seminar papers on strategic trade behaviour were written by James Brander and Barbara Spencer. Their model and its trade policy recommendations will be briefly sketched in the following chapter (for details see Siebert 1988, p. 553; Monopolkommission 1992, p. 379; Kösters 1994, p. 120).

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3 It is important to understand that the term strategic is a technical term used in economic theory to describe possible forms of interaction between individual oligopolists. It is never used in economics to identify or describe a sector as crucially important from a military or political perspective, i.e. as strategically important. Unsurprisingly, the economic usage of the term has often been ignored by policymakers, media journalists, analysts and even academics from other fields.

2.2 The Brander-Spencer-Model

As described above, traditional trade theory argues that protectionism will always lead to welfare losses, a claim disputed as way too simplistic by the proponents of strategic trade policy in markets characterized by imperfections.[4] In an oligopolistic market with high barriers to entry, it is assumed that the rent element of profits can be shifted from a foreign to a domestic firm by providing subsidies or other forms of protectionism to the domestic company. Hence, subsidies will increase the welfare of the protectionist country. This argument was initially developed by the economists Barbara Spencer and James Brander. Later Paul Krugman refined this model and applied it to illustrate a battle for rents between two manufacturers of civil aircraft.

Brander and Spencer discuss the potential of research and development (R & D) subsidies as well as export subsidies to help a government to achieve this objective. Their approach is based on game theory and assumes a duopoly market where two firms from two different countries produce homogeneous products which are sold on a third-country market. Both firms act as Cournot (or Nash) duopolists, i.e. companies adjust their output to the expected output of their competitor. Referring to R & D subsidies, the subsidy enables the domestic firm to expand their expenditures for cost-reducing R & D. An increase in R & D expenditures will, in turn, lower marginal production costs and hence increase sales and finally output. The firm from abroad instead suffers revenue losses and is forced to reduce its R & D efforts as a result. Thanks to the R & D subsidies, the domestic firm widens its market share and profits at the expense of its foreign rival (see Spencer/Brander 1983, pp. 708-711). In another scenario, the authors focus on the impact of export subsidies as an alternative strategic trade policy instrument. Export subsidies will help boost the exports and the market share of the domestic firm and will also contribute to increasing the firm's profits by deterring the foreign competitor from expanding its own production. If the additional profits earned by the exporting firm exceed the budgetary and administrative costs of the subsidy – as is the case in the model – the state aid will raise do-

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4 However, it should be noted that the concept bears strong resemblance to one of the oldest arguments in traditional trade theory in favor of (temporary) protectionism: Friedrich List's and Alexander Hamilton's concept of the so-called "Erziehungszoll", or infant industry protection, respectively.

mestic welfare (see Brander/Spencer 1985, pp. 83-90). In both cases – R & D subsidies as well as export subsidies – the financial aid aims to increase domestic welfare by shifting rents from the foreign firm to the domestic one. To sum up, domestic welfare increases at the expense of the rival country's national welfare, which inevitably decreases as a result. In short, strategic trade policy assumes that free trade in combination with imperfect markets may often result in a zero-sum game.

Based on the Brander-Spencer model, Krugman illustrates a competition between two aircraft manufacturers. Both companies, for example Boeing and Airbus, are capable to build a nearly identical aircraft in terms of technical specifications and operating performance. So, each firm has only one choice to make: either to build the aircraft or not.

Every company's profit depends on the own decision to produce the aircraft and on the decision of the competitor whether or not to produce. Table 1 and 2 below illustrate this simple game for two scenarios: Scenario one, depicted in Table 1, is the outcome if no state aid is provided. Scenario two (Table 2) reflects the outcome if Airbus receives a subsidy of 25.

The calculated difference between the profit the domestic firm earns and the cost of all subsidy measures corresponds to the national welfare increase (or decrease, respectively). Depending on the two companies' strategic decisions, scenario 1 leads to the following outcomes: If both firms do not build the aircraft, both obviously will earn nothing (lower right corner). If only one firm offers the aircraft, it will make a profit of 100 (upper right and lower left corner). But if both firms decide to produce, Boeing as well as Airbus will make a loss (upper left corner). Suppose now that Boeing is the incumbent (or first mover). Here Airbus, without state aids, will not have any incentive to enter the market because the company would not stand any chance to make a profit. The upper right corner shows this very outcome.

Table 1: Payoff Matrix Without Subsidies

		Airbus	
		Produce	Don't produce
Boeing	Produce	-5/-5	100/0
	Don't produce	0/100	0/0

Source: Krugman/Obstfeld 2003, p. 279.

What changes will occur if one of the governments credibly commits itself to subsidize the domestic firm (while the other government does not reciprocate)? In this scenario, the European governments are willing to pay Airbus a subsidy of 25 (please note that the outcomes would be exactly the same if the US government were to subsidize Boeing while Airbus receives no state aid). In this case, it is always the dominant strategy for Airbus to offer its aircraft whatever Boeing does. If Boeing as well as Airbus decides to produce, both would normally make a loss of five. But if Airbus receives a subsidy of 25, the loss of five would turn into a profit of 20 (-5+25=20); Boeing, however, would still suffer a loss of five. Now it is Boeing that has no incentive to enter (or remain in) the market because no profit – the outcome if Boeing does not produce this type of aircraft – is more sustainable than a (permanent) loss of five. As the only market participant, Airbus now earns the profits and rents that Boeing would have made. This means, with a subsidy of 25 Airbus will make a profit of 125 instead of 0. Profits/rents are shifted from Boeing to its European competitor because the subsidy provided to Airbus deters Boeing from remaining in or entering the market. In Table 2 below, the equilibrium shifts to the lower left corner (see Krugman 1987, pp. 134-137; Krugman/Obstfeld 2003, pp. 278-280).

Table 2: Payoff Matrix With Subsidies for Airbus

		Airbus	
		Produce	Don't produce
Boeing	Produce	-5/20	100/0
	Don't produce	0/125	0/0

Source: Krugman/Obstfeld 2003, p. 279.

2.3 Critical Assessment of the Strategic Trade Policy

The Brander-Spencer model seems to justify governmental activism if the subsidy that needs to be invested is lower than the rents which may be shifted away from a foreign competitor. However, to derive such a simplistic policy recommendation from the model would be extraordinarily naïve in any real world setting.

To begin with, Brander and Spencer take for granted that the market provides profits solely for one firm. But in real world, most markets may be profitably served by more than one market participant, even without any governmental interventions. If no market entry barriers exist, newcomers or even potential competitors normally melt away existing monopoly or oligopoly profits. Thus, only the shareholders, management, the employees and the suppliers of the subsidized company as well as foreign consumers, who enjoy lower prices, benefit from subsidies (see Krugman 1987, p. 140).

Secondly, it has to be seriously questioned that politicians can ascertain beforehand, and will only offer support, if the domestic producer is indeed at least as efficient as its foreign competitor, i.e. that it has in fact a long-term comparative advantage over its rival. This important point is illustrated in Tables 3 and 4 below. In Table 3, under scenario three Boeing is assumed to control a superior technology that provides it with a significant cost advantage over Airbus, which does not receive any subsidies. Consequently, it would be profitable for Boeing to produce even if Airbus produces, too (upper left corner). Given its technological disadvantage Airbus, on the contrary, could under no circumstances offer its aircraft profitably, if Boeing produces. Therefore, Airbus is deterred from remaining in or entering the market (upper right corner) in this case.

Table 3: Alternative Payoff Matrix Without Subsidies

		Airbus	
Boeing		Produce	Don't produce
	Produce	5/-20	125/0
	Don't produce	0/100	0/0

Source: Krugman/Obstfeld 2003, p. 281.

Even a subsidy to Airbus of 25 – scenario four – will not fundamentally alter this outcome. For Airbus, it is now profitable to produce (from a company perspective!). If Boeing stays away from the market, Airbus will gain 125. This is extremely unlikely, however, since – in contrast to the outcome above – the subsidy will now not deter Boeing from remaining in or entering the market. In other words, even if Airbus receives a subsidy and starts producing, it would still be profitable for Boeing to offer its aircraft, too. If both Airbus and Boeing enter the market, each manufacturer would earn a profit of 5. This means that the subsidy of 25 would turn Airbus' loss of 20 into a profit of 5. As a consequence, both manufacturers will be in the market and compete. Obviously, Airbus' profit of 5 is much lower than the subsidy. Hence, Europe's domestic welfare decreases by 20 (Airbus' profit of 5 minus the subsidy of 25). However, Boeing's profit drops sharply as well (from 125 to only 5). Hence, both Europe and the US suffer significant welfare losses. In this case, state aid is a disastrous idea with massively negative consequences for both sides (see Krugman/Obstfeld 2003, pp. 280-281).

Table 4: Alternative Payoff Matrix with Subsidies for Airbus

		Airbus	
		Produce	Don't produce
Boeing	Produce	5/5	125/0
	Don't produce	0/125	0/0

Source: Krugman/Obstfeld 2003, p. 281.

What is more, any successful strategic trade policy requires detailed information about the impacts of trade policy measures used in one industry on other industries. Interventionist measures taken in one industry carry the risk that resources are drawn away from other industries (or may result in a higher tax burden). Consequently, subsidies provided to one industry may lead to rising costs and strategic disadvantages in another. To assess the overall impact on the national welfare, these effects have to be weighed against each other (see Krugman 1987, pp. 140-141; Krugman/Obstfeld 2003, p. 281).

Finally, even if the European governments were to overcome all these problems, subsidizing Airbus will clearly not necessarily force Boeing to exit the market. As already said, subsidizing Airbus may be

considered a politically tricky beggar-thy-neighbour policy which increases the welfare of one country on the expense of another. Strategic trade policies by one country therefore often provoke retaliation with a welfare destroying trade war as a consequence. The United States for example could also start subsidizing Boeing or could cross-retaliate on other markets. In both cases, both Europe and the USA would be worse off (see Krugman 1987, pp. 141-142; Krugman/Obstfeld 2003, p. 281).

3. The Economics of the Civil Aircraft Industry

Strategic trade policy basically focuses on monopolistic or duopolistic markets where substantial market imperfections such as massive economies of scale exist. The global market for commercial jet airliners is indeed characterized by a market structure of this kind as we will demonstrate in this chapter.

Today, two producers of large commercial aircraft dominate the market. In 2009, the Chicago-headquartered Boeing Company manufactured 481 airplanes while its European competitor Airbus delivered 498 aircraft. The world's airliner fleet[5] currently totals 16,158 aircraft (in service or temporarily stored due to the global recession). This installed base splits up in 9,131 Boeing aircraft and 5,269 Airbus aircraft. Hence, Boeing controls a market share of 56.5 percent while Airbus accounts for 32.6 percent of the global fleet. The remaining airplanes are McDonnell-Douglas types (1,727 aircraft or 10.7 percent) and aircraft manufactured by Lockheed (31 aircraft; 0.2 percent)[6] (see Kingsley-Jones/Wilding 2009, p. 34-56).

Similar to the market for large civil aircraft, the market for regional jet with 30 to 90 seats is currently dominated by two manufacturers: Canada-based Bombardier and Embraer from Brazil. The world's regional jet fleet[7] consists of 3,415 aircraft. The total Bombardier-made

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5 Figures for mid-2009, aircraft with more than 100 seats, only western production.

6 Boeing took over McDonnell Douglas 1997 which later stopped producing civil aircraft. The production of Lockheed airliners ended in 1984.

7 Figures for mid-2009, aircraft with less than 100 seats, only western production.

fleet amounts to 1,422 aircraft which corresponds to a market share of 41.6 percent. Embraer sees 1,378 of its ERJ-145 family aircraft and the larger E-Jet family in service (40.4 percent market share). Hence, Bombardier and Embraer together make up more than four-fifths of the global regional jet fleet. The remaining 20 percent are aircraft manufactured by BAe/Avro (284 aircraft resp. 8.3 percent), Fokker (272 aircraft resp. 8.0 percent) and finally Fairchild-Dornier (59 aircraft resp. 1.7 percent). The last three manufacturers have ceased aircraft production years ago, however. Bombardier and Embraer are today's only remaining regional jet manufacturers (see Kingsley-Jones/ Wilding 2009, p. 34-56). However, three newcomers are currently entering the market and have received their first firm orders: Russia's Sukhoi Superjet 100 (developed in cooperation with Ilyushin and Boeing), China's AVIC I Commercial Aircraft Company (ACAC) ARJ21 and Japan's Mitsubishi MRJ.

Table 5: Orders, Deliveries and Composition of World Fleet

	Net Orders 2009	Backlog	*Percentage share*	Deliveries 2009	*Percentage share*	In service	*Percentage share*
	Airliners (more than 100 seats)						
Boeing	142	3375	*49.18*	481	*49.13*	9131	*56.51*
Airbus	271	3488	*50.82*	498	*50.87*	5269	*32.61*
McDonnell-Douglas	-	-	-	-	-	1727	*10.69*
Lockheed	-	-	-	-	-	31	*0.19*
Total	413	6863	*100.00*	979	*100.00*	16158	*100.00*
	Regional jets						
Bombardier	72	158	*37.35*	60	*32.97*	1422	*41.64*
Embraer	-39	265	*62.65*	122	*67.03*	1378	*40.35*
BAe	-	-	-	-	-	284	*8.32*
Fokker	-	-	-	-	-	272	*7.96*
Dornier	-	-	-	-	-	59	*1.73*
Total	33	423	*100.00*	182	*100.00*	3415	*100.00*

Source: Kingsley-Jones/Wilding (2009), pp. 34-56; Kingsley-Jones (2010a), p. 9; Kingsley-Jones (2010b), p. 10.

As described above, significant static economies of scale which result from high R & D as well as from investments in production plants characterize the civil aircraft industry. The development of the first Airbus type A300, for example, cost US$1.5 billion while Airbus had to invest US$3 billion in the development of the A330/A340. The R & D efforts for the new flagship, the A380, exceeded US$13 billion and the proposed twin-aisle A350XWB family, which is under development and expected to enter service in 2013, will cost up about the

same amount. On average, R & D expenditures make up 50 percent of the total costs of an aircraft program. Due to the fact that most of these expenditures are specific, as the R & D outcomes can only be used for building aircraft (families), investments in R & D in this industry are sunk costs which act as barriers to market entry (see Berg/Tielke-Hosemann 1989, p. 127; Monopolkommission 1992, p. 387; Tyson 1992, p. 163).

Besides static economies of scale, significant dynamic economies of scale exist in the civil aircraft industry due to strong learning effects as a result of the highly complex production process. “An essential part of learning appears in the assembly of an aircraft. Craftsmanship and timing of thousands of activities is required there. Such experience is embodied in the workforce and accumulates with the number of aircraft that have been produced. There is world-wide consensus that aircraft production exhibits a learning elasticity of 0.2, i.e. production costs decrease by 20% with a doubling of output” (Klepper 1990, p. 777). It is estimated that learning effects may be exploited up to the 700th produced unit. For that reason, a new competitor has to reach a high market share quickly. Otherwise the new market participant will not enjoy learning effects-based cost advantages and it would be much more difficult for him to tackle the position of the well-established manufacturer for lack of similar first-mover advantages (see Berg/Tielke-Hosemann 1989, pp. 123-126; Monopolkommission 1992, p. 387; Tyson 1992, pp. 163-166).

Finally, the entry of potential competitors is hampered by economies of scope. Because numerous R & D results as well as production facilities are not unique to a specific aircraft model, but rather to whole families due to commonality, many components as well as knowledge gained in the production of one type can be transferred to the assembly process of another model. This is the reason why aircraft manufacturers usually continue to develop and redesign existing aircraft models into so-called “derivatives”, and establish aircraft families. Today, all producers offer aircraft families using common features and parts for similar airliners.[8] But airlines enjoy economies of scope

8 For example, the members of the Airbus A320 family are the A318, A319, A320 and A321 subtypes with different payload-range capabilities but a high degree of cockpit commonality. Effectively an A321 can transport twice as many passengers as an A318, but flown by pilots with one and the same type-rating.

as well which, in turn, have also strongly encouraged manufacturers to offer aircraft families (with Airbus having been the more innovative of the big two producers in this regard). If an airline purchases aircraft from one single manufacturer only, costs for aircraft maintenance and training ground, cockpit and cabin crews usually decrease substantially (see Berg/Tielke-Hosemann 1989, pp. 122-123; Klepper 1990, pp. 777-778; Monopolkommission 1992, pp. 387-388; Tyson 1992, pp. 163-164).

4. WTO Trade Disputes in the Aircraft Sector

4.1 Dispute Settlement in the WTO

The World Trade Organization (WTO) dispute between the United States and the European Communities started in October 2004 when the US withdrew from the bilateral EU-US Agreement on Trade in Large Civil Aircraft. The agreement, signed in 1992, limits the direct governmental support for aircraft development to 33 percent of the total development costs. It also stipulates that these launch investments have to be repaid over a maximum of 17 years. Indirect support resulting from technological spillovers from space flight or military programs is limited to 3 percent of the value of large civil aircraft industry sales (see Tyson 1992, pp. 207-210; Carbaugh/Olienyk 2001, pp. 275-278).

With 153 member states, the WTO is the only international organization engaged in establishing binding trade rules and in trying to solve trade disputes with its Rules and Procedures Governing the Settlement of Disputes (DSU). The entire WTO system is based on three key principles: progressive liberalization, transparency and non-discrimination. The new WTO dispute settlement mechanism has brought substantial changes compared to the former procedures under the old GATT dispute resolution regime. Then, the GATT council had to adopt any panel[9] recommendation for solving a trade dispute with unanim-

9 Then and now every dispute will be investigated by a panel of independent experts as soon as bilateral talks among the parties have failed to resolve the issue. The panel's recommendation will then have to be adopted by the GATT, GATS or TRIPS Council, depending on which of the three basic WTO

ity. As a result, a signatory state to the GATT agreement which was represented in the GATT council could effectively veto any decision against it. Under the WTO rules, this has been completely reversed, i.e. unanimity is now required to thwart the adoption of a panel report (which has never happened). Moreover, under the old system, no strict deadlines were imposed, so disputes could drag on unresolved over very long periods. However, the WTO cannot by itself enforce its rulings; instead it must rely on its member states' willingness to accept its rulings. The specific bodies of the WTO, including the dispute settlement body, can therefore be interpreted as an instrument rather than a genuine actor (see WTO 2004a, pp. 18-19; WTO 2008, p. 55).

Three bodies of the WTO are of specific importance for the dispute settlement system: the Dispute Settlement Body (DSB), the panels and the Appellate Body. The DSB is composed of legates from all membership countries and bears responsibility for administering the Dispute Settlement Understanding (DSU).

The DSB is the only body which has the authority to establish panels and to adopt or reject panels' and the Appellate Body's conclusions. The DSB is in charge of the monitoring of the implementation of WTO decisions and has therefore a unique position within the system. "In less technical terms, the DSB is responsible for the referral of a dispute to adjudication (establishing a panel); for making the adjudicative decision binding (adopting of the reports), generally, for supervising the implementation of the ruling; and for authorizing 'retaliation' when a Member does not comply with the ruling" (WTO 2004a, pp. 17-18).

Panels are some kind of tribunals which decide disputes between WTO member states in the first instance. They are composed of three to five experts and specific panels are established for each dispute, i.e. no single permanent WTO panel exists. The Appellate Body instead is a permanent seven-member body which is set up by the DSB. Members of the Appellate Body are nominated for four years and have to be experts in trade law and/or international trade policy. Their task is to review the findings of the panels. Thus, the Appellate Body can be seen as the second and final stage of the dispute settlement process. The existence of the Appellate Body is to be traced back to the aforementioned innovation in the dispute settlement process which

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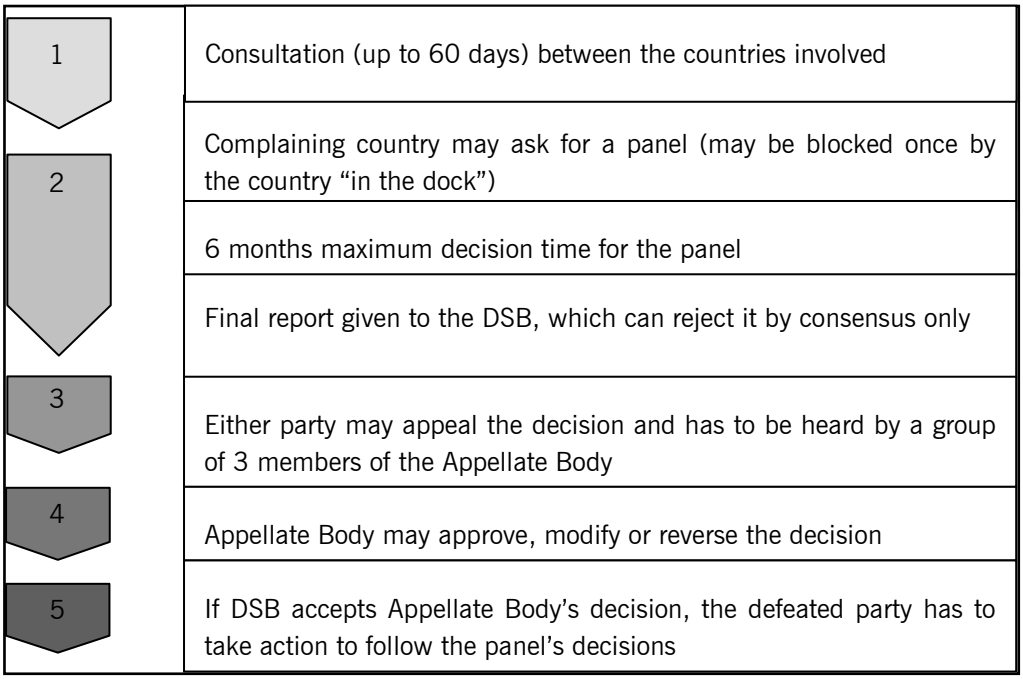
agreements is affected by the dispute. Details will be discussed later in this paragraph.

prevents a single WTO member, e.g. the defeated party, to block a decision. As a result, reports have been adopted rather automatically ever since. In short, the Appellate Body has to correct legal panel errors and thus Appellate Body's decisions contribute to the consistency of decisions which makes the dispute settlement process more predictable (see WTO 2004a, pp. 17-27).

If a dispute arises among WTO member states, either side may take the specific case to the WTO for review. Despite having the power to decide, the WTO's priority is to resolve disputes ‚amicably' between the parties concerned. The first choice is therefore always a bilateral consultation with the aim to resolve the dispute before the formal dispute settlement process begins. By January 2008, more than 200 cases have been settled 'out of court' or remain in the consultation stage. This is the lion's share of all cases and demonstrates the importance of these guided consultations. Only 136 cases have run through the complete panel process. The pre-eminence of consultation can be derived from the fact that, even if the dispute has reached the panel stage, or even a higher level, it is always possible for the parties involved to return to the negotiating table (see WTO 2004a, pp. 43-47; WTO 2008, p. 55).

If bilateral consultations fail within 60 days, a specific panel is set up to deal with the dispute. These panels – independent from any government's advice – are composed on the basis of the required expertise of the panelists and in consultation with the parties to the dispute. The request for the establishment of a panel marks the beginning of the adjudication process. For the panel report to be legally binding it must be adopted by the DSB. As mentioned above, this does no longer require unanimity, while the panels' decision only can be rejected by consensus. Both parties have the right to appeal a panel report when they disagree with the panel's legal decision (see Graph 1). The appeal cannot initiate a sheer reconsideration of the case, but must focus on points of law. The members of the Appellate Body can confirm, modify or reject the panel's decision. A decision by consensus is intended, but not necessary. The period for this follow-up should not exceed 90 days. The DSB has to adopt the report of the Appellate Body, and a refusal to do so is possible only by consensus and has not happened so far. Finally, once the DSB has adopted the Appellate Body report, the report is circulated to all members of the WTO, and the disputing parties have to accept the findings of the Appellate Body (see WTO 2004a, pp. 43-75).

Graph 1: Dispute Settlement in the WTO



Source: Authors' compilation.

4.2 The Boeing-Airbus Subsidy Dispute

Following the withdrawal from the 1992 bilateral EU-EC agreement, the United States initiated two complaints with the WTO regarding measures affecting trade in large civil aircraft. The first request was submitted on 6 October 2004 while the second was filed on 31 January 2006. Both requests are complementary. In the second complaint the US government has provided a list of measures by several European governments which – from the US perspective – constitute illegal subsidies.

The United States argue that specific measures provided by Germany, France, the United Kingdom and Spain as well as the European Communities constitute subsidies that are inconsistent with the requirements of the WTO's Agreement on Subsidies and Countervailing Measures (SCM Agreement) and the General Agreement on Tariffs and Trade 1994 (GATT 1994). In detail, the US complained about launch aids, i.e. the financial support for the design and development of several Airbus models including the A380 (US$3.7 billion) and the A350XWB (US$1.7 billion). More precisely, the United States complained about the (allegedly) non-commercial terms, under which the

launch aid was provided, including low interest rates and special repayment conditions. For example, if a model will not succeed, Airbus will not at all have to repay the launch aid. Furthermore, the expansion and upgrade of Airbus' production facilities through government grants was considered another illegal subsidy by the US. To be more precise, the City of Hamburg and French authorities spent €751 million (US$943 million) resp. €182 million (US$229 million) for infrastructure improvement for the assembly of the A380. Spanish authorities also invested about €125 million (US$157 million) in Airbus' local production facilities. Airbus also received over US$ 1 billion of financial support from the European Investment Bank (EIB). These R & D loans were provided as launch aid for the A320, the A321, the A330/A340 and the A380.

In addition, the United States criticized the EC as well as the governments of the four member states behind the Airbus consortium for having assumed debts resulting from launch, production and developing of some aircraft. French and German equity infusions and grants, which were primarily provided by government-owned and government-controlled banks, e.g. the German Kreditanstalt für Wiederaufbau (KFW), were another source of controversy. Finally, the United States complained about the EC's and member states' funding of basic civil aeronautics research, e.g. under the EC Framework Programs or the German Luftfahrtforschungsprogramm (see WTO 2004b, pp. 1-3; WTO 2006b: 1-12).

To reciprocate, the EC filed two counter-complaints before the WTO. The first request for consultations was submitted on 6 October 2004, followed by a second on 27 June 2005. The focus of the requests was on specific measures provided by the US government to benefit US producers of large civil aircraft, in particular Boeing, which were unsurprisingly interpreted as prohibited and actionable subsidies under the provisions of the SCM Agreement and the GATT 1994. First, the EC objected to state and local subsidies provided for example by the states of Washington and Kansas for production facilities for the Boeing 787 "Dreamliner" (which is currently undergoing flight testing and certification). Besides that, the EC held that Boeing has received illegal tax incentives, relocation assistance and development grants from the state of Illinois and the city of Chicago. Second, several NASA and Department of Defense procurement contracts and R & D subsidies were challenged by the EC for numerous technological advances resulting from these programs that had indirectly bene-

fited, through substantial spillovers, Boeing's commercial aircraft business unit. Third, the US government was blamed for boosting the export of Boeing aircraft by providing tax advantages through the Foreign Sales Corporations (FSCs) for every aircraft sold abroad (see WTO 2004c, pp. 1-4; WTO 2005c: 1-5). According to the EC's calculations, the US had provided up to US$23.7 billion in WTO-illegal subsidies to Boeing (see European Commission 2007, pp. 1-5).

However, both consultations attempts – i.e. the respective US' as well as the EC's request – failed and both parties asked for the appointment of panels, all of which were established in 2005 and 2006 (see WTO 2005a, pp.1-12; WTO 2005b, pp. 1-4; WTO 2006a, pp. 1-17; WTO 2006c, pp. 1-11).

The US case against Airbus was finally decided by the end of March 2010 and the panel report was made public on 30 June 2010. The ruling confirmed the interim findings which were communicated to the two parties in September 2009 (see Agence France Presse 2009; Whoriskey 2009, p. A16). The panel found that the launch aids and "member state financing" (MSF) measures for every single Airbus model – the A300, A310, A320, A330, A340, A380 and A350XWB – as well as for three derivative models – the A330-200, A340-500 and A340-600 –, all of which had been challenged by the USA, constitute subsidies within the meaning of Articles 1 and 2 of the SCM Agreement. Interestingly, the financial measures applied by France and Spain were taken out of this ruling. Furthermore, the report upheld the USA's complaint that the A380 was supported by prohibited export subsidies from the governments of Germany, Spain and the UK. However, the contested French support for the A380 was found to be WTO-complaint by the panel. The report additionally classified the infrastructure grants provided by authorities in Germany, France and Spain for the construction of several manufacturing and assembly facilities as improper. Regarding the R & D loans provided by the EC and certain member states the report concluded that the grants under the EC Framework Programs as well as the French, German[10], Spanish and UK government measures are in violation of WTO law (see WTO 2010, pp. 1046-1048).

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10 Including aid provided to Airbus by the German states of Bavaria, Bremen and Hamburg, where the vast majority of the company's German facilities is located.

Nevertheless, the US complaints were only kept up in part by the WTO ruling. Most importantly, the WTO rejected the US view that the launch of the A350XWB was facilitated by government aid. Furthermore, R & D loans provided by the European Investment Bank (EIB) as well as most French, Spanish and British support schemes for infrastructure improvement were considered to be in full compliance with WTO regulations (see WTO 2010, pp. 1048-1049).

Finally, the WTO recommended the defendants to remove those subsidies which were interpreted as illegal within 90 days (see WTO 2010, pp. 1049-1050). However, it is beyond doubt that the EC and the four involved member states will request the Appellate Body to review the ruling. Moreover, no final resolution will be reached – if ever – before the WTO ruling on the two counter-complaints against the USA's alleged subsidies in favor of Boeing.

4.3 The Bombardier-Embraer Subsidy Dispute

The only legal precedent, the dispute between Canada and Brazil, began in 1996 when Canada requested consultations and the establishment of a panel to investigate whether Brazil's Programa de Financiamento às Exportações (PROEX), an export subsidy scheme (also) benefitting Embraer's foreign customers, violated the SCM Agreement and the GATT 1994 (see WTO 1996a, p. 1; WTO 1996b, pp. 1-2). In a nutshell, the panel then confirmed the Canadian view and ruled that the subsidy had to be withdrawn within 90 days (see WTO 1999a, p. 106).

In turn, Brazil submitted a request for consultation of its own on 10 March 1997. It claimed that the Canadian government and some Canadian provinces provided various forms of financial support for the civil aircraft industry primarily in order to promote the export of civil aircraft. Brazil was of the view that these measures failed to comply with the provisions of the SCM Agreement. The measures concerned included financing and loan guarantees granted by the Export Development Corporation (EDC) and Canada Account; both organizations had been established to finance Canadian exports to developing countries. Additionally, Brazil challenged R & D subsidies handed out to Bombardier for developing new aircraft. Furthermore, Brazil claimed that the sale of a 49 percent share in the aircraft manufacturer de Havilland to Bombardier – which had been initiated by the Ontario

Aerospace Corporation, a government agency – was finalized on other than purely commercial terms. Finally, Brazil objected to the Government of Québec's policy to provide financial support under the Canada-Québec Subsidiary Agreement on Industrial Development and under the Société de Dévéloppement Industriel du Québec (see WTO 1997, pp. 1-2). Siding essentially with Brazil, the panel concluded that Canada Account and the federal Technology Partnerships Canada (TPC), which had identified the aircraft industry as a strategic sector and therefore assumed 25-30 percent of the developing costs for new civil aircraft programs, were not consistent with the SCM Agreement. However, it rejected the Brazilian claim that the EDC support and the sale of the Ontario Aerospace Corporation interests in de Havilland to Bombardier constituted illegal (export) subsidies (see WTO 1999b, pp. 227-228).

In the aftermath, both sides appealed certain issues of law and legal interpretations presented by the respective panels. The Appellate Body reports in both cases were issued on 2 August 1999. Both upheld the findings of the previous panels (see WTO 1999c, pp. 59-60; WTO 1999d, p. 63) which were finally adopted by the DSB.

Following the DSB decision to adopt the panels' and Appellate Body's reports, Canada and Brazil stated in agreement that they had abolished all illegal measures as required within the 90 day period. But after a short while, both parties began accusing each other of violating the rulings and recommendations. Therefore, both parties requested the establishment of compliance panels under Article 21.5 DSU. The respective panel reports were circulated to the parties on 9 May 2000. The compliance panel in the case against Canada ruled that Canada had only implemented the recommendations of the DSB regarding the TPC program. To be more specific, it found that Canada had ceased the TPC support provided to the Canadian regional aircraft industry. Nevertheless, the compliance panel decided that Canada had failed to withdraw the Canada Account financing of regional aircraft exports in time (see WTO 2000a, p. 43). In the Brazilian case, the compliance panel concluded that Brazil had not stopped the assistance to the national regional aircraft industry via PROEX payments within the required 90 days (see WTO 2000b, pp. 34-35). Following up on the compliance panels' findings, Canada announced to take retaliatory action against Brazil worth CAN$700 million (US$471 million) per year. The measures included a 100 percent surtax on specific imports from Brazil and the suspension of Brazil from the list of

countries eligible for the General Preferential Tariff (see WTO 2000c, pp. 1-2). However, Brazil appealed the compliance panel's findings relating to TPC and PROEX. The Appellate Body upheld the compliance panel's ruling that Canada had ended its illegal subsidies to Bombardier, but once again confirmed that Brazil had continued to support its aircraft industry via PROEX (see WTO 2000d, p. 27; WTO 2000e, p. 17). In addition, the Brazilian side requested arbitration trying to figure out whether the proposed Canadian countermeasures were indeed appropriate or excessive. The DSB decided to return the matter to the original panel for arbitration which ruled that Canada could only impose countermeasures to the tune of no more than US$233.6 annually (CAN$344.2 million) (see WTO 2000f, pp. 26-27).

However, instead of imposing these countermeasures, the Canadian government provided US-based Air Wisconsin a US$1.1 billion (CAN$ 1.75 billion) loan to help Bombardier win an order from the airline for 75 aircraft. The conditions attached to the loan were identical with the terms under Brazil's PROEX scheme (see Goldstein/ McGuire 2004, p. 545). Because Brazil assumed that these loan guarantees – which were provided by the Export Development Corporation (EDC) and Canada Account – constituted illegal export subsidies, the Brazilian government initiated yet another request for consultation with Canada on 22 January 2001 (see WTO 2001a, p. 1). The panel, which was established, later concluded that Canada's measures were partly not in line with the WTO's trade rules. In particular, the financing measures provided by the EDC to Air Wisconsin, Air Nostrum (Spain) and Comair (USA) were found to be illegal exports subsidies and had to be phased out within a 90 day time-frame (see WTO 2002, pp. 92-93).

Despite the decision of the panel, the Canadian government continued to financially support Bombardier. In response, Brazil announced countermeasures worth US$3.36 billion. However, Canada refused to acknowledge Brazil's right to ask the DSB for the imposition of countermeasures and claimed that the matter should either be removed from the DSB's agenda or referred to the arbitration process under Article 22.6 of the DSU. Finally, the DSB subjected the matter to arbitration and the arbitration report was issued on 17 February 2003. Here, Brazil was granted authority to impose countermeasures of a maximum amount of US$247.8 million against Canada (see WTO 2003, p. 33).

The last chapter in this case was opened when Brazil announced that it had revised its PROEX program. According to Brazilian officials, all illegal export subsidies had been eliminated. However, Canada maintained the view that even the revised PROEX still violated the SCM Agreement. Hence, Canada requested the DSB to pass the dispute again to the original panel, pursuant to Article 21.5 of the DSU. The panel, the second Article 21.5 panel in this case, concluded this time that the revised PROEX program was compliant with the SCM Agreement per se but that every single government financial aid had to be reviewed individually. Although the revised PROEX program as such was deemed WTO-compliant, Brazil was instructed to withdraw all aircraft-related subsidies that had been granted before 18 November 1999 (see WTO 2001b, pp. 63-64; D'Cruz/Gastle 2002, pp. 26-30).

5. Will the WTO Resolve the Airbus-Boeing Dispute?

5.1 Trends in the Aircraft Industry

The production of aircraft usually requires an amazing number of materials, design features and manufacturing methods. For example, about eight million components are used to assemble a Boeing 747 (six million for an A380). Interestingly, roughly 50 percent of all components are fasteners (see Friehmelt 2008, p. 4). Due to scale as well as scope economies, huge investments (sunk costs), long lead times and substantial market uncertainties, the civil aircraft market is highly concentrated and dominated by a very small number of manufacturers. Furthermore, the aircraft industry is characterized by a relatively low degree of vertical integration. Lead manufacturers like Airbus or Boeing subcontract whole production stages to suppliers and only take responsibility for most R & D activities, design and final assembly (see Goldstein/Le Blanc 2003, pp. 3-5).

Pritchard and MacPherson (2004, pp. 57-73) describe this long-standing trend of decreasing vertical integration by the example of Boeing's 787 "Dreamliner". They argue that the launch of the B787 differs fundamentally from the launch processes of previous Boeing models. In the past, Boeing used to fund the design, development, tooling and infrastructure required for new aircraft with own resources. As Table 6 shows, however, Boeing has steadily been transferring

production tasks to suppliers in foreign countries. While suppliers from outside the U.S. contributed only two percent to a B727, the foreign input to the B777 already amounts to 30 percent. As for the B787, about 65 percent of the airframe will be manufactured by foreign suppliers (see MacPherson/Pritchard 2003, pp. 227-228)[11]. In the 787 program, Boeing as the lead manufacturer still bears the responsibility for the final assembly but technologically complex airframe components are delivered, and often designed (based on Boeing's specifications) by outside partners. In doing so, the lead manufacturer spreads its commercial risks across its suppliers, lowers unit and development costs as well as expenditures for tooling, equipment and infrastructure improvements. Moreover, the development process for new aircraft models speeds up and the assembly process is simplified (see Pritchard/MacPherson 2004, p. 57).

It is noteworthy that this kind of outsourcing may even help gain or secure market access. After its decision to outsource wing, wing box and fuselage section production for the B787 to Japanese companies, Japan's major airlines JAL (Japan Airlines) and ANA (All Nippon Airways) placed orders for 55 (ANA) and 35 (JAL) "Dreamliners". In fact, Boeing has enjoyed a dominant position on the Japanese market for large civil aircraft for nearly six decades. By June 2010, the Japanese airlines have ordered a total of 892 aircraft, of which 735 have been delivered so far. Today, Boeing commands a 85 percent share, higher than anywhere else in the world including its US home market. More generally speaking, many airlines, especially formerly or currently state-owned ones, often tie aircraft orders to the successful manufacturer's commitment to outsource parts of the production to domestic companies (see MacPherson/Pritchard 2003, p. 223; Horng 2007, pp. 98-100). Finally, partnerships with foreign suppliers may help to overcome a shortage of qualified domestic partners and to get access to new technologies.

11 Pritchard/MacPherson (2007, p. 329) state that up to 90 percent of component production for the B787 is outsourced.

Table 6: Boeing's Airframe Suppliers

Aircraft model	727	737	747	757	767	777	787
Maiden flight	1963	1967	1969	1982	1981	1994	2009
Forward Fuselage	D	D	D	D	F	F	F
Center Fuselage	D	D	D	D	F	F	F
Aft Fuselage	D	D	D	D	F	F	D
Center Wing Box	D	D	F	D	D	F	F
Wing	D	D	D	D	D	D	F
Inboard flaps	D	F	F	F	F	D	D/F
Outboard flaps	D	F	F	F	F	F	D
Horizontal stabilizer	D	D/F	D	D/F	D	D	F
Elevator	D	F	D	F	F	F	D
Vertical fin	D	D/F	D	D/F	F	D	D
Rudder	D	F	D	F	F	F	F

D = Domestic production, F = Foreign production.

Source: MacPherson/Pritchard 2003, p. 228; Darby 2008, p. 50.

However, a broad network of partners can also be tricky for the lead manufacturer. First, outsourcing production means transferring technological knowledge and production experience to outsiders. This, of course, involves the risk that today's suppliers might become future competitors or cooperate with future competitors. Second, to achieve the goal of cost reduction, all subcontractor-produced components must fit and interoperate smoothly. Otherwise, components have to be redesigned or refitted on the final assembly line which causes additional costs and provokes time schedule overruns. Thus, much attention has to be paid to the coordination of design and engineering tasks across the entire supply chain. The current problems with the final assembly of the "Dreamliner" make this risk obvious. So, a cost reduction strategy which aims to cut costs on the supply of components will in the worst case lead to higher total costs and longer development times if unforeseen interface difficulties between the lead manufacturer and its suppliers were to occur (see Pritchard/MacPherson 2004, pp. 58-60; Figueiredo/Silveira/Sbragia 2008, pp. 28-30).

In the following, we will present, for illustrative purposes, an in-depth analysis of the supplier relationships of the aircraft manufacturers Airbus, Boeing, Embraer and Bombardier. This will also demonstrate that subsidies granted by national governments to domestic air-

craft manufacturers are increasingly less effective in an ever more internationalized aircraft industry.

5.2 Aerospace Supply Chains

As mentioned above, the strategic trade policy concept is based on the assumption that subsidies raise the national income if the rents shifted as a result of the subsidy exceed their budgetary costs. But in highly internationalized industries it cannot be taken for granted that domestic subsidies will solely benefit domestic producers without any welfare reducing "leakage" to the benefit of foreign producers or consumers.

Keeping in mind how airliners are built today, it has to be questioned that both Boeing and Airbus are still pure "national champions". Boeing, for example, has outsourced large parts of the B787 production process to six major suppliers in three countries. Boeing itself will realise only 35 percent of the 787 work share. About two third of the design, development and fabrication work was outsourced to suppliers from the United States, Europe and Japan. Italy-based Alenia Aeronautica, for example, produces the center fuselage and the horizontal stabilizer, in total a work share of 26 percent. Furthermore, Global Aeronautica is responsible for the integration of more than 60 percent of the fuselage sections which, in turn, are produced by suppliers in Japan and Italy. Table 7 gives an overview of Boeing's main suppliers for its Dreamliner.[12]

The three "heavyweights" of Japan's aerospace industry – Mitsubishi Heavy Industries, Kawasaki Heavy Industries and Fuji Heavy Industries – deliver fuselage sections, the center wing box, wings and cabin interiors, all of which adds up to a 35 percent share of the production process (see Horng 2007, p. 99; Hegmann 2008, p. A2). Hence, most of the companies involved in the B787-program are more than simple suppliers. They are rather risk-sharing partners who bear responsibility for the development and manufacturing of key structures and systems.

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12 Global Aeronautica was initially formed as a 50/50 joint venture between Alenia North America, a subsidiary of Italy's Alenia Aeronautica, and Vought Aircraft Industries in 2004. Due to ongoing quality problems in the 787-program, Boeing acquired Vought's share in Global Aeronautica in March 2008 and bought out Alenia North America in December 2009. Now, Boeing is the sole owner (Boeing 2009a).

Boeing's own role essentially is that of the final system integrator (see Horng 2007, pp. 92-95; Pritchard/MacPherson 2007, pp. 329-330).

Despite the recent problems Boeing had to face in its supplier network, its comprehensive outsourcing strategy has given the company the opportunity to attract widespread support from governments outside the US. To be more precise, the Chicago-based company managed to extract substantial financial support from the Japanese and Italian governments. Pritchard and Macpherson (2005, pp. 9-10) estimate the Japanese support at US$1.588 billion, which splits up into 30 percent for non-repayable grants and 70 percent for repayable loans. The repayment scheme of the granted loans obviously follows arrangements very similar to those criticized by the US government in its WTO case against the EC. "Ironically it seems that whilst Boeing complains about this system being used by its competitor, it is happy to see the same or an even more generous system used by its Japanese suppliers to reduce its own manufacturing costs for the 787" (Pritchard/ MacPherson 2005, p. 10). Concerning Italy, Boeing profits from government aid worth US$590 million which were granted for upgrading one of Alenia's plants in southern Italy (see Pritchard/MacPherson 2004, p. 69-70). Hence, Pritchard and Macpherson (2004, p. 66) take the view that "a substantial portion (46 percent) of the estimated $13.4 billion in launch funding consists of actionable/prohibited subsidies under both the 1994 WTO-SCM Agreements and the 1992-EU Agreement on Trade in Large Civil Aircraft." Regarding the launch aid likely to be in violation of WTO agreements, 60 percent was granted by the state of Washington, 26 percent by the Japanese government, ten percent by Italy and four percent by the state of Kansas for Boeing's Wichita facility.

Table 7: Boeing 787 Suppliers

Forward Fuselage	Spirit Aerosystems (USA) Kawasaki Heavy Industries (Japan)
Center Fuselage	Alenia Aeronautica (Italy)
Aft Fuselage	Vought Aircraft Industries (USA)/Boeing (USA)[13]
Center Wing Box	Fuji Heavy Industries (Japan)
Wing	Mitsubishi Heavy Industries (Japan)
Wing Leading Edge	Spirit Aerosystems (USA)
Wing Trailing Edge	Kawasaki Heavy Industries (Japan) Boeing (USA, Canada, Australia)
Vertical Stabilizer	Boeing (USA)
Horizontal Stabilizer	Alenia Aeronautica (Italy)
Engines	Rolls-Royce (UK), GE Aviation (USA)
Avionics	GE Aviation (USA) Honeywell (USA) Rockwell Collins (USA)
Hydraulics	Eaton Aerospace (UK) Parker Hannifin (USA)
Landing Gear	Messier-Dowty (France)
Cabin Interiors/Lighting	Boeing (USA) Jamco (Japan) Koito Industries (Japan) Recaro (Germany) Diehl Aerospace (Germany) Sell (Germany) Driessen (Netherlands)

Source: Airframer 2010a; Boeing 2010.

However, Airbus has awarded manufacturing work contracts to a wide range of suppliers as well. It is worth pointing out in this context that about 40 percent of the contracts Airbus concluded with external suppliers for the A350XWB program were with US-based companies.

13 Due to massive quality issues, Boeing acquired the production of the rear fuselage from Vought Aircraft Industries in July 2009. Boeing is now responsible for the fabrication of the aft fuselage and the integration of the center sections (see Boeing 2009b).

These contracts are worth US$24 billion, representing around 80 percent of all outsourcing contracts so far (see Butterworth-Hayes 2009, p. 2). Spirit AeroSystems, for instance, was chosen by Airbus to manufacture the center fuselage and the leading edge of the wing. Ironically, Spirit AeroSystems was established in 2005, when Boeing sold its own facilities. Moreover, Spirit AeroSystems is still a major supplier for Boeing, manufacturing components for every aircraft model currently in production. Contracts with Boeing contribute 85 percent to the total revenues of the company. In contrast, only eleven percent of Spirit's net revenues are being generated from sales to Airbus (see Kingsley-Jones 2009, p. 10; Spirit AeroSystems 2009, pp. 1-8). The main suppliers incorporated into the A350XWB-program are shown in Table 8.

Table 8: Airbus 350XWB Suppliers

Forward & Aft Fuselage	Premium Aerotec (Germany)
Center Fuselage	Spirit Aerosystems (USA)
Center Wing Box	Airbus (France)
Wing	GKN Aerospace (UK)
Wing Leading Edge	Spirit Aerosystems (USA)
Wing Trailing Edge	GE Aviation (USA)
Horizontal Stabilizer	Airbus (Spain)
Engines	Rolls-Royce (UK)
Avionics	Rockwell Collins (USA) Thales (France) Sagem (France)
Hydraulics	Parker Aerospace (USA)
Cabin Interiors/Lighting	Diehl/Thales (Germany, France) B/E Aerospace (USA) Airbus North America Engineering (USA)
Landing Gear	Liebherr Aerospace (Germany) Messier Bugatti/Messier Dowty (France/UK)

Source: Airframer 2010b; Butterworth-Hayes 2009, pp. 7-13.

The A350XWB-program is not the only Airbus program subject to the outsourcing of key component and stages of production. Even though major fuselage sections and components of the A380 are designed, developed and manufactured by Airbus entities in France, Germany, the United Kingdom and Spain, a number of US firms participate substantially in the A380 production. The engines, for example, are made by General Electric and Goodrich takes responsibility for the main landing gear, the evacuation systems and the interior lighting system. The navigation equipment is delivered by Northrop-Grumman and Honeywell is Airbus' partner for avionics. In total, nearly half of the components of the A380 are assembled by US companies, mostly in US facilities. Since 1990, Airbus has spent about US$50 billion in the United States, and 120,000 jobs in the US aircraft industry currently depend on Airbus (see European Commission 2004, p. 3; Lynn 2005, p. 15).

The same trends are unfolding in the regional aircraft industry. The two leading manufacturers, Bombardier and Embraer, have built nearly global supply chains as well. Table 9 below provides an overview of Bombardier's main suppliers for its CRJ-program (CRJ=Canadair Regional Jet), with variants seating 50 to 100 passengers. Moreover, the future CSeries airplane – designed to seat 100 up to 149 passengers and projected to enter commercial service in 2013 – will have its center fuselage and center wing box manufactured by the Chinese Shenyang Aircraft Corporation. Alenia Aeronautica from Italy has won the contract to manufacture the horizontal and vertical stabilizers. The fixed leading edge of the wing is made by the Belgium-based Sonaca in cooperation with the Czech Aero Vodochody. US-firms like Rockwell Collins, Goodrich, Honeywell and C&D Zodiac have signed delivery contracts for the avionics and cabin interiors respectively (see Kirby 2009, p. 81).

Table 9: Bombardier CRJ 700/900/1000 Series Suppliers

Forward & Center Fuselage	Bombardier Belfast (UK)
Aft Fuselage	Mitsubishi Heavy Industries (Japan) (CRJ) RUAG Aerospace (Switzerland) (CRJ NextGen)
Wing	Bombardier Belfast (UK)
Vertical & Horizontal Stabilizers	Avcorp Industries (Canada)
Engines	GE Aviation (USA)
Avionics	Rockwell Collins (USA) Sagem (France) Thales (France)
Hydraulics	GE Aviation (USA) Parker Aerospace Europe (Germany)
Cabin Interiors/Lighting	C&D Zodiac (USA) Goodrich (USA, Germany) B/E Aerospace (USA)
Landing Gear	Goodrich (USA)

Source: Airframer 2010c.

Last but not least, Table 10 provides details of the major suppliers incorporated into the Embraer 170/190-program. External suppliers deliver whole systems which only have to be integrated on the final assembly line. In doing so, suppliers have been taking about one-third, in figures US$850 million, of the total launching costs (see Goldstein/Le Blanc 2003, p. 8). US companies dominate Embraer's external supplier list (57 percent), followed by European-based suppliers (27 percent share) and Japanese companies (8 percent share). The remaining 8 percent spread out over firms from other countries (see Figueiredo/Silveira/Sbragia 2008, p. 32).

Table 10: Embraer Series 170/190 Suppliers

Center Fuselage	Latécoère (France) Sonaca (Belgium)
Aft Fuselage	Gamesa Aéronautica (Spain)
Wing	Fuji Heavy Industries (Japan)
Vertical & Horizontal Stabilizers	Gamesa Aéronautica (Spain)
Engines	GE Aviation (USA)
Avionics	Honeywell (USA)
Hydraulics	Parker Aerospace (USA)
Cabin Interiors/ Lighting	C&D Zodiac (USA)
Landing Gear	Liebherr Aerospace (Germany)

Source: Airframer 2010d; Airframer 2010e; Figueiredo/Silveira/Sbragia 2008, p. 32.

6. Conclusion

The recent publication of the panel report in the trade dispute initiated by the United States against the EC and its member states which are involved in the Airbus program will not be the end of the story. Although this dispute already is one of the longest lasting, and probably the trickiest, in the WTO's history, no compromise appears possible before the WTO's final ruling in this case and the EC's counter-claims against the USA. However, both the conclusions and policy recommendations by the panel in the first did not come as a big surprise to trade policy insiders familiar with WTO law. However, it exposed some serious shortcomings in the WTO's dispute settlement procedures.

First of all, the WTO's ruling closely follows the legal precedent set in the Bombardier vs. Embraer case. Both parties had won their consultation requests and had been found guilty of illegally subsidizing their domestic producers. But nevertheless, neither government altered its state aid practices towards the aircraft industry. The WTO now found the EC and some of its member states partly guilty of providing illegal financial support to Airbus and ruled that the respective measures have to be withdrawn within 90 days. But the WTO has no power to enforce its ruling at all. So even if, as is to be expected, the

WTO finds both parties in the four Airbus vs. Boeing cases guilty of breaching WTO law, the aircraft industry will continue to receive massive financial support from governments worldwide. Even worse, if the WTO finds the majority of state aid programs to aircraft manufacturers in compliance with the multilateral trade rules, even more countries might be tempted to implement a protectionist – but WTO-legal – sector-specific trade policy in the civil aircraft industry to bolster their respective "national champions". As a consequence, Embraer, Bombardier and – even more important in the long-run – the new competitors from China, Russia (which is currently not a WTO member anyway) and Japan are extremely likely to follow this example and will prop up their national aircraft manufacturers with similar state aid schemes.

Second, the ruling raises the question if the WTO rules and institutions are basically effective in solving cases as commercially and politically important as the Airbus vs. Boeing dispute. "The industry is too concentrated, too large, too complex and too deeply interwoven with overriding government policies to be governed by the rules that serve the general marketplace" (Herzstein 2006).

Third, the trade dispute between the United States and the EC member states, which economically is influenced by strategic trade policy concepts, ignores the supply-chain realities of today's civil aircraft manufacturing. The civil aircraft industry has changed tremendously over the past twenty to thirty years, in parallel with the progressive liberalization of air transport markets which also resulted in massive challenges for aircraft manufacturers. Moreover, since the beginning of the legal battle between Airbus and Boeing, new competitors from Russia and China have emerged.[14] Even Bombardier's CSeries aims to tackle Airbus' A320 as well as Boeing's 737 and is projected to offer substantially lower costs per available seat mile (CASM) as well as lower landing fees due to lower weight. It is obvious that Airbus and Boeing will lose their cozy duopoly in the category of short- and medium-range narrow-body airliners – currently the bread-and-butter business for both manufacturers – in the next few years.

Moreover, the airliner industry has increasingly become a highly internationalized industry, with all major makers of large commercial

14 The Chinese Comac C919 for example is a narrow-body airliner with a projected seating capacity from 168 to 190. Its first flight is scheduled for 2014.

aircraft as well as regional aircraft having established complex global networks of suppliers. In this setting, lead manufacturers only serve as system integrators solely responsible for most of the design work and final assembly. However, the former suppliers of components or smaller parts have increasingly become risk-sharing partners who participate in the development process of new aircraft and deliver ready-made systems for final assembly. For the leading manufacturer, a widespread supplier network has the advantage of lower R & D and production costs. Within its 787 program, Boeing, for example, has outsourced significant parts of the production process to foreign suppliers, mainly from Japan and Italy. About two-thirds of the components are made by non-US companies. Airbus takes advantage of external supplier's work as well. More than half of Airbus' new flagship aircraft, the A380, is manufactured in the United States, in part even by suppliers with strong ties to Boeing. Bombardier and Embraer also heavily rely on foreign suppliers. Both have established complex risk-sharing partnerships with companies located in Europe and the United States.

Therefore, it has become increasingly doubtful that nationally focused government financial aid is an effective measure for fostering the domestic aircraft industry so as to attain the economic effects of strategic trade policy. This concept takes for granted that solely domestic firms will profit from public support (which must be financed by domestic taxpayers). However, the concept ignores the fact that financial aid given to a domestic firm might leak through to a foreign one. But in real world, companies are offered the chance to free-ride on subsidies granted by foreign governments in manifold ways. The Japanese government for instance indirectly supports Boeing by providing subsidies for those Japanese companies Boeing has chosen to produce the wing, fuselage and wing box of its most modern aircraft. Without this launch aid Kawasaki, Fuji and Mitsubishi would not have been able to acquire the skills necessary to manufacture the composites used for the B787's wings, nor to meet Boeing's low price demands for this task. Pritchard and MacPherson (2004, p. 71) therefore rightly conclude that because a wide range of high-value work on the B787 is performed by foreign companies, "US institutions might better serve the national interest by subsidizing those aspects of Boeing's aerospace business that operate with higher US content" (see also Herzstein 2006; Morrison 2010, p. 11).

The European Communities meanwhile announced to appeal the WTO's ruling, and the member states backing the Airbus consortium continue to stress their unfaltering support for Airbus. The ruling in the European complaint against the United States, initially scheduled for July 2010, has meanwhile been postponed and is not expected before September 2010. It is therefore safe to assume that dispute over the WTO-legality of subsidies for Airbus and Boeing will still remain on the WTO's agenda for a long time to come.

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