OVERCAPACITY IN REGIONAL AIRCRAFT PRODUCTION

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ABSTRACT
Capacity decisions are among the most important operations decisions for companies. One of the potential outcomes of bad decisions is a resulting overcapacity. Although some textbooks treat overcapacity as an issue for individual companies, there are indications that it may be an industry wide issue. This paper describes the global regional aircraft industry, comparing the demand and available production capacity. A small number of companies is active in this industry and a larger number of companies are starting or planning to start production. Under these conditions, the probability of overcapacity is high. The analysis shows that a number of structural factors exist that cause individual regional jet manufacturers to make capacity decisions that are not beneficial for the industry as a whole. Overall, in this type of industry, once the decision has been made to offer a new aircraft type, manufacturers do not have many options to prevent overcapacity situations.

Keywords: Regional jets, overcapacity, aircraft industry

INTRODUCTION

Regional aircraft production has been targeted by a number of companies and governments, including several in industrially developing countries. Around a decade ago, the main competitors in regional turboprop aircraft were mostly based in industrially developed countries; British Aerospace (UK), Fokker (The Netherlands), ATR (Italy), Saab (Sweden). Currently, most of these companies have been replaced by other companies producing regional jets such as Embraer (Brazil) and Bombardier (Canada). There are several other companies that are either trying to enter the market with their products, such as IAe (Indonesia), AVIC (China) and RRJ (Russia), or that are currently barely surviving such as Fairchild-Dornier (Germany) and Rekkof (the Netherlands).

In the large commercial aircraft manufacturing industry there are only two significant companies: Airbus and Boeing. For specific segments, e.g. jumbo aircraft, the market may not even be large enough to sustain two competitors. With the number of companies already involved in regional aircraft manufacturing and an additional number of companies planning to enter it, the question is whether the market can sustain so many producers or whether it will lead to problems with overcapacity. In this paper, this issue will be discussed.

PRODUCTION CAPACITY

Capacity is one of the important structural, or long-term, design parameters for an organization (Hayes and Wheelwright, 1984; Hayes, Pisano and Upton, 1996; Hayes, Pisano, Upton and Wheelwright, 2005). Capacity decisions deal with the amount, the timing, and the type of capacity (Hayes and Wheelwright, 1984: 31). A capacity strategy is a longer-term sequence of capacity decisions which are triggered by a capital authorization request for an expansion of capacity (Hayes and Wheelwright, 1984: 46). A capacity strategy is based on a series of assumptions and predictions about long-term market, technology, and competitive behavior. These include: (1) the predicted growth and variability of primary demand, (2) the costs of building and operating different sized plants, (3) the rate and direction of technological evolution, (4) the likely behavior of competitors, and (5) the anticipated impact of international competitors, markets, and sources of supply (Hayes and Wheelwright, 1984: 46).

Hayes and Wheelwright (1984: 47) state that it is sometimes difficult to define or measure capacity. For example, it can be physical space, equipment, output rates, human resource capabilities, materials, or a combination. Finch (2006: 481) makes a similar statement and identifies several resource groups that contribute to capacity such as: labor capacity, equipment capacity, packaging capacity, equipment maintenance capacity, sales force capacity, inventory storage capacity, facility capacity, and material receiving capacity. Hayes and Wheelwright (1984: 47) therefore argue that capacity requires a statement of how much of what kinds of capacity are to be provided in conjunction with a specific scenario describing the likely evolution of the firm's environment over time.

Because of the importance of capacity decisions, operations management textbooks typically describe how companies should take their decisions. For example Stevenson (2005: 175) describes the capacity planning process in eight steps:

- Estimate future capacity requirements
- Evaluate existing capacity and facilities and identify gaps
- Identify alternatives for meeting requirements
- Conduct financial analysis of each alternative
- Assess key qualitative issues for each alternative
- Select one alternative to pursue
- Implement the selected alternative
- Monitor the results

One of the main challenges in capacity decisions is to match capacity with demand, as Stevenson (1984: 169) states: "The goal of strategic capacity planning is to achieve a match between the long-term supply capabilities of an organization and the predicted level of long-term demand". Unevenness in demand may lead to underutilization or overcapacity. Some of the typical strategies discussed in capacity decision are to add capacity proactively, neutral or reactively (Davis, Aquilano and Chase, 2003; Russell and Taylor, 2006; Heizer and Render, 2004). There are several problems with these approaches. First, it often assumes demand growth, see e.g. (Davis, Aquilano and Chase, 2003: p. 308; Heizer and Render, 2004: 280; Russell and Taylor, 2006: 246). This may not apply to regional aircraft manufacturing which may have more of a cyclical demand. Second, in manufacturing situations, it is often assumed that companies have the opportunity to buffer capacity from demand swings by utilizing inventory build up, see e.g. (Finch, 2006: 489). However, in regional aircraft manufacturing this condition may not be true since there are high costs associated with the storage of completed aircraft in inventory. Third, there is often some implicit assumption about the flexible use of capacity. For example, Heizer and Render (2004: 279) suggest that in cases of seasonal or cyclical demand patterns, management may find it helpful to offer products with complementary demand patters. This assumes that capacity can easily be used for different products and that a company can offer these different types of products. These conditions do not hold for regional aircraft manufacturers. Fourth, the theories often ignore the influence of competitors, i.e. they do not take actions from competitors into account. This may be satisfactory for industries with many companies where each company's capacity decisions have a minimal influence on the overall industry capacity. However, there are only a few regional aircraft manufacturers and each manufacturer's capacity decisions have important implications for the other manufacturers.

The above discussion shows that the commonly taught theories on capacity decision making are insufficient for regional aircraft manufacturers.

OVERCAPACITY

As indicated in the introduction section, the regional aircraft manufacturers may be dealing with an overcapacity situation. Overcapacity is not uncommon in several industries. For example in sectors of the chemical industry overcapacity occurs frequently (Young, 1999). Overcapacity may lead to a reduction in prices (Adams, 1999) or even a depletion of natural resources such as for example a fish population (Vitalis, 2003). To solve overcapacity either demand needs to increase or capacity needs to be scrapped. The question is what leads to industry overcapacity?

Some practical examples are used here for illustrative purposes. One example is overcapacity in global chemical shipping at the end of the 1990s (Young, 1999). From 1982-1997 the marine chemical transportation growth rate was 5% a year worldwide. Then, in mid-1997 due to the Asia crisis, the industry faltered, seaborne trade in chemical products declined 1% in 1998. Prior to the crisis, chemical shipowners had anticipated continued demand growth and ordered new ships. "It was a good market in 1995-96…Everyone thought it would continue into 1997-98" (Young, 1999: 45). Shipbuilding had also become les expensive, attracting operators to an already overcrowded market. In 1998, the global fleet expanded by 6%. Also, fewer ships were being scrapped, many ships were not demolished after the traditional 25 years of service. As Young (1999:45) states "Confident of continued growth, chemical tanker operators ordered ships years before scrapping decisions were due". One owner of a fleet of chemical tankers stated "The world economy was growing so fast that we made sure our vessels were delivered before the older ships were scrapped…We all erred on the side of caution so that we would not lose market share by scrapping and then have to regain it with new ships. We have a great deal of replacement in mind, but the question is when to act." (Young, 1999: 45). The oversupply in the chemical shipping sector is estimated at 30% - 35% and has caused a 10% - 20% fall in freight rates on major routes (Young, 1999). In this example, overcapacity was a result forecasting errors. If demand is forecasted to increase, based on which companies add capacity, and actual demand decreases then a situation of overcapacity occurs. The overcapacity situation was exacerbated because old capacity, which was expected to be scrapped, was not scrapped. This may partly be caused by cautious capacity expansion decisions where new capacity is added before the old capacity needs to be scrapped. Furthermore, another complicating factor may be that the decision to add capacity, due to the lead time of building the capacity, may have to be far in advance. Therefore, industries with demand uncertainty and/or industries where capacity decisions are made far in advance may me more susceptible to overcapacity situations.

Dearden, Lilien and Yoon (1999) provide an example of capacity for markets where product differentiation is marginal. In these markets, prices are typically set by the supply-demand balance in the market place (Dearden, Lilien and Yoon, 1999). Dearden, Lilien and Yoon (1999: 59) state "The dynamics in many high capital investment markets produce cycles of various sorts…Firms, driven by the desire to capture new customers and to satisfy and retain existing customers invest in production capacity. When market demand fails to match production capacity, costs rise, prices fall and firms may selectively delete capacity. So, all competing firms simultaneously balance two objectives: they weigh their desire to capture market share through assurance of supply by building production capacity against their desire to keep capacity utilization high by not building or even divesting production capacity. Although in a monopoly a firm might tune its production capacity to track demand cycles optimally, such coordination cannot occur naturally in an oligopoly when firms make decisions independently." Dearden, Lilien and Yoon (1999) argue that demand forecasts are a primary reason for cyclical behavior and they built several scenarios for firm actions. They conclude that among other things flexible manufacturing systems, sharing or reallocating production capacity with other, countercyclical products can help. In other words, companies that face cyclical industries should strive to be flexible or offer additional countercyclical products.

Porter (1980) discusses capacity from an industry viewpoint. According to Porter (1980: 328) the risk of overbuilding capacity is most severe in commodity businesses for two reasons. The demand is generally cyclical this not only guarantees overcapacity in downturns but also seems to lead to excessively optimistic expectations in upturns. Second, commodity products are not differentiated, this factor makes costs crucial to competition. Also, the absence of brand loyalty means that firms' sales are closely tied to the amount of capacity they have. Thus, firms are under great pressure to have large, modern plants to be competitive and adequate capacity to achieve their target market share. Porter (1980: 328-334) identified a range of factors that may contribute to overcapacity, see table 1. Porter (1980: 35-338) offers some solutions to prevent overcapacity to occur. However, these are primarily preemptive strategies. It is questionable whether this works in regional aircraft manufacturing because there are limited players and these players do not necessarily have flexibility to move into other types of businesses.

Table 1 – Factors that contribute to overcapacity

Technological	Adding capacity in large lumps
	Economies of scale or a significant learning curve
	Long lead times in adding capacity
	Increased minimum efficient scale
	Changes in production technology
Structural	Significant exit barriers
	Forcing by suppliers
	Building credibility
	Integrated competitors
	Capacity share affects demand
	Age and type of capacity affects demand
Competitive	Large number of firms
	Lack of credible market leaders
	New entry
	First mover advantages
Information flow	Inflation of future expectations
	Divergent assumptions or perceptions
	Breakdown of market signaling
	Structural change
	Financial community pressure
Managerial	Production orientation of management
	Asymmetric aversion to risk
Governmental	Perverse tax incentives
	Desire for indigenous industry
	Pressures to increase or maintain employment

METHODOLOGY

Our purpose is to explore capacity for regional aircraft manufacturers. This industry may be faced with overcapacity. We want to determine how companies are dealing with capacity decisions and, in the case of overcapacity, whether there are specific strategies that the companies may follow. For our analysis, we use a mix of primary and secondary data, i.e. data that has been published on the aircraft industry from a variety of sources including manufacturers and industry data from industry publications such as Flight International. We look at capacity from an output perspective, i.e. capacity is determined by how many aircraft companies produce. Regional jets are defined as small jet aircraft, i.e. no more than approximately 100 passengers, for short flights, i.e. 200-1500 nautical miles.

FINDINGS

The demand for regional jet aircraft is provided in table 2, which is adapted from (O'Toole and Moxon, 1996; O'Toole, 1997; O'Toole, 1998; Kingsley-Jones, 1999; Kingsley-Jones, 2000; Kingsley-Jones, 2001; Kingsley-Jones, 2002; Kingsley-Jones, 2003; Kingsley-Jones, 2004; Kingsley-Jones, 2005). Table 2 includes the regional jet manufacturers that were active from 1994 until 2004. Fairchild-Dornier went bankrupt in 2002 but AvCraft took over the 328Jet and Fairchild Dornier Industries the 728Jet production. Table 2 shows the orders placed with regional jet manufacturers as well as the creation of a back-log. Backlog is created for several reasons. First, airlines typically start their aircraft purchasing decisions up to four years in advance and delivery of the last aircraft from an order can take place six or more years after the order is placed. In other words, the backlog is about future demand. Second, Aircraft production has long through-put-times, i.e. there is quite a time difference between the start and finish of the production of an aircraft. Consequently, aircraft manufacturers need to know well in advance of delivery dates how many aircraft are required to be able to schedule their production. For example, Boeing decided to close its 757 production line in October 2003 when the order backlog was 12 aircraft of which the last were expected to manufactured by the end of 2004 (Norris, 2003). Similarly, Boeing decided to close its 717 production line in January 2005 because its order backlog was only 32 and these were due to be delivered by early 2006 (Wastnage, 2005). In other words, the appearance of backlog in this industry is not a signal of under capacity but is a consequence of the lead times involved in ordering and producing aircraft. In a sense, rather than inventories of finished aircraft, manufacturers use 'inventories of orders' (backlog) to adjust capacity to changing demand patterns.

Table 2 - Net Regional Aircraft Orders and Backlog

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AvCraft										12	18
AVIC I										35	0
BAe	25	37	12	32	9	2	17	-1	0	4	0
Bombardier	33	38	58	156	190	173	228	230	36	72	130
Embraer	13	5	45	121	192	161	418	30	19	139	108
Fairchild Dornier				17	27	172	63	53	-176	0	-
Fairchild Dornier Industries										0	-
Fokker	29	47	0	0	0	0	-	-	-	-	-
TOTAL	100	127	115	326	418	508	726	312	-121	262	256
Total backlog	144	167	144	348	609	880	1286	1228	803	747	657

Regional jet deliveries are provided in table 3, which is adapted from (O'Toole and Moxon, 1996; O'Toole, 1997; O'Toole, 1998; Kingsley-Jones, 1999; Kingsley-Jones, 2000; Kingsley-Jones, 2001; Kingsley-Jones, 2002; Kingsley-Jones, 2003; Kingsley-Jones, 2004; Kingsley-Jones, 2005).

Table 3 - Regional Aircraft Deliveries

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AvCraft										7	8
AVIC I										0	0
BAe	26	21	26	22	20	23	15	10	0	4	0
Bombardier	26	41	52	61	75	82	99	148	180	221	175
Embraer	0	0	4	31	60	97	157	153	121	87	134
Fairchild Dornier				0	0	15	33	31	8		
Fairchild Dornier Industries										0	
Fokker	30	41	17	5	0						
TOTAL	82	103	99	119	155	217	304	342	309	319	317

Stevenson (2004; 171) distinguishes two types of capacity. Design capacity is the maximum output rate or service capacity an operation, process, or facility is designed for. Effective capacity is the design capacity minus allowances such as personal time, maintenance, and scrap. Design capacity is the maximum rate of output under ideal condition. Effective capacity is usually less than design capacity owing to the realities of changing product mix, the need for periodic maintenance of equipment, lunch breaks, coffee breaks, problems in scheduling and balancing operations, and similar circumstances. Furthermore, Stevenson (2004; 171) states that the actual output cannot exceed effective capacity, and is often less because of machine breakdowns, absenteeism, shortages of materials, and quality problems, as well as factors that are outside of the control of the operations managers.

Since we do not know the design capacity of the different regional aircraft manufacturers, we use the actual output as an estimate of the effective capacity. As outlined above, the effective capacity is usually higher and therefore this can be considered a rather conservative indicator. To determine the industry capacity, we look at existing companies and their maximum production rate per year over the last 10-year period as an indicator of the effective capacity. For companies that are starting up their production, their estimated production rates are used as an indication of their planned capacity. This is shown in table 4. Estimated production rates for Rekkof, a company that plans to continue the production of Fokker aircraft, are based on (Rekkof, 2005), for AvCraft and Embraer Harbin they are based on (Goold, 2004).

Numbers for Fairchild Dornier Aeroindustries, AVIC I, Sukhoi, and Japan are not (yet) available. Fairchild Dornier Aeroindustries, was formed after the bankruptcy of Fairchild Dornier. The 728Jet line was purchased by D'Long Aerospace, which later renamed it to Fairchild Dornier Aerospace. Fairchild Dornier Aerospace itself had problems and filed for insolvency in 2003 making the future of the 728Jet uncertain (Goold, 2004). AVIC I is currently producing the ARJ21 prototype, it started cutting the first metal in January 2004 and hopes to fly the prototype in 2006 for first deliveries late in 2007 (Flight International, 2004c). A Sukhoi led consortium is working on the RRJ. This will be the first Russian aircraft designed from scratch to meet Western certification standards. Prototypes are planned to be completed in 2005 with first deliveries late in 2007 (Goold, 2004). JADC from Japan is at an earlier stage. Currently it carries out feasibility studies for an indigenous regional jet. The Japanese government has been focusing on regional jets for a longer time. Approximately 10 years ago it was already looking into the YS-X, a 100-seat regional jet, but it gave up these plans in 1998 to focus more on components and subsystem technologies (Flight International, 1998). However, in 2002 it again initiated studies on a 30-seat regional jet (Doyle, 2002) and a 150-seat regional jet (Sobie, 2003).

Table 4 - Indicators for Effective Capacity

Manufacturer	Maximum output rate per year	Estimated production rate per year
AvCraft (328Jet)		54
AVIC I (ARJ21)		Not available
Bombardier	221	
Embraer	157	
Embraer Harbin		24
Fairchild Dornier Aeroindustries (728Jet)		Not available
JADC		Not available
Rekkkof (Fokker)		45
Sukhoi (RRJ)t		Not available

Based on table 4 it can be inferred that a conservative estimate for the production capacity of the two 'stable' manufacturers Bombardier and Embraer is approximately 380 aircraft per year. Furthermore, maximum capacities for other manufacturers add another 110 aircraft per year (excluding ARJ and RRJ). So the projected capacity is somewhere around 500 aircraft per year.

Considering the demand levels over the last decade this is quite a high number indicating that there is overcapacity.

Another indication comes from forecasted demand. Frequently, mistakes are made with these forecasts which can cause overcapacity. For example, due to slackening of sales, Bombardier had to trim its CRJ200 production in 2004 (Flight International, 2004a). Embraer, cut back its two year delivery forecast by 12% in 2004 (Shannon, 2004) and AvCraft cut its forecast from between 700 to 1200 aircraft to between 250-350 aircraft (Norris, 2004). Table 5 provides the adjusted forecasted demand by Embraer for regional jets for the next 20 years, based on (Flight International 2004b).

Table 5 - Forecasted Demand for Regional Jets

Period	30-60 seat	61-90 seat	91-120 seat	Total
2005-2014	650	1300	1250	3200
2015-2024	1300	1550	1750	4600

Table 5 shows that the total forecasted demand until 2014 is 3200 regional jets, which translates in a demand for approximately 320 aircraft per year. As shown above, the combined capacity of Bombardier and Embraer can easily fill this demand which again shows that this industry is faced with overcapacity especially if other companies enter the market.

Table 6 shows projected production quantities for Embraer and Bombardier for the next five years, based on (Jaworowski, 2005).

Table 6 - Forecasted Production Quantities

	2005	2006	2007	2008	2009
Bombardier	143	120	117	104	110
Embraer	135	135	142	141	143

Table 6 shows that both manufacturers expect to stay under their maximum output levels. Also, very interestingly, Embraer is forecasting a relatively stable production rate which is quite strange considering the many fluctuations in production rates in the past decade.

Causes for Overcapacity

The discussion above shows that overcapacity is an important issue in regional aircraft production. Overcapacity occurs because of several specific factors that influence this industry. Several of these are mentioned by Porter (1980). Where the factors deviate from Porter (1980) we will specifically mention it in our discussion below.

First, capacity gets added in large lumps. To be able to produce more aircraft typically requires that a whole series of jigs has to be duplicated and a separate manufacturing line needs to be set up. Although when demand declines producers can decide to use less labor, the fixed costs for these jigs remain and they can not be sold or used for other types of production.

Second, there is a significant learning curve in aircraft production. This translates into economies of scale and hence there is a force on manufacturers to produce many aircraft and have a high capacity. The typical break-even point for aircraft production is around 500-600 aircraft.

Third, there are, compared to other industries, relatively long lead-times in adding production capacity. On the one hand, adding production capacity requires for example more jigs, these have to be produced or which takes time. On the other hand, it may also require adding new labor, these have to be trained which also takes time. Our conversations with airlines indicate that airlines notice when production rates go up at aircraft producers because these airlines subsequently experience more quality problems that are the result of less experienced production workers.

Fourth, there are significant exit barriers. This industry uses rather specific skill sets and equipment combined with huge investments which make it very hard to exit the industry other than by bankruptcy. As a consequence, capacity is not easily removed from the industry. For example, even though Fokker and Fairchild Dornier both went bankrupt, their products are either still produced (328Jet) or there are plans for continued production (728Jet and Fokker 70 and 100).

Fifth, in contrast with Porter (1980) it is a small number of firms that leads to overcapacity. The problem is related to the break-even point of 500-600 aircraft. Once a manufacturer decides to produce an aircraft it needs to produce a significant number of aircraft to break-even. Table 5 shows that expected demand for the next 10 years is around 3200 aircraft. This shows that the required capacity for a single aircraft is a substantial number considering the total demand for aircraft and it also has a big impact on actions and reactions from the few competitors. This aspect is also illustrated by the numerous announcements of aircraft manufacturers for new aircraft types. Many of these programs are never carried out to fruition, for example the 428Jet, 928Jet, Fokker 130, BRJ-X.

Sixth, there are often political motives for indigenous aircraft production. Consequently, nations build up aircraft production capacity that might not have happened under strict free market principles, especially for start-up or relatively new or not yet established companies in the market. Examples are IAe from Indonesia, AVIC from China and the Sukhoi led RRJ. Eight, there are political motives for employment which may keep aircraft capacity in place much longer than would be warranted by free market principles. Since the number of people involved in aircraft production is high, the loss of employment by terminating an aircraft program or reducing production rates can be high. For example, during the downturn in the early 2000s, Boeing cut its workforce by more than 35,000 jobs (Daniel, 2003). With these types of job cuts, there is a lot of pressure to keep producing. For countries with more restrictive labor laws than in the US, it may also be more difficult to lay-off people.

Seventh, and in addition to Porter (1980), this industry is characterized by high technology investments. Not being able to offer the latest technologies and/or products can easily lead to bankruptcy. In combination with this, it makes it hard to forecast the market and the potential companies in the market. In other words, each individual company can not easily make decisions based on whether other companies are already active in the market or planning to be active in the market because in a few years time these companies may not exist any more.

Eigth, also in addition to Porter (1980) the life of aircraft programs complicate matters. Aircraft typically fly for 20 or more years. Due to this, it is difficult for aircraft manufacturers to keep their research and design departments active. This drives the search for new markets and new aircraft types or derivatives which leads to overcapacity.

Ninth, forecasting is difficult. In the regional jet market, in the last 10 years there was considerable growth leading to capacity investments from a number of companies. This growth was partly due to the fact that it was a new market, i.e. the demand for regional jets was caused by airlines replacing their turboprop aircraft with jets. However, the market has caught up with this trend and growth has slowed down leading to recently revised forecasts from the manufacturers. Regional jet sales patterns are now likely to show similar cyclical behavior as large aircraft sales.

All in all, one of the key elements that causes overcapacity is that the capacity for aircraft production is rather inflexible. A high capacity is needed in order to break-even but a lot of the tools for aircraft production are specific to a specific aircraft. Hence, an aircraft manufacturer does not have a lot of flexibility in times of low demand to move resources around aside from the fact that producers typically only produce a few aircraft types. Once an aircraft manufacturer has made the decision to produce, it is pretty much stuck with the decision and overcapacity is a continuous threat. Each of the limited number of producers is therefore stuck with a type of prisoner dilemma. If all of them develop new aircraft, they are likely to have loss making operations because they do not reach the break-even point. If none of them develop new aircraft, they are missing out on market opportunities. But if only one producer designs a new aircraft, it will probably be able to take advantage and have high profits. The prisoner dilemma is confounded because companies can not be sure who will be involved in the industry in the medium to long term.

CONCLUSIONS

In this paper we studied regional aircraft manufacturing. This industry is currently characterized by having two major companies; Bombardier and Embraer, but a number of other companies are in the process of getting involved in producing aircraft also leading to a potential problem of overcapacity in the industry. The theory on capacity decisions shows that most common theories implicitly assume that there is either growth in demand or that manufacturers are flexible in using their capacity. Theories on overcapacity show that some causes for overcapacity are known but solutions on dealing with overcapacity, other than preemptive strategies, are not provided. Our analysis shows that regional aircraft manufacturers are continuously faced with overcapacity threats due to industry characteristics such as high break-even point, long lead-times, and inflexible manufacturing systems. We conclude that regional aircraft manufacturers are faced with a type of prisoner dilemma and that once the decision has been made to develop a new aircraft type, the aircraft manufacturers do not have many options to adjust their capacity strategy.

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