

## The Global Aircraft Manufacturing Industry

### Extract 1: China's Entry into Aircraft Manufacturing

The Chinese government is looking to target the fast-growing global market of single-aisle aircraft with the C919. China has set its sights on commercial aircraft manufacturing - a sector that has arguably more hurdles and stumbling blocks than any other.

The state-owned Commercial Aircraft Corporation of China (Comac) is the one tasked with helping Beijing break into the sector. Comac is up against one of the world's strongest duopolies of Boeing and Airbus. Set up in 2008, the firm is betting on its C919 aircraft – a single-aisle plane that can seat up to 156 passengers - to be its launch pad. It is priced competitively at US\$68 million each. The company is targeting the market for 100 to 200-seat single-aisle planes which is forecasted to be worth a lucrative US\$20 trillion over the next 20 years. So far all of 400 Comac's orders have been from China.

However, Comac is up against stiff competition. The sector is dominated by Airbus A320 with more than 6,000 built and Boeing 737, with 8,000 already in service. The price of an Airbus A320 is at a whopping US\$93.9 million while the Boeing 737 is at a slightly lower US\$84.4 million.

"The barriers to entry in commercial aircraft manufacturing are extremely high, and they are not just technological. When it comes to aircraft manufacturing, perception is everything." says Richard Bitzinger, a senior fellow at Singapore's S. Rajaratnam School of International Studies. Perhaps an even bigger hurdle is winning the trust and loyalty of airlines that it can build a reliable and safe plane, not least because hundreds of lives are at stake every time a plane is airborne. Planes are highly complex machines. Thousands of parts need to be fitted and integrated together for them to function properly and any faults can create serious problems. This is where, analysts say, China's reputation over safety issues may prove to be a stumbling block.

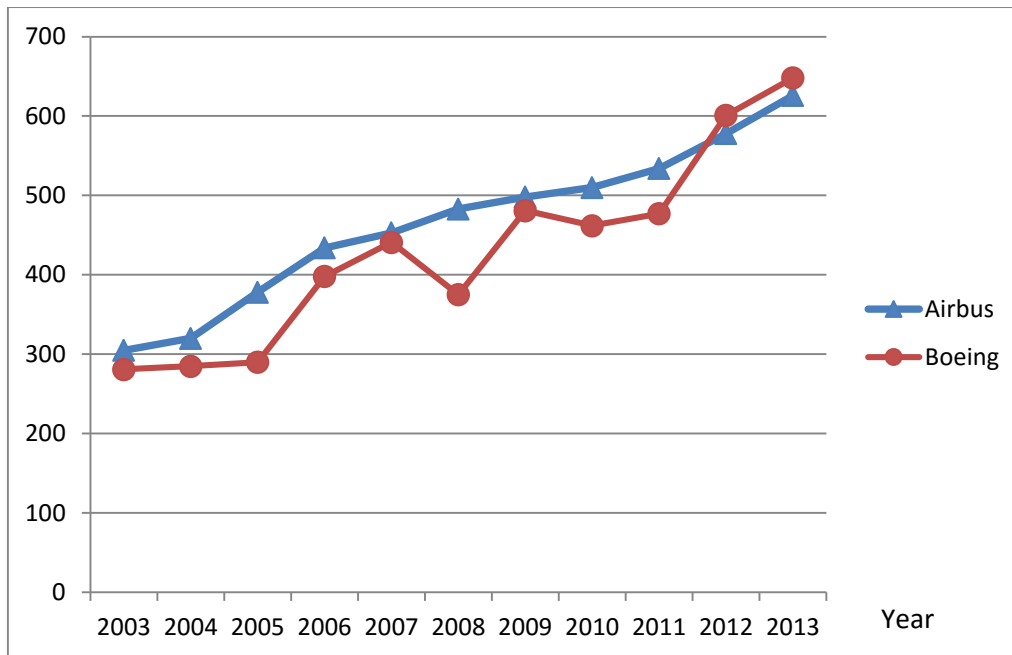
Source: Adapted from BBC News 10 Feb 2014

**Table 1: Market Share (in %) of Global Wide-Body Aircraft Capacity, 2012**

Aircraft Manufacturer	%
Boeing	57.6
Airbus	37.5
Others	4.9

Source:innovata.com

**Figure 1: Total Deliveries of Aircraft by Manufacturer, 2003-2013 (Units)**



Source: Boeing and Airbus websites

### Extract 2: Boeing Overtakes Airbus as Problems Gather

Boeing reclaimed the title of world's biggest aircraft maker, overtaking European arch rival Airbus, even as it grapples with its most serious crisis in years.

But the grounding of its Boeing 787 Dreamliners could deal a serious blow to its prospects, particularly if the U.S. investigation into a problem with its battery reveals flaws in the design of the lightweight, carbon-composite aircraft. The Dreamliner's batteries are energy efficient, light and compact, but they generate a lot of heat.

In recent years, aircraft manufacturers have been trying to find ways for more fuel efficient planes as airlines' profit margins are squeezed by high oil prices and the weak global economy. Experts said Boeing would need to move quickly to contain any loss of confidence in its aircraft but that there could be broader anxiety among airlines about the shift to new and unproven technologies.

Any cost increase due to Boeing's problems with the Dreamliner would be painful. Union Bank of Switzerland (UBS) already expects Airbus to lose up to 700 million euros on the new Airbus A350 in 2014 as production costs exceed launch prices. This spells trouble for the two manufacturers which are considering either slashing their budgets on the R&D for the new generation of aircrafts or abandoning their new projects altogether.

Source: Adapted from CNN Money 17 January 2013

### Extract 3: Labour cost issues for Boeing

For the past five years, Boeing's profits had been increasing. With the notable exception of the recession in 2009, Boeing had been running profits in region of US\$500 million per quarter, hitting a high of US\$1.23 billion in the fourth quarter of 2013.

Current work arrangements has made Boeing's employees in Washington state one of the best paid workers in the manufacturing sector in USA and one that also carries much prestige. With a big pay check and comfy retirement plan, it is no wonder that the Boeing management has reported a lack of initiative and productivity amongst its workers in its Washington plants, even when they are regarded as a skilled workforce.

Recognising the labour cost issues surrounding its Washington operations, Boeing opened its South Carolina plants to build its new generation aircrafts in 2008 where operating costs was

cut by 30% through lower facilities and labour cost. However, lower productivity and the ability to staff sufficient skilled manpower were challenges.

Most analysts agree that Boeing is able to achieve healthy profits due to the strong demand for its goods rather than its ability to contain cost and deliver value-for-money products.

Source: various

### Questions

- (a) Compare the trend in total aircraft deliveries by Boeing and Airbus from 2003 to 2013. [2]
- (b) Explain two possible internal economies of scale that can be reaped by Boeing. [4]
- (c) With the aid of a diagram, explain the change in profits for Boeing when there is an entry of a competitor such as Comac. [3]
- (d) (i) Distinguish between fixed and variable cost. [2]  
(ii) Explain whether an investment in fuel efficient planes will change the pricing of an airline. [3]
- (e) With reference to the data, assess if the market for aircraft manufacturing would become more competitive. [6]
- (f) Discuss how market dominance might affect efficiency in the aircraft manufacturing industry. [10]

**[Total:30]**

**Suggested Answers and Examiner's Comments**

<p><b>(a)</b></p>	<p><b>Compare the trend in total aircraft deliveries by Boeing and Airbus from 2003 to 2013.</b></p> <p>Both <b>increasing</b> from 2003 to 2013. [1m]</p> <p>Possible Refinement mark [1m]</p> <p>(a) Airbus had a higher aircraft delivery from 2003 to 2011, but Boeing <b>overtook</b> Airbus since 2012.</p> <p>(b) Generally, Airbus had a higher aircraft deliveries than Boeing</p> <p>(c) The percentage increase of Boeing delivery (about 130%) is higher than Airbus (about 110%)</p> <p>(d) Airbus had a steady increase from 2003 to 2013 but Boeing had a fall in deliveries from 2007 to 2008.</p> <p><b>Note: We will not accept fluctuations and volatility.</b></p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><i>Markers Comments:</i></p> <ul style="list-style-type: none"> <li>• <i>Most candidates are able to obtain the first mark on increasing trend, while the refinement mark was a hit-and-miss affair. A large number pointed out to a volatile trend. A possible reason for this is due to the recent data response question in tutorial comparing EU price for sugar and world price – the former was very stable while the latter was indeed very volatile.</i></li> <li>• <i>Most failed to take the hint in Extract “Boeing overtakes Airbus” as the possible answer for this question but this is not that crucial as there are many points examiners accepted for refinement.</i></li> </ul> </div>	<p><b>[2]</b></p>
<p><b>(b)</b></p>	<p><b>Explain two possible internal economies of scale that can be reaped by Boeing.</b></p> <p><b>Define internal EOS: Cost savings leading to a fall in unit costs when firm increases output by having larger scale of production.</b></p> <p><b>Technical Economies –</b>  Specialisation and Division of Labour: There will be greater <b>scope</b> for specialization in the Assembly of aircraft such as in the assembling of different parts (e.g. each department is responsible for wings, cockpit or flight instrumentations) which enables workers to specialize leading to improved productivity and reduced unit cost due to the reduced need to switch between jobs. <i>Evidence: Extract 1, para 1, ‘Thousands of parts need to be fitted and integrated together for them to function proper’.</i></p> <p><b>Research and Development –</b>Boeing can invest in technology that improves fuel efficiency, safety and aerodynamics as they can spread R &amp; D costs over a large output to achieve lower per unit cost. Smaller firms may not be cost efficient to pursue these activities.</p> <p><b>Note: Students are required to elaborate on one of the two points above and not both.</b></p> <p><b>Non-technical economies</b></p> <p><b>Marketing economies –</b> bulk purchasing of parts such as glass, fibreglass, seats. Boeing is buying in bulk since it manufactures a large quantity of planes, and hence can bargain for lower prices per unit and thus leading to a fall in unit cost.</p>	<p><b>[4]</b></p>

**Financial EOS:** Boeing, being large and thus have more collateral, can borrow money at lower interest rates from banks.

Any other acceptable EOS

**Note: At least one of the EOS must be related to aircraft manufacturing to obtain 4 marks.**

If both EOS are generic and no reference to the context, max 2m.

*Markers Comments:*

- Most candidates were unable to give applications relating to the context but instead opt to reproduce information from the lecture notes.
- Some lack accuracy for failed to bring in fall in unit cost or/and due to increase in scale of production.
- Some gave two types of technical EOS instead of two different categories.

(c) With the aid of a diagram, explain the change in profits for Boeing when there is an entry of a competitor such as Comac. [3]

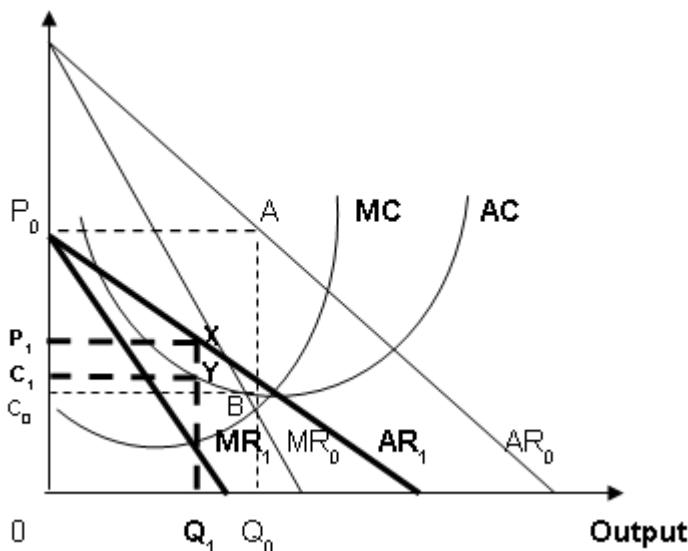
The entry of a new competitor would compete away some demand from Boeing since they are considered as substitutes – in fact Comac serves as a cheaper alternatives – 400 are sold. [1m]

**Note: Just recognition that new competitor denotes a fall in demand is insufficient to earn the 1 mark. It's a must to bring in the concept of substitutes.**

Diagram of AR/MR shifts to the left. Supernormal profit decreases to a smaller supernormal profit. No change in cost curves.[1m] The shift can be parallel or non-parallel shift. The effect of AR curve becoming flatter/more elastic not crucial and should not penalized.

**Note: The shift in AR creating subnormal profit is not acceptable in this context.**

Price/Revenue/Cost (\$)



Explanation of the diagram. [1m]

A fall in demand will cause  $AR_0$  and  $MR_0$  to decrease to  $AR_1$  and  $MR_1$  respectively. These resulted in lower output from  $Q_0$  to  $Q_1$ , lower price from  $P_0$  to  $P_1$ . As a result Total Revenue is reduced from  $OP_0AQ_0$  to  $OP_1XQ_1$  and also cost decreased from  $OC_0BQ_0$  to  $OC_1YQ_1$ . Since the decrease in TR is more than TC, supernormal profit decreases from  $P_0C_0BA$  to  $P_1C_1YX$ .

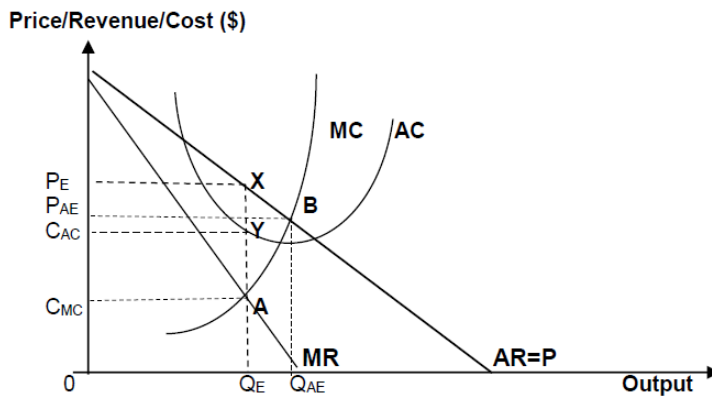
	<p><i>[If student were to give a subnormal profit diagram and explanation, award only 1 mark for the explanation but <b>not</b> the diagram as with a competitor like Comac, the demand for Boeing should not fall by a large extent.]</i></p> <div data-bbox="236 360 1469 607" style="border: 1px solid black; padding: 5px;"> <p><i>Markers Comments:</i></p> <ul style="list-style-type: none"> <li>• <i>Generally, the quality of the diagram drawn was commendable. Most were able to produce a correct diagram with appropriate labeling and explanations.</i></li> <li>• <i>There were some candidates that failed to explain the economic reasoning for the decrease in demand. They stated the decrease without further explanations.</i></li> <li>• <i>Some candidates explained subnormal profits, which is incorrect given the case information.</i></li> </ul> </div>	
<p><b>(d) (i)</b></p>	<p><b>Distinguish between fixed and variable cost.</b></p>	<p><b>[2]</b></p>
	<p>Fixed cost is incurred when output is zero (or when there is no output) <b>while</b> variable cost is incurred only when production starts and output increases. [1m]  Fixed cost does not vary directly with output <b>whereas</b> variable cost varies directly with output. [1m].</p> <p><b>Note: Full definition but no comparison max 1m. The connecting word such as ‘whereas’ and ‘while’ MUST be inserted to denote a distinguishing command word.</b></p> <div data-bbox="236 1043 1469 1261" style="border: 1px solid black; padding: 5px;"> <p><i>Markers Comments:</i></p> <ul style="list-style-type: none"> <li>• <i>The connecting word was not mentioned and a large number of candidates just ‘explained’ rather than ‘distinguish’ the two costs.</i></li> <li>• <i>A glaring deficiency was the inability of most candidates to define the costs properly even when they were ‘explaining’</i></li> <li>• <i>Providing examples is not equivalent to explanation</i></li> </ul> </div>	
<p><b>(d) (ii)</b></p>	<p><b>Explain whether an investment in fuel efficient planes will change the pricing of an airline.</b></p>	<p><b>[3]</b></p>
	<p>When the fuel efficient planes are purchased, it involved a fixed cost and only average cost (AC) will rise. Marginal cost (MC) which is the additional cost incurred when additional unit of output is produced does not change and there is no change to marginal revenue (MR). Thus, the profit maximization condition does not change and hence the price remains unchanged.</p> <p>When the plane is brought into service, the fuel efficient plane would reduce MC and AC since the use of less fuel would reduce variable cost. The new profit maximization condition would reduce the price, c.p since MC cuts MR at a lower point.</p> <p><b>Note: Any one of the changes in variable or fixed cost – max 2m  Students should bring in the concept of variable and fixed cost and link them correctly to AC and MC.</b></p> <div data-bbox="236 1868 1469 1975" style="border: 1px solid black; padding: 5px;"> <p><i>Markers Comments:</i></p> <ul style="list-style-type: none"> <li>• <i>Most candidates did not realise that d(ii) is related to d(i). Thus the ‘hint’ from d(i) was not fully used to answer d(ii).</i></li> </ul> </div>	

	<ul style="list-style-type: none"> <li>• <i>Most failed to use the framework of changes in AC/MC and profit maximization to arrive at the changes of price.</i></li> <li>• <i>Some also brought in irrelevant information from the extracts such as a weak economy to relate to changes in demand/revenue when the focus of the question was on cost.</i></li> <li>• <i>In essence, the question requirement of d(ii) was not fully understood by most candidates.</i></li> </ul>							
<b>(e)</b>	<b>With reference to the data, assess if the market for aircraft manufacturing would become more competitive.</b>	<b>[6]</b>						
	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Clarify what is meant by becoming more competitive – <b>more firms in the market + market more contestable – barriers to entry are lowered.</b></li> <li>• Define barriers to entry: deterrence to new entrants into the market</li> </ul> <p><b>Body</b></p>							
	<p><b>Thesis: More competitive</b></p> <ul style="list-style-type: none"> <li>• Ext 1, para 2 – Large market with <b>huge supernormal profit</b> (\$20 trillion market a huge market for single-aisle planes). Supernormal profits can attract new firms such as Comac.</li> <li>• Ext 1, para 2 – <b>Government’s backing</b>: Potential entrant’s cost could be financed by the state/government such as in the case of China. Favourable barriers to entry in terms of <b>lower start-up cost</b>. Also, there is some form of guaranteed demand – all 400 orders are from Chinese airlines.</li> <li>• Ext 2, para 2 and 4 – Airlines may <b>lose some brand loyalty</b> to Airbus and Boeing. They may search for other substitutes. ‘Loss of confidence in Boeing aircraft due to technical faults could result in broader anxiety among airlines about the shift to new and unproven technologies’.</li> <li>• Ext 2, para 5 – Boeing and Airbus may be <b>X-inefficient</b>. Both could run into financial problem may not have sufficient funds to be conduct R&amp;D or give up new projects altogether. This may give potential entrants an advantage</li> </ul> <p><b>Anti-thesis: The market may still remain largely a duopoly – no significant competition</b></p> <ul style="list-style-type: none"> <li>• <b>High barriers to entry</b> – high cost of production and perceptions important to prevent entry of significant entrant – Extract 1, last para.</li> <li>• Table 1 – Largely a duopoly with Boeing and Airbus with 95.1%. Market. Other firms would find difficult to penetrate such a market.</li> <li>• Figure 1: Aircraft delivery by Boeing and Airbus had doubled in the last decade.</li> <li>• With such high scale of production, incumbent firms like Boeing and Airbus <b>could</b> lower price to keep out potential competitors (though not likely in the short-run).</li> </ul> <p><b>Conclusion</b></p> <p>In the short run the duopolistic nature of the market would remain largely intact despite their setbacks. In the long run, with a lucrative market, more countries (especially China and other larger countries such as India, Japan and Brazil) may want a piece of a large and growing pie and would set themselves up to enter this market.</p> <table border="1" data-bbox="263 1906 1442 2031"> <thead> <tr> <th>Level</th> <th>Descriptor</th> <th>Marks</th> </tr> </thead> <tbody> <tr> <td>L3</td> <td>Analysis with reference to the case and balanced view with appropriate conclusion.</td> <td>5-6</td> </tr> </tbody> </table>	Level	Descriptor	Marks	L3	Analysis with reference to the case and balanced view with appropriate conclusion.	5-6	
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$BX_{Q_E Q_{AE}}$  while the incremental cost not incurred is  $BA_{Q_E Q_{AE}}$ . And benefits outweigh costs, the society suffers from a welfare loss of  $ABX$  for  $Q_E - Q_{AE}$  of goods not being produced.



**Evaluation:**

Boeing may be able to reap substantial internal EOS, as explained in part b, price can be lower than a perfect competitive situation.

**Note: This is an evaluative comment rather than anti-thesis as it is not about efficiency.**

**2. Complacency and lax control over costs - X-inefficiency will arise - elaborate**

Extract 3 says, "With a big pay check and comfy retirement plan, it is no wonder that the Boeing management has reported a lack of initiative and productivity amongst its workers in its Washington plants"

**Productive efficiency from firm and society's point of view.**

As firms are profit-driven, they have the incentive to operate on LRAC and be productive efficient.

There is evidence that the firms are cost-conscious.

*Extract 3, para 3, Boeing opened its South Carolina plants to build its new generation aircrafts in 2008 where operating costs was cut by 30% through lower facilities and labour cost*

Also, with market dominance, Boeing and Airbus might be operating at a larger scale and this may allow them to reach a production level of output closer to their Minimum efficient scale (MES) of production.

**Evaluation:** It is unlikely for them to be operating beyond the MES, resulting in

diseconomies of scale outweighing the economies of scale as technical EOS is huge for such industry.

**Dynamic efficiency:**

Consumers benefit from continuous product and process innovation if monopolists channelled their profits to do R&D, eg extract 2 “aircraft manufacturers have been trying to find ways for more fuel efficient planes.

*I'll need to rephrase this*

**Synthesis and Conclusion**

Boeing and Airbus, with enormous resources does have its merits such as dynamic efficiency as elaborated above. The government may have to keep a close watch over it to make sure that they will not abuse their monopoly power at the expense of the airlines and the other players in the same market.

Level	Descriptor	Marks
L3	Analysis with excellent reference to the case and balanced view with evaluation. Discussion must include at least 3 efficiency criteria (Allocative, Dynamic and X-inefficiency)	7-8
L2	Adequate discussions on the impact of market dominance of aircraft manufacturers with some substantiation from the data. May not provide evaluation. Discussion includes at least allocative efficiency and a balanced argument (1 point each side) <b>*A well explained answer without any case use will be capped at low L2.</b>	4-6
L1	Descriptive addressing of market dominance without using diagram nor case evidence Lop-sided arguments capped at High Level 1.	1-3
Evaluation		
E2	Conclusion with substantiation	2
E1	Conclusion without substantiation	1

**Markers Comments:**

- Many students drew the diagram to compare the price and output between the monopoly firm and PC market without making clear that it was intended to be a theoretical benchmark.
- Or they went into great details on how there is a transfer of consumer surplus to producers comparing monopoly situation and PC. There is no need for such since the question is on efficiency and not about consumer exploitation.

- |  |  |  |
|--|--|--|
|  | <ul style="list-style-type: none"><li>• <i>In fact, there is no need to compare to a PC situation as students could just explain why a typical oligopolist which is a price setter (downward AR) will always produce <math>MR=MC</math> (MC is rising) and not <math>P=MC</math> so there is always no AE. Once a typical firm has no AE, the industry will not have AE. To compare to a PC situation requires more details to explain why <math>MC_M = \sum MC_{PC} = SS_{PC}</math>.</i></li><li>• <i>Some students explained that the firm's allocative efficiency would improve if it produced at a larger scale and its MC shifts downwards. This is however incorrect, as the gap between P and MC will not be narrowed.</i></li><li>• <i>Allocative efficiency (<math>P=MC</math>) is strictly speaking not socially efficiency (<math>SMB=SMC</math>) – E.g. In a perfect competitive market, there is AE (<math>P=MC</math>) but it may not be socially efficient as there might be presence of externalities.</i></li><li>• <i>Too many scripts showed an obvious lack of case evidence.</i></li></ul> |  |
|--|--|--|