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**Technological collaboration: the
Airbus case**

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1. Introduction



- **The aerospace industry**
- **Airbus – a closer view**
- **Government's hand**
- **Effects of state intervention**
- **Trade friction in the aircraft industry**

2. The aerospace industry



- ...is generally broken down into three product segments “aircraft”, “missiles” and “space”
- ...accounted for 1% of Europe’s GDP and 2% of the GDP in the USA → Boeing is the largest U.S. exporter today
- ...is a strategic industry and its technological innovations spill over to other sectors



- 1920s and 1930s: small and poorly financed producers throughout Europe and the US
- World War II: mass production of aircraft
→ technological advance accelerated
- 1950s: invention of the jet engine → superior performance relative to previous engines, but much larger fixed development costs

- European industry was fragmented with a large number of independent producers (Hawker Siddeley, de Havilland, Sud Aviation...)
- Four big producers in the USA: Boeing, Convair, Douglas and Lockheed
- Economic and geographical reasons helped the US-producer to establish on the market (Douglas with the DC8 and Boeing with the 707)
- European industry was a victim of small national markets and fragmented supply

- Convair left the market
 - Boeing and Douglas diversified their portfolio with smaller planes (727/737 and the DC9, respectively)
 - Financial difficulties: Douglas merged with McDonnell (MDD)
 - European producers disappeared
- Risen costs led to consolidation in the industry
- Governmental support became important

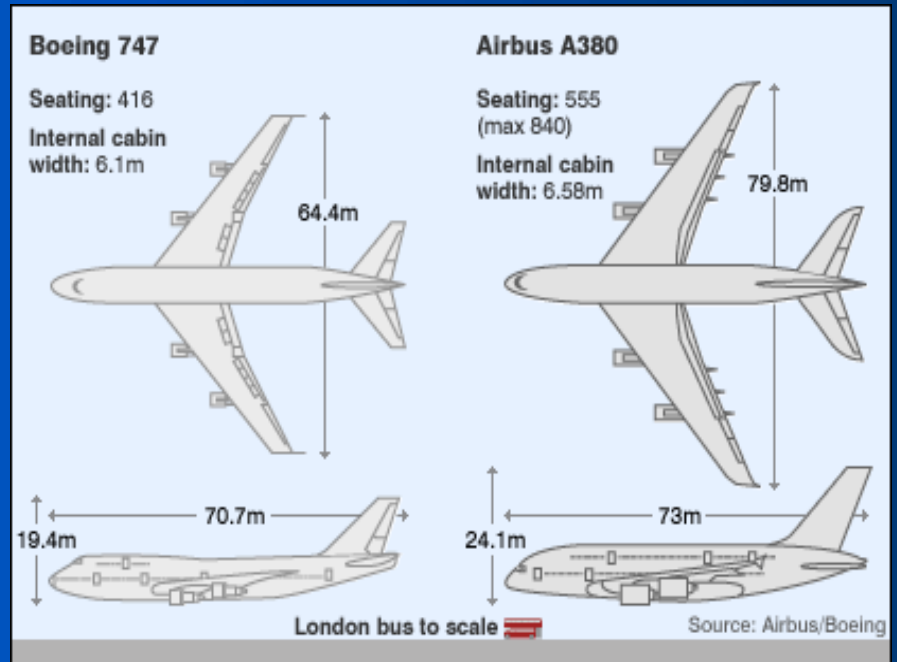
- New development in engine technology: the turbo-fan technology
- MDD and Lockheed designed similar jets
→ Lockheed incurred substantial losses and left the market by the end of the 1970s
- Boeing leapfrogged this competition with a larger aeroplane (the 747)
- Airbus entered the market with the A300/A310
- a “hole in the sky“ and the oil price crisis helped Airbus to gain market shares; Boeing responded with the 757/767

- Deregulations and boom in air transport: demand for a short- to medium-range aircraft → Airbus first mover with the innovative A320, Boeing and MDD produced derivatives of existing aircrafts
- Airbus developed the A330/A340 as a result of the inefficient use of the Boeing 747 → Boeing designed the 777 two years later
- MDD in financial troubles
- 1997: Merger between MDD and Boeing

The latest Airbus project



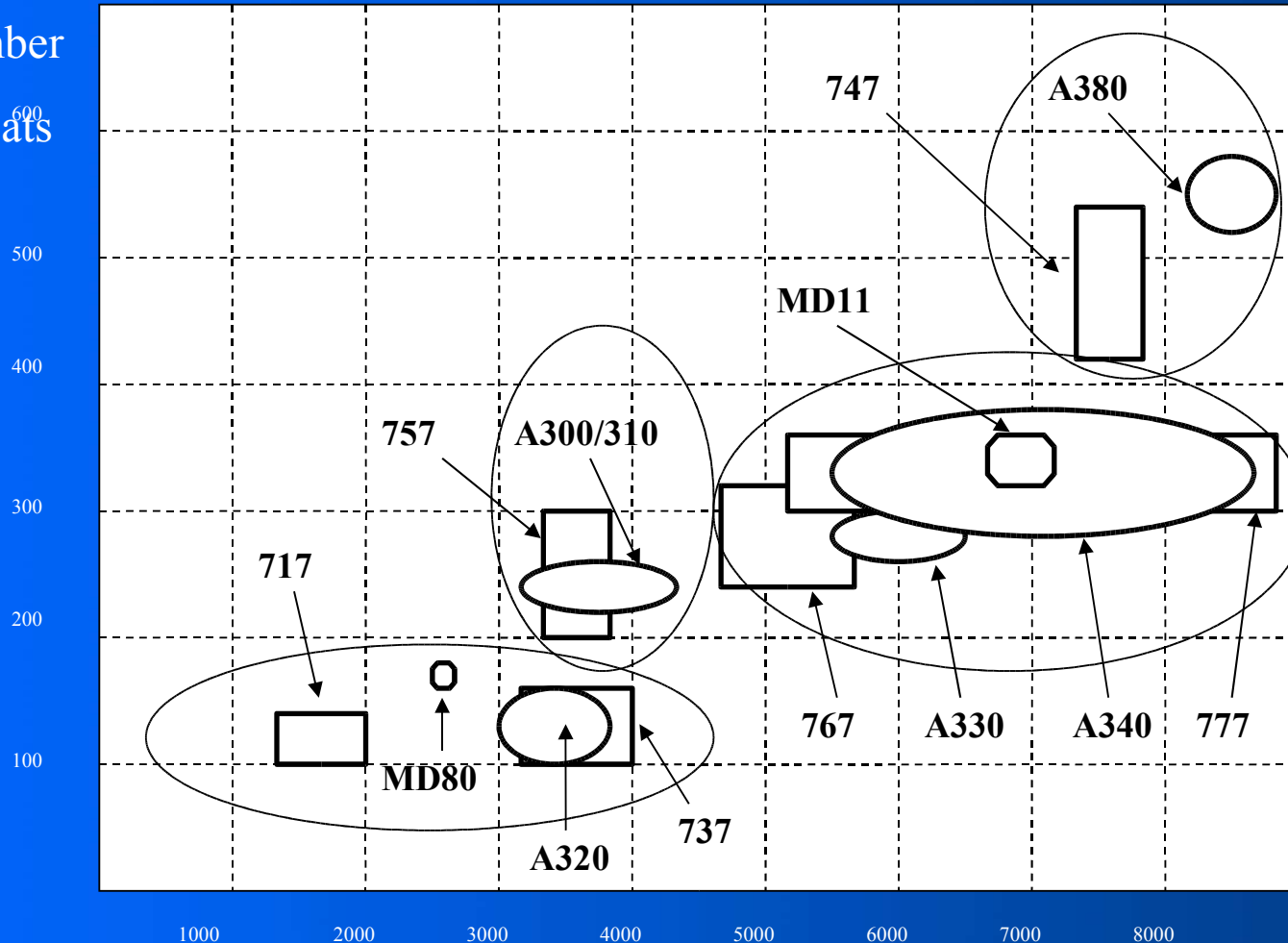
The A380



Main product developments

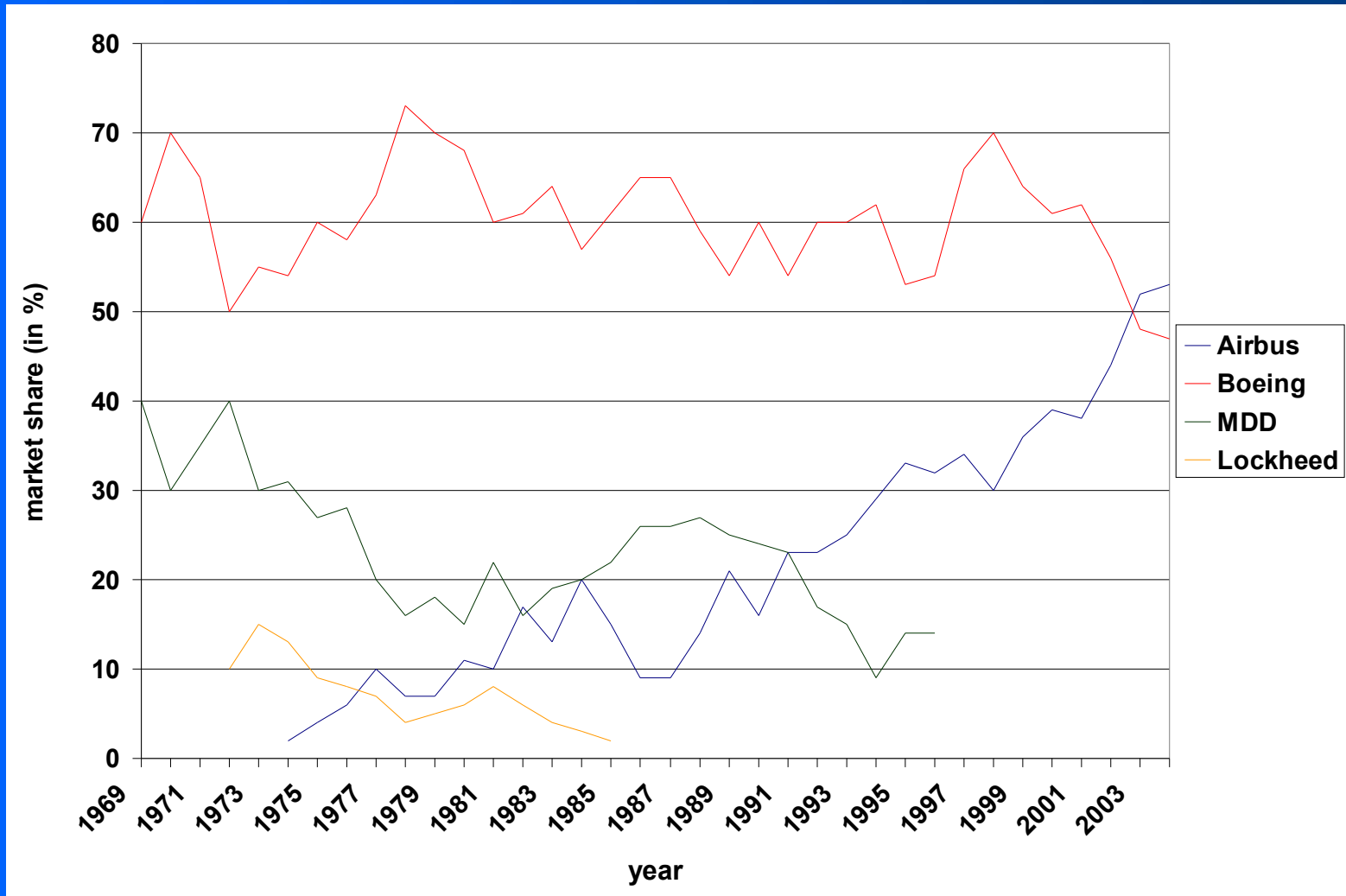


Number
of seats



Range (nautical miles)

Firm market shares



Factors that lead to a concentrated industry:

- Airframe Technology
- Cost Structure → Scale and scope economies
- Product Differentiation and Launch Risk

3. Airbus – a closer view



Reasons for European collaboration:

- American market dominance
- Limited domestic markets
- Undercapitalization
- Poor marketing

→ only option for European governments: Pooling resources together

- 1967: Memorandum of Understanding signed by the British, French and German governments → each country designated a national contractor
- 1970: Formation of Airbus Industrie as a Groupement d'Intérêt Economique (GIE)
 - unlimited partnership
 - no capital of its own, profits and losses flow through the partners

- Members: Aerospatiale (France; 37.9% ownership), Deutsche Airbus (Germany; 37.9%), British Aerospace (GB; 20%), CASA (Spain; 4.2%)
- Financing, R&D and production: matter of the members → individual work shares result of extensive negotiations
- Public face of Airbus: Airbus Industrie, based in Toulouse → coordination, management and marketing

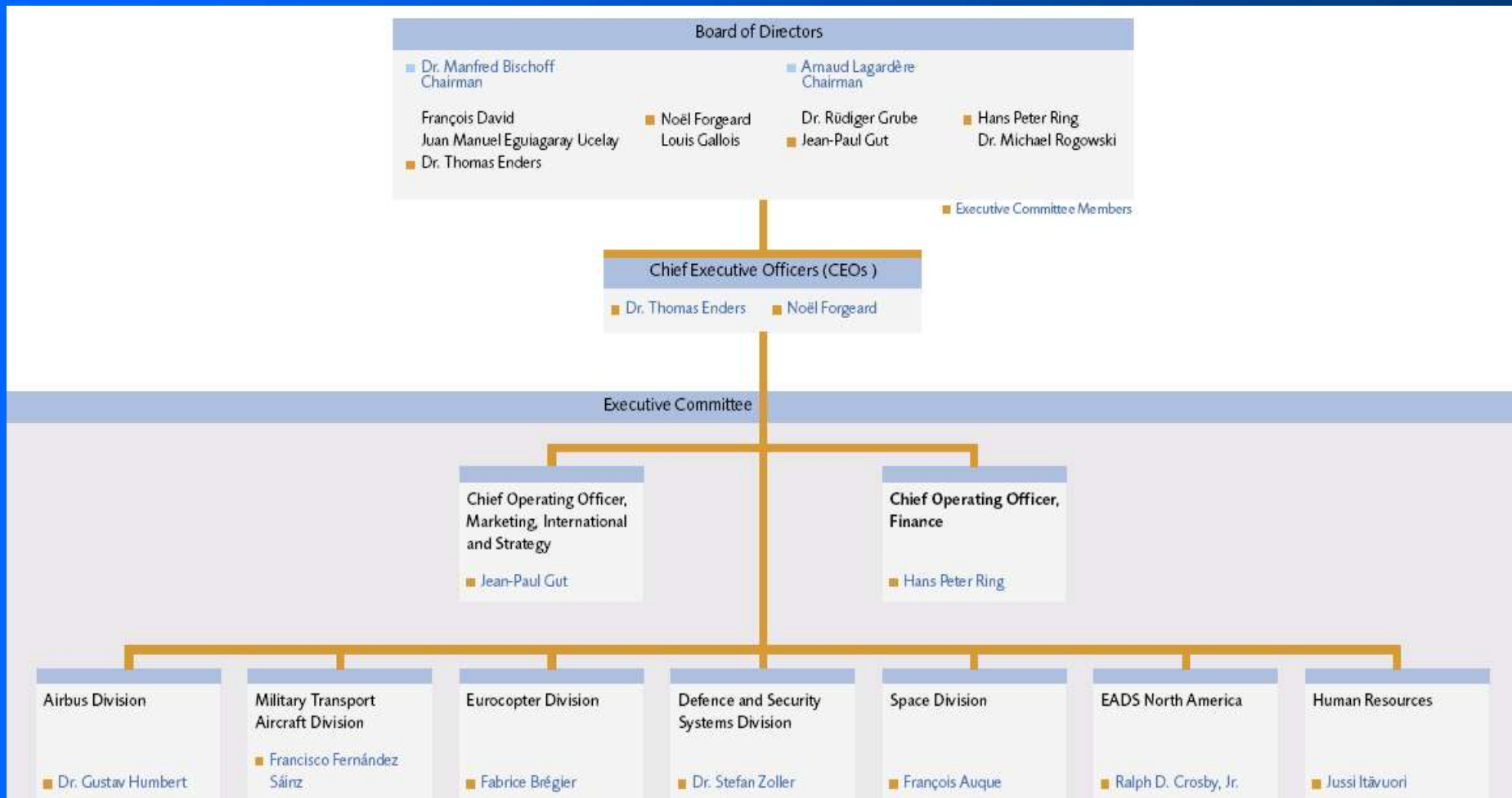
Challenges for the members: share costs and technical skills \leftrightarrow pursue own individual and national interests

→ the unique structure led to not share innovations, because...

- ...outside Airbus the members are competitors
- ...each firm may attempt to increase its own profitability at the expense of its partners

Costs: 10% of the turnover

2000: Merger to the European Aeronautic and Space Company (EADS) with Airbus as an Integrated Company (EADS 80% ownership and BAE 20%)



4. Government's hand



Airbus funding:

- Matter for the individual members
- Members depend on different national attitudes towards state aid

Reasons for state intervention:

- Political → prestige
- Technological → growth theory

Launch aids:

- Loans by European governments
- Individual repayment conditions
- Payback periods and interest charged bear little resemblance to open market loans

Aircraft	France	Germany	UK	Total
A300/310	988	1,490	83	2,561
A320/321	755	790	394	1,939
A330/340	876	1,581	746	3,203
Total	2,620	3,860	1,223	7,703

European Government launch aids for Airbus (\$ millions)

- Beside launch aids: equity infusions, non-program-specific operating loans, R&D funding and production subsidies
- Estimations: Total support exceeded \$13.5 billion (until the early 1990s) → actual numbers difficult to obtain as Airbus didn't publish its financial statements

Support	France	Germany	UK	Total
Launch aids	2,620	3,860	1,223	7,703
Other supports	1,035	3,909	884	5,829
Total	3,655	7,770	2,107	13,532

Total Government support (\$ millions)

Main instrument of European technology policy: The Framework Programmes (FP)

The FP...

- ...are funding programmes created by the EU in the late 1970s
- ...should help to improve Europe's competitiveness
- ...and its detailed objectives and actions vary from one funding period to another
- ...are now in the sixth period

Airbus funding through the FP:

- R&D support for the aerospace industry through FP II-V
→ Airbus main beneficiary
- 50-75% of the upcoming R&D-costs

FP	2.	3.	4.	5.	1990 until 2002
Volume aerospace industry	66	110	400	700	1,276
Total	5,396	6,600	13,100	16,300	41,396
Proportion aerospace industry (in %)	1.2	1.7	4.3	4.3	3.1
Growth rate aerospace industry (in %)		67	264	75	

Airbus funding through the FP (€ millions)

5. Effects of state intervention



The effects of state intervention in the commercial aircraft industry can be illustrated by the strategic trade policy

The strategic trade policy...

- ...refers to trade policy that affects the outcome of strategic interactions between firms in an actual or potential oligopoly
- ...is based on the idea that trade policies can raise domestic welfare by shifting profits from foreign to domestic firms

Instruments: Export subsidies, import tariffs and subsidies to R&D

Suppose that...

- ...only two firms, America's Boeing and Europe's Airbus, are capable of producing a certain kind of passenger aircraft
- ...the aircrafts are all exported to a third country → each country's benefit = profit earned by each country's firm – cost of any subsidy
- ...the third-country market is profitable if there's only one producer
- ...both firms would make losses if they both enter and must share the market
- ...the European government is considering whether to subsidize the entry of Airbus

Numerical examples

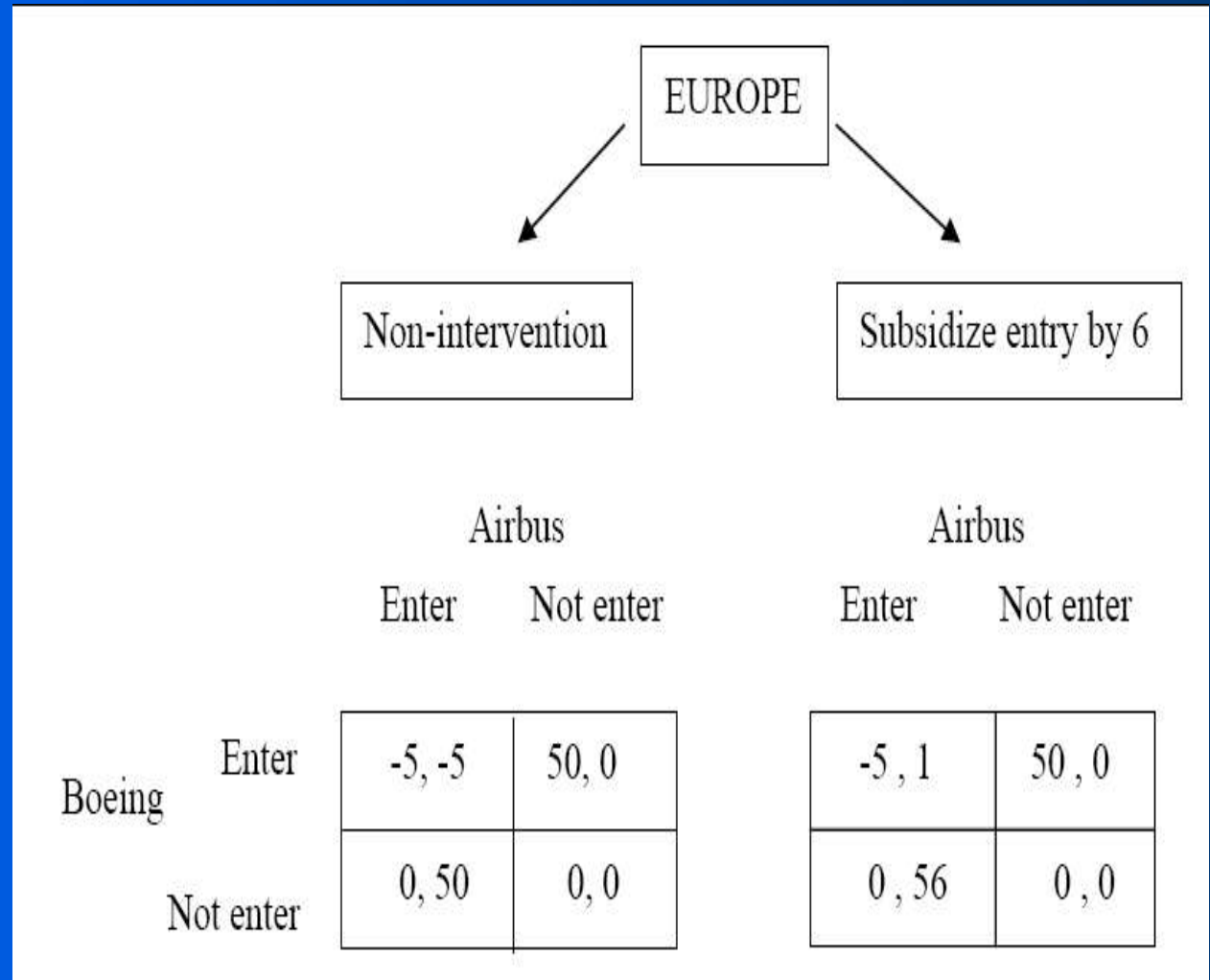


Non-intervention:

- Outcome of the game is indeterminate

Subsidize entry:

- Outcome of the game is a Nash equilibrium in which Airbus enters and Boeing does not



- Europe is made better off by the subsidy
→ Airbus earns 56, but Europe's payoff is reduced by 6 due to the cost of the subsidy to taxpayers
→ if there's a 50% chance that Airbus would have captured the market in absence of intervention, the expected gain to Europe is 25 from intervention
- Strategic trade policy requires that the governments have the ability to commit to policy → government policy must be 'credible'

Intervention by both governments



In a non-cooperative one-shot game in which countries move simultaneously:

- Dominant strategy for each country is to subsidize (with a payoff of 10 each)
- Both countries would be better off if they could cooperate as to achieve the higher payoff of 25

		EUROPE	
		Subsidy	No Subsidy
AMERICA	Subsidy	10, 10*	35, 5
	No subsidy	5, 35	25, 25

- Prisoner's Dilemma
- Solution: Negotiations

Empirical studies



Study	Model	Aircraft prices	US			EU			Rest of the world
			Consumer surplus	Producer surplus	Overall welfare	Consumer surplus	Producer surplus	Overall welfare	Overall welfare
Baldwin and Krugman	Competition between the A300 and the Boeing 767	40% lower	higher	lower	lower	ambiguous	ambiguous	ambiguous	higher
Klepper	Extension of Baldwin and Krugman's model -->small, medium and large aircrafts	lower	higher	lower	lower	higher	higher	higher	lower
Neven and Seabright	Extension of Klepper's model -->presence of a third producer	lower	higher	lower	lower	higher	higher	higher	lower

→ other effects like labor-market and innovation effects are neglected

→ if these effects are added to the picture, even the American economy profits

6. Trade friction in the aircraft industry



The controversy over subsidies:

Airbus → \$13.5 billion direct subsidies (launch aids...)

VS.

Boeing → \$18 to \$22 billion indirect subsidies through NASA and the Department of Defense

The 1979 GATT Agreement on Civil Aircraft



The Tokyo round...

- ...was successfully in liberalizing trade
- ...was the first attempt to put the subsidy issue to rest

but...

- ...used compromise language
- ...left space for various interpretations

Article 6

Government Support, Export Credits, and Aircraft Marketing

- 6.1 Signatories note that the provisions of the Agreement on Interpretation and Application of Articles VI, XVI and XXIII of the General Agreement on Tariffs and Trade (Agreement on Subsidies and Countervailing Measures) apply to trade in civil aircraft. They affirm that in their participation in, or support of, civil aircraft programmes they shall seek to avoid adverse effects on trade in civil aircraft in the sense of Articles 8.3 and 8.4 of the Agreement on Subsidies and Countervailing Measures. They also shall take into account the special factors which apply in the aircraft sector, in particular the widespread governmental support in this area, their international economic interests, and the desire of producers of all Signatories to participate in the expansion of the world civil aircraft market.
- 6.2 Signatories agree that pricing of civil aircraft should be based on a reasonable expectation of recoupment of all costs, including non-recurring programme costs, identifiable and pro-rated costs of military research and development on aircraft, components, and systems that are subsequently applied to the production of such civil aircraft, average production costs, and financial costs.

The 1992 US-EU agreement on trade in civil aircrafts...

- ...prohibits the use of production subsidies
- ...limits the direct subsidies (launch aids) to 33% of the development costs
- ...limits the indirect subsidies to 4% of the firm's commercial sales
- ...establishes procedures to monitor the implementation on the agreement

- The commercial aircraft industry is an important sector with lots of particularities
 - Airbus is unique in uniting the three major European aerospace nations
 - Airbus' success can be ascribed to government assistance as illustrated with the strategic trade policy
- Airbus a successful example of European collaboration, but hard to translate into other industry sectors