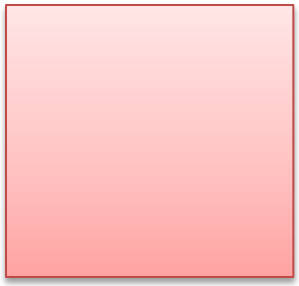
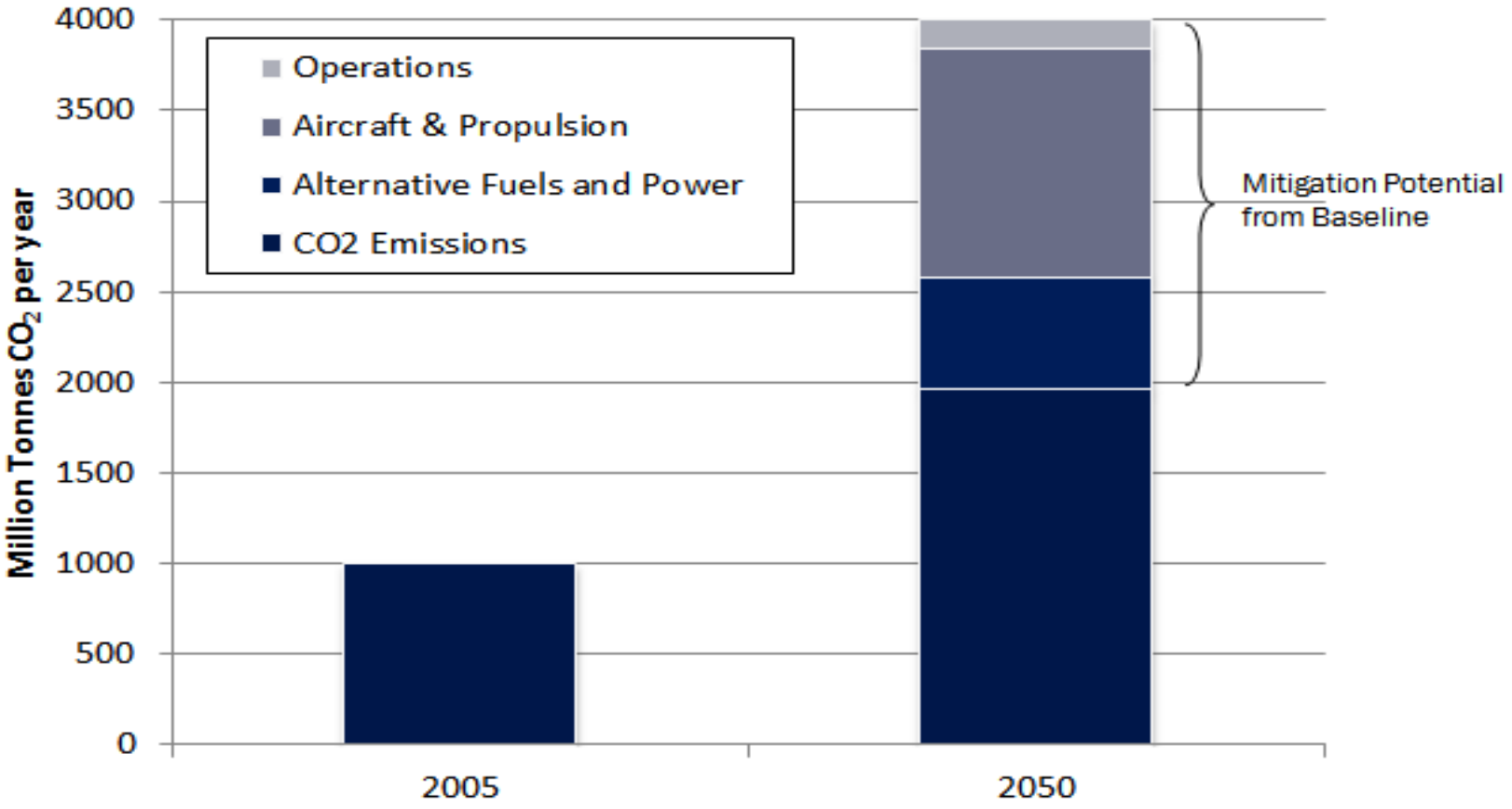


Will the EU ETS affect the competitiveness between EU and Non-EU airlines?

15th Global Conference on Environmental Taxation, September 2014, Copenhagen

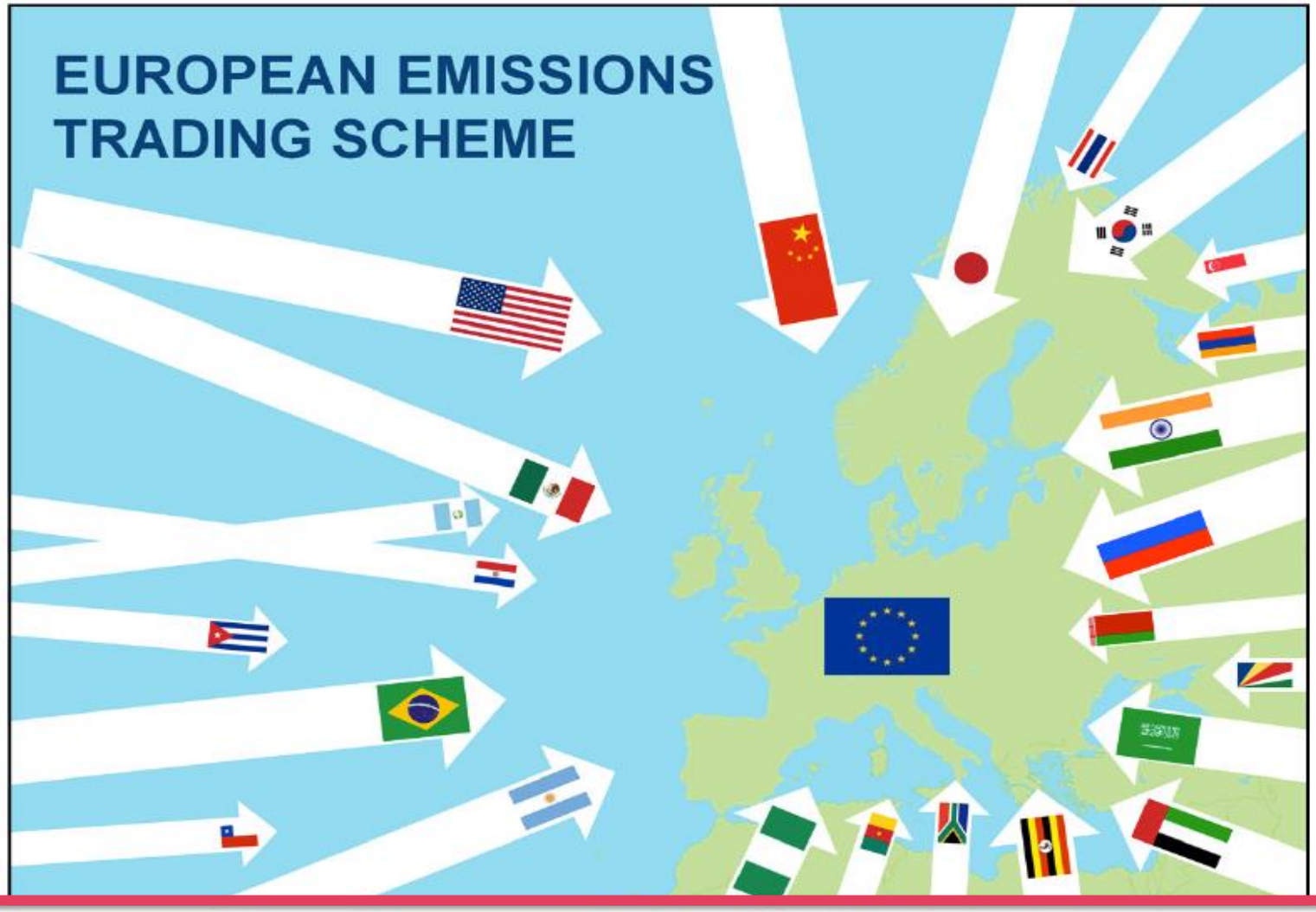
Xuebing Wang & Antony Evans

The necessary of aircraft emissions abatement



(Source: IATA & ICAO)

The inclusion of aviation into EU ETS



Kyoto Pro

ICA

1997

spension

013

Assembly

g year

Aviation emissions trading within the EU ETS

Key features of new proposal to revise the ETS:

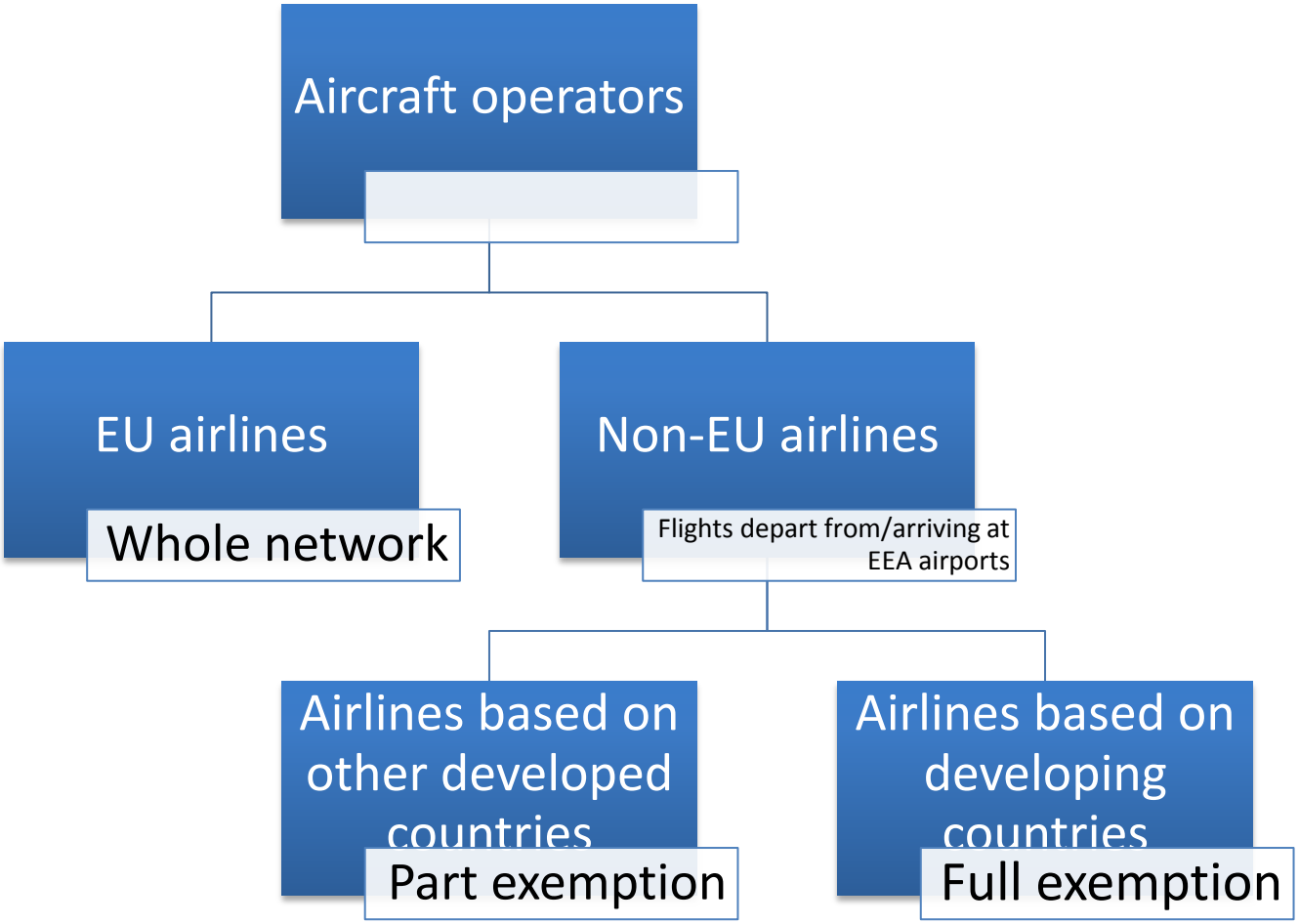
1) flights between EEA (European Economic Area, 28 EU countries plus Norway and Iceland) continue to be covered,

2) a general exemption,

3) special circumstances of developing countries.

(MEMO/13/1906, 2013)

Airline competition



Airline competition

Airlines compete for passengers and market share on:

- Frequency of service and departure schedule on each route served
- Price charged, relative to other airlines, to the extent that regulation allows for price competition
- Quality of service and products offered—airport and in-flight service amenities and/or restrictions on discount fare products

Passengers choose combination of flight schedules, prices and product quality that minimises disutility of air travel:

- Each passenger would like to have the best service on a flight that departs at the most convenient time, for the lowest price

Air transport demand simulation—AIM model

- Apply a simple one-equation gravity model

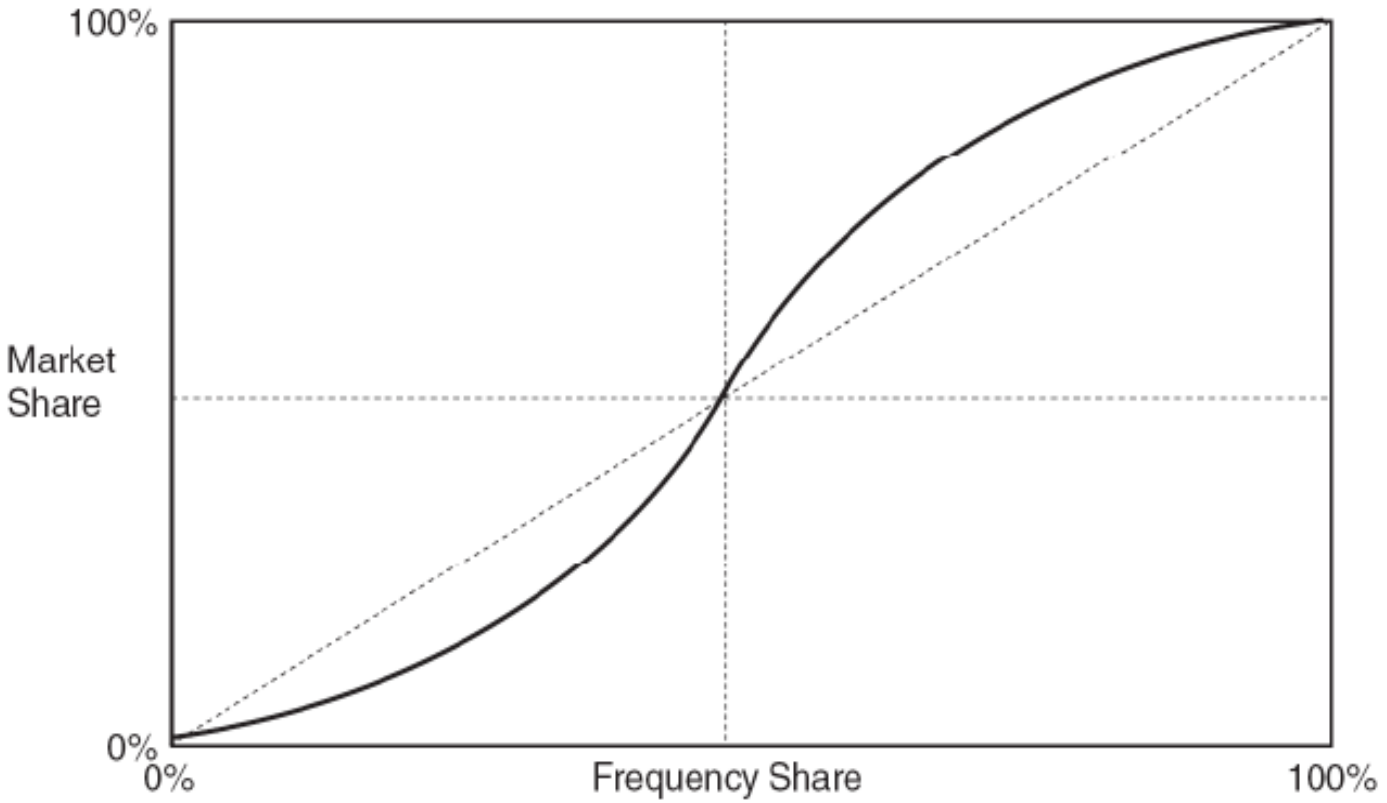
  Function of income (I), population (P), airfare (F), travel time (TT), flight delays, special city characteristics (A, B), road/high speed rail links (S, R), domestic/international (DF)

$$D_{ij} = K \cdot (I_i I_j)^{\alpha} \cdot (P_i P_j)^{\beta} \cdot e^{\delta A_{ij}} \cdot e^{\varepsilon B_{ij}} \cdot e^{\varphi S_{ij}} \cdot e^{\omega DF_{ij}} \cdot e^{\mu R_{ij}} \cdot (F_{ij} + VoT \cdot TT_{ij})^{\tau}$$

- Estimates explanatory variables using available data separately for short-, medium-, and long-haul, and for different world regions

Market share/frequency share

- S-curve relationship between market share and frequency share
- Higher frequency shares associated with disproportionately higher market shares



S-curve model formulation

$$MS_i = \frac{FS_i^{\alpha}}{\sum_{j=1}^{n} FS_j^{\alpha}} \quad (1)$$

Where, MS_i is the market share of airline i
FS_i is the frequency share of airline i
n, is the number of competing airlines
$\alpha \geq 1$, is the model's paramentre

(Simpson, 1970; Belobaba, 2009a)

S-curve model formulation

The overall optimisation model is as follow

$$maximise \sum_{s \in S_a} p_{as} Q_{as} - C_{as} f_{as} \quad (2)$$

Subject to:

$$Q_{as} \leq \frac{{f_{as}}^{\alpha_s}}{\sum_{a' \in A_s} {f_{a's}}^{\alpha_s}} M_s \; \forall s \in S_a \quad (3)$$

$$Q_{as} \leq LF_{max} S_{as} f_{as} \; \forall s \in S_a \; \forall s \in S_a \quad (4)$$

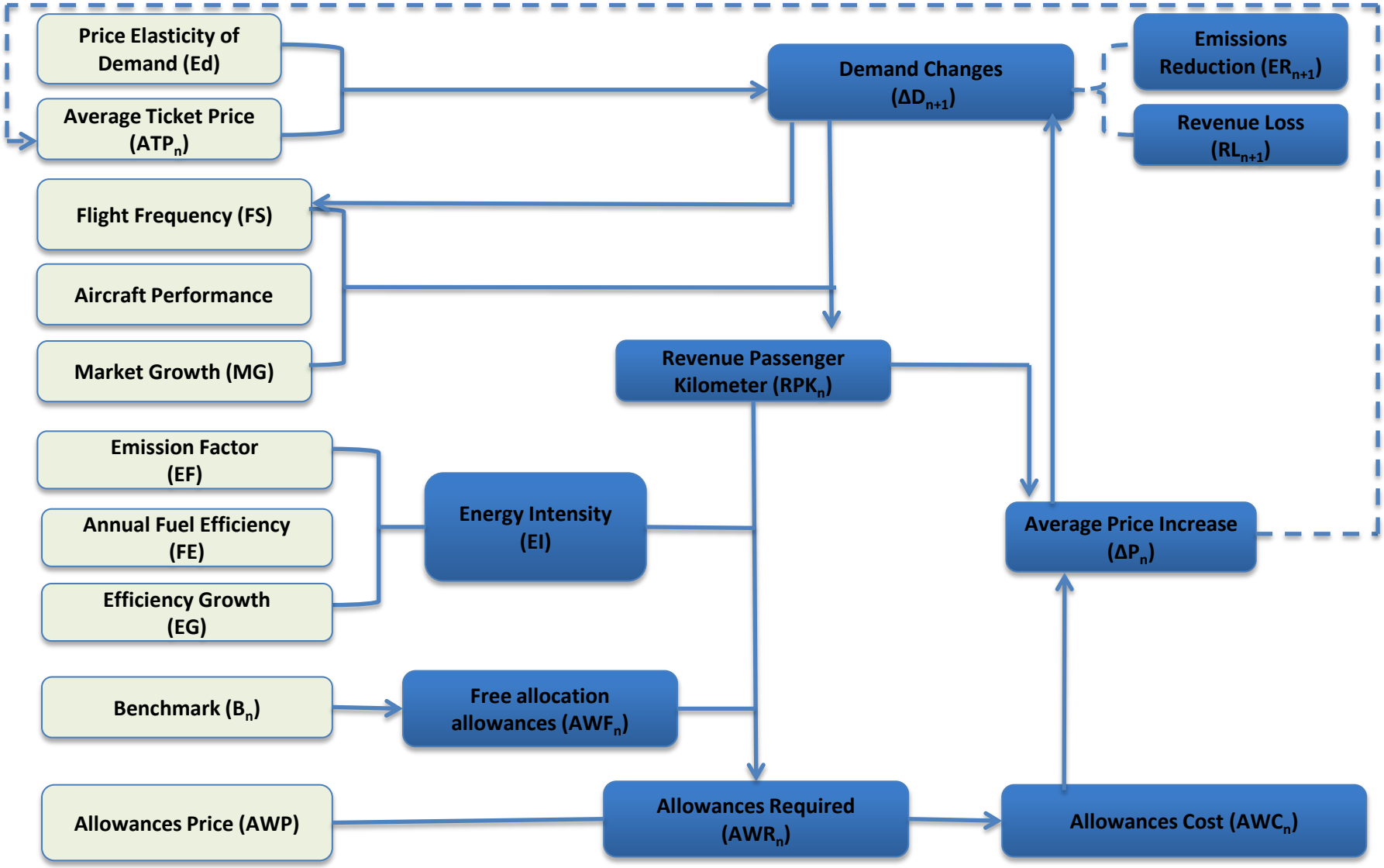
$$\sum_{s \in S_a} f_{as} \leq U_a \quad (5)$$

$$\sum_{s \in S_a} f_{as} \geq L_a \quad (6)$$

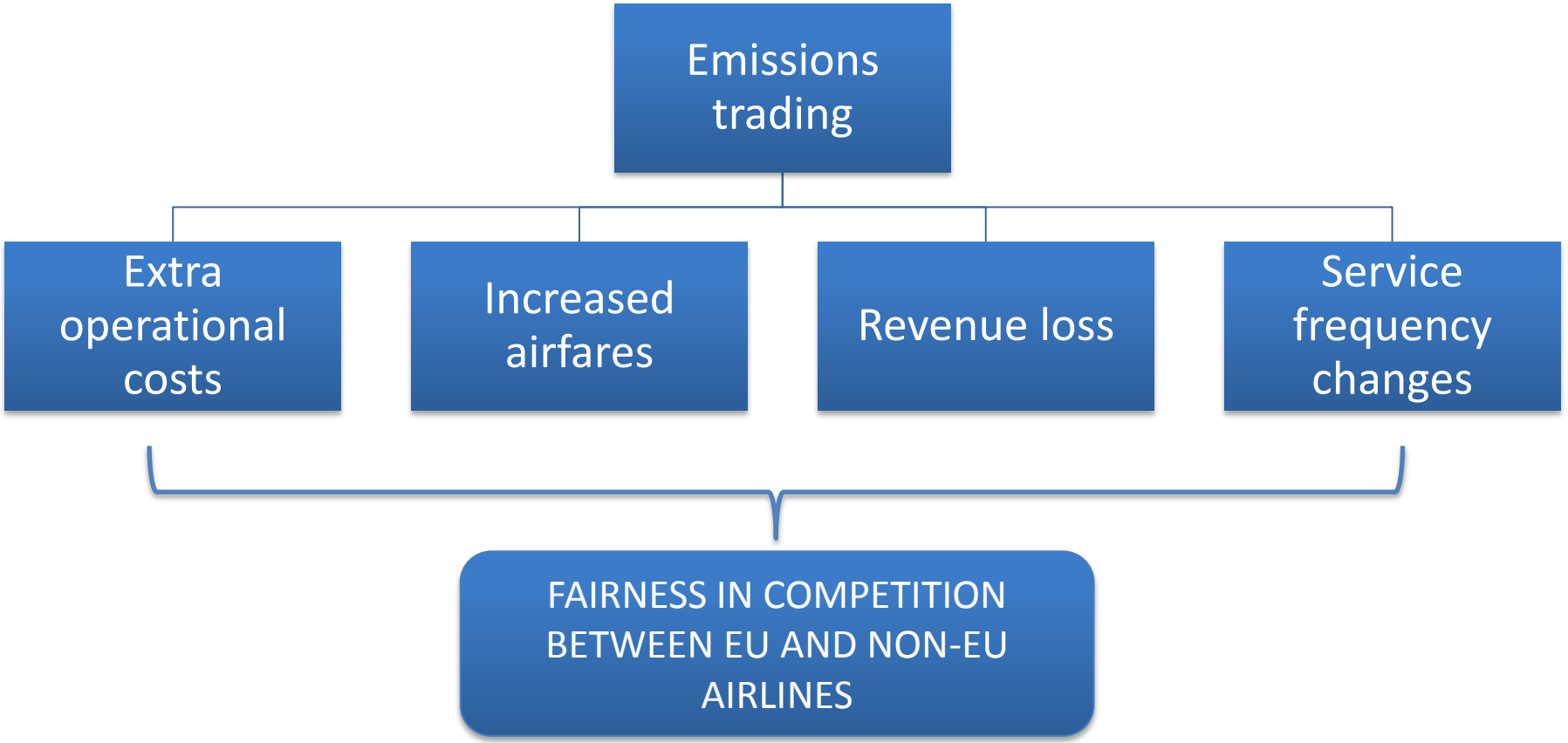
S-curve model extension—Fare differentiation

$$Q_{as} \leq \frac{\theta_a {f_{as}}^{\alpha_{st}} {p_{as}}^{\beta_{st}}}{\sum_{a' \in A_s} \theta_{a'} {f_{a's}}^{\alpha_{st}} {p_{a's}}^{\beta_{st}}} \gamma_{st} M_s \qquad (7)$$

- Q_{as} is the total number of passengers on flight segment s carried by airline a
- f_{as} is the service frequency of airline a on segment s
- p_{as} is the airfare of airline a on segment s


Price Elasticity of Demand (Ed)
Average Ticket Price (ATP_n)
Demand Changes (ΔD_{n+1})
Emissions Reduction (ER_{n+1})
Revenue Loss (RL_{n+1})
Flight Frequency (FS)
Aircraft Performance
Market Growth (MG)
Revenue Passenger Kilometer (RPK_n)
Emission Factor (EF)
Annual Fuel Efficiency (FE)
Efficiency Growth (EG)
Energy Intensity (EI)
Average Price Increase (ΔP_n)
Benchmark (B_n)
Free allocation allowances (AWF_n)
Allowances Price (AWP)
Allowances Required (AWR_n)
Allowances Cost (AWC_n)

Conclusions



Thank You!