INTERNATIONAL CONFERENCE

Skyward Bound: Innovating the FUTURE OF AVIATION

FRIDAY, 20 SEPTEMBER 2024

Room “Castoldi”, Campus Sant’Agostino, Città Alta - Bergamo

UNIVERSITÀ DEGLI STUDI DI BERGAMO | Department of Law

AIR-CARE
AIR transport law, Consumers And other Related issues in Europe
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brussels AIRLINES

Sustainability: the case of air transport

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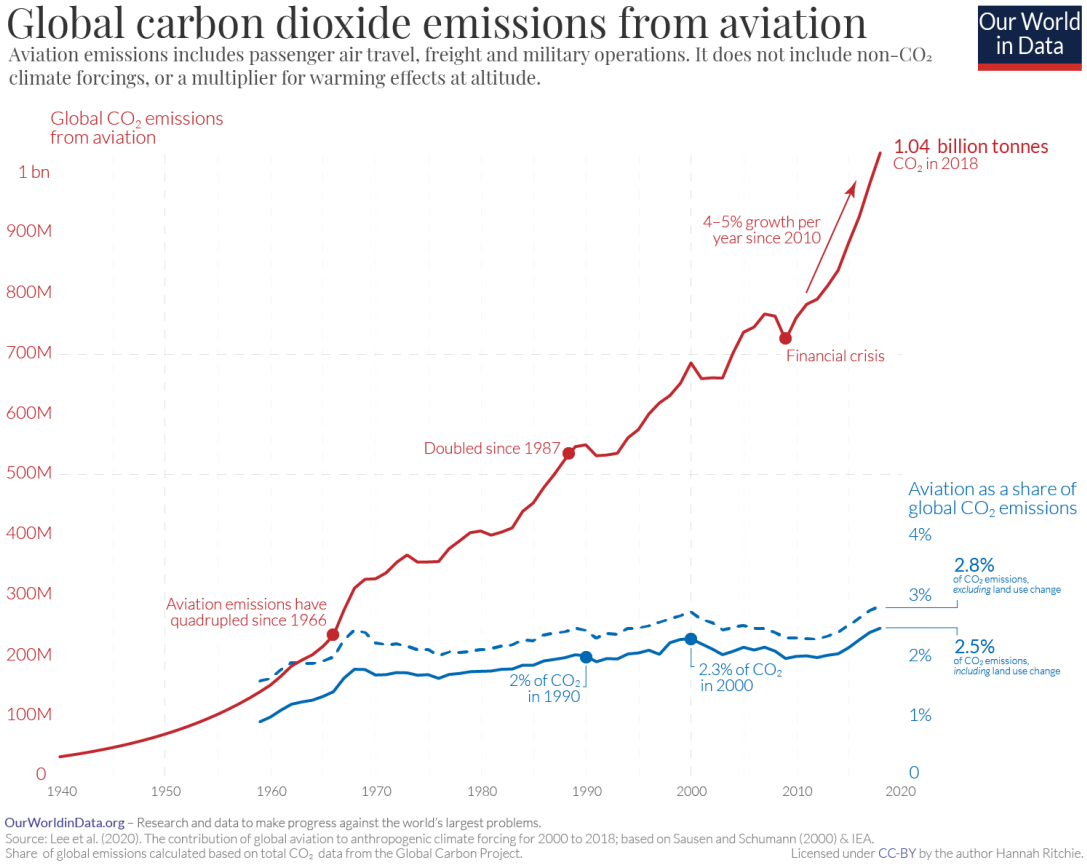
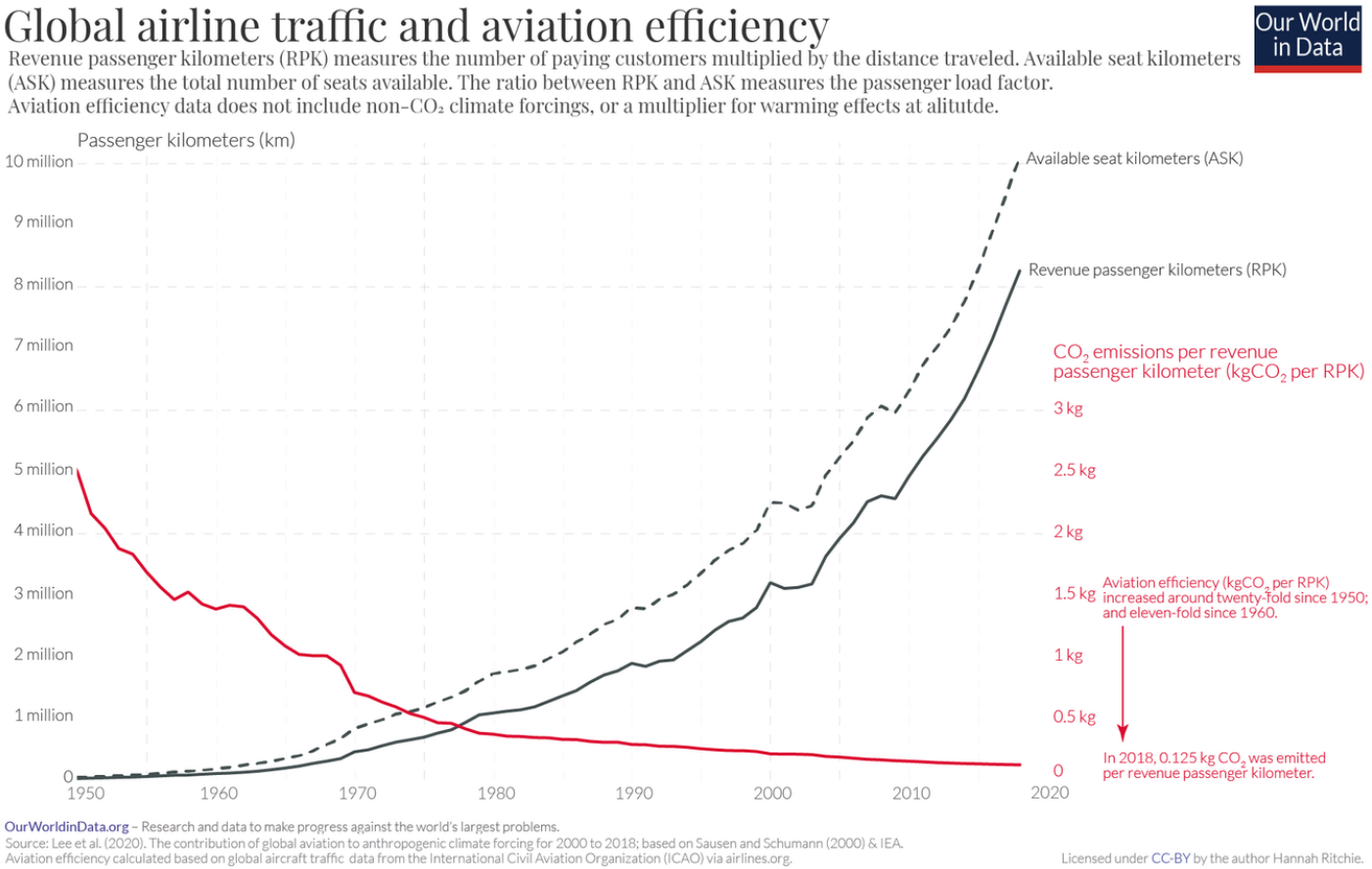
Air Transport Contributes Relatively Little, Today...



- Significant development possibilities, especially in Asia and Africa (Button, Porta, Scotti, *JTEP*, 2022 & Martini, Porta, Scotti, *JPA*, 2023)
  - Africa will double its population by 2050, reaching 2.5 billion. 1 in 4 inhabitants of the planet will be African (UN estimates, 2022).

Technological Innovation Has Reduced Emissions



- EU market liberalization allowed the growth of LCCs, which have reduced CO2 emissions per ASK.
  - Liberalization in Europe has reduced CO2 externality per passenger (Porta et al., *Transport Policy*, 2020).
  - Rate of fuel efficiency improvement $\approx 2\%$

The Impact of Air Transport

- Economic growth: Aviation is essential for global trade, representing over a third of world trade in value
- Employment: The aviation industry supports tens of millions of jobs worldwide
  - Campante, F., & Yanagizawa-Drott, D. (2018). Long-range growth: economic development in the global network of air links. The Quarterly Journal of Economics, 133(3), 1395-1458.
  - Brugnoli, A., Dal Bianco, A., Martini, G., & Scotti, D. (2018). The impact of air transportation on trade flows: A natural experiment on causality applied to Italy. Transportation Research Part A: Policy and Practice, 112, 95-107.

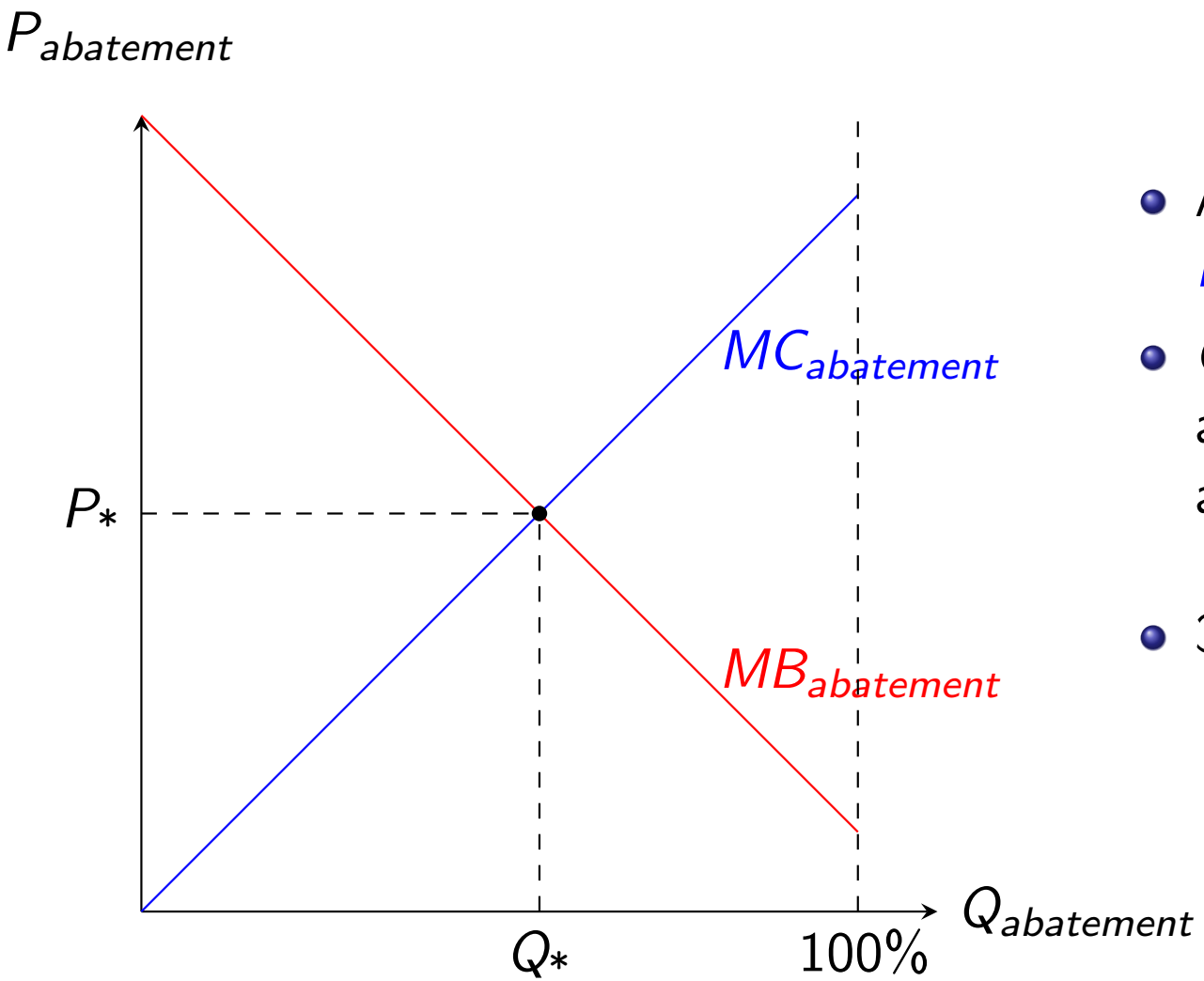
The Economic Problem of Emissions: an example

You are having dinner at a restaurant, imagine these scenarios:

1. you pay for your own food
2. at the end, the bill is split equally among all diners (now imagine that at this dinner are sit 8.1 billion people)

The Economic Problem of Emissions: a modern approach

- **A firm produces 2 products:** 1) *flights* and 2) *pollution abatement*



- Abate pollution until $MC = MB$
- Q^* is the optimal amount of pollution abatement
- 3 possible strategies:
  1. Direct controls
  2. Taxation
  3. Cap and trade

Who is gonna pay for additional costs?

- In air transport, the pass-through (the % of how much an increase or decrease in costs is passed on to consumers through the price) is very high (Bontemps, Martini & Porta, WP, 2023).
  - Any additional costs will largely end up in the prices of airline tickets, reducing the number of passengers, consumer welfare, and the profits of economic actors.

- Decrease in airlines' profits and in passengers' welfare

Possible Solutions?

- Divide solutions into 2 different temporal horizons
  - Net zero emissions by 2050 (ICAO)
  - Very approximately: the 2050 fleet is the one ordered today
- Post-2050 horizon: fleets and infrastructure radically changed
  - Hydrogen engines as a possible long-term solution?

Pre-2050 horizon: "unchanged" fleets and infrastructure

- More fuel efficient aircrafts
  - Retrofitting (e.g., winglets)
  - Decrease fleet age (e.g., cash for clunkers - Brueckner et al., 2024)
- SAF (Sustainable Aviation Fuel)
  - SAF has great potential, but their cost remains high
  - Possible risk of competition with food
- Replacement with high-speed trains (HSR)
  - The coexistence of air and HSR ensures greater competition
  - Building HSR infrastructure is very expensive and carbon intensive
    - HRS carbon break-even?
    - $\approx$ 20% of long-haul flights emit $\approx$ 80% of CO2
- Offsetting
- Demand management solutions
- Non-carbon emissions (e.g., detailed weather forecasting with AI)
- Reducing inefficiencies

One example of inefficiency

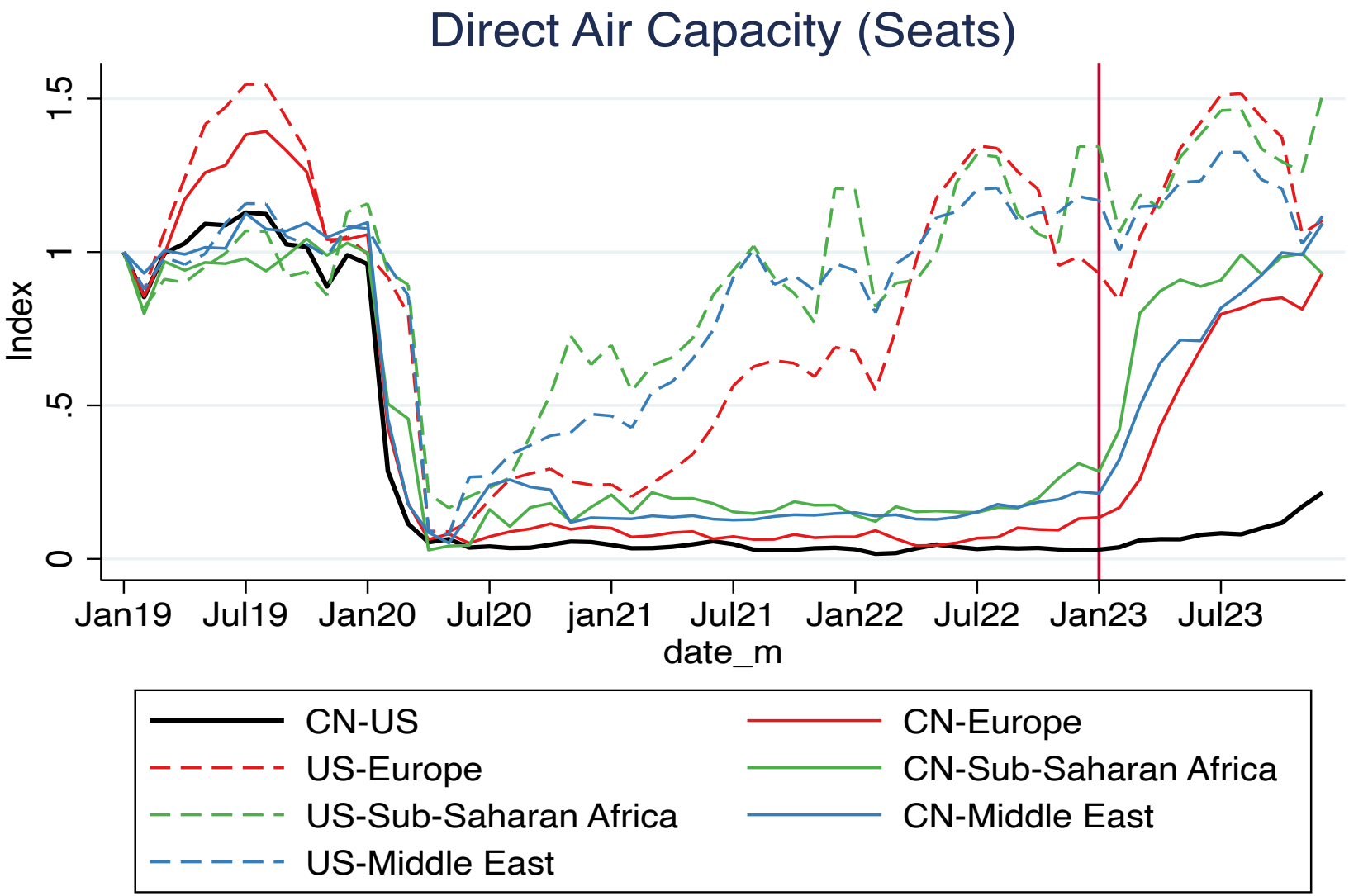
Rerouting flights around Russia increases emissions

As flights are rerouting to avoid Russian airspace, flights are getting longer and emitting more greenhouse gas. Here's a look at four flights that have changed since the Russian invasion of Ukraine:

Approximate increases in flight times and emissions

Route	Flight time increase	Fuel burn increase	CO_2 increase
Tokyo to London	2 hours 26 minutes	5,684 gallons	54,566 kg
Frankfurt to Tokyo	42 minutes	1,428 gallons	13,710 kg
Seoul to Helsinki	4 hours 8 minutes	7,425 gallons	71,285 kg
Helsinki to Tokyo	4 hours	7,186 gallons	68,985 kg

China-US Post-Covid Air Connectivity



Source: OAG schedule analyser.

China-US Post-Covid ticket prices

Average quarterly values					
Covid	Stops	Passengers	$\frac{PAXPost}{PAXPre}$	Price*	$\frac{PricePost}{PricePre}$
Pre	All	1,033,742		360	
Post	All	166,324	16%	1,295	360%
Pre	Direct	592,642		354	
Post	Direct	52,991	9%	1,519	429%
Pre	1	440,845		368	
Post	1	112,610	26%	1,191	323%
Pre	2	255		344	
Post	2	723	284%	1,196	348%

Pre-COVID: 2018 (Q1-Q2-Q3-Q4) and 2019 (Q1-Q2-Q3)

Post-COVID: 2023 (Q2-Q3)

*Economy tickets in US$ and exclude taxes, fees and fuel surcharges

- Pre-COVID: $\approx$ 57% of pax on direct flights (Post-COVID: $\approx$ 16%)
- If prices $\uparrow$ & quantities $\downarrow$: **consistent with a supply shock**

China-US Post-Covid itineraries

- Market share for hub regions or countries in 2019 and 2023 for passengers China-US

gateway country/region	market share 2019	2023	difference
...	...	...	...
Middle East	0.27%	10.68%	10.41%
Western Europe	0.53%	13.52%	12.99%
Japan	2.42%	20.19%	17.77%
South Korea	4.33%	32.19%	27.85%

- Longer travel times implies also higher emissions *per passenger*

Conclusions

- One of the most important challenges of this century is to reduce emissions without reducing mobility.
- Diffusion and economic convenience of new technologies.
- Promoting investments in the decarbonization of the aviation sector would also bring benefits in other sectors.
- Building an economic-legal context favorable to innovation, competition, diversification of supply, and sensitive to the well-being of consumers and the profit of economic actors.
- Infrastructure and fleets are unlikely to change significantly by 2050. In this context, SAF plays a major role, and increasing its use is essential.