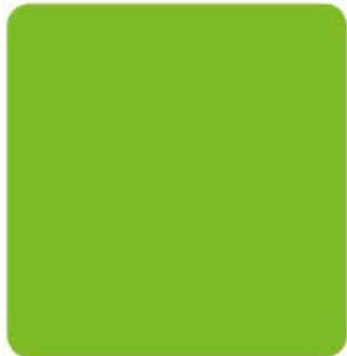


Flight dependence: between carbon lock-in and social inequalities in air travel

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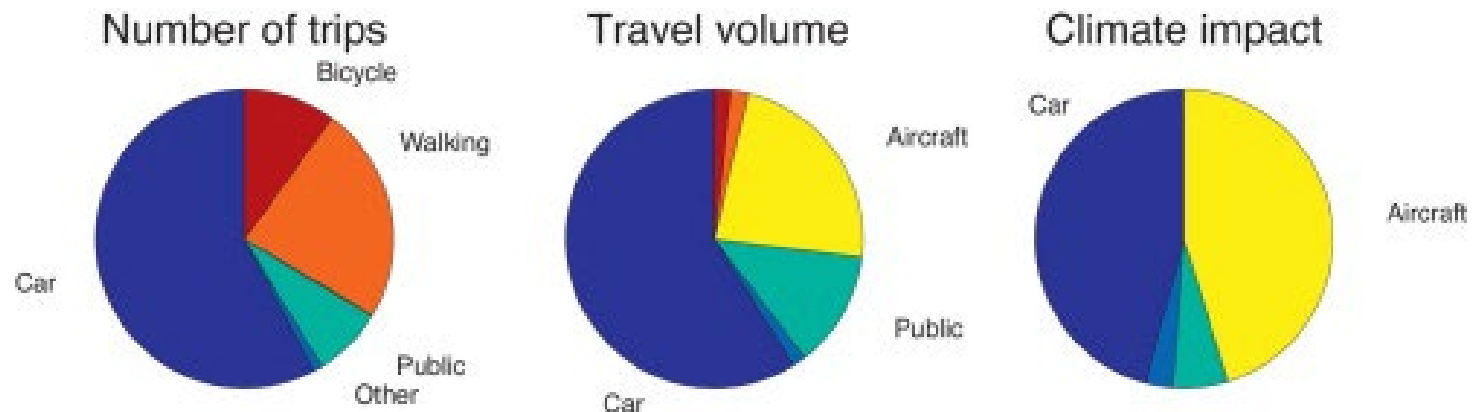


Transport and climate change: the big picture

- **29% of greenhouse gas emissions (GHG)** in the EU in 2022, predicted to account for 44% by 2030 (T&E, 2024)
- A ‘hard-to-abate’ sector: even in countries with sustained GHG emission reductions, transport emissions are **stable or increasing** (Lamb et al., 2022)
- To date, **technological improvements** in energy efficiency and carbon intensity have been **offset by increasing travel activity**
- ‘**Travel demand management**’ measures (e.g., pricing) would be needed but these are **difficult to introduce** for various reasons

Transport climate impact: it's mainly about car & air travel

- In high-emission countries ca. **90% of climate impact from passenger transport** is from just two modes: car and air travel



(Aamaas et al., 2013)

This presentation

1. Car dependence: the transport studies debate
2. Flight dependence: an emerging issue?
3. Overview of empirical findings from LDS research project (2018-2025)
 - possible lock-in mechanisms
 - social inequalities
4. Conclusions

“Car dependence”

- Concept that **originates from urban planning** (Newman & Kenworthy, 1989)
 - over time it has broadened to include a range of **interdisciplinary approaches** (from e.g., psychology, sociology)
- 3 (not entirely overlapping) perspectives:
 1. CD as **inertia** / resistance to efforts to reduce car use
 2. CD as when car use is essential for the satisfaction of human **needs** / social inclusion
 3. CD as a self-reinforcing, path-dependent **process** that leads to (carbon) “lock-in”

Car dependence: 3 levels

micro

- attribute of **individuals**
- (pro-car) **attitudes**
- focus on **agency**
- social psychology

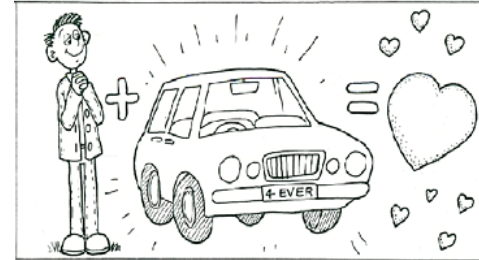


Image: Jillian Anable ©

MESO

- attribute of **trips / activities / practices?**
- sociology / social practice theory



Image: eltpics ⓘ

MACRO

- attribute of (local) **societies / built environment**
- density, diversity of land uses, etc.
- focus on **structure**
- urban / transport planning



Image: Mark Strozier ⓘ

(Mattioli et al., 2016)

How car dependence makes climate policy more difficult

- Car dependence: when car use is essential to be able to access services and opportunities that are essential for the satisfaction of human needs (Mattioli, 2016)
- This **pressures low-income households to own & use cars, but they struggle with the resulting expenditure**, especially when fuel prices increase
- **EU Emission Trading System (ETS)** based on “cap and trade” principle
- **From 2027 emissions from buildings & road transport will be included (ETS2)**
→ expected to result in substantial fuel price increases (Kalkuhl et al., 2023)
- 2023: **‘Social Climate Fund’ (SCF)** created to address the social impact of ETS2, “to support vulnerable households” (= EUR 86.7 billion over the 2026-2032 period)

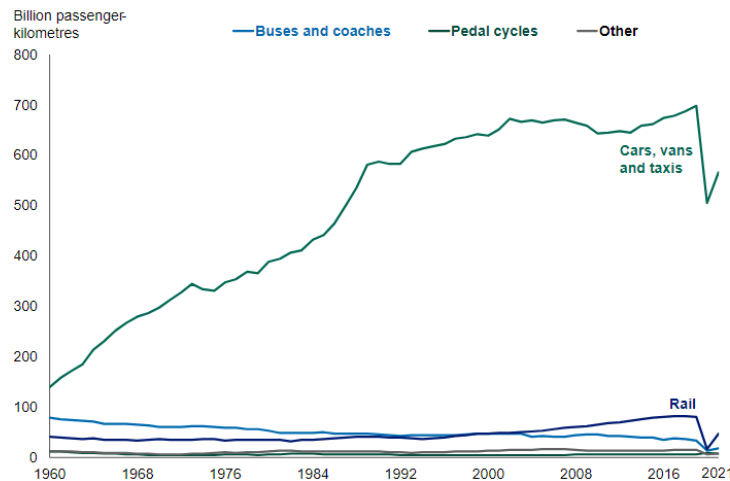


- Few trips but **long distances** + **high GHG intensity** = **high share of GHG**
- **Travel activity growth** + **few technological solutions** = rapid **GHG growth**
- **Need for air travel demand management measures** in addition to technological solutions, e.g.:
 - pricing (currently exempt from many taxes)
 - ‚frequent flyer levy‘
 - moratorium on airport expansion
- Very **unequal**: most people fly very little, few (typically higher-income) frequent flyers‘ are responsible for a large share of GHG
- **More luxury** (holiday) than necessity (visiting friends and relatives)

Two kinds of lock-in in the (passenger) transport sector

Car / daily travel

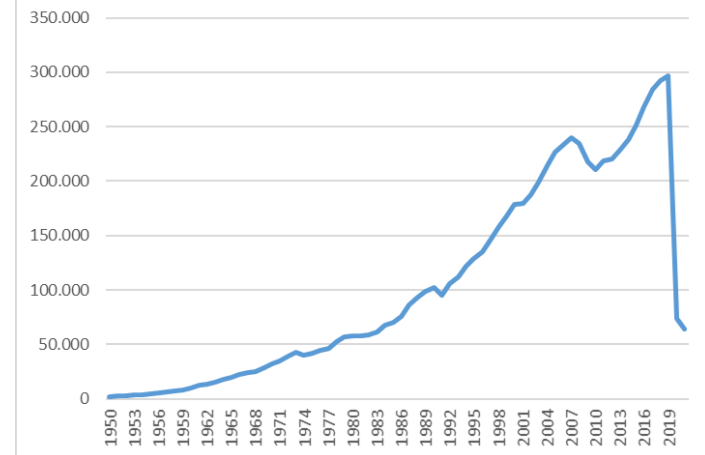
Chart 1: Passenger kilometres by mode, Great Britain, 1960 to 2021



- Entrenched
- Hard to “unlock”

Air / long-distance travel

Terminal passengers: arrivals and departures (thousands) in Great Britain, 1950 to 2021



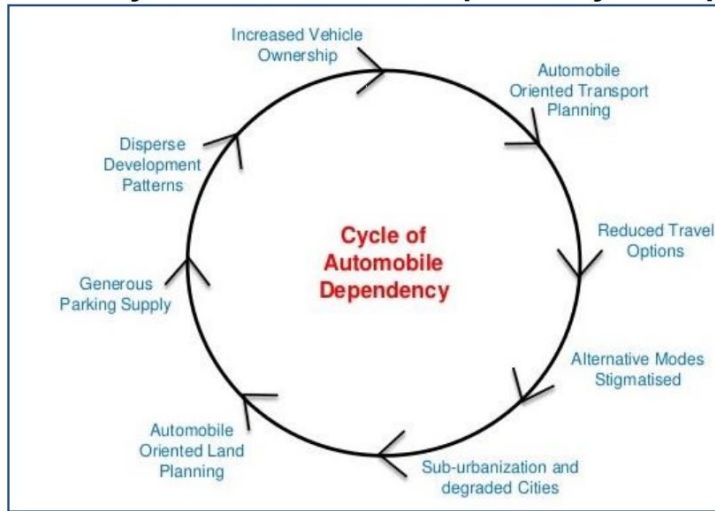
- **Lock-in “in the making”?**
- **Emerging “flight dependence”?**

Two kinds of lock-in in the (passenger) transport sector

Car / daily travel

Air / long-distance travel

Figure 1 Cycle of Automobile Dependency and Sprawl



(Litman, 2021)

- Entrenched
- Hard to “unlock”



- **Lock-in “in the making”?**
- **Emerging “flight dependence”?**

“Flight Dependence”: towards a research agenda

- What explains **inertia** / **resistance** to efforts to reduce (the growth of) air travel?
 - at the **micro**-level of individuals?
 - at the **meso**-level of social practices?
 - at the **macro**-level of social structures?
- Is air travel becoming essential for the satisfaction of human **needs** / social inclusion *of at least some people under certain circumstances*?
- Which self-reinforcing, path-dependent **processes** are driving air travel growth and locking-in high levels of air travel?

The LDS project (2018-2025)

1. “Long-Distance Society - Advancing Knowledge of Long-distance Travel: Uncovering its Connections to Mobility Biography, Migration, and Daily Travel” (2018-2022)
 2. “Change in long-distance travel: uncovering travel activity trends, inequalities, and dynamics over the life course” (2022-2025)
- Provided suggestive **evidence of emerging “flight dependence”** through:
 1. stretching of **social networks** and activity spaces
 2. **induced demand effect** of airport infrastructure
 3. **socialisation** to holidaying abroad
 - Provided evidence on **inequality** in air travel activity and how it changed over time

- **UK Household Longitudinal Study (UKHLS, 2012 + 2019)**
 - no. of private flights in last 12 months by world region (→ GHG)
 - **migration generation**
 - spatial dispersion of **social networks**
 - spatial identifiers at neighbourhood level
- **TU-Dortmund student survey** (unique but non-representative, 2007-2017)
 - interviewed themselves, **parents & grandparents** on travel behaviour
 - includes questions on **holiday travel (abroad) over the life course**
- **National travel surveys** of England (NTS, 2006-2017) and Germany (MiD, 2008 + 2017)
 - air travel frequency

The impact of migration and social network dispersion on personal air travel

- Regression study based on cross-sectional UKHLS data (2012)
(Mattioli & Scheiner, 2022):
 - recent (<5 years) **migrants**: +41% flights, **+1,502 kgCO₂e for personal flights**
 - **Asian** / Asian British: **+550 kgCO₂e**
 - close **family abroad**: +27% flights, **+619 kgCO₂e**
 - best **friends abroad**: +45% flights, **+624 kgCO₂e**
- Model on subsample of people in a cohabiting relationship
(Mattioli & Scheiner, 2024a)
 - further increase in no. of flights if **partner** has migration background / friends abroad
- Regression study based on **longitudinal data (2012-2019)**
(Mattioli & Scheiner, 2024b)
 - acquiring (but also maintaining) family abroad tends to increase no. of flights

The „induced demand“ effect of transport infrastructure

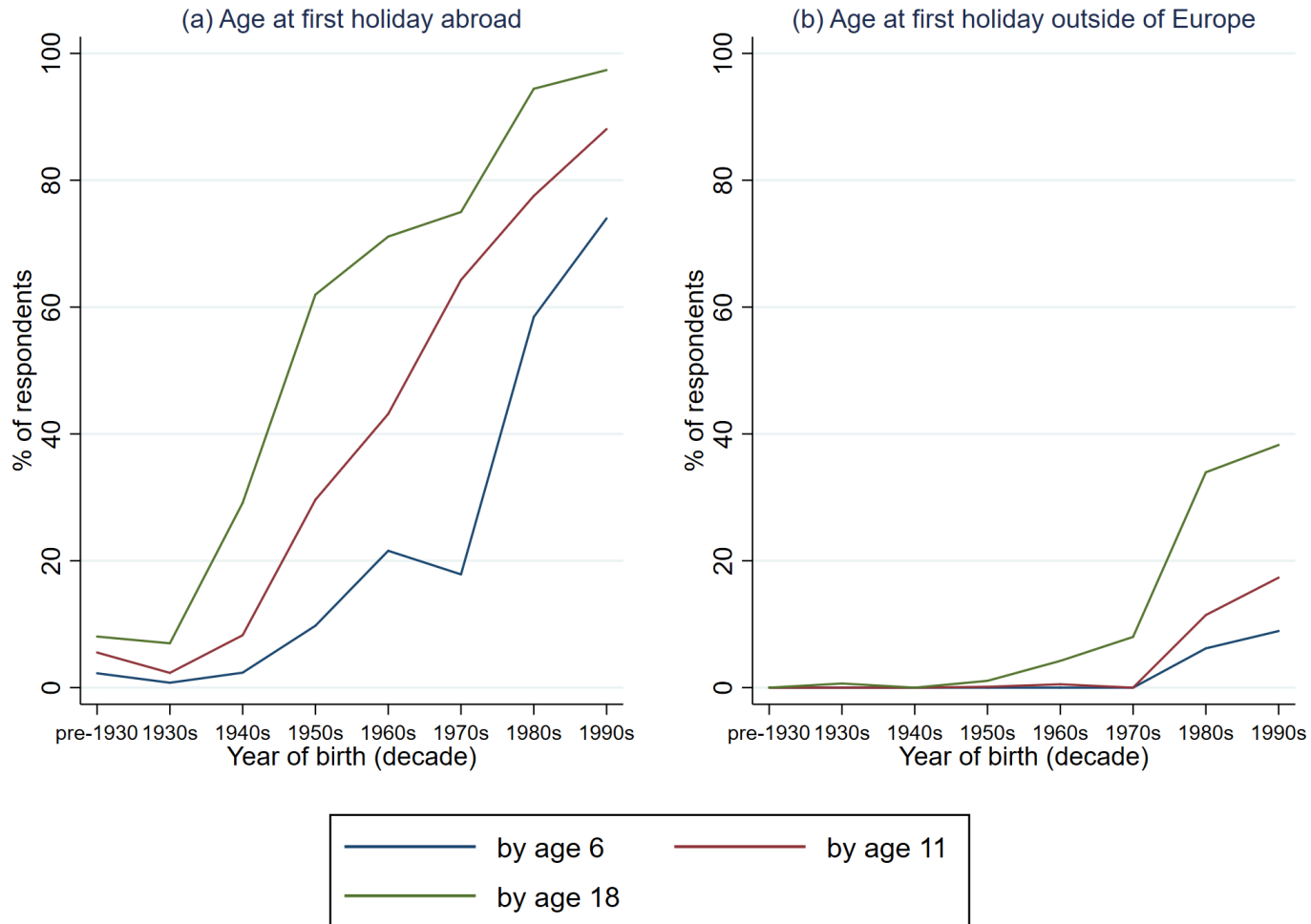
- **“Build them and they will come”**: Well-documented effect in the transport sector
- **Self-reinforcing dynamic** between more travel activity → more infrastructure supply → more travel activity



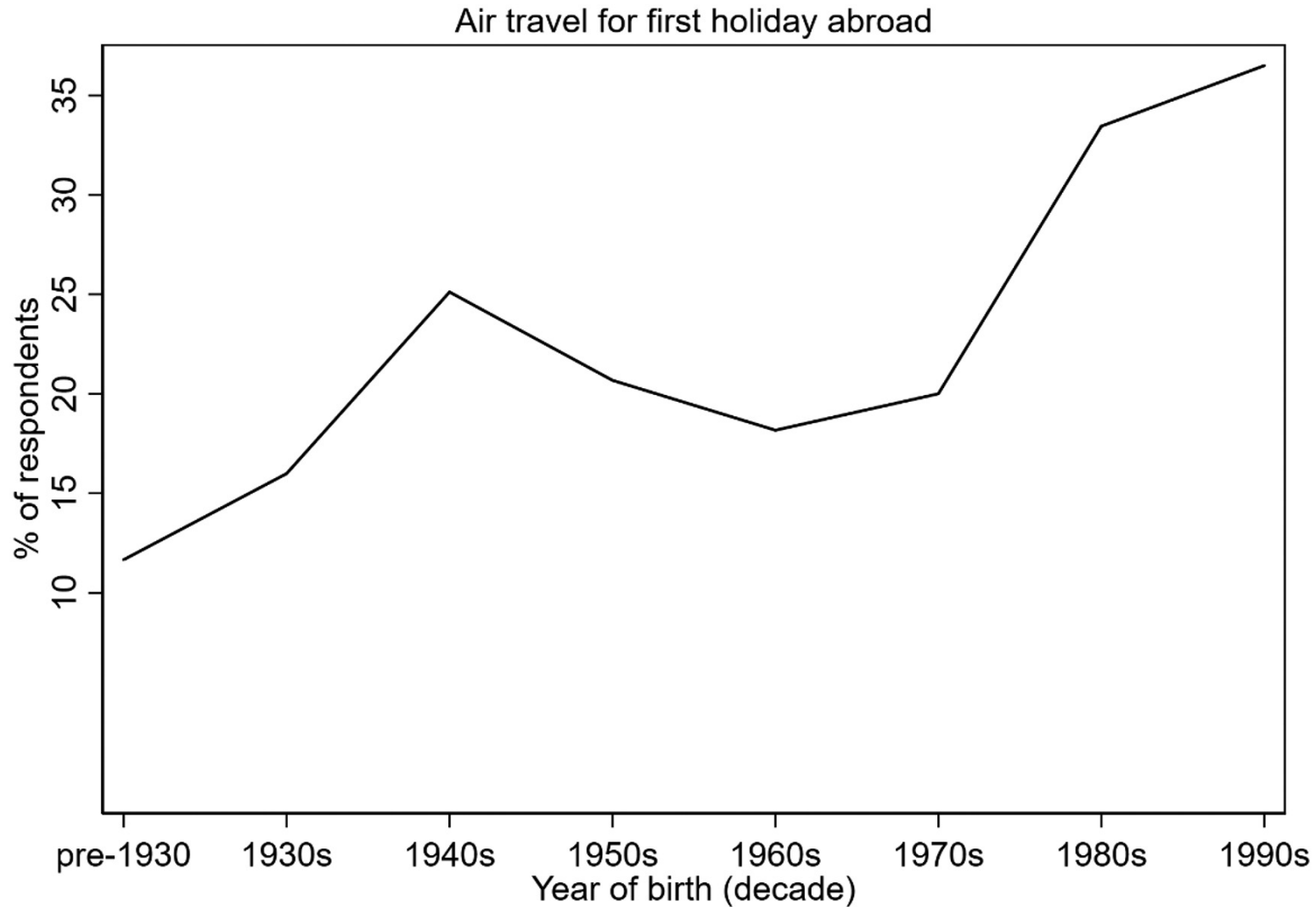
'Induced demand' effects of airport expansion?

- Multivariate regression model that **matched UKHLS data (2012) with spatial accessibility data for small spatial units** (Mattioli et al., 2021)
 - 1 less hour travel time to nearest large airport → **+37 kgCO₂e for personal flights**
 - 1 more airport within 60 minutes travel time → **+125 kgCO₂e**
- **Longitudinal analysis (2012-2019)** (Mattioli & Scheiner, 2024b):
 - better airport accessibility in 2012 → greater increase in no. of flights
 - but increase in accessibility → no greater increase in no. of flights
- Consistent with evidence from Switzerland (Bruderer Enzler, 2017) & US (Kim & Mokhtarian, 2021)

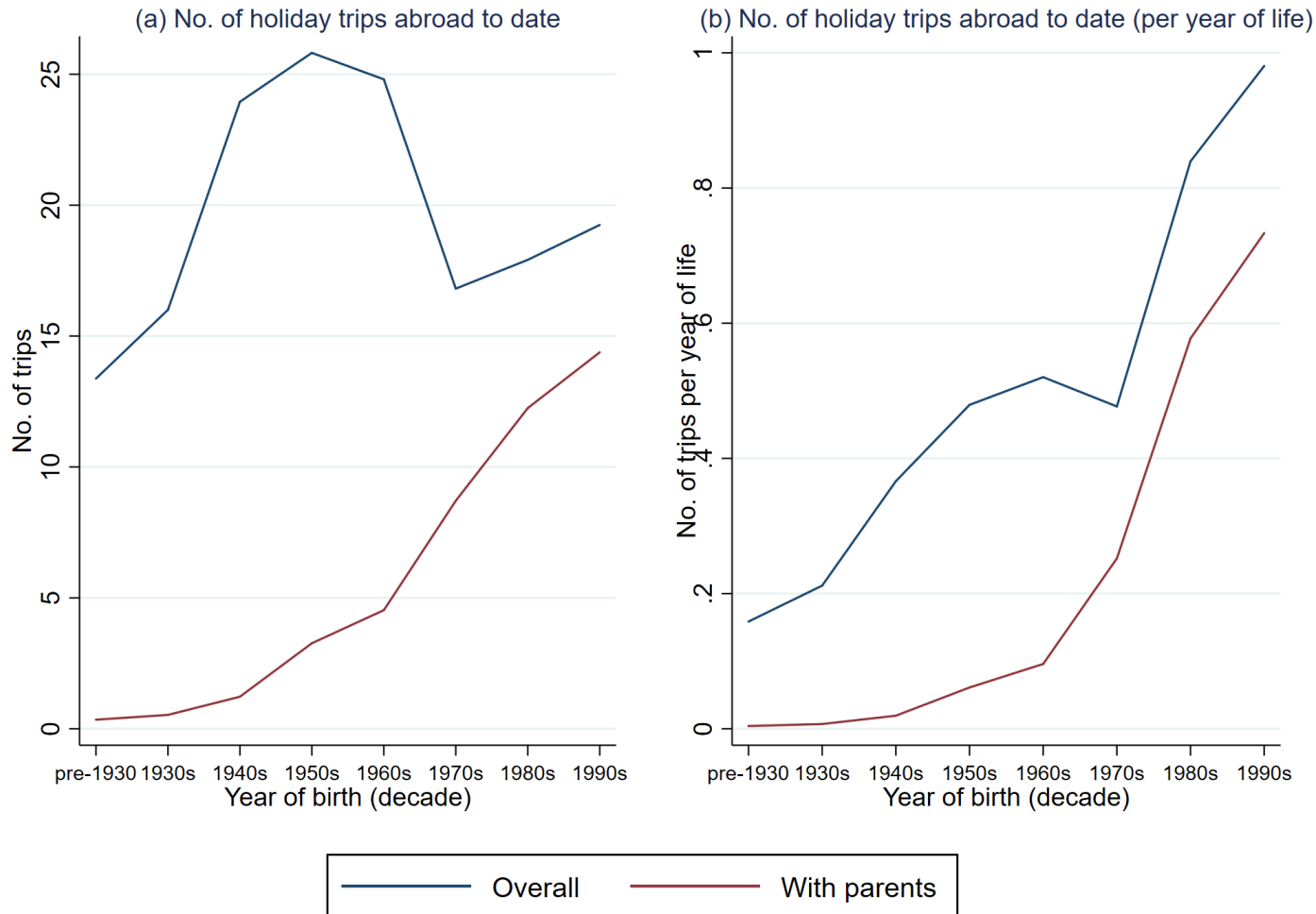
Socialisation to international holiday travel across generations (Mattioli et al., 2022)



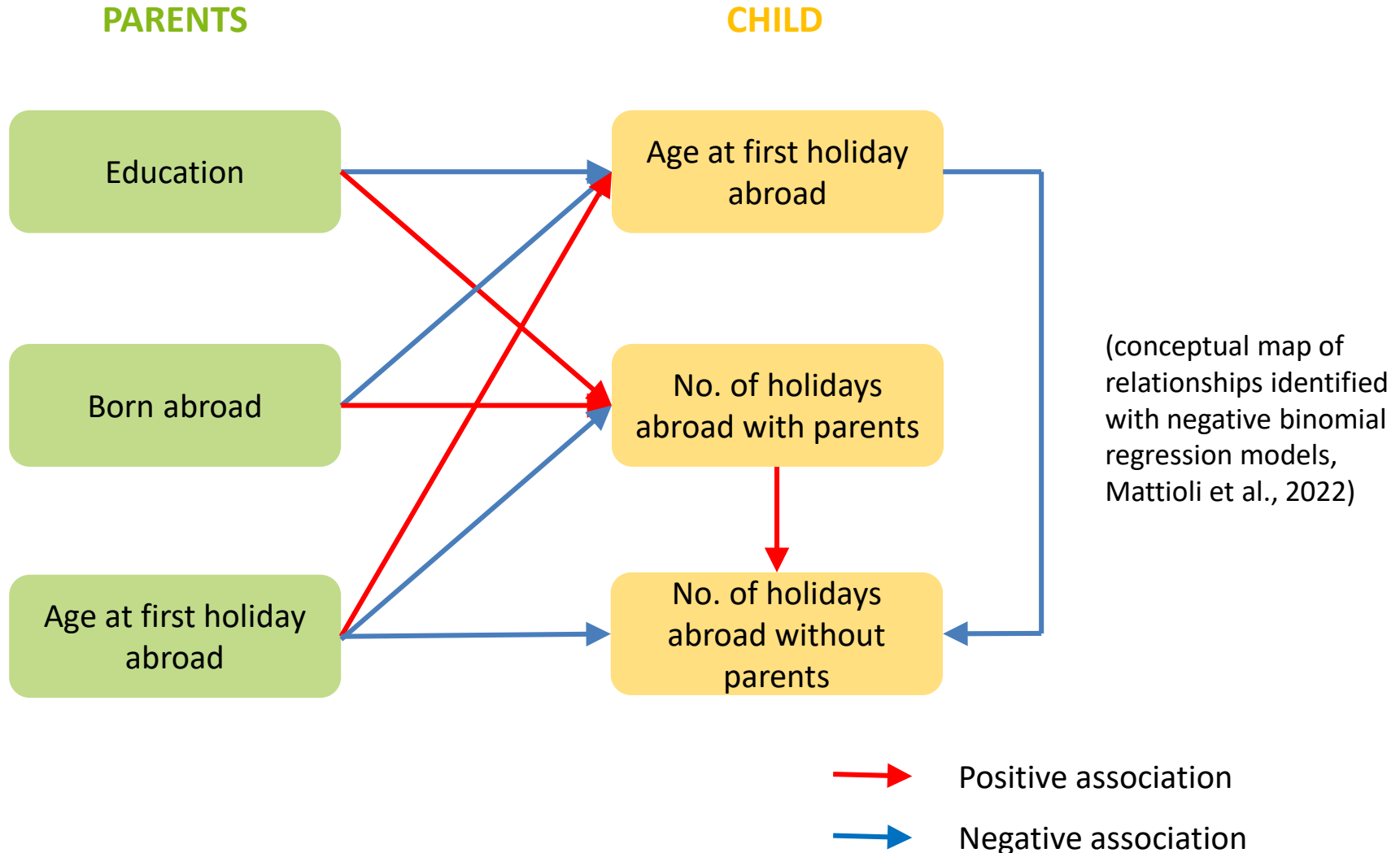
Socialisation to international holiday travel across generations (Mattioli et al., 2022)



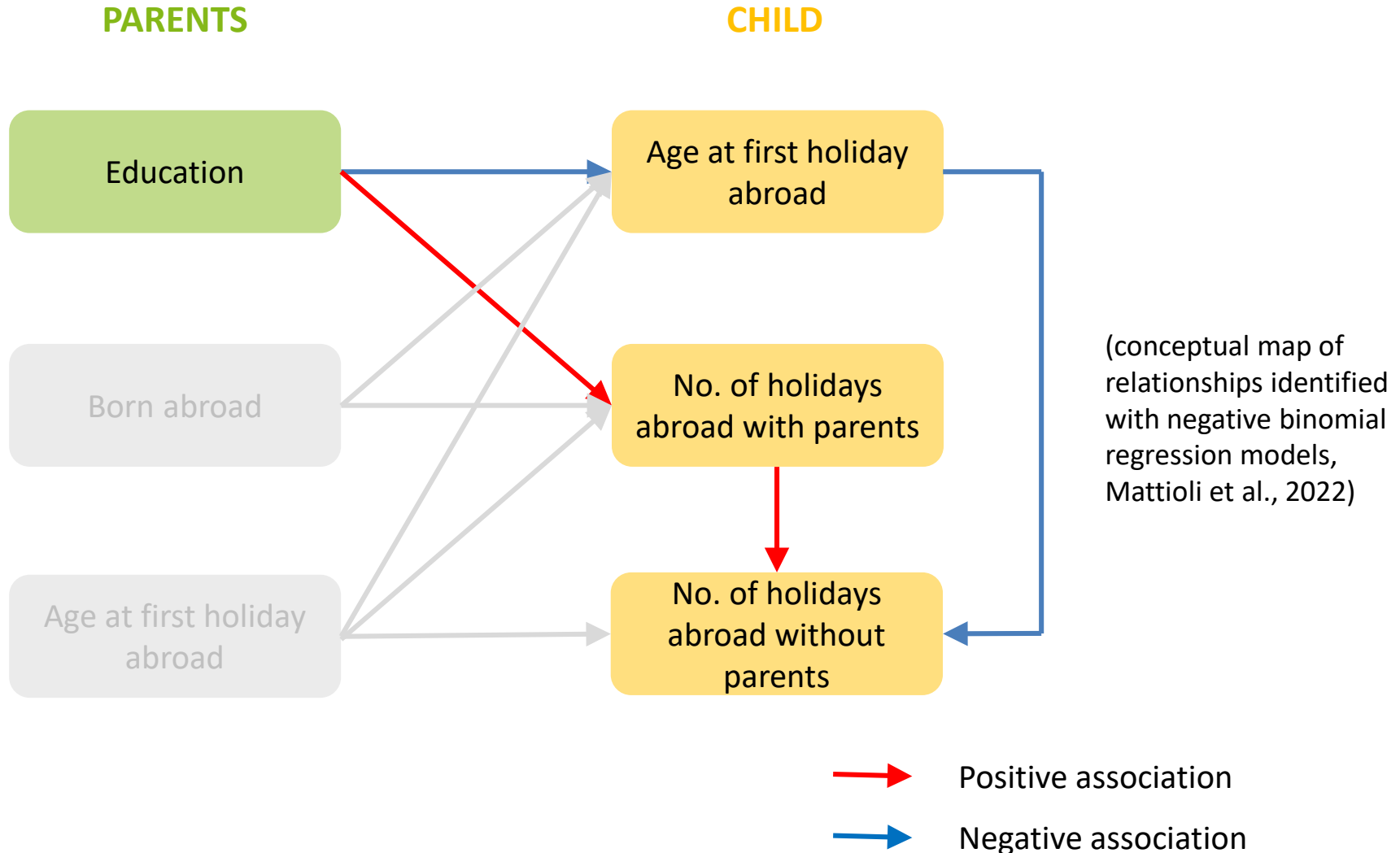
Socialisation to international holiday travel across generations (Mattioli et al., 2022)



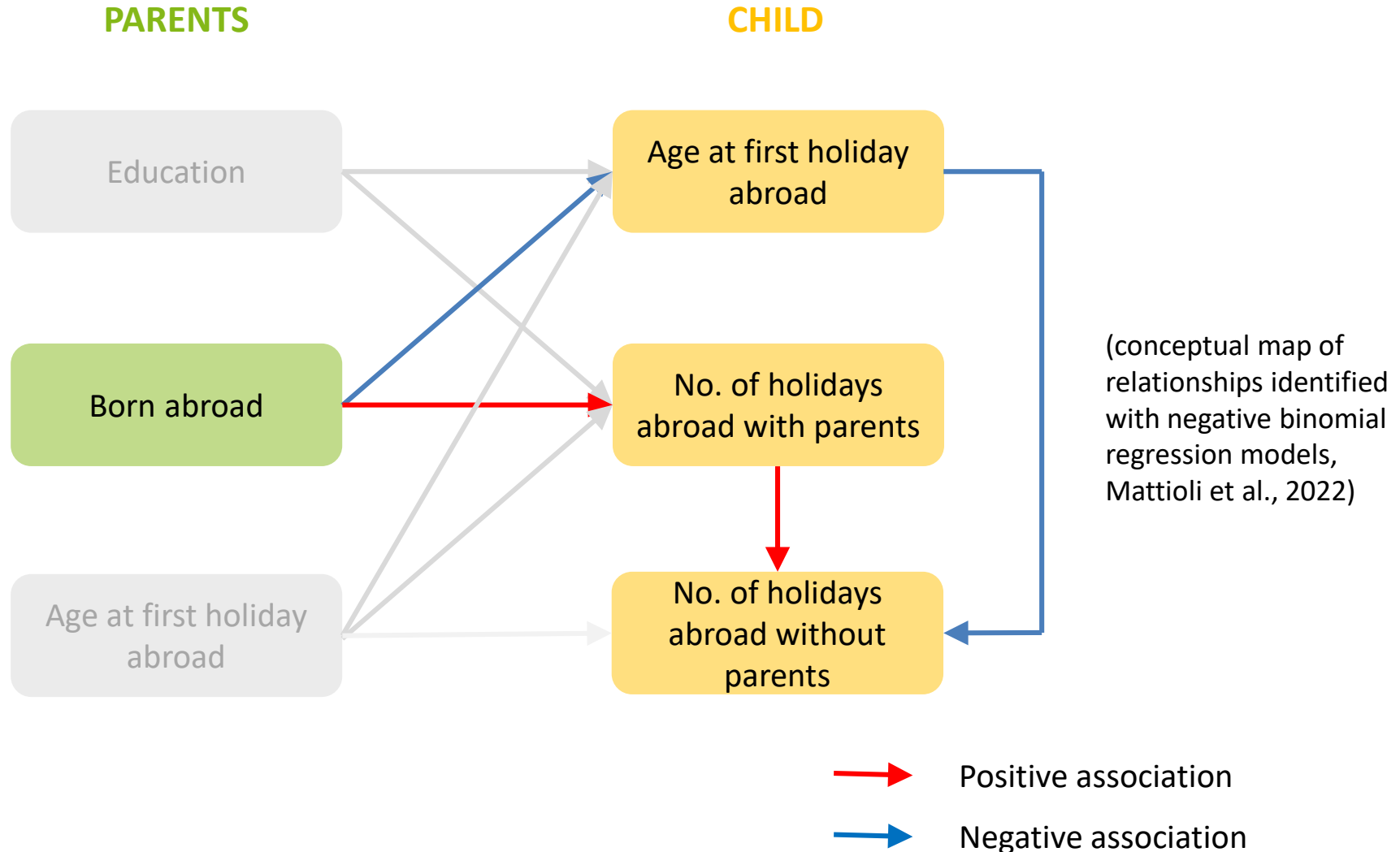
Socialisation effects



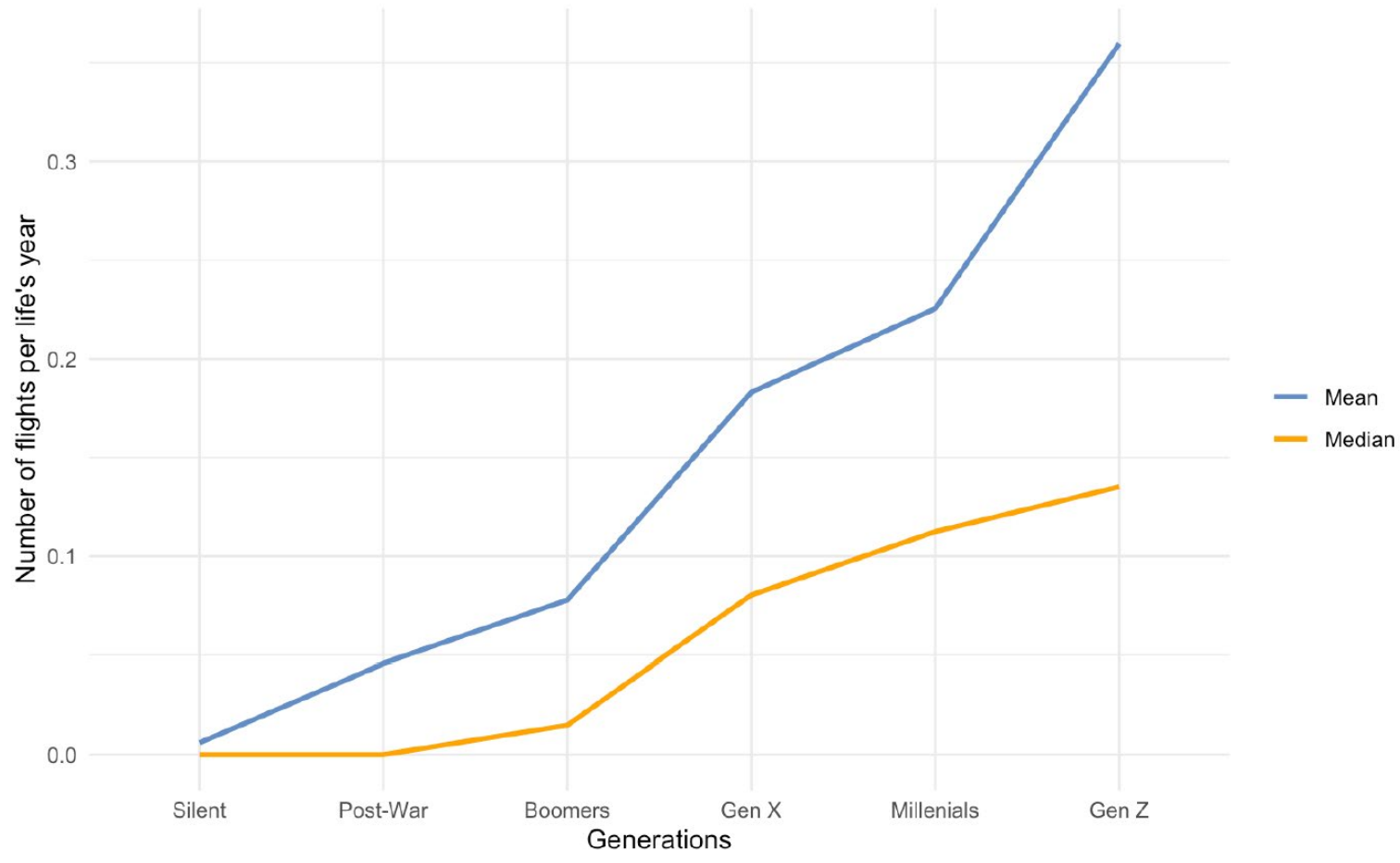
Socialisation effects



Socialisation effects



Rapid change across generations in Poland

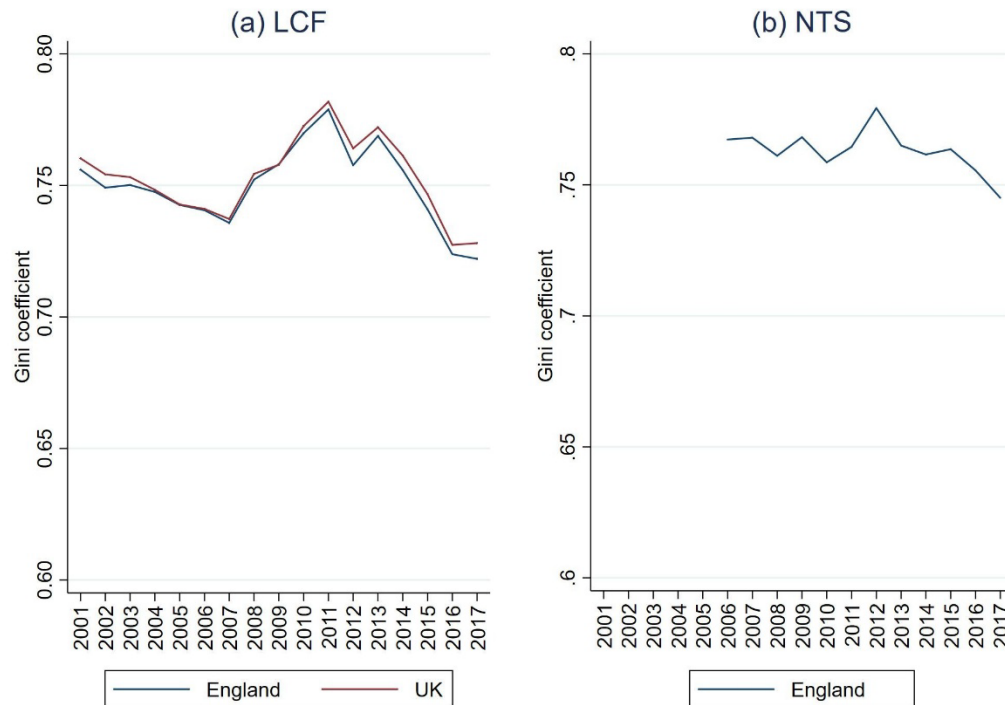


(Schmidt, Czepkiewicz, Mattioli, Kostecka, & Krysiński, forthcoming)

- **Trends in air travel inequality** in the UK (2001-2018) (Büchs & Mattioli, 2021)
 - inequality in participation in air travel is **decreasing** (slowly), both in absolute terms and between income groups.....but **still very high**
 - ...greater *relative* contribution by disadvantaged groups to the expansion of air travel
 - ...but **well-situated groups contributed more to growth in *absolute* terms**
- Consistent with evidence from France 1974-2008 (Demoli & Dobruszkes, 2024)

Air travel inequality in the UK

Gini coefficient for the distribution of flights over the population

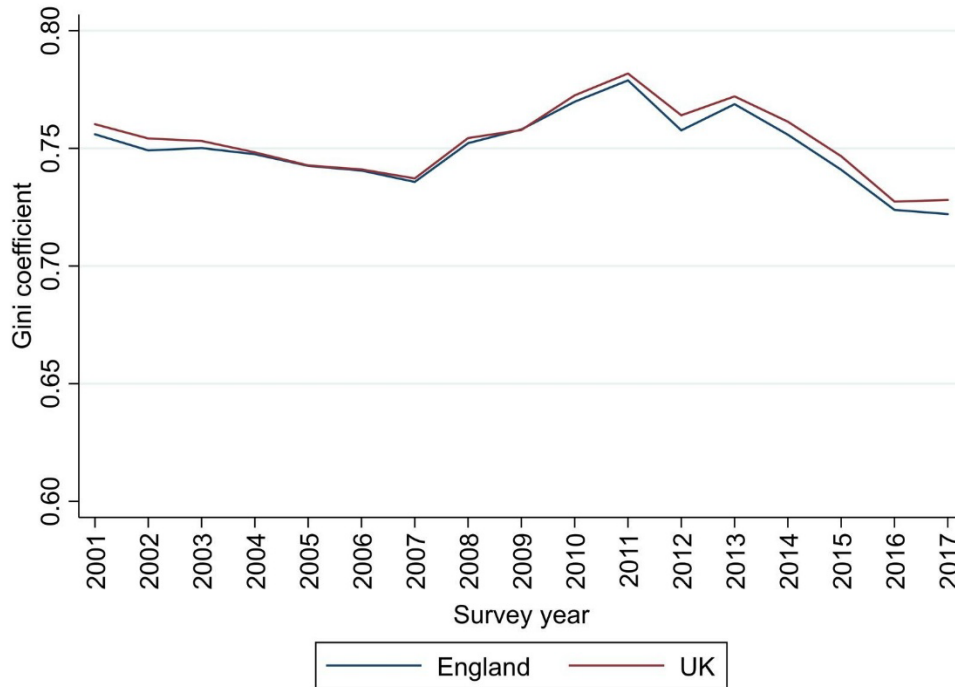


- 40%-60% do not fly in a year
- 20% of households → ca. 75% of flights

(Büchs & Mattioli, 2021)

Air travel inequality in the UK

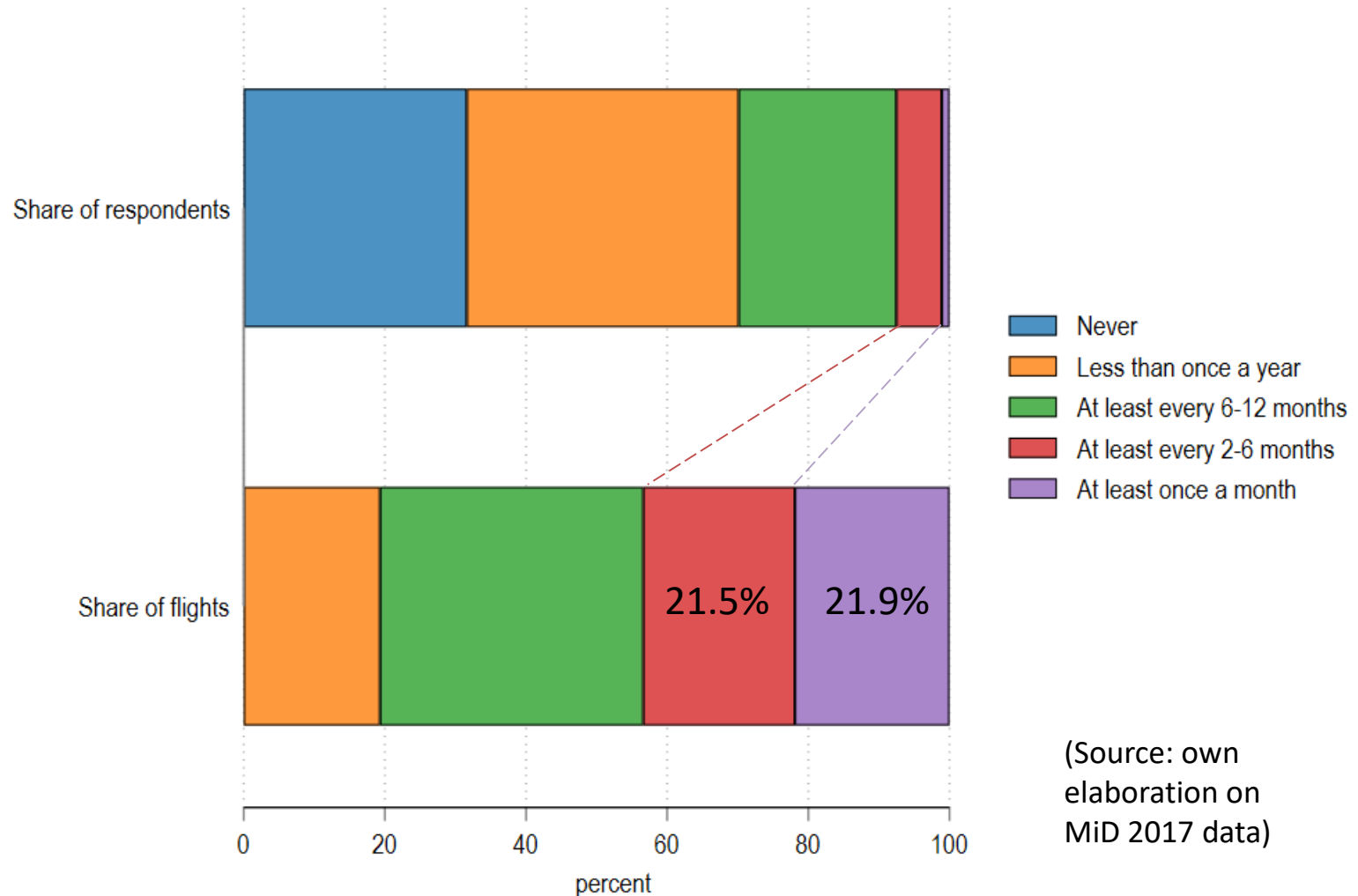
Gini coefficient for the distribution of flights *over the income distribution*



- 60%-80% in bottom income decile do not fly in a year
- Top income quintile → ca. 40% of all flights

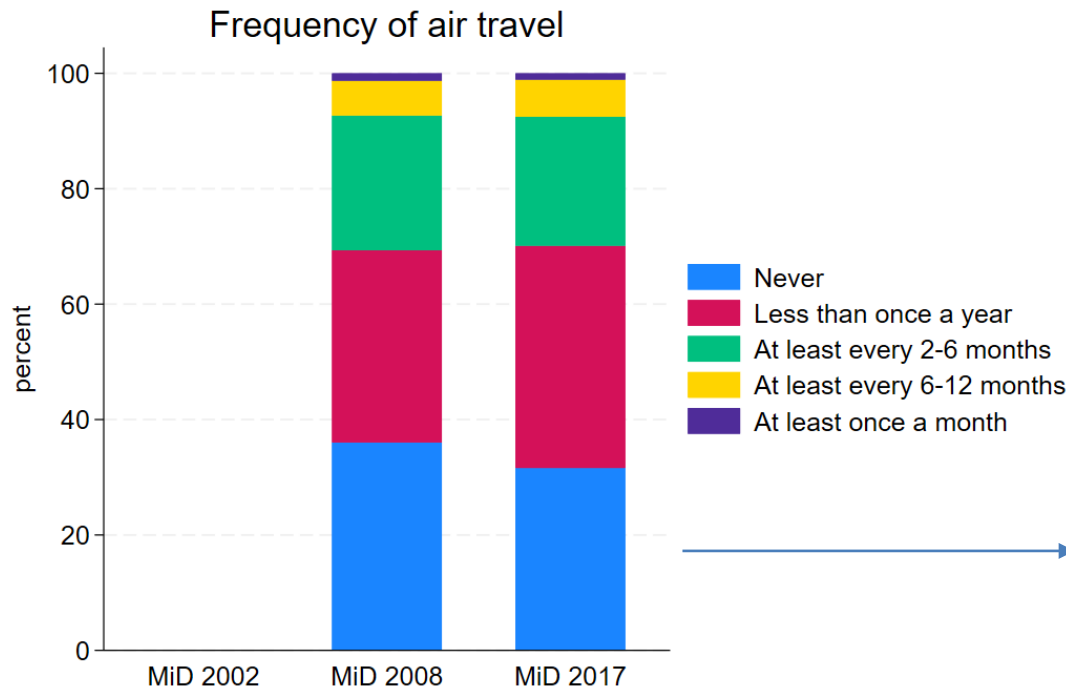
(Büchs & Mattioli, 2021)

Air travel inequality in Germany



(Source: own
elaboration on
MiD 2017 data)

Air travel inequality in Germany

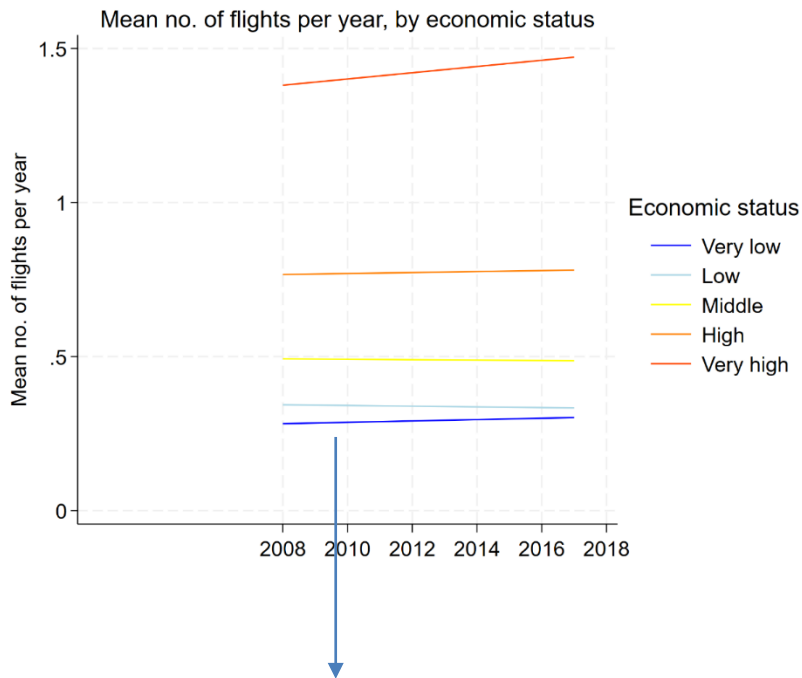


(own elaboration on MiD 2017 data)

Non-flyers group:

- decreasing share over time
- weakening association with age (consistent with socialization effects)
- strengthening association with urbanity (living outside of metropolitan areas)
- strengthening association with education (lack of university degree)

Air travel inequality in Germany

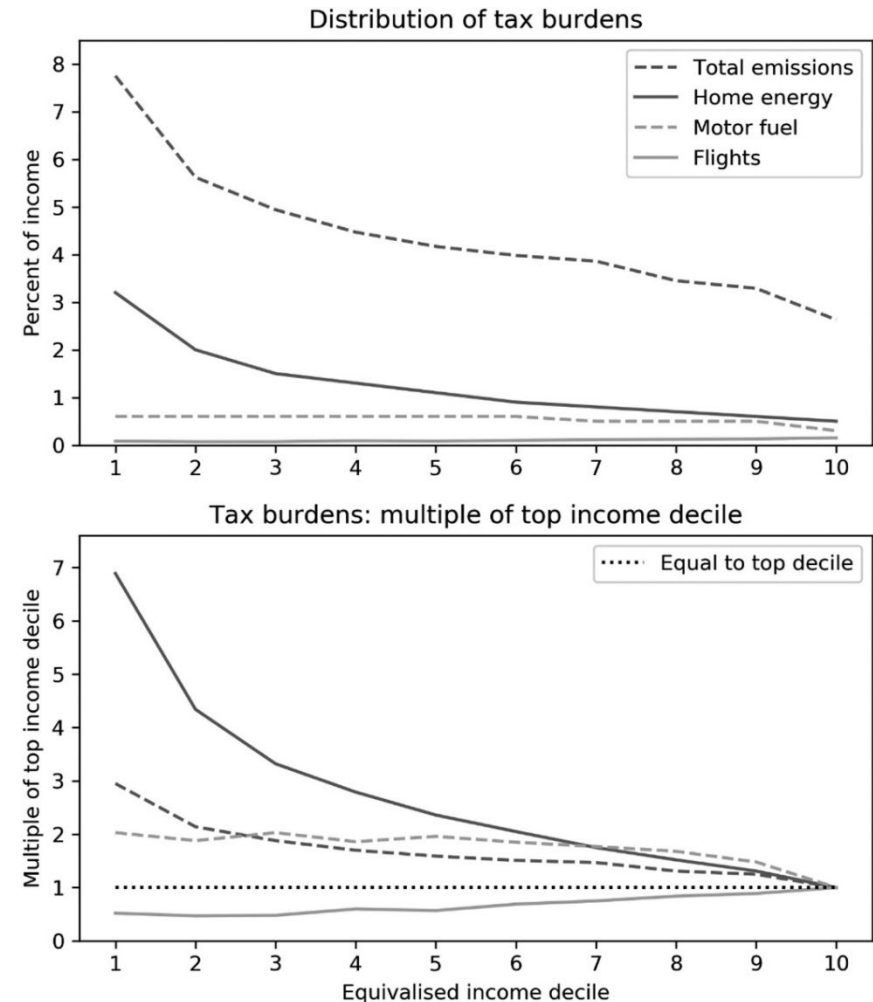


86% with very low economic status fly less than once a year or “never”

- **Concentration ratio (CR):** share of trips by people with high+very high income status / share of respondents with high+very high income status (Hopkinson & Cairns, 2021)
- $CR > 1 \rightarrow$ air travel is more common amongst higher-income households
- CR: 2008=1.50, 2017=1.50
- In 2017 higher-income groups accounted for 36% of respondents but 54% of flights

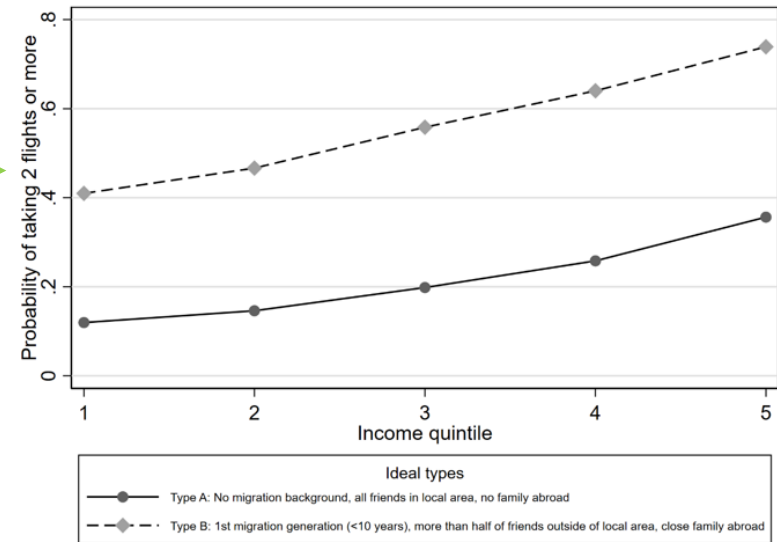
Distributional impact of air travel taxes in the UK (Büchs & Mattioli, 2024)

- Air travel taxes are **progressive** – unlike taxes on CO₂ or home energy
- ‘**Frequent flyer levies**’ that exempt 1 flight per year and increase with the no. of flights are **particularly progressive**
- But factors like migration background and having family abroad are also associated with frequent flying



Distributional impact of air travel taxes in the UK

- (in theory) a low-income recent migrant with family abroad is more likely to be a 'frequent flyer' than a high-income very "local" UK person ...
- ...in practice though, it is a very small group (less than 0.002% of the population in the UK)
- Residents of **peripheral regions** (e.g., Scotland and Northern Ireland in the UK) are also more likely to be frequent flyers, which might raise **regional inequality issues**



Supplementary Figure 4: Predicted probability of being a 'frequent flyer' by income

Note: Predicted probabilities are estimated for two 'ideal types': a) individual with no migration background, all friends in the local area and no close family member abroad (other predictors held at their mean value); b) individual born abroad, in the UK since less than 10 years, with more than half of friends outside of the local area and at least one close family member abroad (other predictors held at their mean value). The predicted

The next 'can of worms' for climate policy in the transport sector?

- Frequent flyer levy: one reason for exempting the first return flight in each year is to “**ensure that immigrants ... are not unduly burdened**” (Murray 2015, p.10)
- ‘Stay Grounded’ (2019): taxes & regulation for “degrowth of aviation”... but with **special provisions for migrants** and those with families in distant places
- Individual carbon rationing for air travel... but with **exemptions for visits to relatives** (Ruffin & Batho, 2020)



Giulio Mattioli @giulio_mattioli · 16 Aug
Replying to @allengraetz and @keithalexander

That's assuming reducing air travel requires "resources" because it has to be replaced 1:1 with HSR. We could simply fly less. And with most emissions being from long-haul flights, that's in fact much more important than building HSR.

2



87



Allen Graetz @allengraetz · 16 Aug
Replying to @giulio_mattioli and @keithalexander

You're taking about denying rare family visits to my beloved co-workers.

You're evil and you don't even know it.

1



27



Conclusion: Emerging Flight Dependence?

- Overall, it still is extremely unequal, GHG **mostly due to few, mostly privileged frequent flyers**
- But also evidence of lock-in “in the making” / **emerging “flight dependence” in certain sectors of the population:**
 - through **early socialisation** (with long-lasting effects?)
 - through **migration** & spatial dispersion of **social networks**
 - through **induced-demand** from airport expansion
- Raises some **issues for climate policy** in the transport sector
 - if **future growth is already ‘baked-in’**
 - if **perceived as ‘taken for granted’ or a ‘necessity’**
- A reason to act “sooner rather than later”?

PS: this is an **urban** issue in many ways!

- Important net **association between air travel and urbanity** (Czepkiewicz et al., 2018) due partly to:
 - concentration of people with migration background & dispersed social networks
 - greater accessibility to large airports
 - cosmopolitan attitudes (Czepkiewicz et al., 2019; 2020)
- Key role of “**global cities**” in the emergence of flight dependence?
- In Europe, **city tourism growth has outpaced** tourism at the national level + average length of stay in city tourism has decreased = more trips (Gunter & Wöber, 2022)
- EU cities like Brussels (Boussauw & Decroly, 2021) and Barcelona (Rico et al., 2019) have **huge climate footprint from inbound tourism** by air
- ‘City-marketing’ strategies **rely on tourism inflows** from distant locations
- An overlooked aspect of the urban decarbonization agenda (Creutzig et al., 2024)

Thank you for your attention!



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