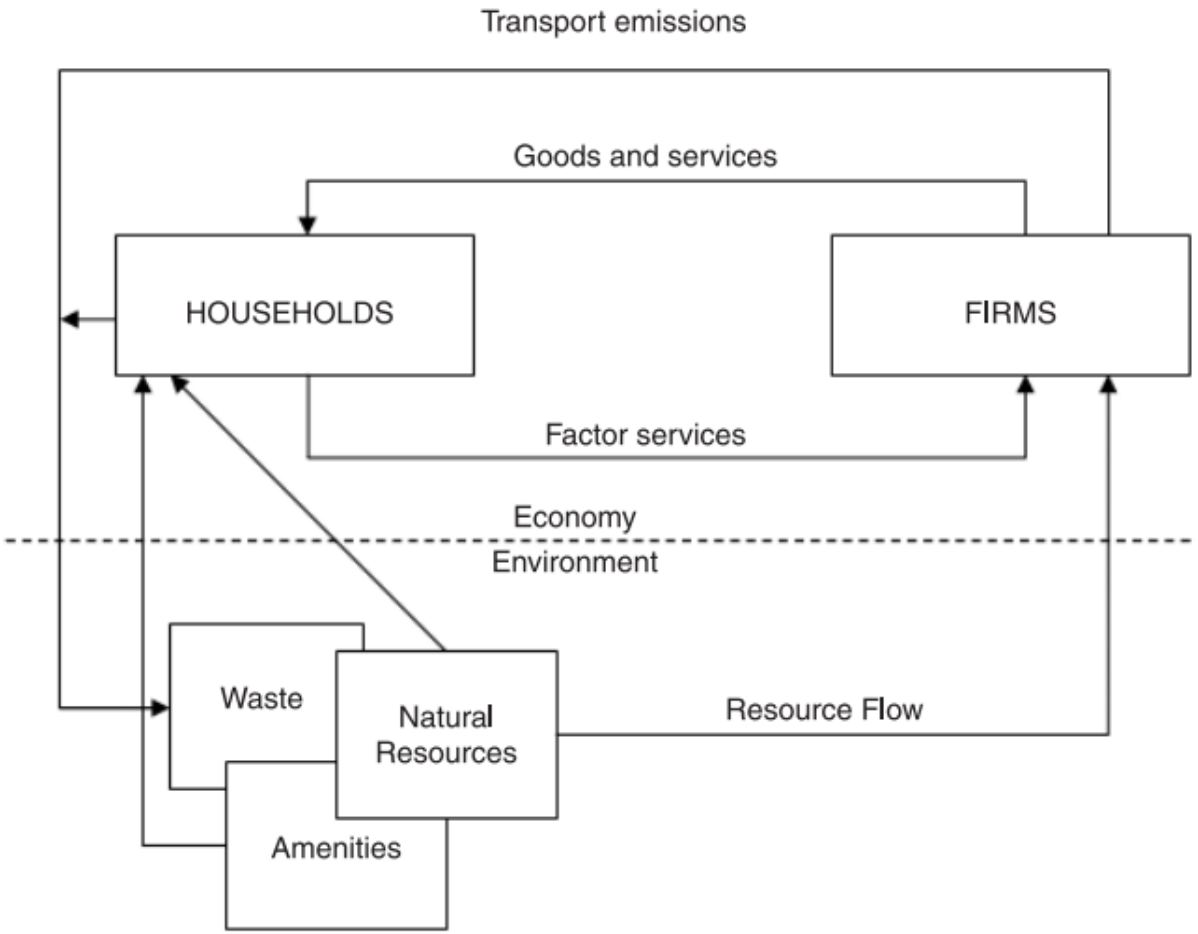
10. Transport and the Environment
The Economics of Freight

Introduction

- There is a **link** between the demand for transport and economic growth → this link has environmental implications → if left unchecked these will impact on economic activity
- **Vehicle emissions** impact on the quality of life both at the local and global level
- **Air** transport is also contributing to a climate change
- Transport is also a major consumer of **energy**

Transport and Environment



Transport emissions

- Carbon dioxide
- Carbon monoxide
- Nitrogen oxide
- Particulates
- Benzene
- Lead

Aviation and environment

- The air traffic has been increasing steadily → there are undoubted **economic benefits**, but there are also significant **environmental costs** (emissions, noise)
- The **growing income** is encouraging more flying
- Flight shame or ***flygskam*** is an anti-flying social movement, with the aim of reducing the environmental impact of aviation. Flight shame refers to an individual's uneasiness over engaging in consumption that is energy-intense and climatically problematic

Table 9.3 *Pollution emissions from transport and other end users in the UK: 1995–2005*

Thousand Tonnes/percentage

Pollution type:	*1995*	*1997*	*1999*	*2001*	*2003*	*2005*	*% of 2005 total*
Nitrogen oxides:							
Road transport	1,098	1,014	900	749	636	549	34
Civil aircraft	4.4	4.9	6.3	7.3	7.5	9.1	0.6
All transport	1,204	1,127	1,004	840	756	684	42
Non transport users	1,180	1,030	965	988	972	983	58
Carbon monoxide:							
Road transport	4,180	3,664	3,003	2,128	1,594	1,124	46
Civil aircraft	31	39	47	59	47	58	2.4
All transport	4,224	3,717	3,065	2,200	1,655	1,199	50
Non transport users	2,072	1,957	1,875	1,691	1,292	1,218	50
Sulphur dioxide:							
Road transport	52	28	14	4.2	4	3	0.4
Civil aircraft	0.3	0.5	0.4	0.5	0.5	0.6	0.1
All transport	83	58	39	23	31	43	6
Non transport users	2,239	1,583	1,188	1,096	960	660	94
Particulates (PM_{10}):							
Road transport	54	47	43	38	36	34	22
Civil aircraft	0.1	0.1	0.1	0.1	0.1	0.1	0.1
All transport	59	53	48	42	42	41	27
Non transport users	179	161	149	136	113	109	73

Source: Adapted from DfT (2007b)

Freight transport and the environment

- Close relation between **freight** transport activity and **GDP** → in the EU intensified by the reduction in trade restrictions
- What is the impact on the **environment**?
- Geographical areas with valuable environment and significant growth in freight traffic (**Alps**) → **Switzerland** (truck 28 tonne weight limit) → **Austria** (ban on night and weekend road haulage movements)

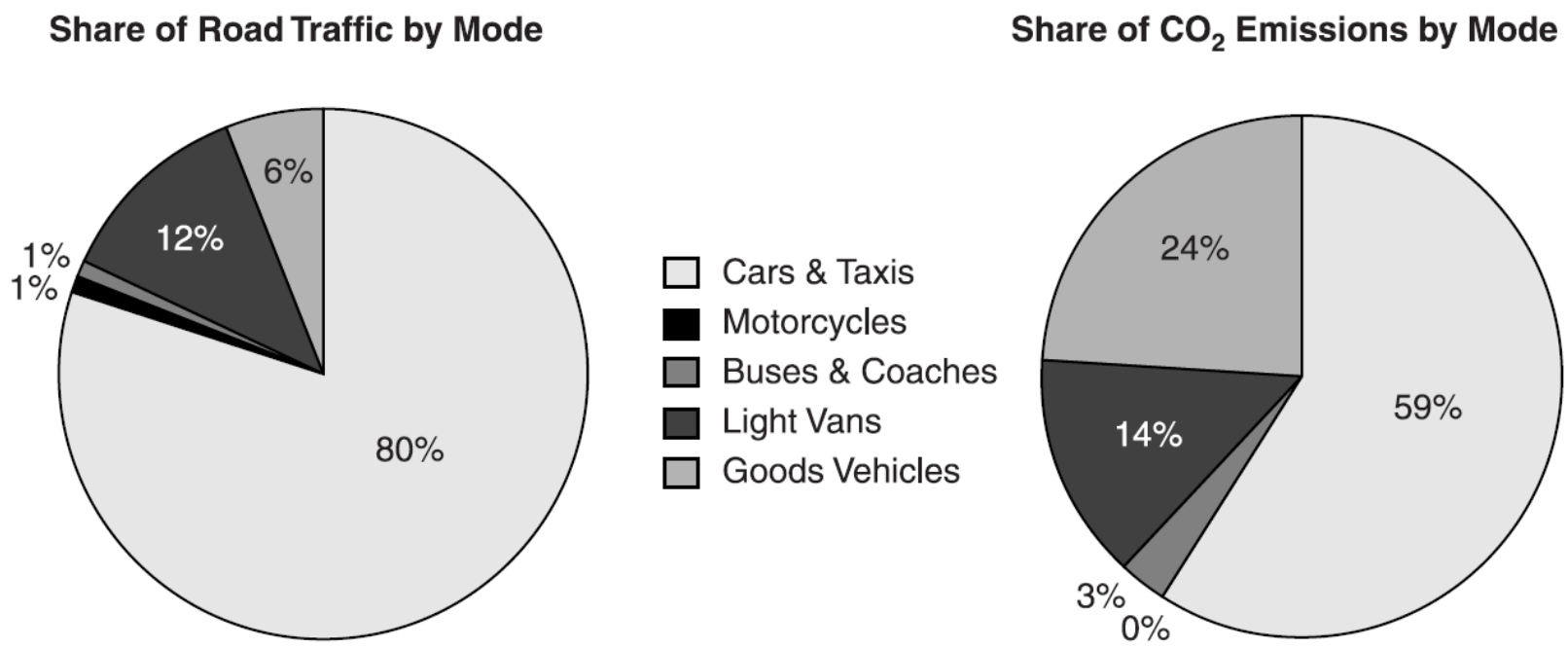


Figure 9.2 *Road transport 2005: modal share and share of CO_2 emissions*

Source: Drawn from DfT (2007b)

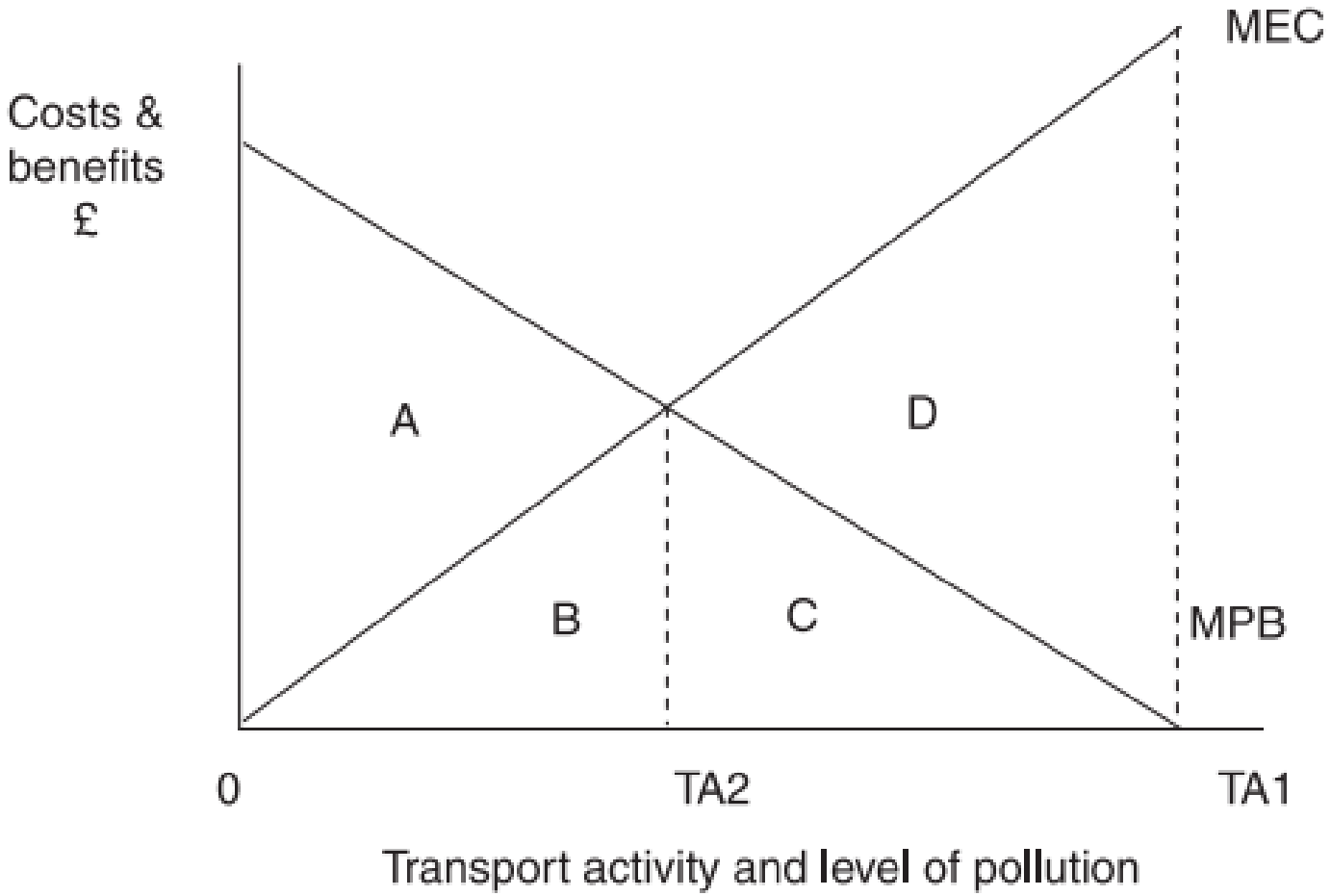
Is it really road haulage that is bad for the environment?

- **Road** haulage is a major contributor to the deterioration of the natural environment
- If road freight is so bad for the environment, why don't we just **get rid of it**?
- Lets speculate about the world with significant reduction or eradication of road haulage (e.g. stimulating modal shift to rail)

Problems with modal shift away from road

- Road network is about **25 times longer** (in the UK) than rail network → rail just could not cope with such increased traffic; rail cannot serve the lower level of supply chains
- **Product substitution** → (move away from fresh to frozen products, greater stocks needed, shift away from consumer society)
- **Modal substitution** → rail network would have to change completely to accommodate new traffic
- **Locational substitution** → reversion of trends of geographical decentralization of economic and residential activities

An Economic Model Of Transport and Pollution



Explainer

- **Marginal private benefit** (MPB) = additional benefits in terms of satisfaction received by road user or airline passenger from undertaking journey
- **Marginal external cost** (MEC) = additional environmental cost of transport activity in terms of air pollution, noise and so on
- If the transport user/sector is not constrained in terms of their level of activity → they will consume/provide an amount equal to **TA1**
- However, the optimal level of pollution is **TA2**

Policy options

There are a **number of options** how to deal with the environmental impacts of road and air transport:

1) Bargaining solution
2) Tax based solution
3) Tradable permits
4) Setting of standards
5) Technological change
6) Encouragement of alternative modes

1) Bargaining solution

- If **property rights** are assigned, than bargaining will occur between parties affected by external costs
- **Example**: airport noise pollution. Who has the right for quieter operations ? Airport+ operators or people leaving nearby?
- In both cases successful **negotiation** can occur about the compensations

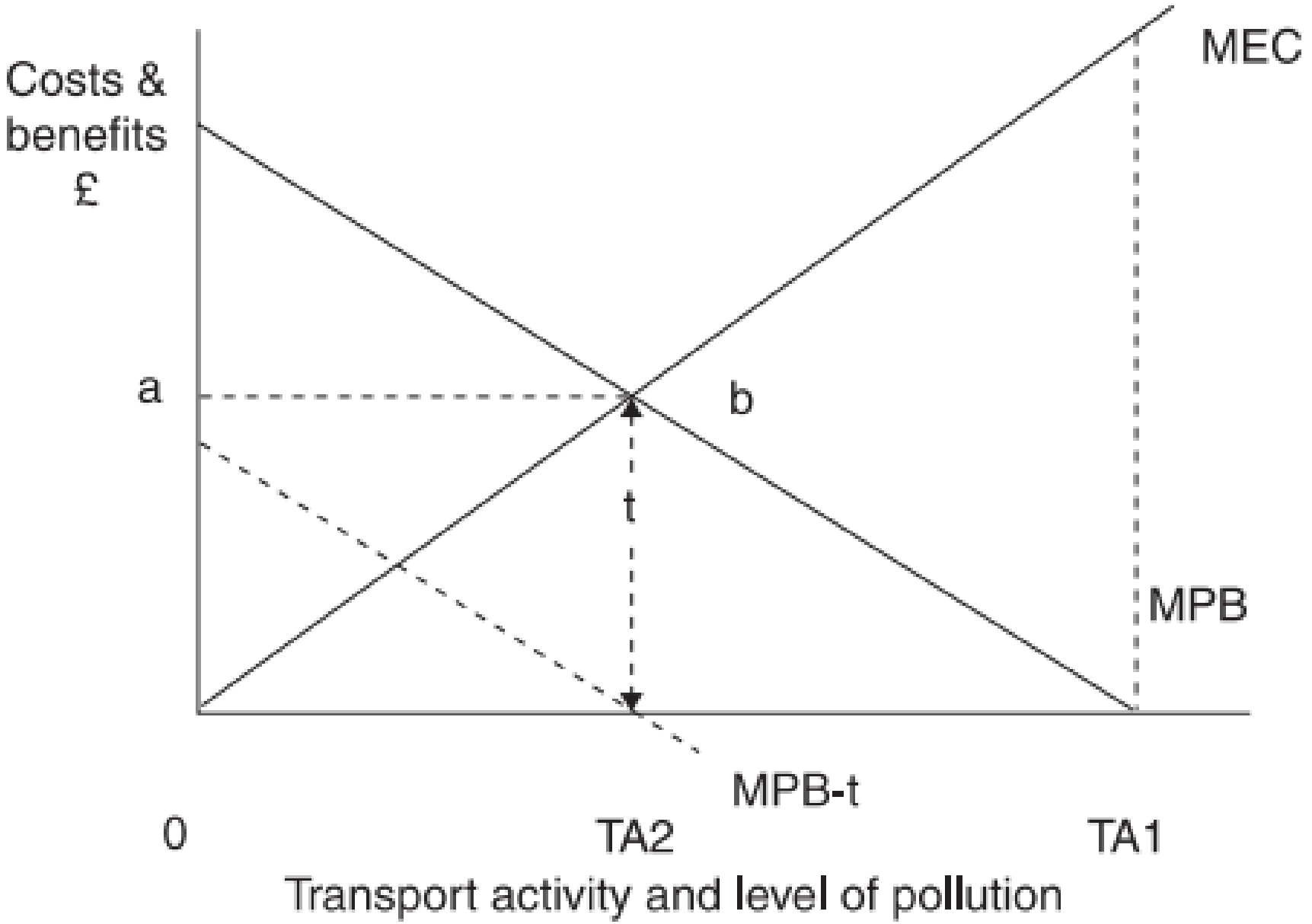
Equity issues

- Those affected by pollution will often find **difficult to organize** themselves
- Those who suffer from pollution may have not **sufficient funds** to compensate those who pollute
- Certain individuals who suffer from pollution may be reluctant to contribute (**free riders**)
- If **polluters** were to pay → they would curb activities or support R&D (e.g., quieter aero engines)

→ these issues seem to favour the **polluter pays principle**

2) Tax based solution

- The principle of tax based solution involve **setting a price** which places a monetary value on the environmental costs of transport using taxation and imposes these upon the polluter
- Such solution is likely to **reduce the demand** to travel and therefore the environmental impact
- Using an environmental tax is a way of **internalising** the external cost and the tax can be viewed as the **optimum tax**.


Costs &
benefits
£
MEC
a
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t
MPB
MPB-t
0
TA2
TA1
Transport activity and level of pollution

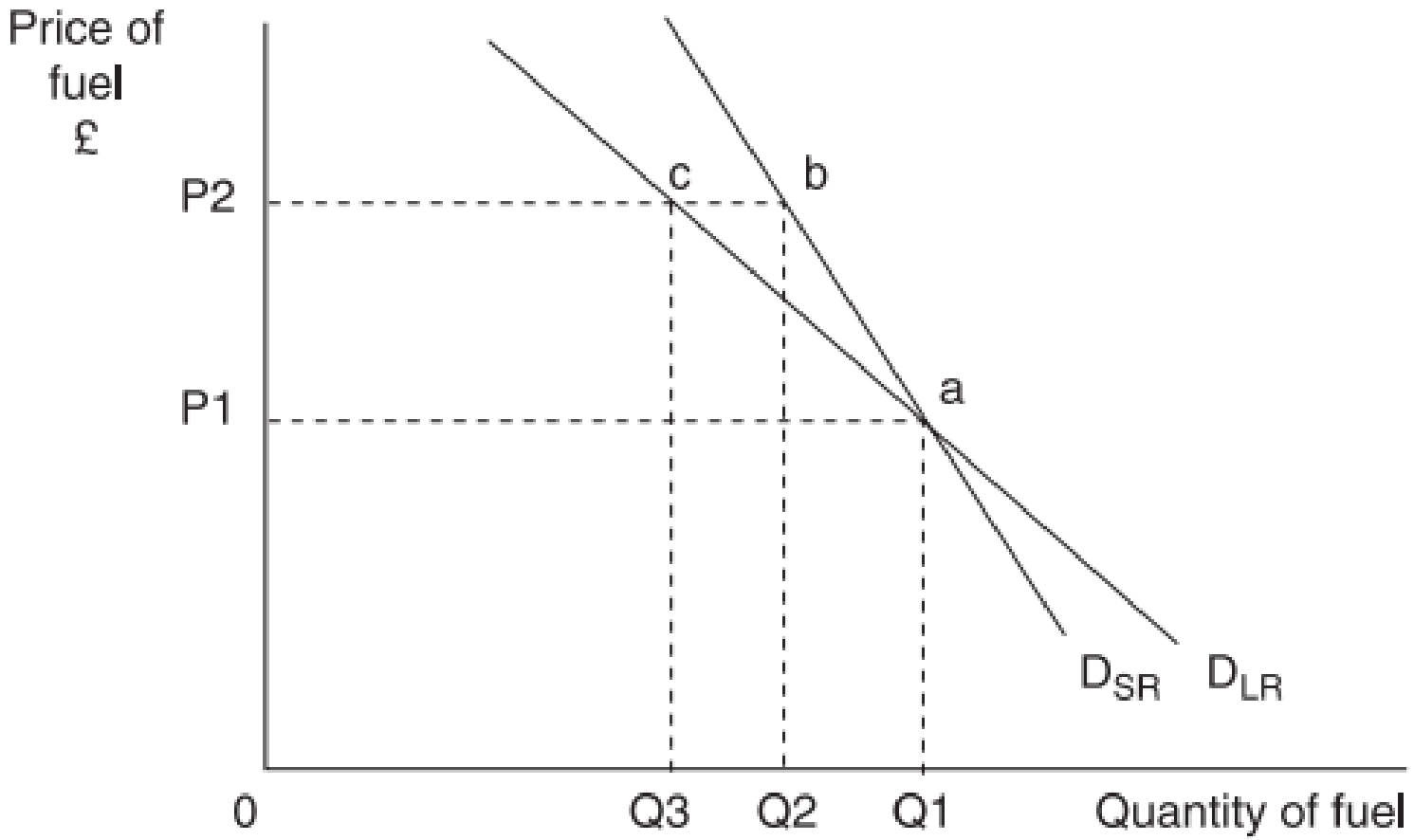
Advantages of tax-based solution

- The air or road users or operators has to pay a price for pollution → the polluter has the **incentiv**e to reduce their level of activity to the optimal level TA2
- The introduction of an environmental tax allows the **users to decide** how they will respond (unlike the use of standard which sets a particular limit)

Disadvantages of tax-based solution

- **Difficulties** in establishing the optimum tax t
- There are often **political difficulties** when introducing a new tax. There may be resistance in the belief that the tax will be raised above the optimal level as a way of revenue collection
- Transport user is penalized **twice** – lower activity, paying the tax

Fuel tax



Advantages of fuel tax

- The amount of tax paid **varies** with the environmental cost
- It is **simple** to administer, it costs little to collect, is difficult to avoid or evade and can easily be modified
- Road users have **discretion** how to respond

3) Tradable permits

- The idea behind tradable **permits** is that polluters are presented with a number of permits which allow them to emit a particular level of CO2
- The number of permits which exist limits the amount of **emissions**
- The permits are **tradable** in that they can be bought and sold to other polluters who are participating in the scheme
- CASE: The **EU Emissions Trading** Scheme → the major economic instrument in addressing greenhouse gas emissions

Design

1) How are permits **allocated** at the beginning? (the issue of previous environmental investment)
2) Should permits be **freely** allocated or should they be auctioned?
3) What should be the **overall** number of permits in circulation?
4) The incumbents may **corner** the market in permits → making it barrier to entry
5) There are **administrative** costs

Advantages

- It is **flexible**. Companies may choose to reduce emissions in operations or buy permits
- It may be **politically** easier to introduce than outright taxation
- It is **cost effective** → incentives are provided to address emissions levels
- Unlike a Pigouvian tax which needs to estimate the cost of pollution, with tradable permits it is the **market** (in the tradable permits) that will find the optimum price

4) The setting of standards

- It is not the economic instrument and may have a **considerable impact**
- e.g.: Requirement for annual vehicle **inspection** for road vehicles
- Setting of standards aims to achieve the optimal level of transport activity → if achieved this would result in the **optimal level** of pollution
- As with taxation, the **challenge** is to set them correctly (overestimation x underestimation)

5) Technological change

- Can decrease **emissions** by new technologies → e.g. cleaner fuels, catalytic converters, fuel efficient cars, renewable sources
- It improves ways in which individuals can make choices → in car **information** and real time information in public transport stops
- **On-line meetings** can be undertaken without the need to travel

6) Promotion of alternative modes of transport

- This policy option involves encouraging the **alternative modes** such as public transport, walking, cycling, rail freight and shipping
- The **private car** has the advantage of convenience and flexibility, whereas **public transport** tends to be confined to fixed routes.
- **Solutions**: dedicated bus lines, introduction of new public transport, improved facilities for cycling and walking

Summary and Reflection

- **Bargaining** → theoretically attractive, it raised many issues in terms of the practicalities of implementation
- **Taxes** → how to set the correct tax? But it allows flexibility in responding
- **Permits** → also allow flexibility and may be easier politically to introduce. How to design it?
- **Alternatives** → standards, technological change, promotion of alternatives

Shall we ban short flights?

Dobruszkes, F., Mattioli, G., & Mathieu, L. (2022). Banning super short-haul flights: Environmental evidence or political turbulence?. *Journal of Transport Geography*, *104*, 103457.

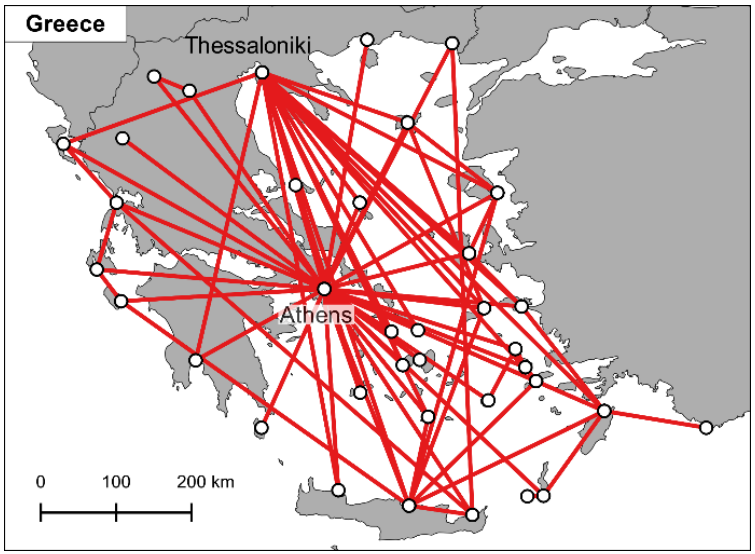
Should we ban short distance flights?

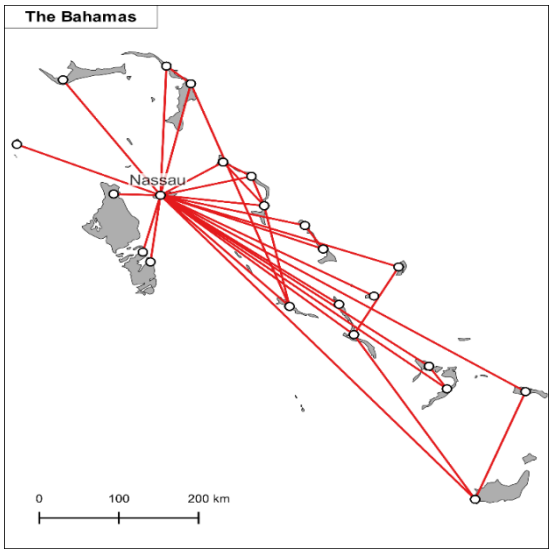
- Several countries have considered banning or even decided to **ban or tax super short-haul flights**, arguing that the availability of rail alternatives makes them unnecessary.
- Such policies result from the need for governments to be seen as **acting to mitigate climate change** and scholars favouring energy (climate) efficiency perspectives over the absolute amount of fuel burnt (greenhouse gas emissions emitted).

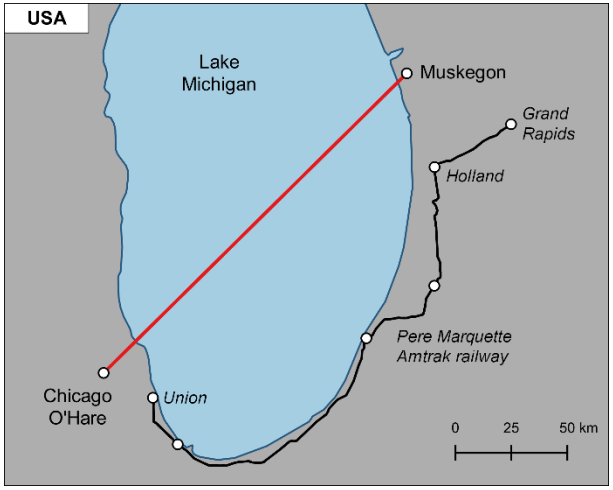
Evidence

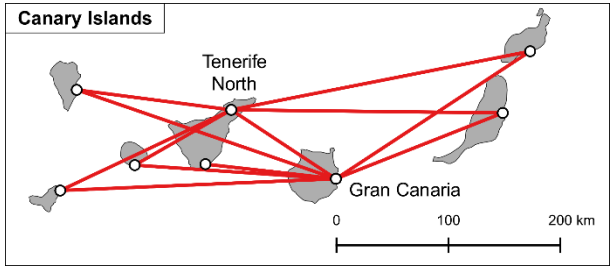
- Yet **climate change** is due to absolute emissions, and it is a fact that the longer a flight is, the greater the amount of fuel is burnt (emissions).
- Considering all departing flights from 31 European countries, our study found that flights **shorter** than 500 km account for 27.9% of departures but 5.9% of fuel burnt. In contrast, flights **longer** than 4,000 km account for 6.2% of departures but 47.0% of fuel burnt, although with significant variation across countries.
- We conclude that **targeting shorter flights** (which often exist to alleviate physical obstacles imposed by physical geography) will contribute little to reducing the impact of aviation on climate, and that policy initiatives that target longer flights are urgently needed

Examples of short haul flights

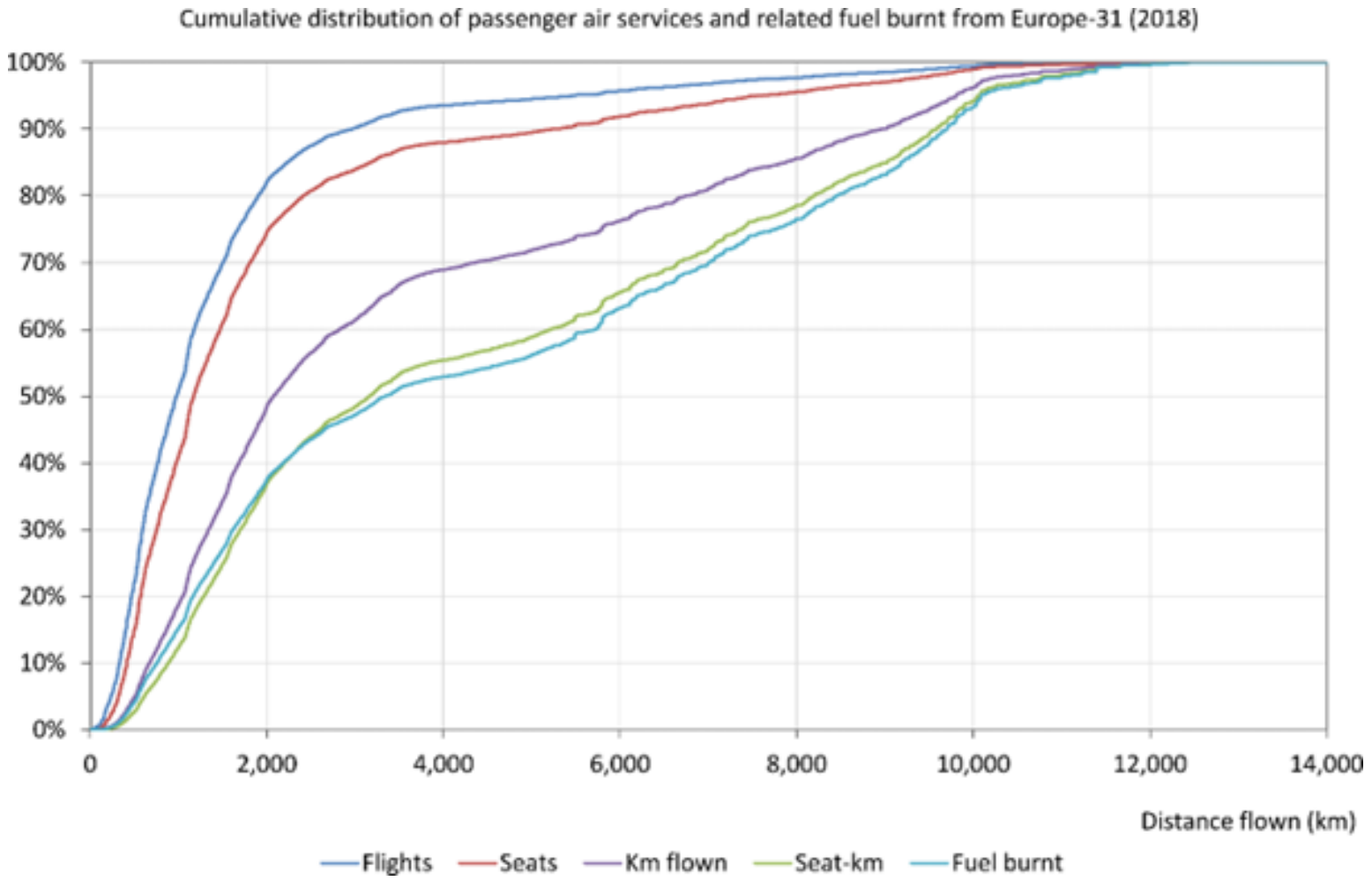




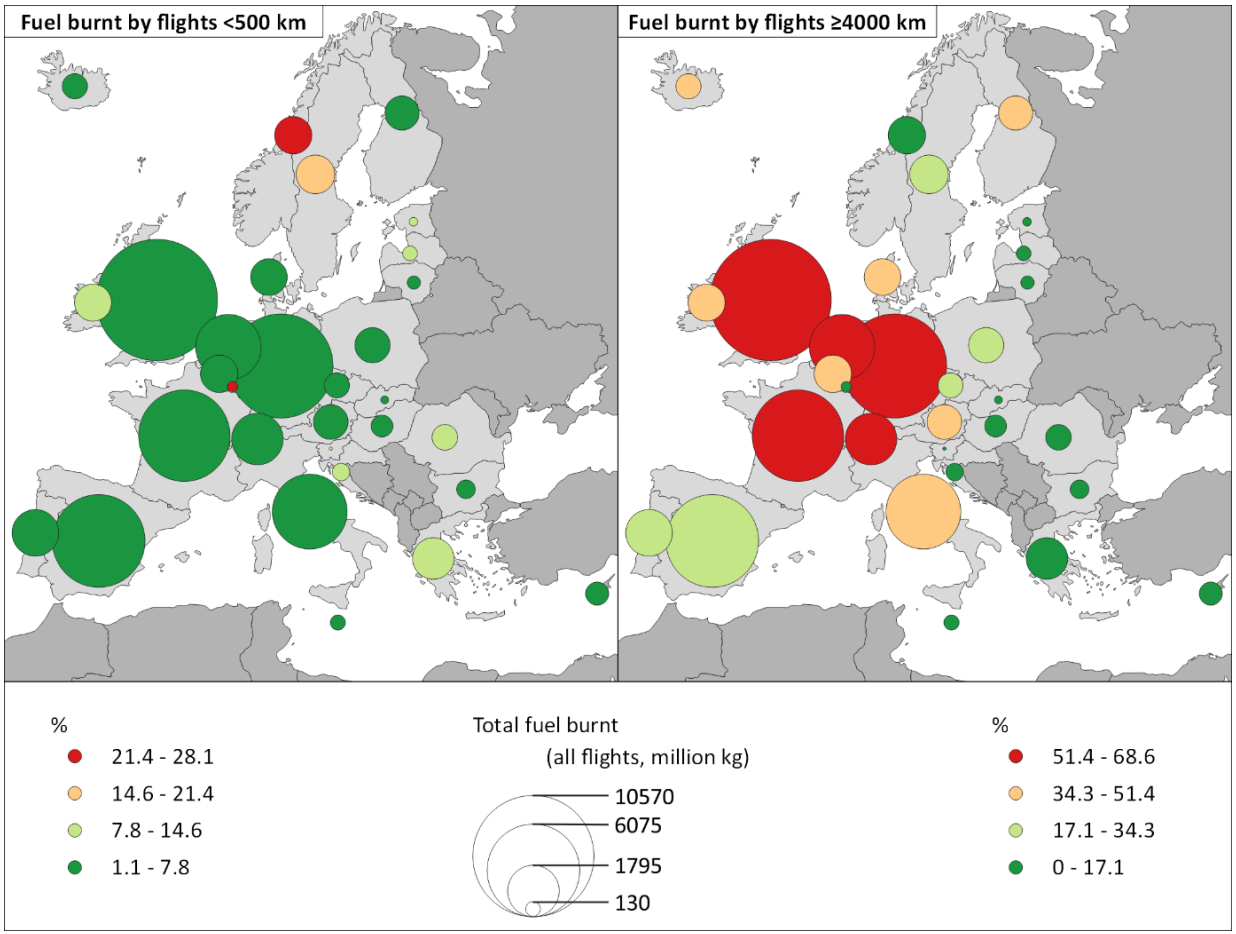




Cumulative distribution of passenger air services and fuel burnt from Europe



Fuel burnt by the shortest and longest flights at the country level



Conclusions

- Our results lead to a conclusion: in nearly all the 31 European countries under investigation, **banning** super short-haul flights will **help** very **little** in mitigating aviation's contribution to climate change.
- While these measures might make a difference in some countries such as **Norway**, this would likely be to the detriment of **remote, small communities**, for which limited transport alternatives are available.
- In other words, if the goal is to reduce the climate footprint of aviation, it is **longer**, not shorter flights that ought to be the primary target for action.

Policy implications

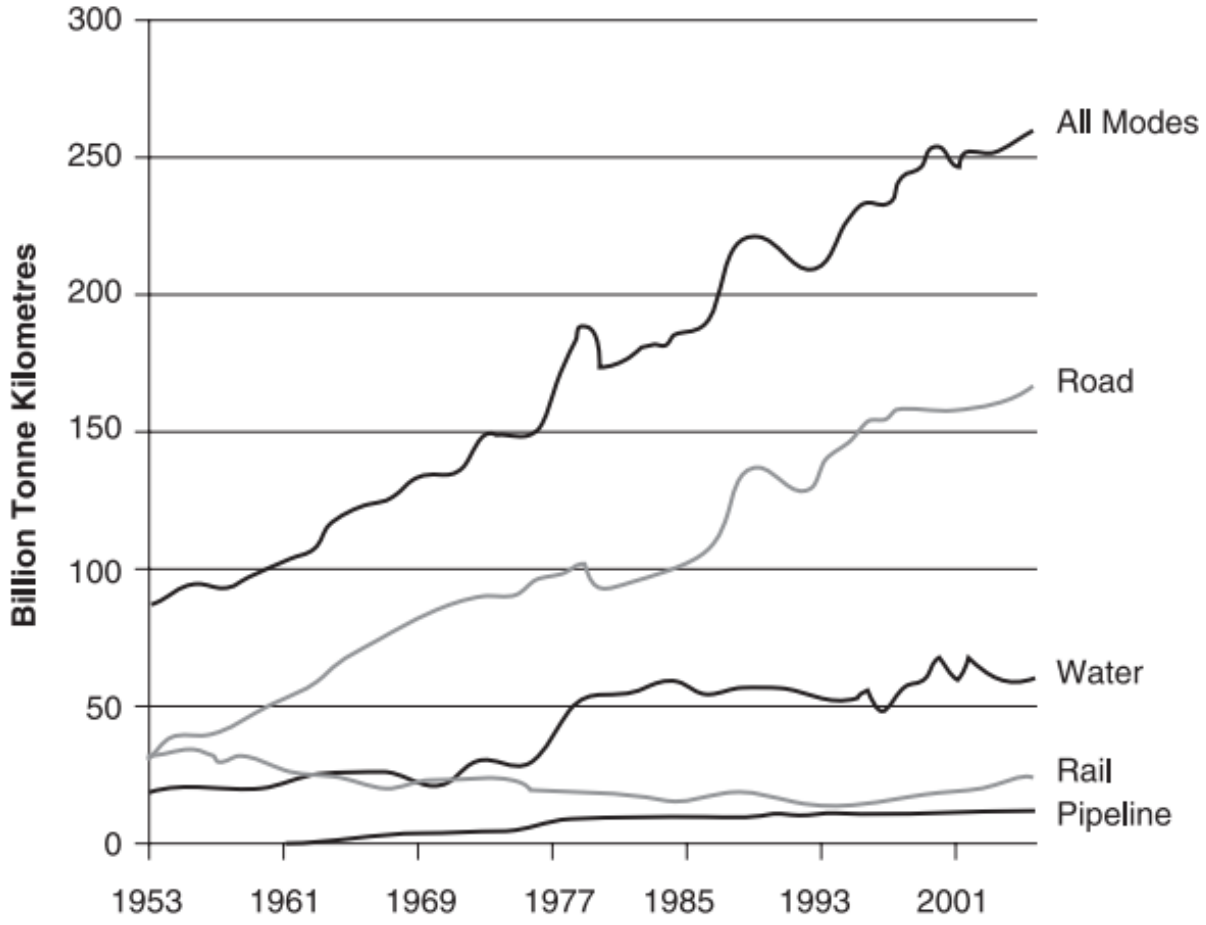
- The current debate also tends to overlook that shifting passengers from super-short haul **flights to trains** may also induce unexpected effects in two ways.
- **First**, freeing slots at constrained airports (namely, airports in which no more slots are available at relevant hours) by banning shorter flights could mean they would be replaced by longer flights, which would generate more GHG emissions.
- **Second**, the lack of super short-haul flights may induce passengers to consider car travel instead of railways, and car travel can result in as much emissions as air travel

THE ECONOMICS OF FREIGHT

Introduction

- In comparison with passenger transport, freight is an often overlooked and under researched area.
- The freight transport in Europe (and elsewhere) is becoming more international (because of decline of transport costs)

Trends in the UK freight transport



Road haulage

- Market **segments**: truck load x less than truck load (LTL)
- **Truck load** – many small firms, point to point operations over long distances
- **LTL segment** – much more sophisticated – demanding logistic – parcel services
- **Cost structures** – higher fixed costs in LTL
- **Economies of density** crucial

Rail freight

- Determined by **history** (infrastructure, organization)
- **Decline** of modal **share** of rail freight in Europe unlike other parts of the world (especially N. America)
- **USA (2006):** rail freight carried 3% of the value of the freight; 10% of the weight and 31% of tonne-km
- Differences in **structure and ownership**: US x EU

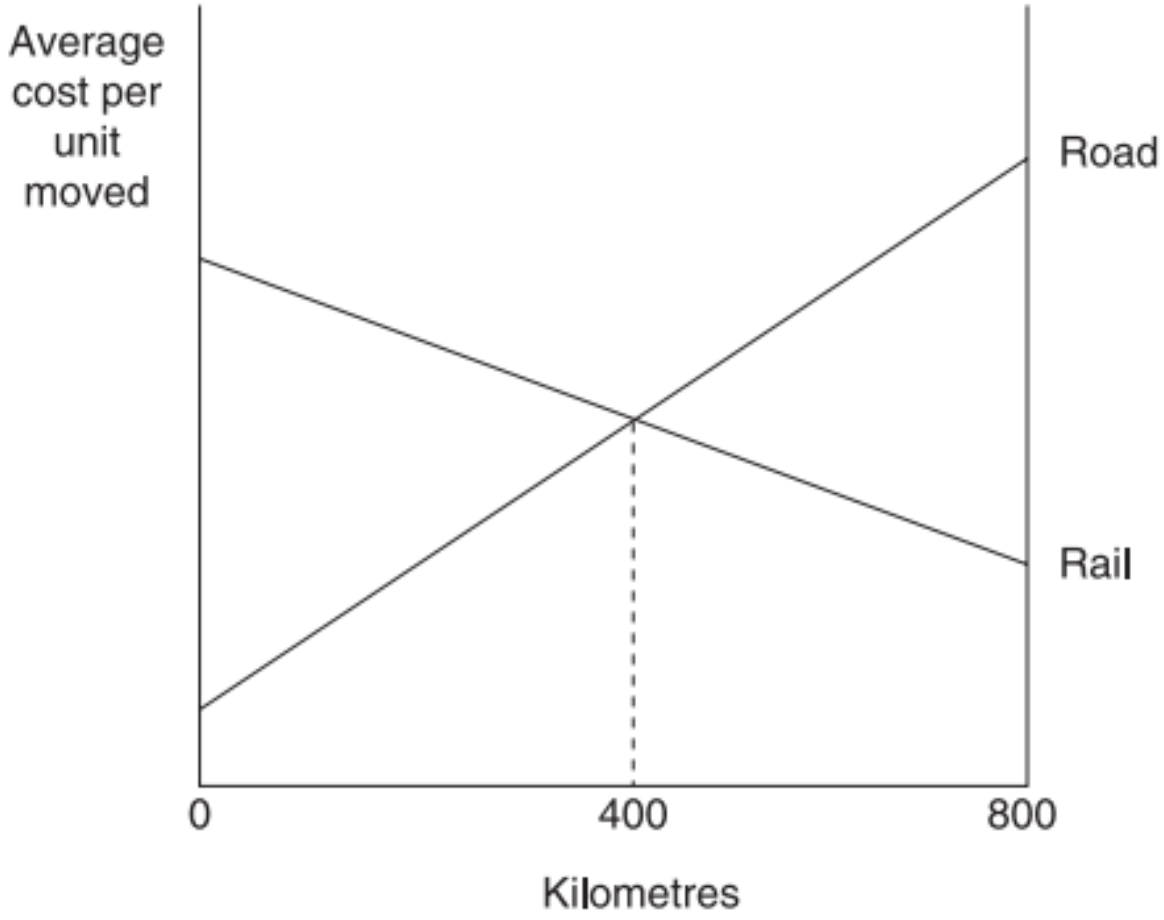
Key economic characteristics of rail freight

- **Barriers to entry** (legal obstacles, high start-up costs, firm size, infrastructure bottlenecks)
- **Costs structures** (high fixed costs, economies of density)
- **Economies of scale** and scope
- **High break even point**

Advantages of rail freight

- Friendly **environmental** impact
- High **capacity** – the potential to move large volumes of freight quickly and efficiently
- **Power** costs – rail transport per tonne handled has a very low power costs
- **Distance** – rail has a major cost advantage in medium and long distances over road transport

Rail x Road: Average costs per unit moved



Disadvantages (rail freight)

- **Accessibility**: rail has only limited number of point of access; last mile problem
- **Shipment size** – to capture benefits, it is necessary to have a minimum shipment size; however the economy is moving towards weightless economy
- **Frequency** – rail is less frequent
- **Security** – may be a challenge

Challenges

- Industry has been facing falling or stagnating **freight tonnage**
- **National focus** of railways
- **Lack of harmonization** standards – complex patchwork of conflicting standards and requirements
- **Bottlenecks** around major cities (e.g. Milano, Vienna, Munich, Rotterdam)
- **Structural** economic **change** (move from heavy industry towards services)
- **Passenger oriented** rail networks (in Europe)

Rail - summary

- Rail freight has the **potential** to reduce road congestion and its impact upon the environment by switching large volumes of freight to railways
- It is **easier said than done**
- Rail freight in Europe is **declining** and even reforms (UK, EU) have not been able to reverse the declining trend
- Potential measures: **increasing capacity**
- **Summary**: however, the total market opportunities seem limited

Air and maritime freight

- **Air freight** → fastest growing mode of freight transport recently → strongly tied with the globalization of the world economy → most air freight goes by passenger aircraft (goods in joint supply) → increasing environmental concerns may limit future growth
- **Maritime shipping** → main mode of transport for long distance international freight → economies of scale are important