Airport noise pollution:

how to regulate efficiently by confronting victims and polluters?

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Introduction

- Noise pollution = societal problem for all major airports
- Tension: residents versus airlines, airport developers, airport workers (NIMBY)
  - Noise = Externality between residents and aircraft
  - currently (un)solved through regional/urban development policies
  - problem of increasing world air traffic

Current noise solutions

- landing/take-off time slot management;
- quotas or/and noise tax
- regional development/government;
- Brussels Airport: medium size, 3 regions; 2 conflicting communities; 30 municipalities; federal investments to double air traffic
- Other airports: Roissy, Schipol, Heatrow, Chicago, Singapore

Social costs to residents

- Hedonic prices models or surveys
  - typically in urban area!
  - noise costs = 75 % social cost
  - noise costs = 0.0201 Euro per passenger-km = 2,000 Euros per 100-seat aircraft flight over 1,000 km.
  - -1% housing rents per 1% per acoustic decibel
    - the price of a house would diminish by 15% if it is located in a noisy airport environment that increases the average decibel (dBA) by 15% compared to quiet locations.
  - Bréchet et al. (2009) confirms for Brussels' airport.
    - Few 1,200 Euros per year; Many 220 Euros per year; Total 10 m euros

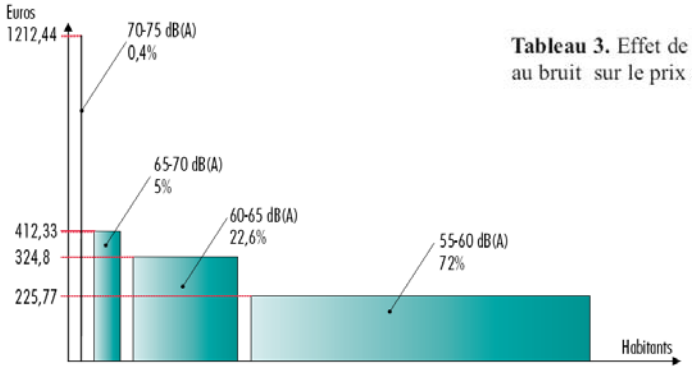
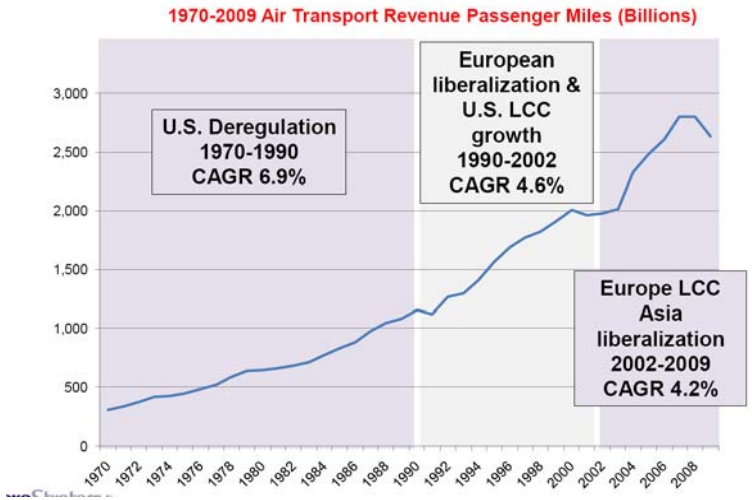


Tableau 3. Effet de l'exposition au bruit sur le prix des maisons

Niveau de bruit (dB(A))	Valeur des coefficients	Impact effectif
Zone 2 : 55-60	-0,057	-0,055
Zone 3 : 60-65	-0,083	-0,079
Zone 4 : 65-70	-0,104	-0,099
Zone 5 : 70-75	-0,306	-0,264

Local economic benefits

- Air traffic growth
  - Revenue 3-4% annual growth
  - Double by 2030
  - 18 of the 31 large hub airports in the US plan to add runways in the next decade
- Benefits
  - High profit,
  - tax revenues and
  - direct and indirect employment opportunities
- Brussels' airport
  - Airport revenues 300 m Euros, profit 160m
  - Plus airlines revenues and indirect activities
- Should we count jobs?
  - caution to substitution effects! Count only, if involuntary unemployment or imperfections in labor market.



Cost-benefit analysis

- Benefit >>> costs
  - Heatrow
    - 2% on air fares would suffice to compensate for the whole set of environmental effects (noise pollution, air pollution, etc.)
  - Brussels:
    - 160mEuros>>>10mEuros
    - Tax 12.5 Euros/passenger allows to pay house rents below a route
- Problem:
  - how to assess the tax?
  - how to assess demand for aircraft movement?
  - how to assess local cost of aircraft movement and noise?
    - Difference between theoretical noise and practical impact
  - how to arbitrage?

Objectives of paper

- How to internalize the externalities between aircraft noise makers and victims?
- How to organize tax/compensation?

- Market institutions can be appropriate
  - Local market for noise licenses
  - principle of « polluter pays »

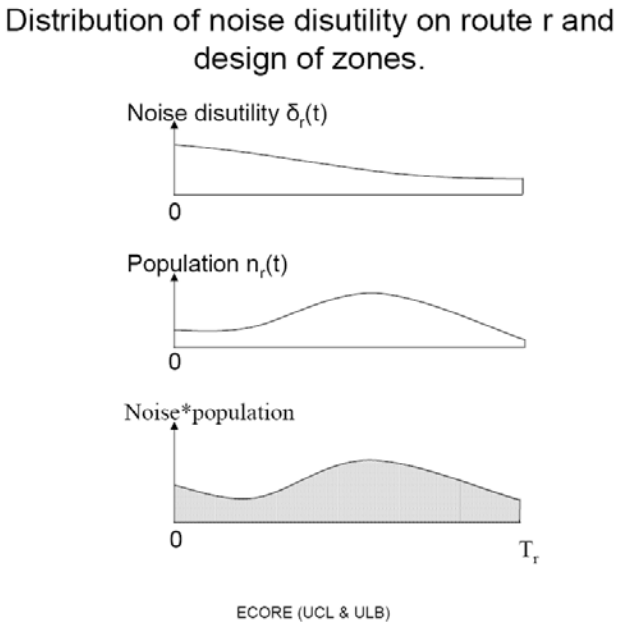
- Minimum government intervention
  - No federal, no municipal negociation; No resident and airport lobby; No empirical study
- Theory viewpoint
  - See earlier paper by Bréchet Picard
  - Here, brief overview

- Utopia? Decent benchmark for discussion

Fact 1

- Residents' disutility from aircraft noise
- depends on location

=> willingness to pay to avoid noise



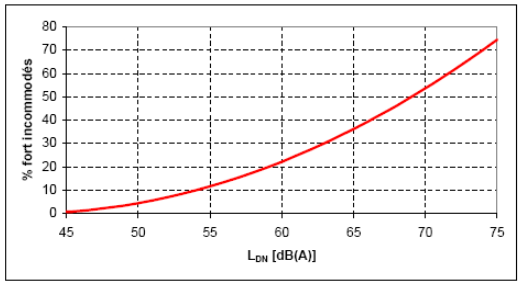
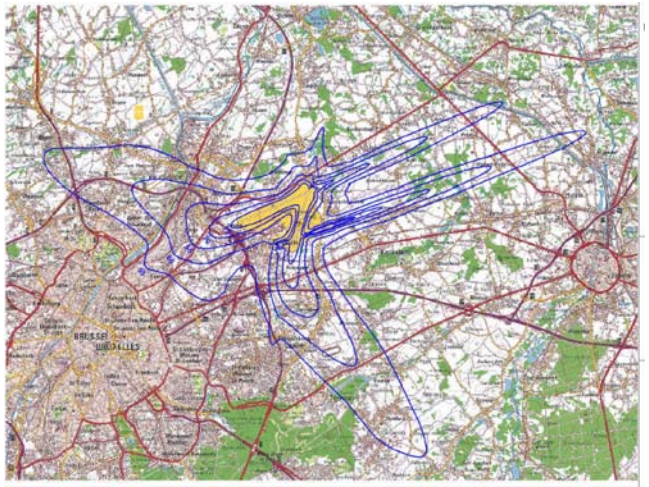


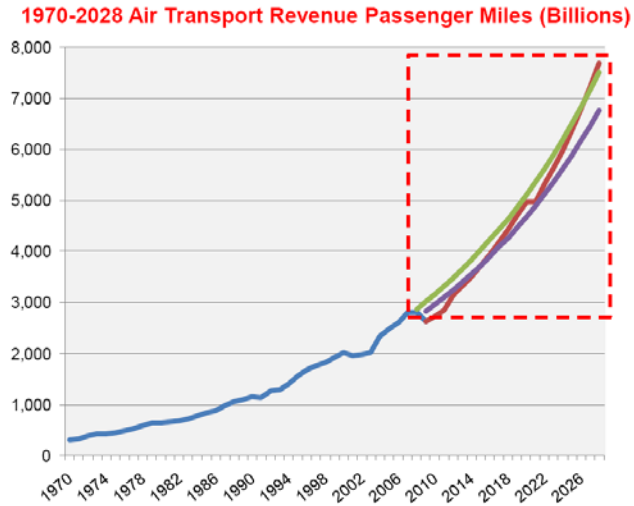
Schéma 2 Pourcentage d'habitants potentiellement fort gênés en fonction du L_{DN} pour le bruit d'avions (Source : Miedema 1992)



Fact 2

- Aircraft/airline companies offer air city-connections with various profitability levels
  - GDP Growth
  - Oil price
  - CO2 emissions
  - Alternative transport (fast rail, road, sea…)

=> demand for aircraft movements



Fact 3

- several routes for land and take off
- on several zones (e.g. municipalities)

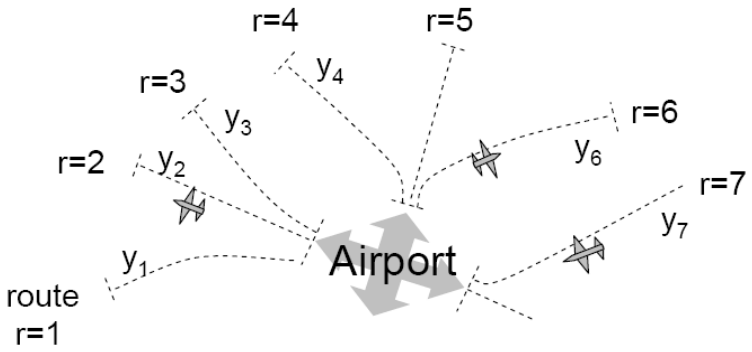


Fig. 1: Feasible routes from an airport.

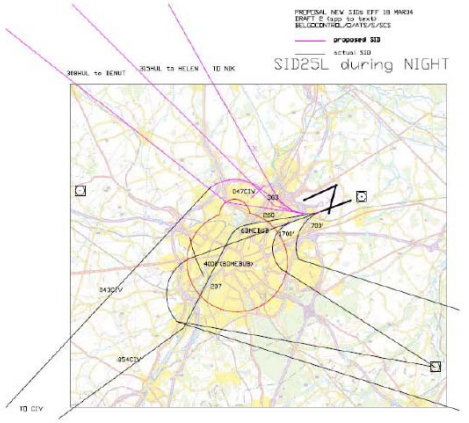
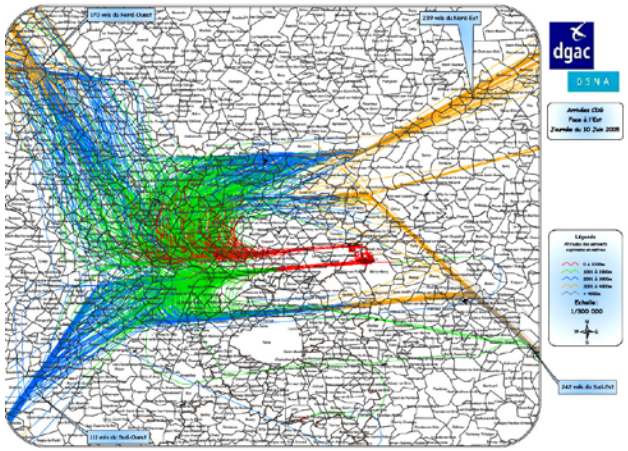


Figure 2: Actual and proposed routes from Brussels airport.



Market design

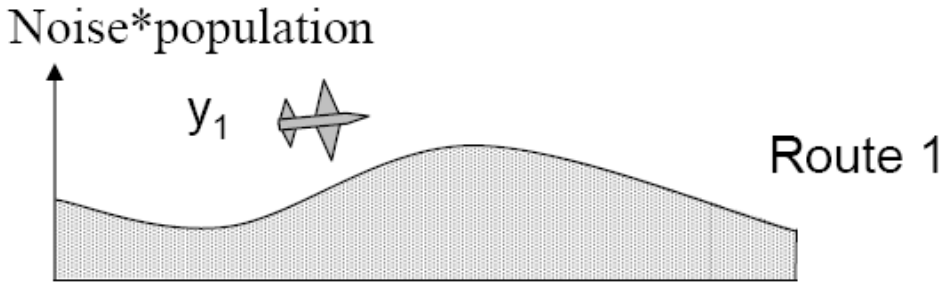
- Zones (e.g. municipalities) assign/elect residents representatives
- Assign the right to emit noise permits to representatives along each route
- Ask aircraft/airline companies to buy noise permits for aircraft movement
- Organize a market clearing (computer program like but simpler than markets for CO2 (ECX), Energy EUREX)
- Allow transaction at market clearing price

This presentation

- one type of aircraft
- homogenous residents
- one relevant time period, say day 8:00-20:00 or night 20:00-8:00

- More details in Bréchet Picard 2010-2011

The case of a single route



- Monopsony: residents have market power
- Market clearing

The case of a single route

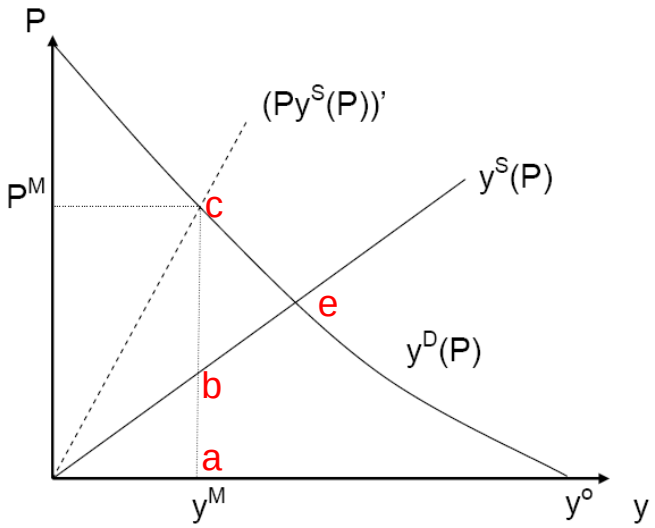
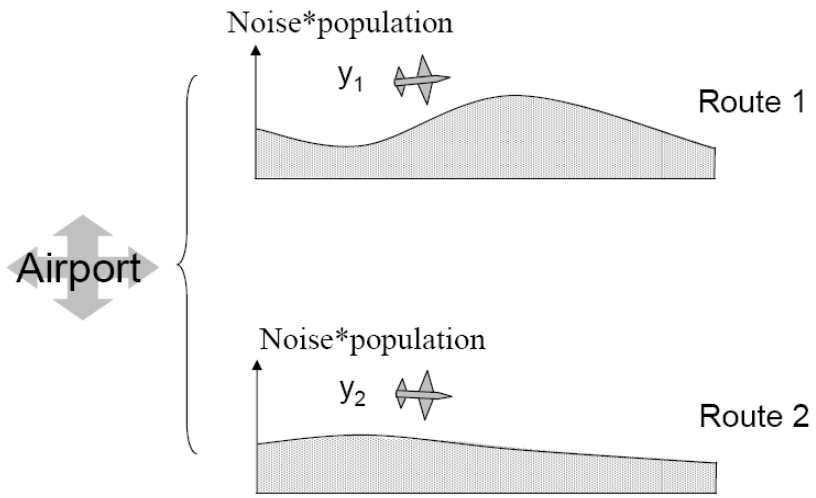


Fig. 4: Market equilibrium with monopsony route

- Compensation for noise damage (ab, 55 Euros/movement ZVT, Bréchet)
- Rent to residents (bc, 55 Euros/movement ZVT, Bréchet)
- Reduction in aircraft movements (y^o to y^M)
- Efficient compensation and activity (e)

The case of two routes



1. Competition reduces residents' market power
2. Spread reduces marginal damage

The case of two routes

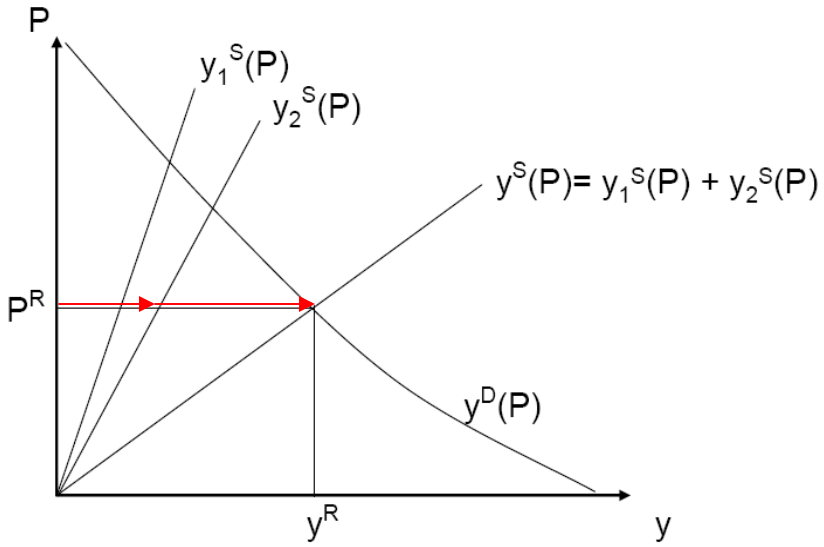
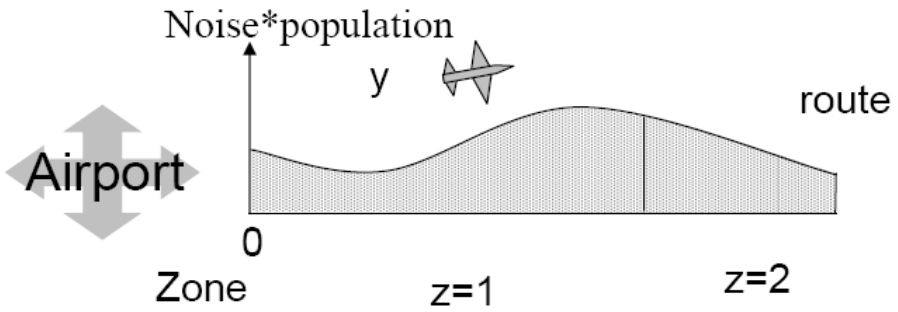


Fig. 5: Market equilibrium with two routes

The case of two zones



- Zones bid two permit prices (P1,P2) for the same route
- Market design: auctionneer calibrates the permit price of most harmed critical zone (P=2*P1)

- Route is a complementary good (*tragedy of the anti-commons; double marginalization)*

The case of two zones

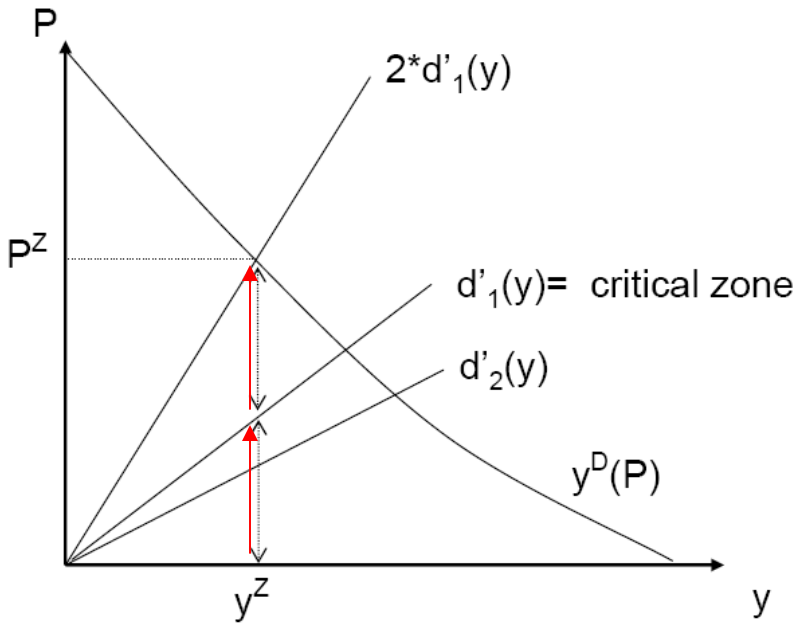


Fig. 6: Market equilibrium with two zones

Theory result: *tragedy of the anti-commons mitigated if zones are balanced in harm (that is P1 close to P2)*

Conclusion

- How to internalize the externalities between aircraft noise makers and victims?
- How to organize tax/compensation?

- Market institutions can be appropriate
  - local market for noise licenses
  - principle of « polluter pays »
  - exits rents (as in any market) to residents
  - price and rents mitigated if many routes and balanced zones

- Discussion benchmark
  No other policy
  - compensates noise victims
  - balances marginal benefits and costs

- Natural economists' response to noise pollution around airport
- This can be used as a benchmark for the discussion of other policies