The economic and social value of aircraft noise effects: a critical review of the state of the art

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What is the economic value of noise? Is it possible to valuate noise?

- Noise does not have a market price, but it has a value.
- **Value are not the same as prices**
- Values are a measure of benefit, utility, pleasure….provided by a good or service to a human being
- Prices depends on values. Values depends on judgments.
- Values are generally measured relative to a currency (money).
- Need of a monetary value for aircraft noise effects: positive and negative social consequences.

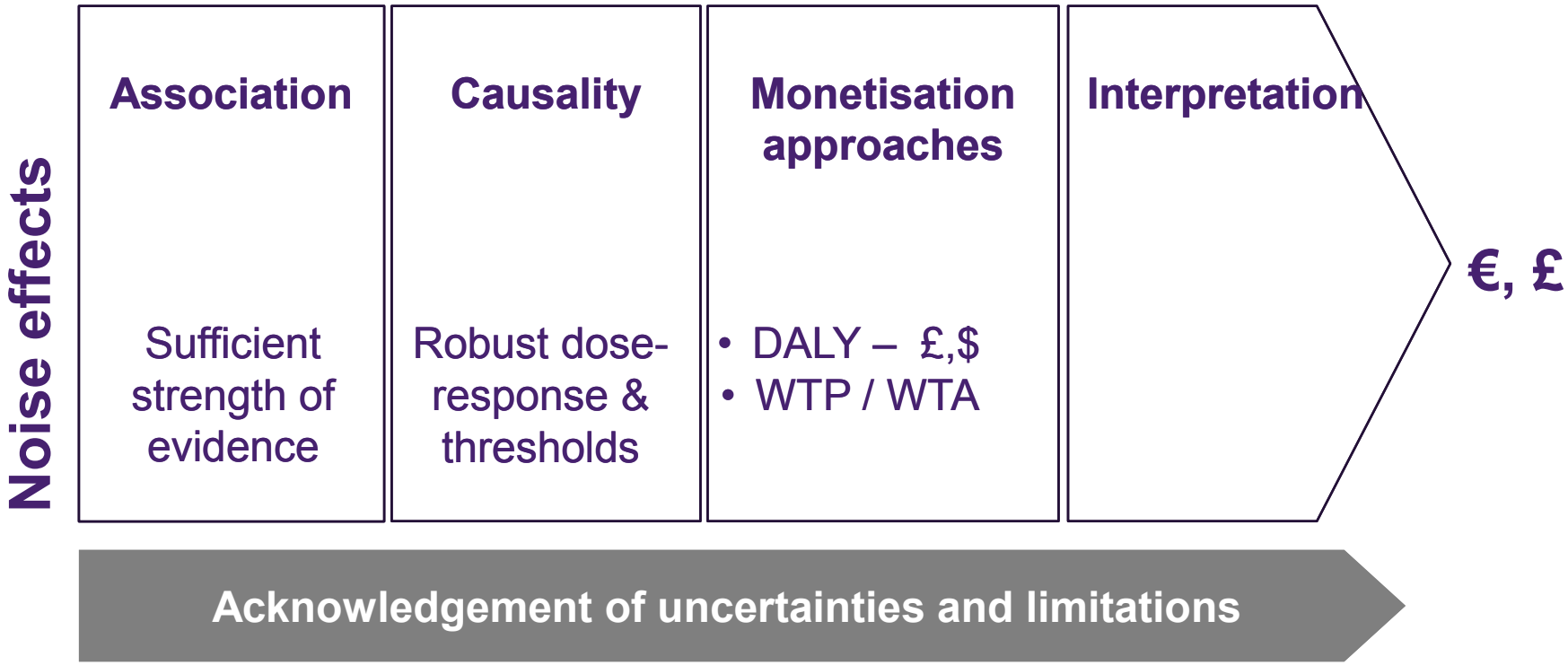
1. Why it is important?

- ✓ Only acousticians understand all the various metrics and descriptors for sound and its impacts.
- ✓ Provides a common language across all aspects of sustainable airports management
- ✓ Enables comparison and contextualisation of noise in sustainability.
- ✓ Input to inform decisions & policy making (CBA)
- ✓ Helps us to understand the balance between the benefits and negative effects of aviation.
- ✓ Pivotal role in ongoing UK Aviation Policy

"The Government wants to strike a fair balance between the negative impacts of noise and positive economic impacts of flights"

UK Airports Commission

3. How to undertake monetisation?



Approaches for economic valuation….

DALY:
Disability- Adjusted Life Years

- Economic measure the cost of lost productivity caused by exposure to pollutants
- One lost of “healthy” life
- DALY Includes mortality (YLL) & morbidity (YLD)
- Weighting and discounting

Health
Annoyance
Sleep disturbance
AMI
Hypertension

Social preference: WTP / WTA

Revealed Preference

Hedonic Price
Changes in house prices as proxy of cost of noise

Stated preference

Contingent valuation /
Choice Modelling
Questionnaire based surveys

“Social preference on aircraft noise”

Review of the approach for each effect:

- Cardiovascular disease:
  - Acute myocardial infarction (AMI)
  - Hypertension (HT)
- Sleep Disturbance (SD)
- Annoyance (A)

	Association	Causality	Monetisation Method	
AMI	**Sufficient**	**2014 Babisch OR** • **Road traffic** • OR= 1.08 per 10dB • 55 - 77dB(A) L_{den}	**DALY** • DW: 0.405 • 72% of cases is fatal • AMI risk: 0.0596%	**Analysis / Interpretation**
HT	**Sufficient**	**2012 WHO pooled curve** • **Aircraft noise** • OR= 1.06 per 5dB • 47.5 -67.5 dB(A) L_{den}	**Harding 2013 /QALY** • HT outcomes: stroke dementia & AMI • OR into relative risk • HT prevalence >10%	**Analysis / Interpretation**
SD	**Sufficient**	**%HSD** • WHO from Miedema • 45 - 70dB(A) L_{night}	**DALY** • DW: 0.04 to 0.1	**Analysis / Interpretation**
A	**Sufficient**	**% HA** • EU position paper & WHO • 45 – 75 dB(A) L_{den}	**DALY** • DW: 0.01 to 0.12	**Analysis / Interpretation**

Multiple uncertainties associated

An example: AMI

Association

- Noise can be a risk factor for CVD
- Studies indicate links form exposure to high levels of AN

- Confounders and modifiers
- No evidence of effects on children

Causality

2014 Babisch OR

- **Road traffic**
- OR= 1.08 per 10dB
- 55 - 77dB(A) L_{den}
- From meta analysis of 12 studies

- Causal link has no conclusively proven
- Uncertainties in pooling studies
- Confounders
- AMI: D-R for road traffic

Monetisation Method

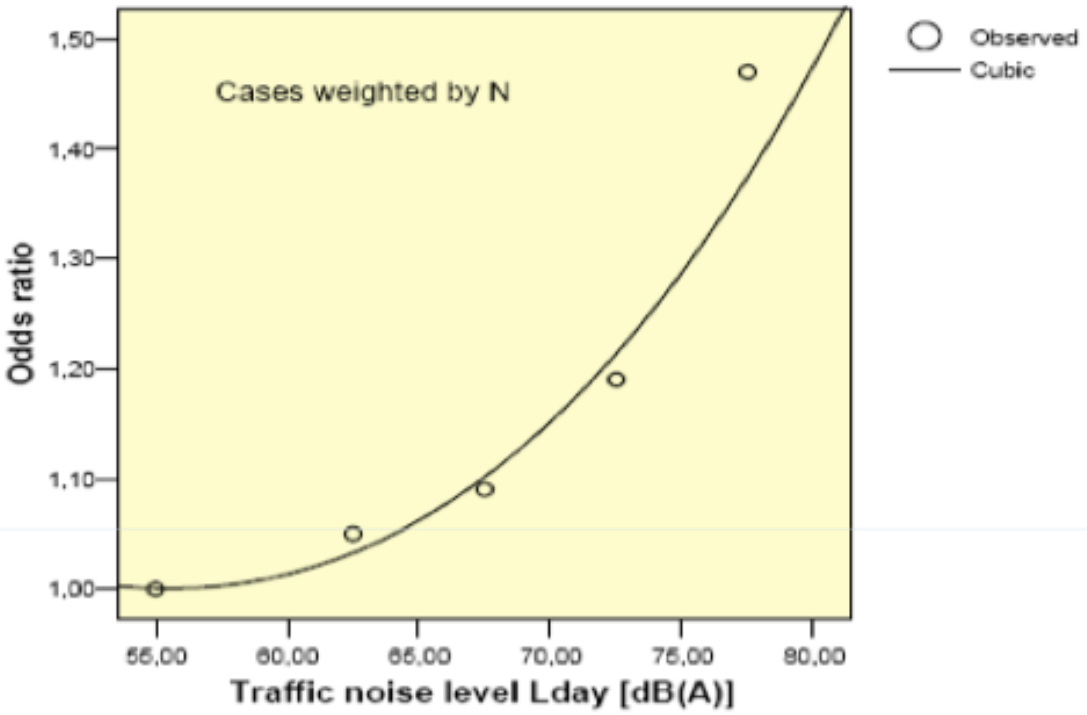
DALY (ERCD)

- Exposure data
- Estimate number of AMI cases (using D-R)
- YLL= Cases * mortality rate * average loss of life per death
- YLD= Cases * DW * surviving AMI likelihood
- 1 DALY = £ 60,000 (UK)

- DALY inherent limitations (e.g. do not capture other aspects of disease)

- Correlation ≠ causality
- Confounders
- Preliminary / indicative results
- More research on aircraft noise

Pooled AMI OR Babisch 2006 vs. 2014. Road traffic noise



Year	Studies	Exposure range	OR	Threshold
2014	12 studies & 17 estimates Male & female	<50 to 75 dB(A)	1.08	<=55 dB(A) to 77dB(A)L_{den}

AMI cost estimations step by step

- Exposure data = $L_{Aeq\ 16\ Hrs}$
- Number of AMI cases = $\sum_{55.5}^{69.5} (ORAMI * Population) * AMI\ risk$

  Where:
  - OR means Odds Ratio (Babisch one) estimated for each noise level
  - AMI risk = 0.0596% (for UK estimated from mortality data and risk of death from an AMI)

- YLL = No. of AMI cases * AMI risk of death * average loss of life per death
- YLD= No. of AMI cases * DW * likelihood of surviving an AMI

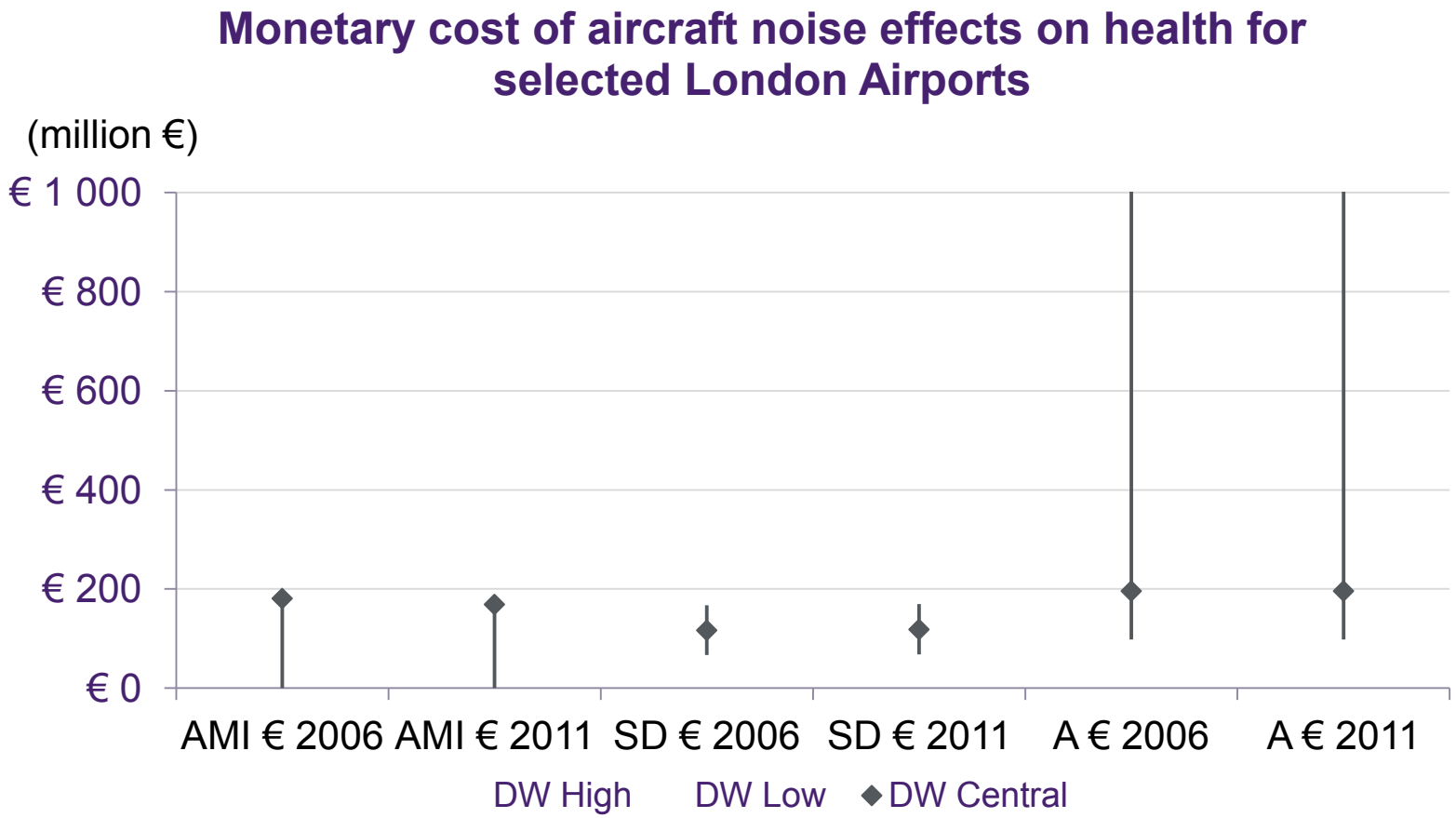
  Where: DW = 0.405 according to WHO.

- Number of DALY =YLL + YLD
- Monetary cost of a DALY = number of DALY * €76,200

5. Estimates for London Airports: Heathrow, Gatwick & Stansted

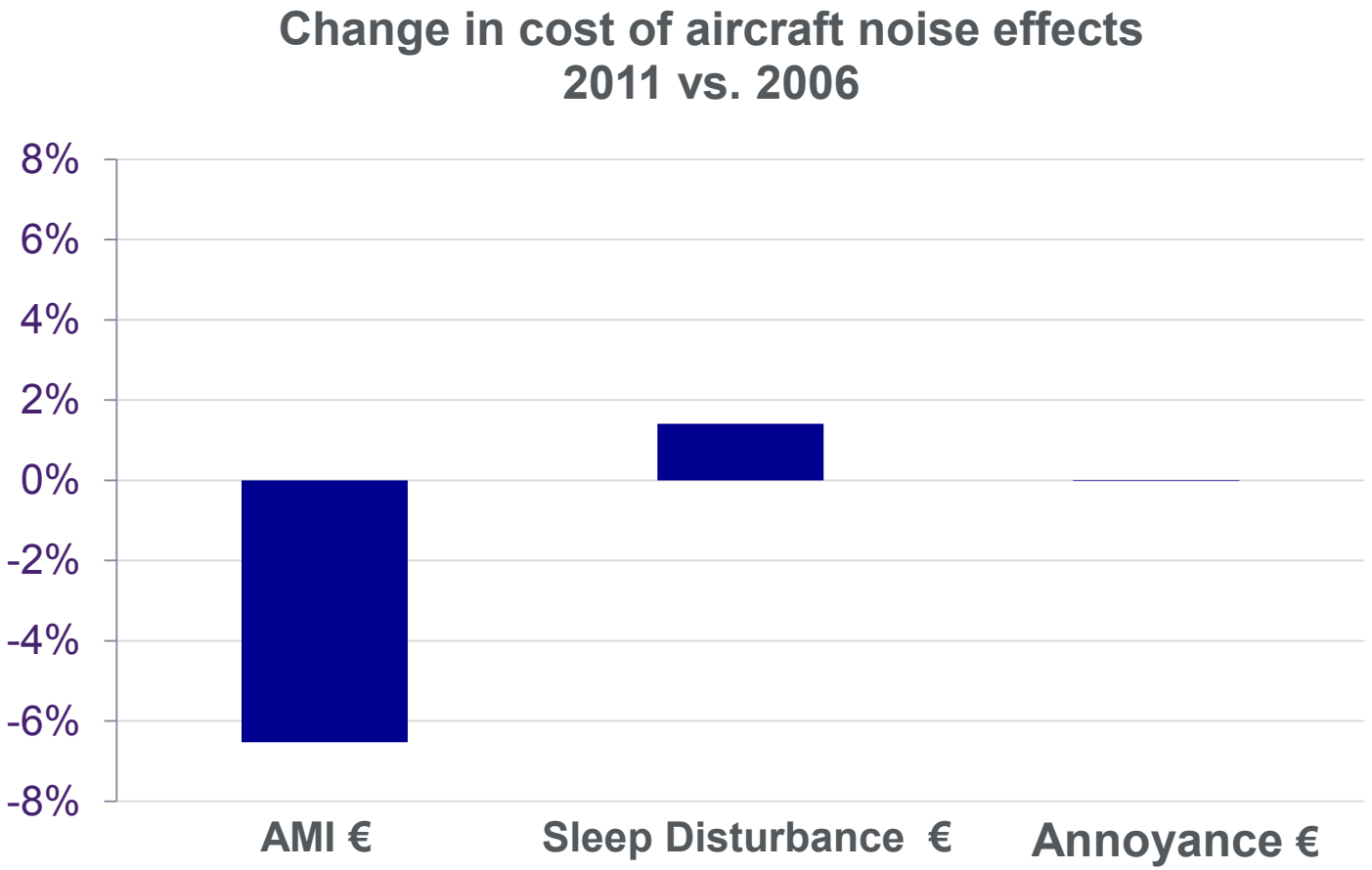
- 2006 and 2011 DEFRA and CAA noise maps contours
- Lower threshold depended on availability of data:
  - AMI: 55dB $L_{Aeq,\ 16\ hrs.}$
  - Annoyance: 55 dB(A) L_{den}
  - Sleep Disturbance: 50 dB(A) $L_{night\ 8hrs}$
- Contours use different data set for population. However, this was the only consistent available information across airports
  - 2006 noise maps are based on 2001 UK Census
  - 2011 are based on 2011 UK Census..
- Since data was available at 5dB steps, mid points values were chosen for each band.

Annoyance cost ranges from €200m to €1.2bn.. **What does this mean?**



IGCB(N) estimated the total cost from environmental noise in England as approx. €7bn; aircraft noise from London Airports represent between 4% & 17%

Change in cost between 2011 & 2006: Net benefit for AMI; marginal net cost for annoyance and sleep disturbance



5. Conclusions: Monetisation process

- ✓ Monetisation of aircraft noise effects on health is a **complex process**. Consideration of uncertainties and limitations is a key part of it.
- ✓ There are no universally accepted methodologies
- ✓ Monetisation should be used to **enhance understanding of trends rather than absolutely quantify a value of a specific health effect.**
- ✓ **No definite conclusions** can be given on **an absolute cost** of aircraft noise around airports.

Challenge: How to aggregate different cost in relation to understanding the balance between positive an negative effects of aviation?

5. Conclusions: Application of monetary values

- ✓ Provide input for decision making, They are NOT a decision itself.
- ✓ **Precautionary principle** – deliver responsible airport's operations
- ✓ Analysis of monetary values should be **contextualised** to local conditions
- ✓ Could be used to guide **mitigation and compensation** budgets
- ✓ Sustainable noise management should be based on a **generous and responsible** approach
- ✓ Suggest to have an UK expert group for monetising aircraft noise effects.

Thank you for your kind attention!

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