

Special issues related to health impact assessment of traffic in sensitive Alpine areas

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Special issues: impact assessment

- Combined traffic exposure
 - Interaction between exposure to noise from more than one source
 - Interaction between exposure to noise and vibration
 - Interaction between exposure to noise and air pollution

Interaction between exposure to noise from **more than one source**

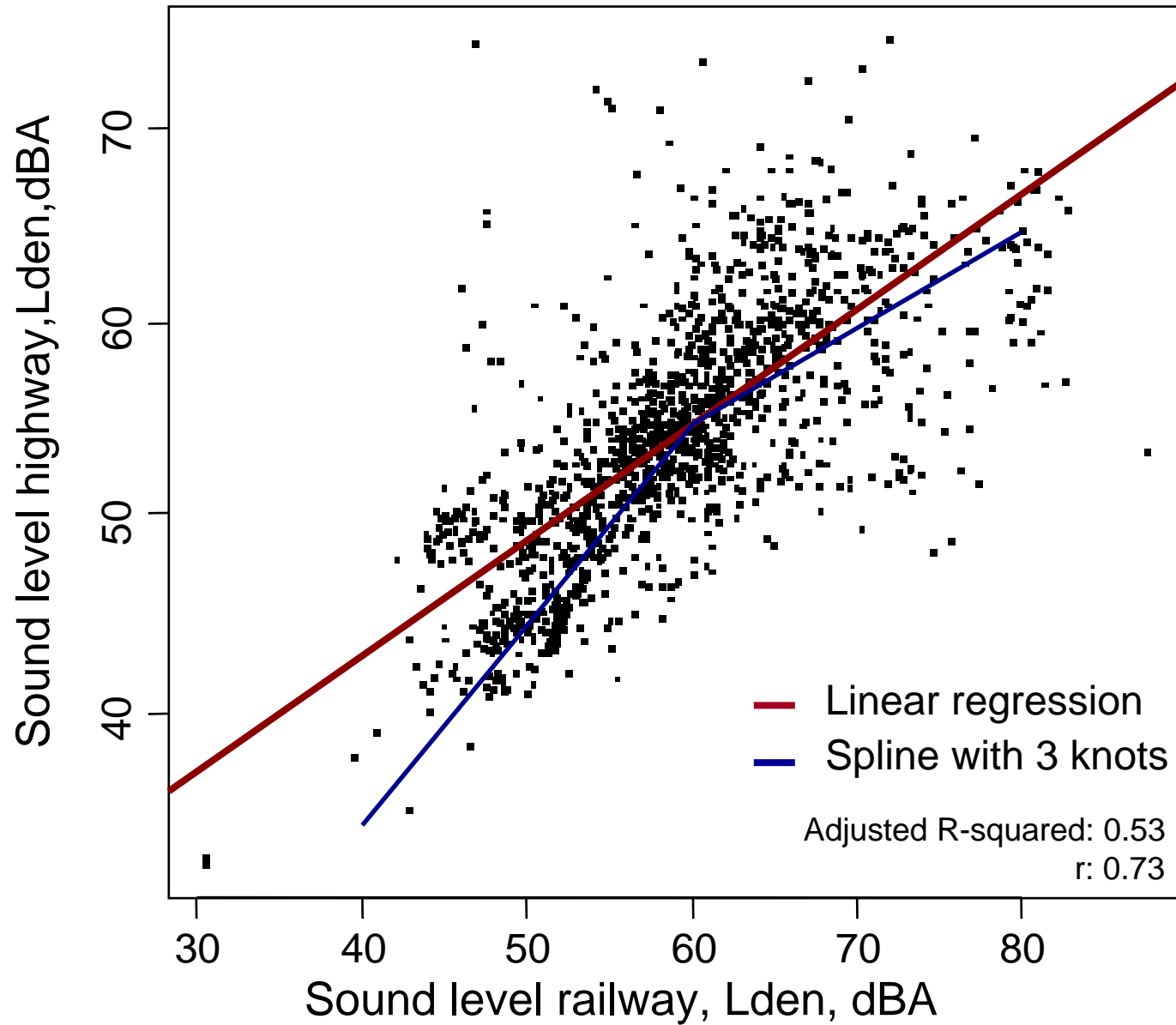


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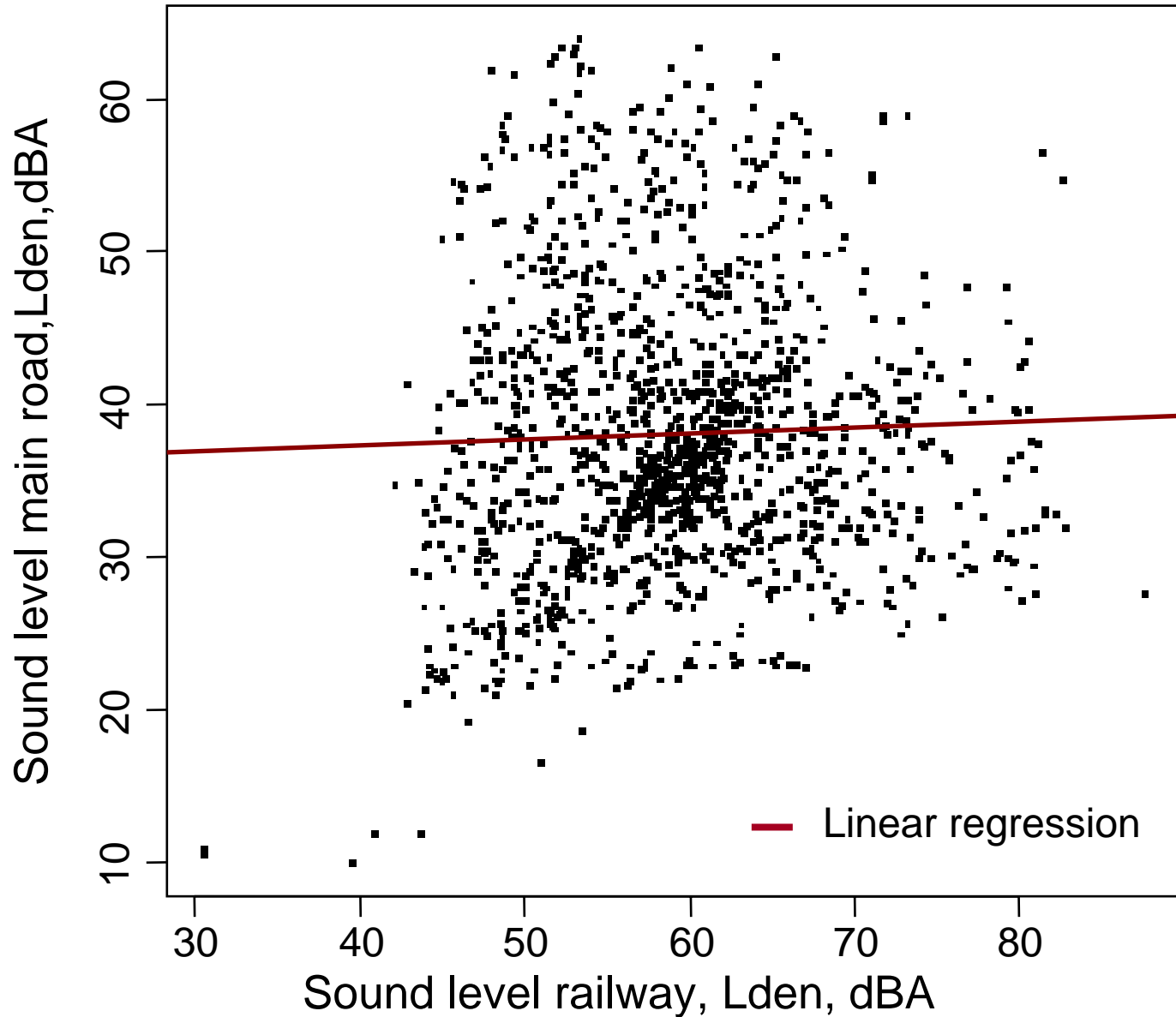
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Correlation between sound level railway and highway



Correlation between sound level railway and main road



Using differences between the sources as measure by 4 rail-highway-difference levels

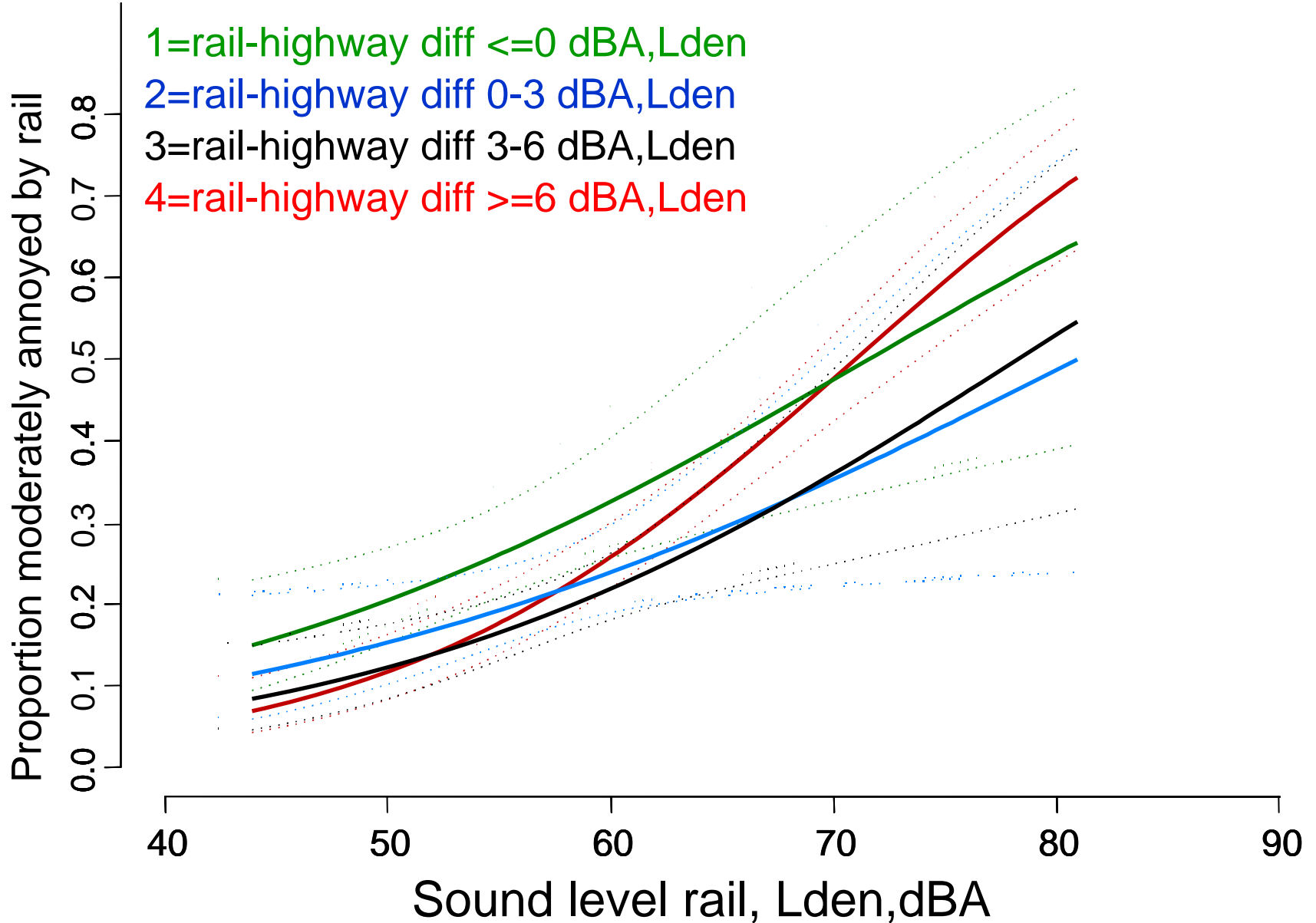


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Rail noise - moderately annoyed by rail-highway difference



Using distance from the investigated source as measure

within 300 m of the source*

* Adjusted for other source

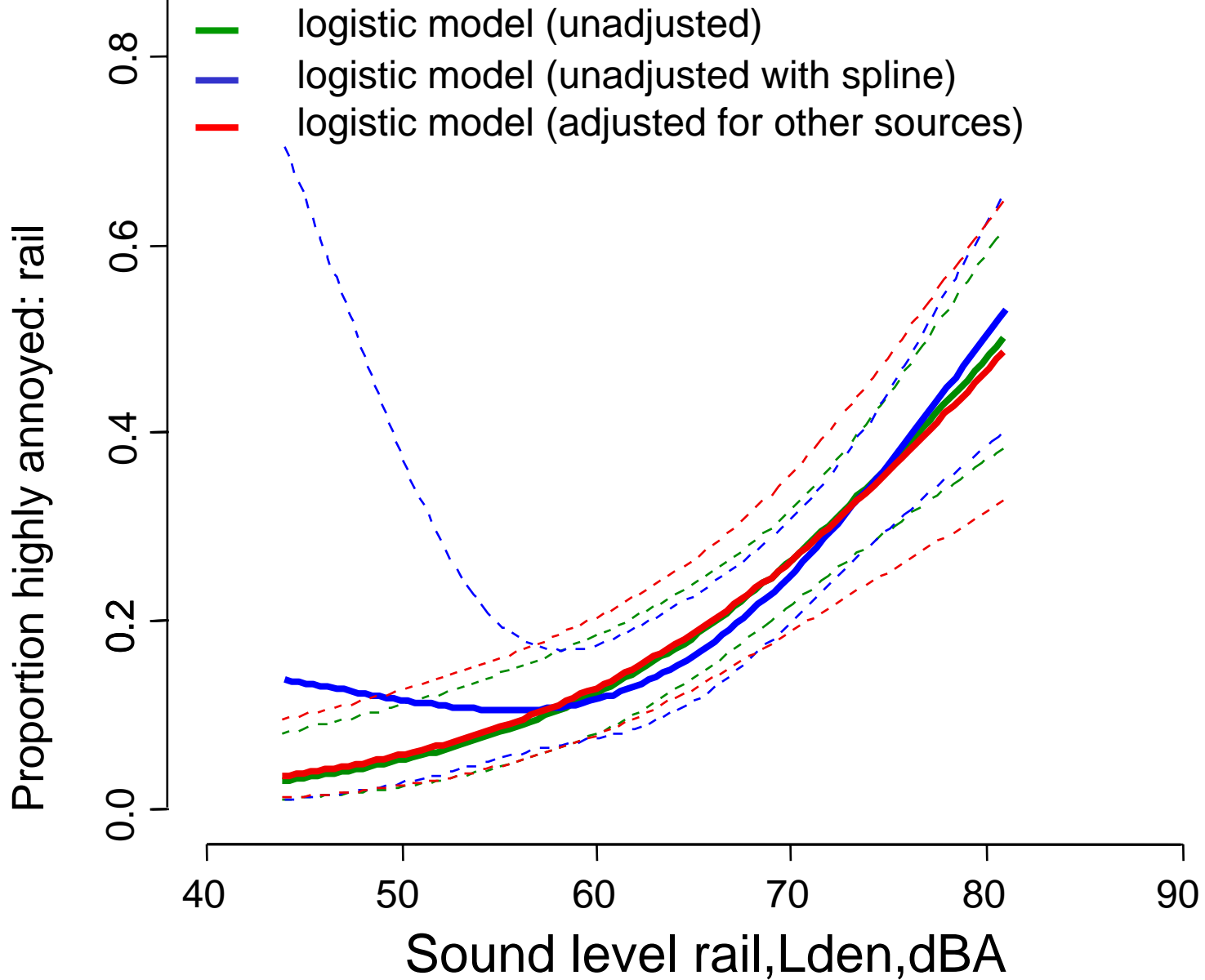


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Rail noise - highly annoyed within 300m*



Using distance from the investigated source as measure

beyond 300 m of the source *

* Adjusted for other source

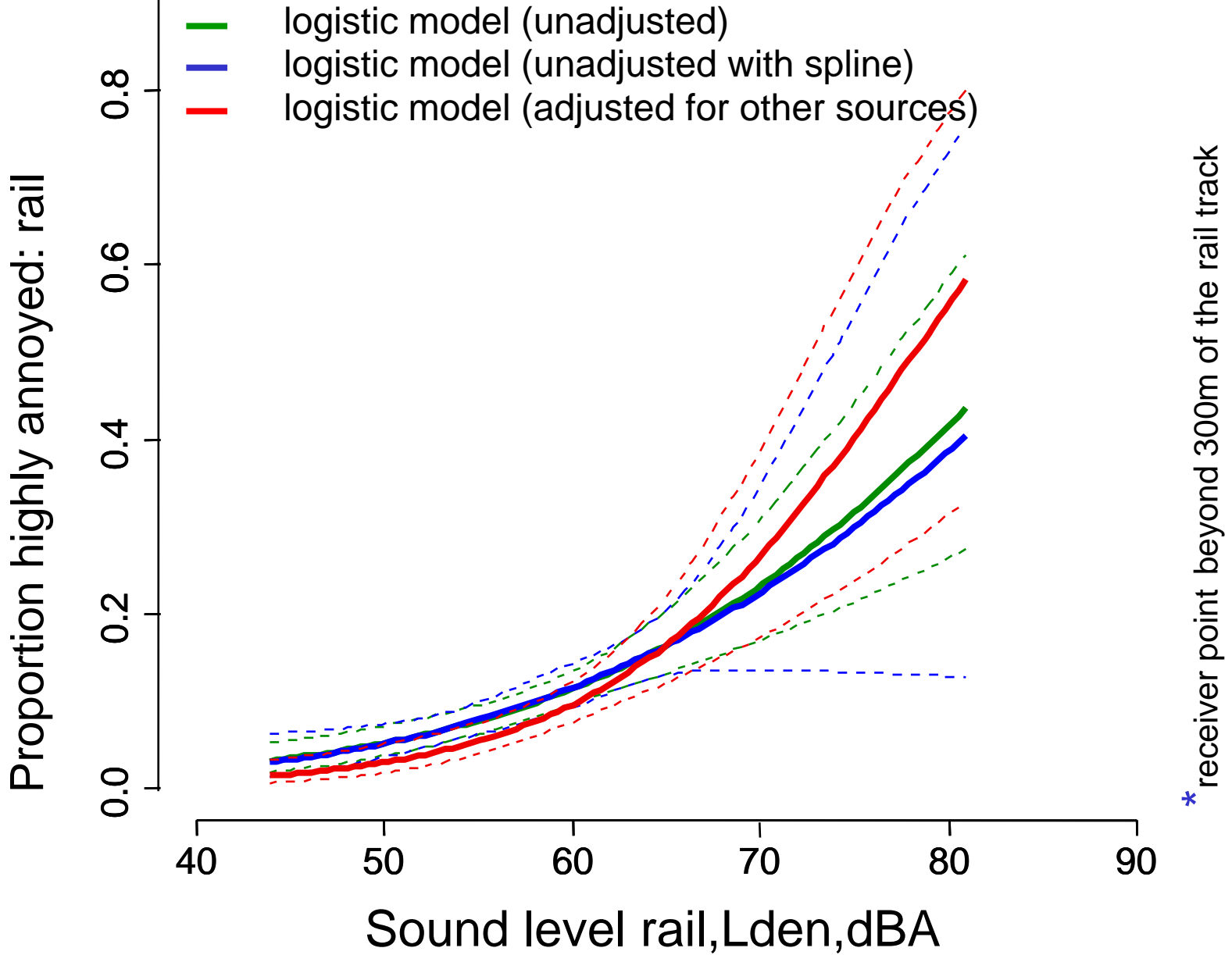


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Rail noise - highly annoyed beyond 300m*



Using distance from the investigated source as measure

beyond 300 m of the source
by modifying source: highway *

* Adjusted for other source

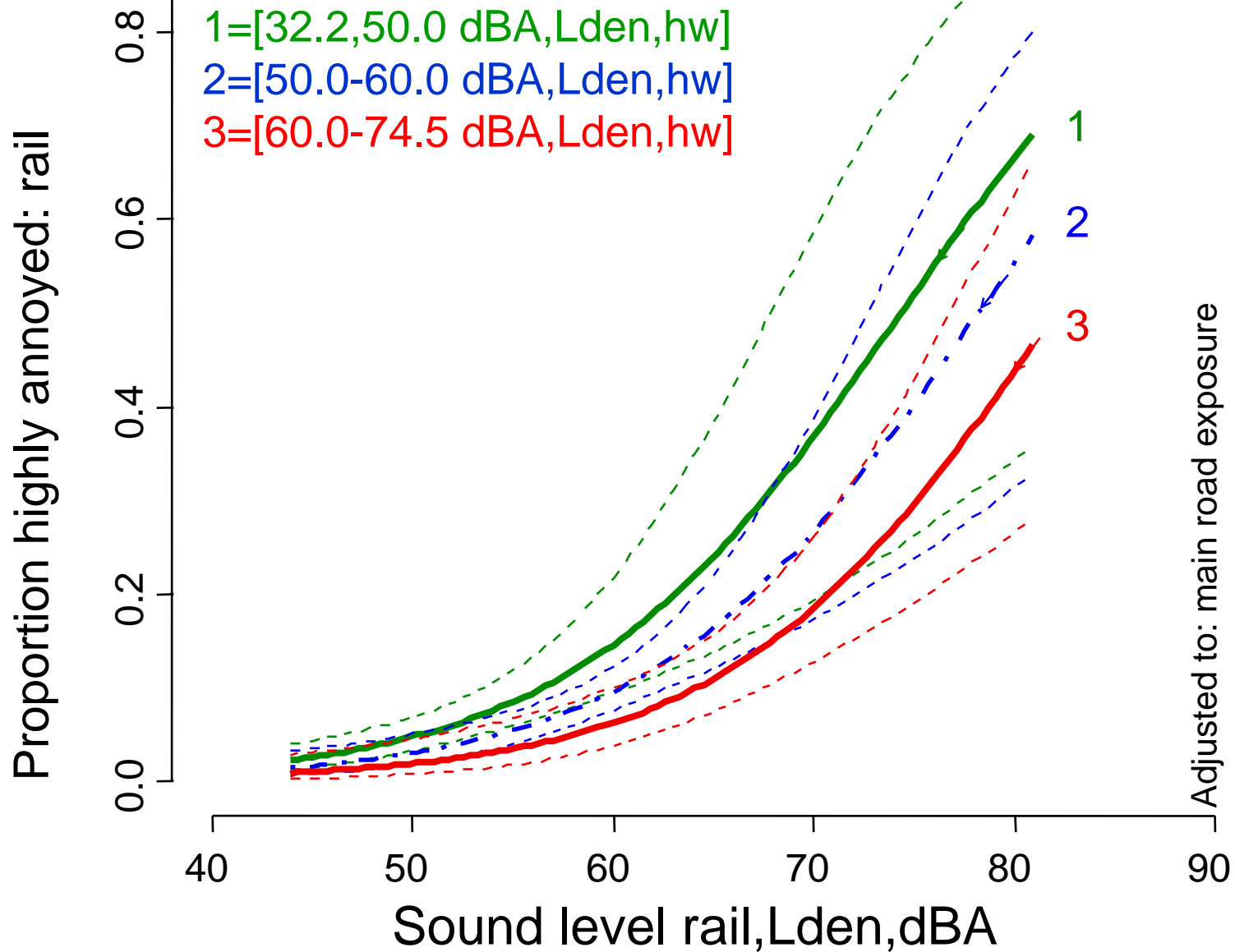


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Rail noise - highly annoyed by highway exposure receiver point beyond 300m of the rail track



Using distance from the investigated source as measure

beyond 300 m of the source
by modifying source: main road *

* Adjusted for other source

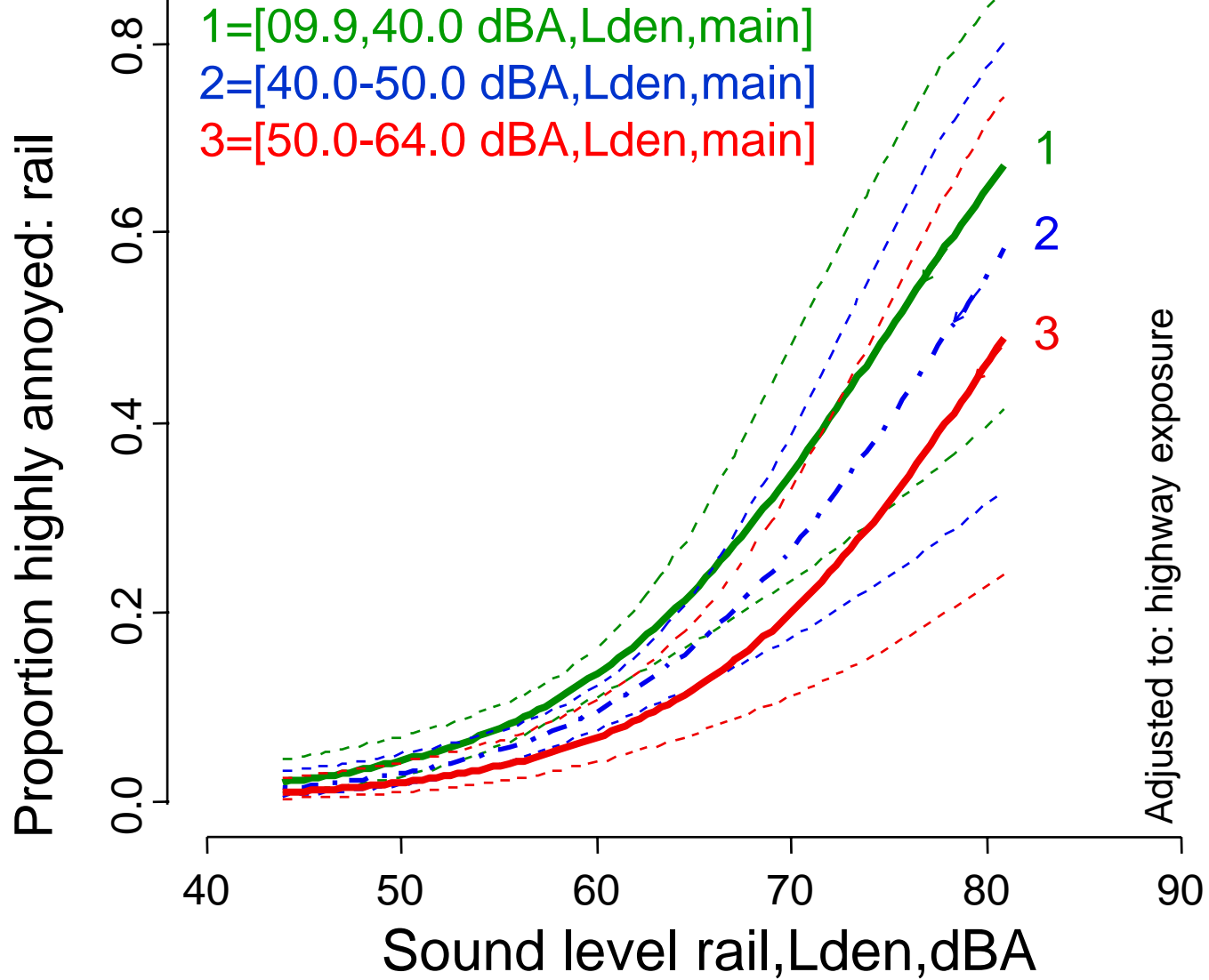


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Rail noise - highly annoyed by main road noise receiver point beyond 300m of the rail track



For comparison: Flanders (Be) Exposure-effect pattern: rail Field study

within and beyond 300 m of the track

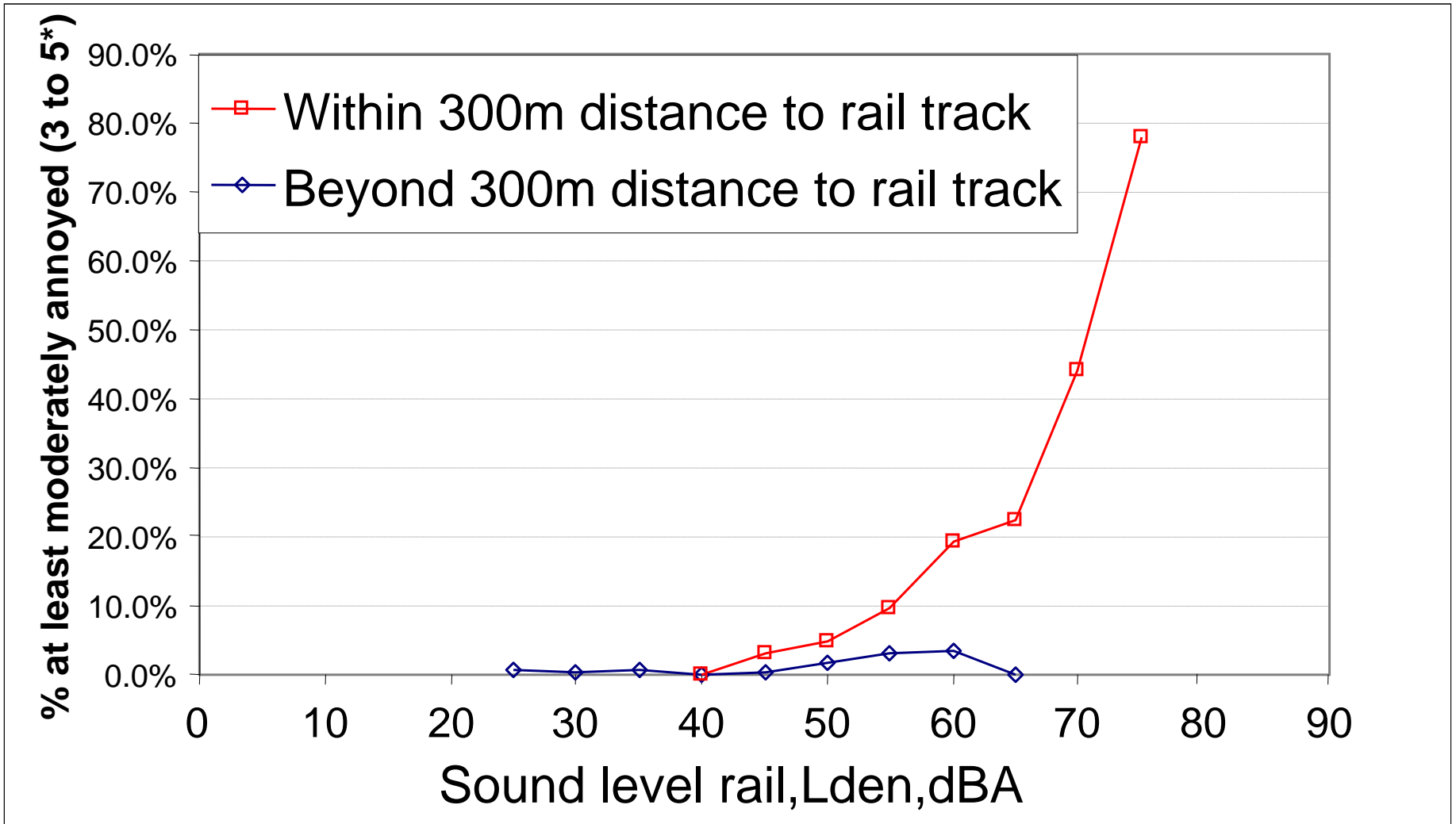


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Exposure-effect pattern by distance: Flanders



Source: Botteldooren et al. ICA 2007

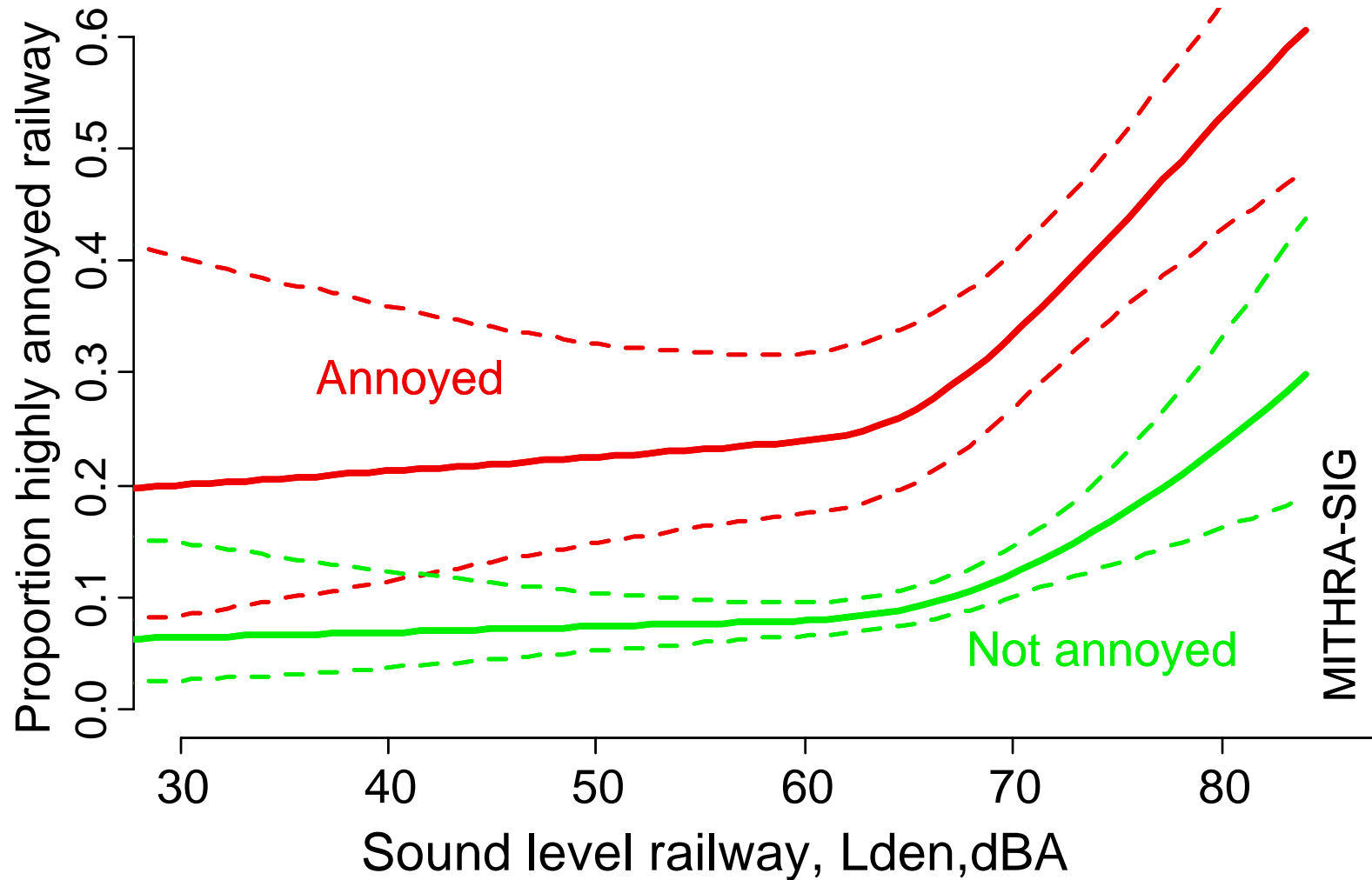
* IC BEN verbal annoyance scale: 1-5

Summary of results: several sources

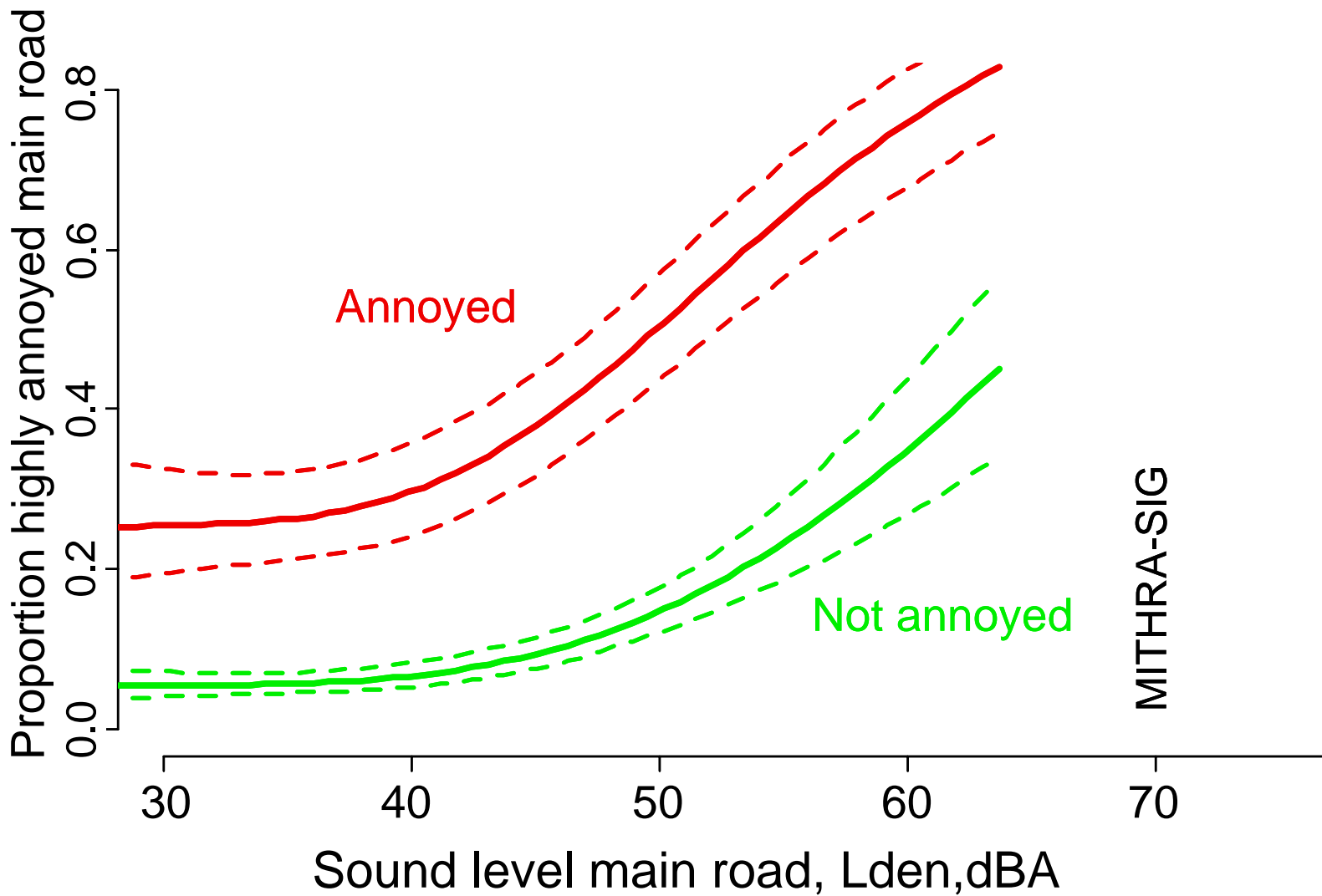
- Annoyance due to rail noise is significantly modified through additional highway or main road noise.
- This modifying effect preferably takes place beyond 300m from the rail track.
- Overall, when the rail exposure is significantly higher ($>6\text{dBA}$) than the highway noise – the effect is strongest.
- The alpine exposure pattern differs from the one in flat areas like Flanders.

Interaction between exposure to noise and vibration

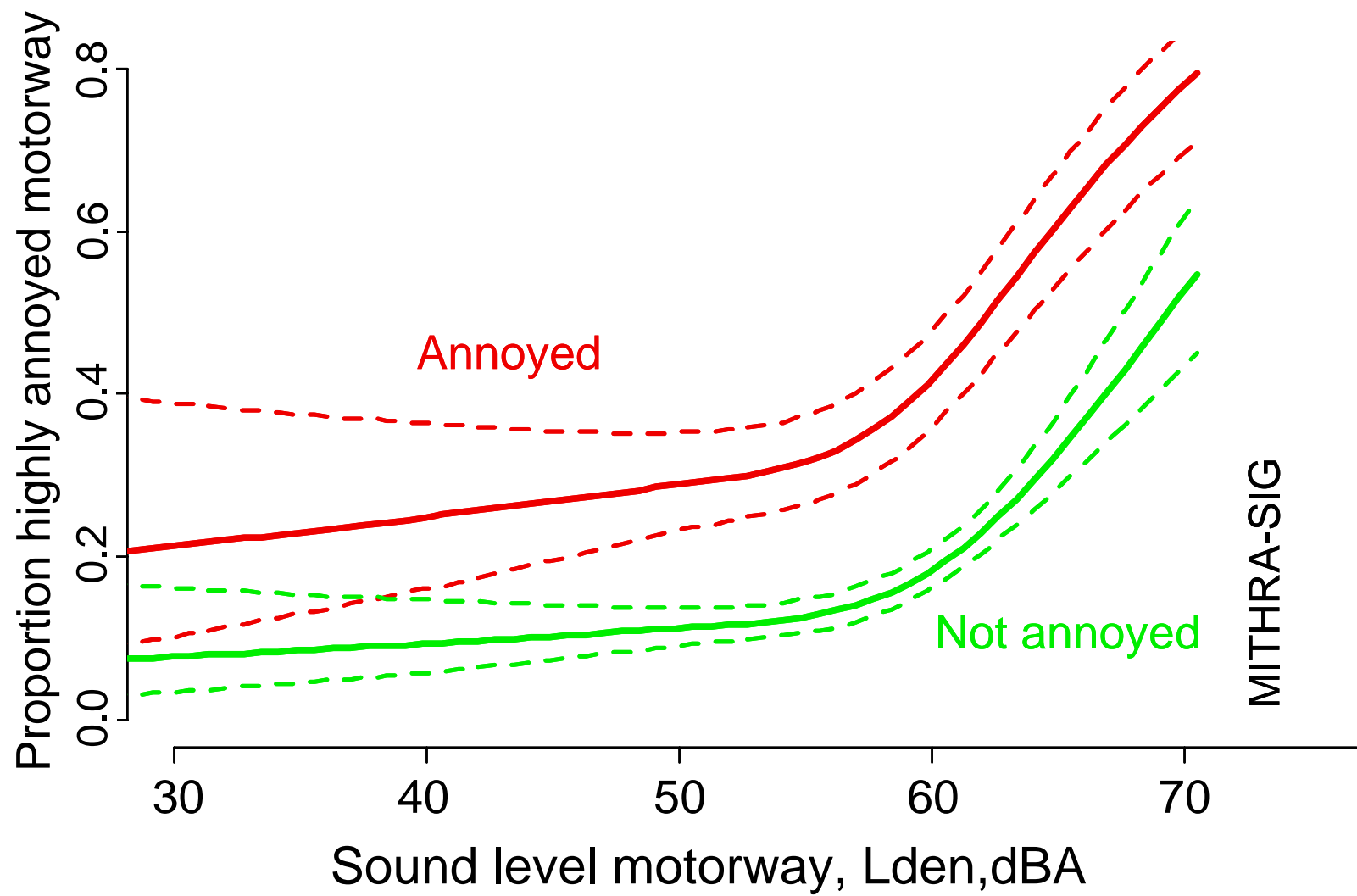
Railway noise-annoyance curves by degree of annoyance from perceived vibration exposure.



Main road noise-annoyance curves by degree of annoyance from perceived vibration exposure.

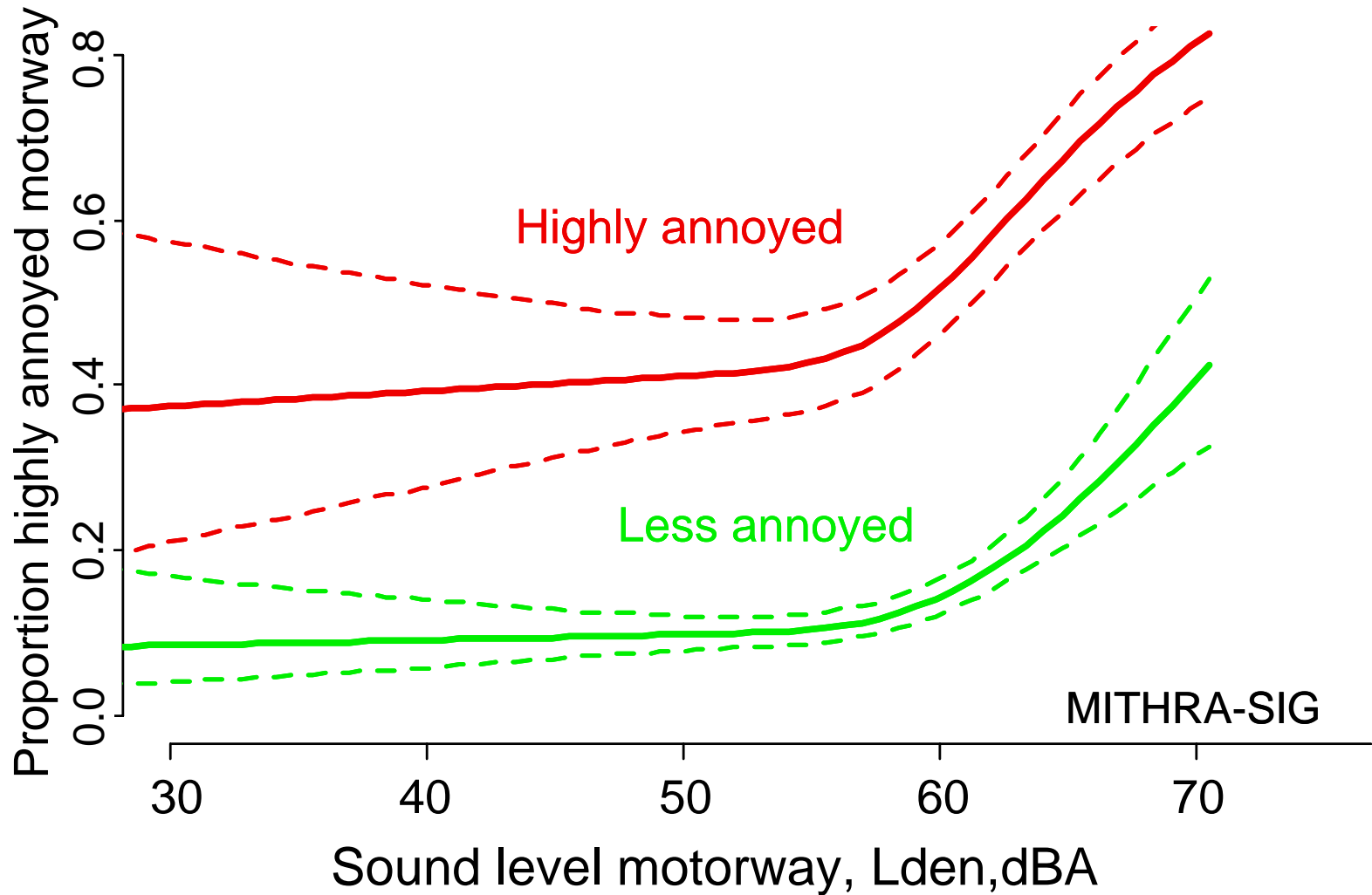


Motorway noise-annoyance curves by degree of annoyance from perceived vibration exposure.

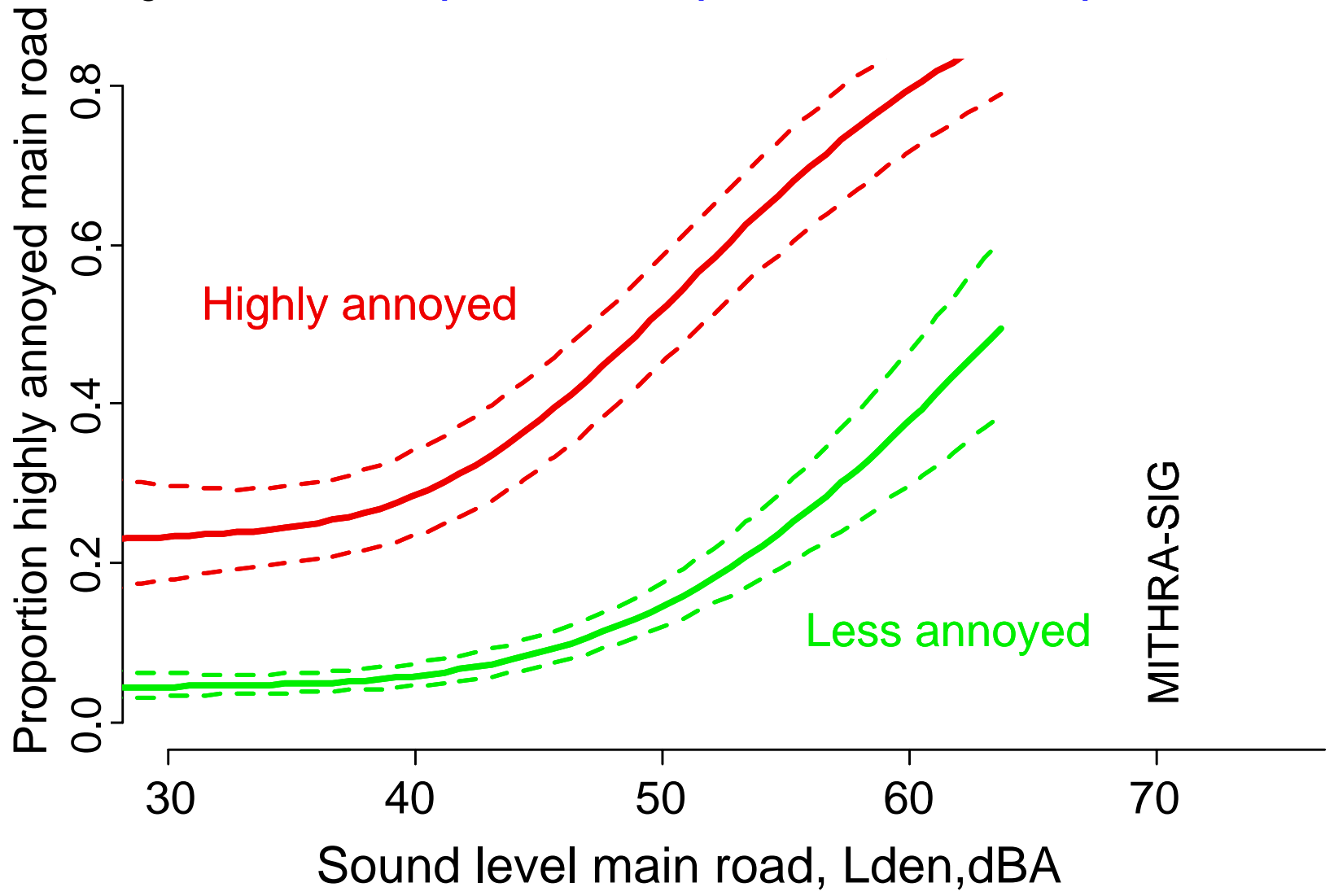


Interaction between exposure to
noise and air pollution

Motorway noise-annoyance curves by degree of annoyance from perceived particle/soot exposure.



Main road noise-annoyance curves by degree of annoyance from perceived particle/soot exposure.



Railway noise-annoyance curves by degree of annoyance from perceived particle/soot exposure.

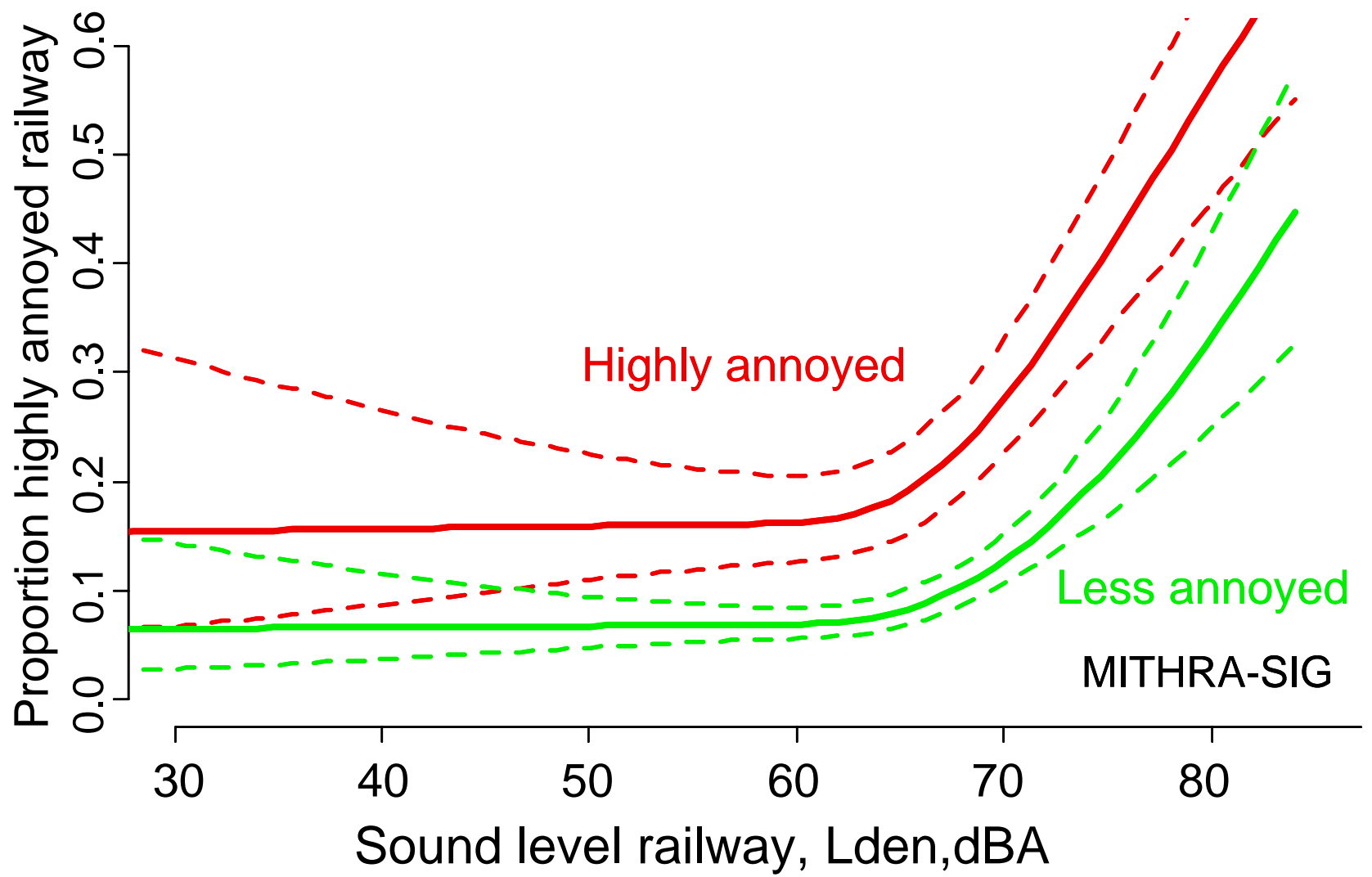


Table 1. Cumulative increase in variance explanation* with the combination of air and vibration exposure.

Source	Vibration	Particles	Exhaust gas	Vibration and Particles
Railway	12.02 %	11.29 %	9.27 %	14.98 %
Motorway	13.46 %	23.16 %	17.92 %	25.06 %
Main road	25.70 %	27.14 %	26.70 %	33.44 %

* R-square from regression analysis

Summary of results: vibration

- Annoyance due to noise from any source is modified through additional vibration.
- The effect takes place already at low levels.
- The modifying effect is strongest in the vicinity of the main road.
- The modifying effect at main roads shows a strong increase already at 40-50 Lden,dBA.
- At motorway and rail tracks the levelling off takes place at higher levels: >60 Lden,dBA.

Summary of results: air pollution

- Annoyance due to noise from any source is modified through perceived air pollution.
- The effect is observed already at low levels
- The effect is strongest for motorway and main road and significantly smaller for rail.
- The modifying effect increases earlier around main roads: 40-50 Lden,dBA.
- At motorway and rail tracks the levelling off takes place at higher levels: >60 Lden,dBA.

Conclusions: Alpine traffic management

- Traffic runs often parallel in alpine valleys
- Single source and exposure impact assessment is inadequate
- Perceived vibration and air pollution exposure modifies the reaction to noise
- The strong interactions may be part of the deviation from standard reaction curves
- Traffic measures must be planned around integrated information from all sources and exposures or will fail