

APPENDIX A - SUMMARY STATISTICS AND BALANCE TEST

We present here the summary statistics and our covariate balance test, as specified in our pre-analysis plan.

TABLE A.1—SUMMARY STATISTICS

Variable	N	Mean	Std. Dev.	Median
WHOfive	727	14	5.8	15
Change in WHOfive	727	0.31	3.9	0
Change in ACI	727	50	29	50
Change in BIO	727	-2.6	4.4	-1.5
Change in H	727	-0.006	0.009	-0.006
NS	727	17	6.8	18
education	727			
... Completed Secondary School	235	32%		
... Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS)	87	12%		
... Some Secondary	21	3%		
... Some University but no degree	57	8%		
... University Bachelors Degree	184	25%		
... Vocational or Similar	143	20%		
age	727			
... 18-24 years old	31	4%		
... 25-34 years old	79	11%		
... 35-44 years old	135	19%		
... 45-54 years old	164	23%		
... 55-64 years old	156	21%		
... 65+ years old	162	22%		
income	727			
... 20,000-39,999 pounds	268	37%		
... 40,000-59,999 pounds	160	22%		
... 60,000-99,999 pounds	106	15%		
... Less than 20,000 pounds	162	22%		
... More than 100,000 pounds	31	4%		
garden	727			
... No	80	11%		
... Yes (private)	591	81%		
... Yes (shared)	56	8%		
vehicle	727			
... No	176	24%		
... Yes	551	76%		
urban_rural	727			
... A suburban area	235	32%		
... A town	252	35%		
... A village	117	16%		
... An inner city area	92	13%		
... Rural or countryside	31	4%		
Country	727			
... England	621	85%		
... Scotland	72	10%		
... Wales	34	5%		

Notes: ACI = Acoustic Complexity Index. Bio = Bioacoustic Index.

H = Entropy, NS = Noise Sensitivity. See section III

Any variable with "change in" in the title is the difference in levels for that variable between wave 1 in winter and wave 2 in spring.

APPENDIX B - ROBUSTNESS CHECKS

Here we add additional robustness checks as mentioned in Section V. First we show simple regressions where we separate the winter and spring samples and regress, with and without covariates, on the winter or spring soundscape. The outcome and treatment variables here are in levels rather than changes.

As specified in our pre-analysis plan, we report results from the following two-way fixed effects regression as a benchmark:

$$(B1) \quad Y_{it} = \alpha_i + \lambda_t + \theta D_{it} + \mathbf{x}_i \beta + \varepsilon_{it}$$

Where Y_{it} is the WHO5 score, α_i is the time-invariant individual fixed effect, λ_t is the time-varying fixed-effect, which equals 1 in spring and 0 in winter, D_{it} is the soundscape metric (i.e. the treatment variable), and \mathbf{x}_i our vector of covariates (see section III).

TABLE B.1—WINTER AND SPRING CROSS-SECTIONAL REGRESSIONS

Treatment Variable	ACI		BIO		WHOfive		H		H		H	
	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring
mean	-0.0019 (0.0034)	-0.0135 (0.0088)	-0.0011 (0.0032)	-0.0047 (0.0084)	-0.0397** (0.0184)	-0.0736 (0.0726)	-0.0405** (0.0169)	-0.0510 (0.0699)	20.79** (9.773)	15.69 (34.71)	12.80 (8.765)	18.63 (33.18)
R ²	9.47 × 10 ⁻⁵	0.00226	0.18655	0.17347	0.00141	0.00113	0.18794	0.17372	0.00140	0.00021	0.18704	0.17349
Observations	3,394	974	3,386	965	3,394	974	3,386	965	3,394	974	3,386	965
education fixed effects			✓	✓			✓	✓			✓	✓
age fixed effects			✓	✓			✓	✓			✓	✓
income fixed effects			✓	✓			✓	✓			✓	✓
local Greenspace fixed effects			✓	✓			✓	✓			✓	✓
garden fixed effects			✓	✓			✓	✓			✓	✓
outdoors fixed effects			✓	✓			✓	✓			✓	✓
vehicle fixed effects			✓	✓			✓	✓			✓	✓
Country fixed effects			✓	✓			✓	✓			✓	✓

Notes: ACI = Acoustic Complexity Index, Bio = Bioacoustic Index, H = Acoustic Entropy
Robust standard errors used.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

These results can be seen in table B.2. For each acoustic metric we first regress without covariates and then with. In all cases, the estimate of the treatment effect is not statistically significant. For ACI and BIO, the point estimate is extremely small and the intervals are also small, indicating a precise null effect. For H, the point estimate is extremely large, given the maximum WHO5 score is 25. However, there is very little variation in our H metric, so we expect any results for this metric to be erratic but we report anyway as it was pre-specified.

Next we add northing and easting variables to our regressions, as spring happens at different times depending on the latitude, so northing and easting variables may account for how far into spring each area is. The combination of northing and easting variables takes into account different location effects, but may also account for some of the variation in birdsong. Nevertheless, we find no effect.

Then we look only at rural households as they may be closer to birdsong and more able

TABLE B.2—BENCHMARK RESULTS

Treatment Variable	WHOfive Outcome variable					
	ACI	ACI	BIO	BIO	H	H
Estimate	-0.0001 (0.0047)	-0.0011 (0.0047)	0.0457 (0.0302)	0.0335 (0.0311)	10.13 (15.26)	7.135 (16.59)
R ²	0.88	0.88	0.88	0.88	0.88	0.88
N	1,454	1,454	1,454	1,454	1,454	1,454
Clusters	727	727	727	727	727	727
Individual Fixed Effect	✓	✓	✓	✓	✓	✓
Time	✓	✓	✓	✓	✓	✓
Education		✓		✓		✓
Age		✓		✓		✓
Income		✓		✓		✓
local Greenspace		✓		✓		✓
Garden		✓		✓		✓
Outdoors		✓		✓		✓
Vehicle		✓		✓		✓
Country		✓		✓		✓

Notes: ACI = Acoustic Complexity Index, Bio = Bioacoustic Index, H = Acoustic Entropy

SE = standard errors clustered at panel level.

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

to hear it.

We look only at households which reported different location data in wave 1 and 2. This could mean they were inattentive or deliverability providing inaccurate information, but many of these households may have moved. This gives us a sample of those people before and after moving to a different soundscape.

Finally, we use alternative soundscape data at a much more granular level, but the use of this data means we have fewer households in the sample.

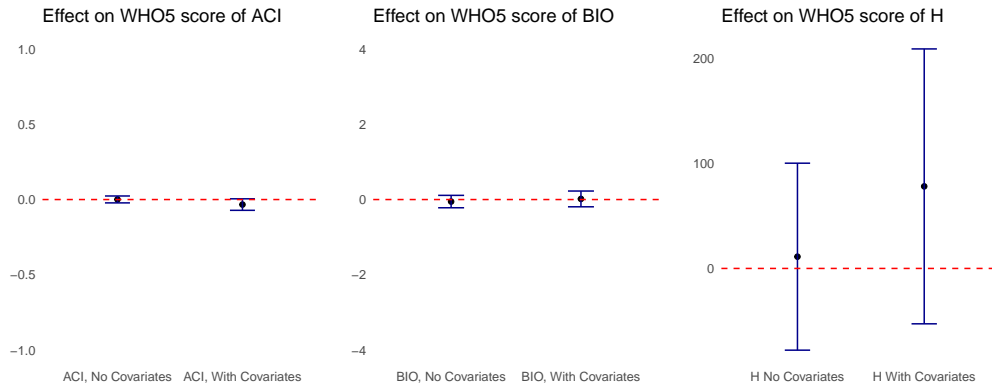


FIGURE B.1. EFFECT OF ACOUSTIC CHANGES ON WHO5 SCORE, WHEN NORTHING AND EASTING VARIABLES ADDED



FIGURE B.2. EFFECT OF ACOUSTIC CHANGES ON WHO5 SCORE, RURAL HOUSEHOLDS ONLY

TABLE B.3—MOVERS ONLY SAMPLE

	ACI	BIO	WHOfive	H
mean	0.0137 (0.0152)	0.0340 (0.0938)		22.63 (50.65)
R ²	0.67170	0.67056		0.67067
Observations	486	486		486
education fixed effects	✓	✓		✓
age fixed effects	✓	✓		✓
income fixed effects	✓	✓		✓
local Greenspace fixed effects	✓	✓		✓
garden fixed effects	✓	✓		✓
outdoors fixed effects	✓	✓		✓
vehicle fixed effects	✓	✓		✓
urban_rural fixed effects	✓	✓		✓
Country fixed effects	✓	✓		✓

Notes: ACI = Acoustic Complexity Index, Bio = Bioacoustic Index, H = Acoustic Entropy
Robust standard errors used.

Signif. Codes: ***, 0.01, **, 0.05, *, 0.1

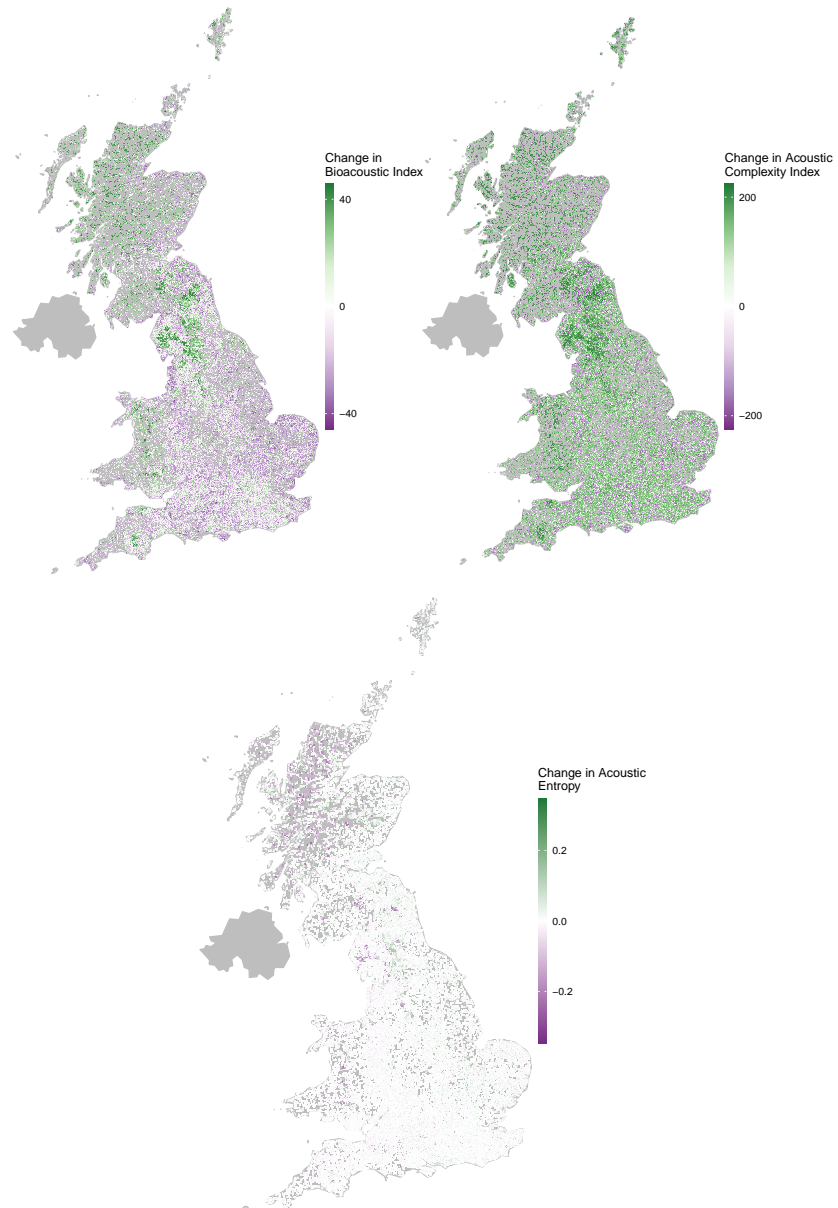


FIGURE B.3. CHANGE BETWEEN WINTER AND SPRING IN ACOUSTIC INDICES

Note: Areas with no data are grey. Variables are pseudo-log transformed before plotting.

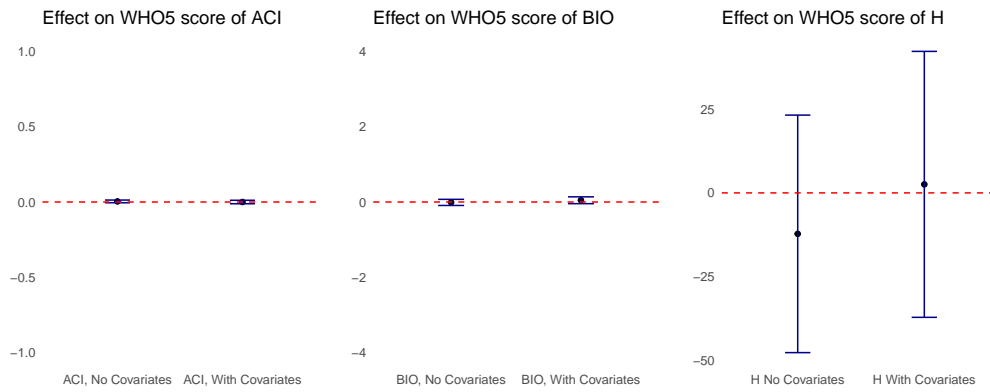


FIGURE B.4. EFFECT OF ACOUSTIC CHANGES ON WHO5 SCORE

TABLE B.4—EFFECT OF ACOUSTIC CHANGES ON WHO5 SCORE

Variable	$\hat{\theta}$	SE	Z-score	P-Value	MDE	N
ACI, No Covariates	0.00	(0.01)	0.85	0.20	0.03	681
ACI, With Covariates	0.00	(0.01)	0.01	0.50	0.04	681
BIO, No Covariates	-0.01	(0.04)	-0.25	0.60	0.10	681
BIO, With Covariates	0.05	(0.05)	1.01	0.16	0.12	681
H No Covariates	-12.23	(18.10)	-0.68	0.75	45.24	681
H With Covariates	2.55	(20.26)	0.13	0.45	50.66	681

Notes: ACI = Acoustic Complexity Index.

Bio = Bioacoustic Index.

H = Entropy. SE = standard error. $\hat{\theta}$ is the WAOSS estimate (see section IV).

MDE is minimal detectable effect, calculated as $2.5 \times SE$.

P-value shows one-tailed p-values.

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

In all cases, results show no effect, similar to our main results.

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REFERENCES