Planes Overhead: How Airplane Noise Impacts Home Values

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Supplemental Appendices

These appendices supplement our article "Planes Overhead: How Airplane Noise Impacts Home Values" with the following material:

- Supplemental Appendix A includes data details on noise exposures, the correlation between alternative noise metrics, data details on house transactions and assessment data, the matching process between house addresses and noise grids, and spatial resolution discussion.

- Supplemental Appendix B contains robustness checks on results from our preferred model.

  Appendix C provides additional findings on the effects of alternative noise metrics.

Appendix

Supplemental Appendix A Data Details and Additional Evidence

Supplemental Appendix A.1 Data Details: Noise Metrics

The process of generating noise output at the grid level around airports using the AEDT (Aviation Environmental Design Tool) model involves several steps(Roof et al., 2007). First, we define the study area, specifying the geographic region of interest. Next, airport and flight data are input into the model, including information such as runway configurations, aircraft types, flight schedules, and air traffic data. Grid settings are then configured, determining the size and resolution of the grid used for analysis. With all the necessary inputs in place, the noise simulation is initiated within the AEDT model, incorporating the flight data, airport characteristics, and atmospheric conditions to calculate noise levels generated by aircraft operations. The output obtained from the simulation provides detailed noise information at the grid level, including noise contours and specific noise levels within each grid cell. These data can be further analyzed to assess noise exposure and evaluate the impact of aircraft activities on the surrounding environment[27].

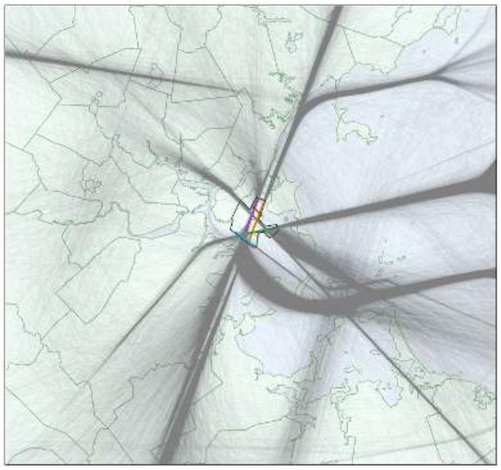
To construct our measure of noise exposure, we consider not only the cumulative noise measures, such as day-night average sound level, but also the intensity of extremely loud events and the duration of these loud events as factors influencing residential property prices. We annualized the daily day-night average sound level by calculating the cumulative noise exposures over a year, penalizing each nighttime operation as we did in the daily DNL calculation. Since we do not have a full-year coverage of observations on daily DNL, we utilize as many daily DNLs as possible each year and generate annual DNL measures. We use the number of events that exceed a certain noise level on the peak day over a year at a location to represent the intensity of extremely loud events. We consider the number of days over a year with noise events exceeding a certain noise level multiple times at a location to represent the duration of these loud events.

To determine the noise threshold that best reflects households' response to airplane noise exposure, we closely follow the findings by Jensen et al. (2017) and consider 60 dBA a good indicator of annoyance towards airplane noise. We use 60 dBA as the noise threshold to construct five unique noise metrics and explore their impacts on housing prices in three localities. Figures A2-A4 show the correlation of noise metrics in three localities.

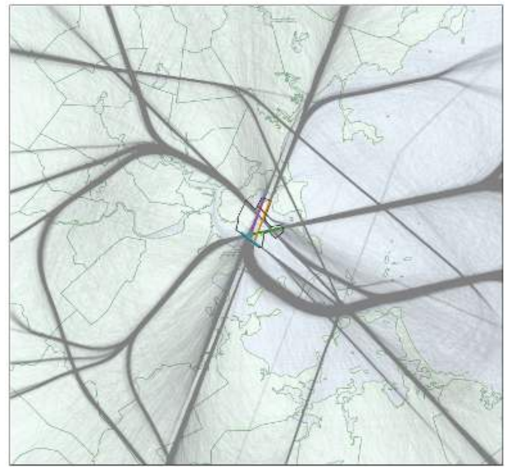
[27] For specific guidance on using the AEDT model effectively, please refer to the AEDT user manual or relevant documentation is recommended.

Figure A1: Flight Track Changes from 2011 to 2016 in three localities

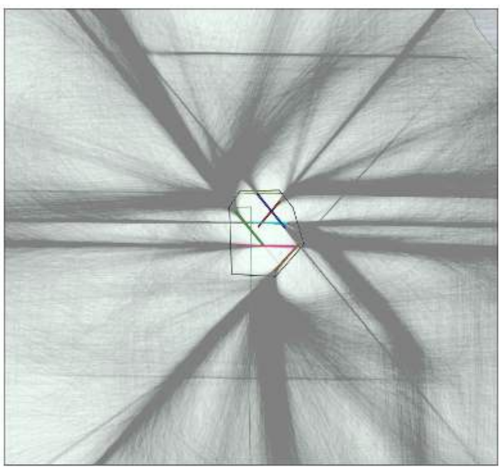
(a) Boston (2011)



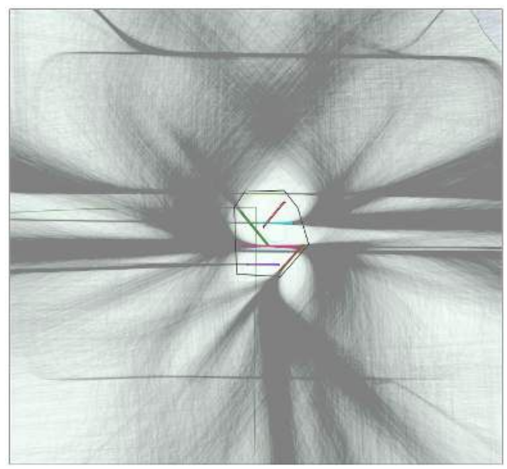
(b) Boston (2016)



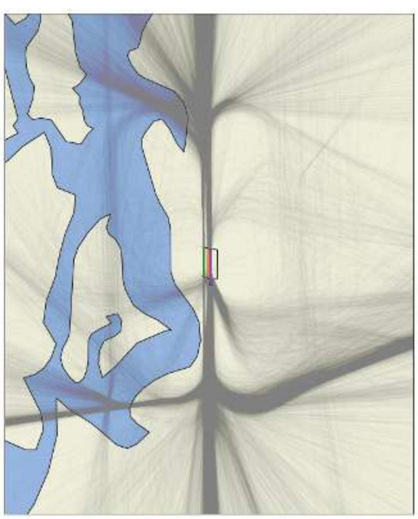
(c) Chicago (2011)



(d) Chicago (2016)



(e) Seattle (2011)



(f) Seattle (2016)

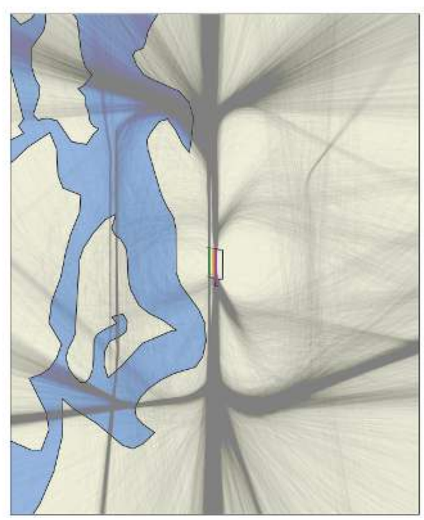
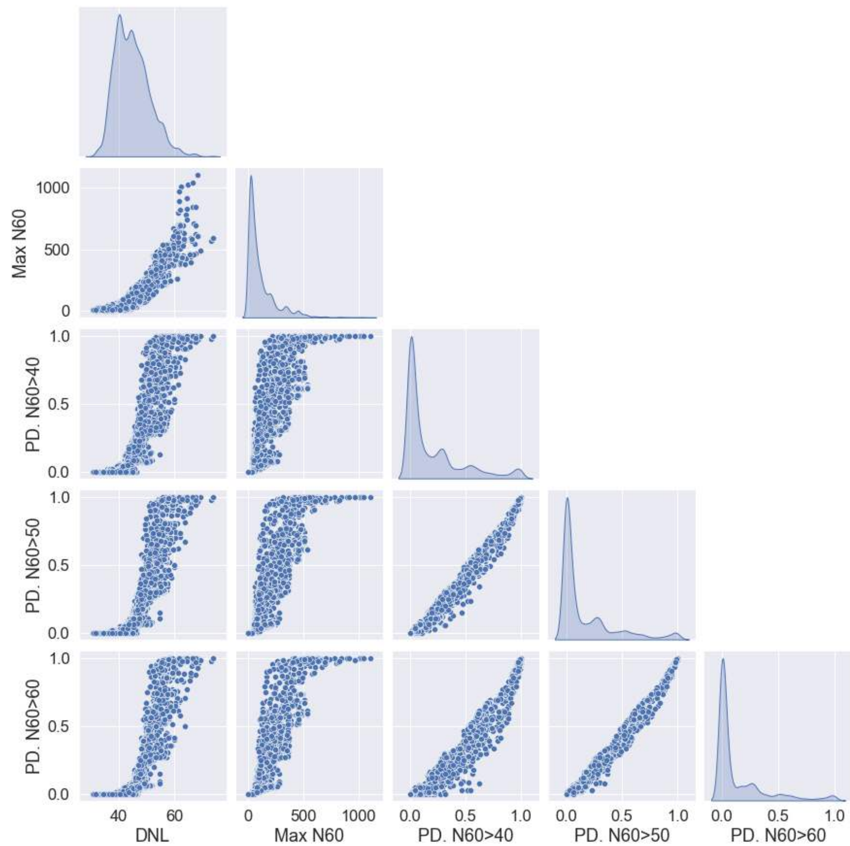


Figure A2: Correlation of Noise Metrics in Boston

(a) Pairplot



(b) Correlation Heatmap

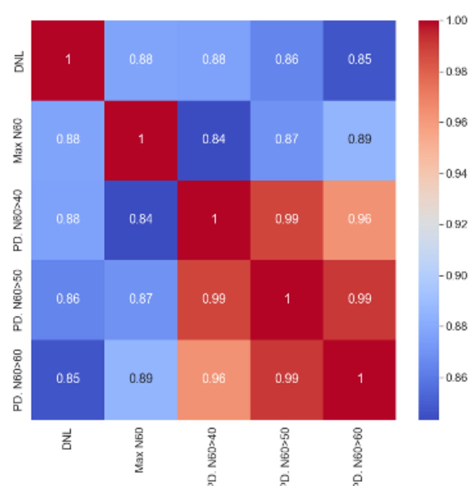
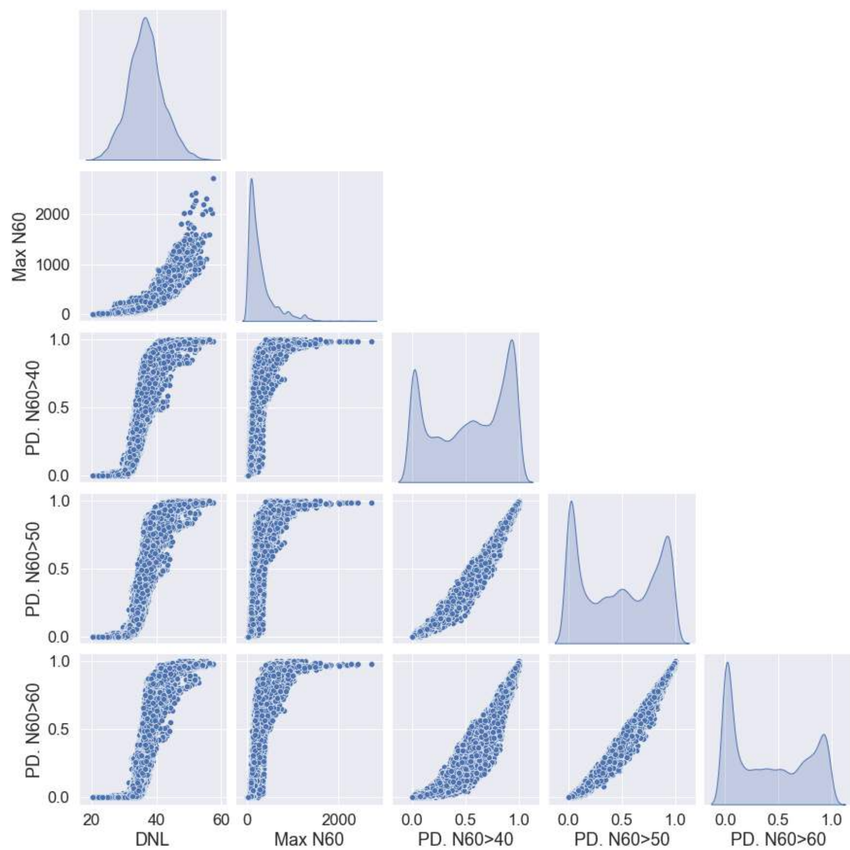


Figure A3: Correlation Among Noise Metrics in Chicago

(a) Pairplot



(b) Correlation Heatmap

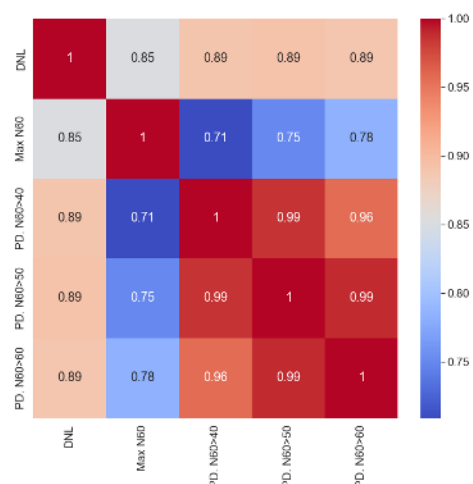
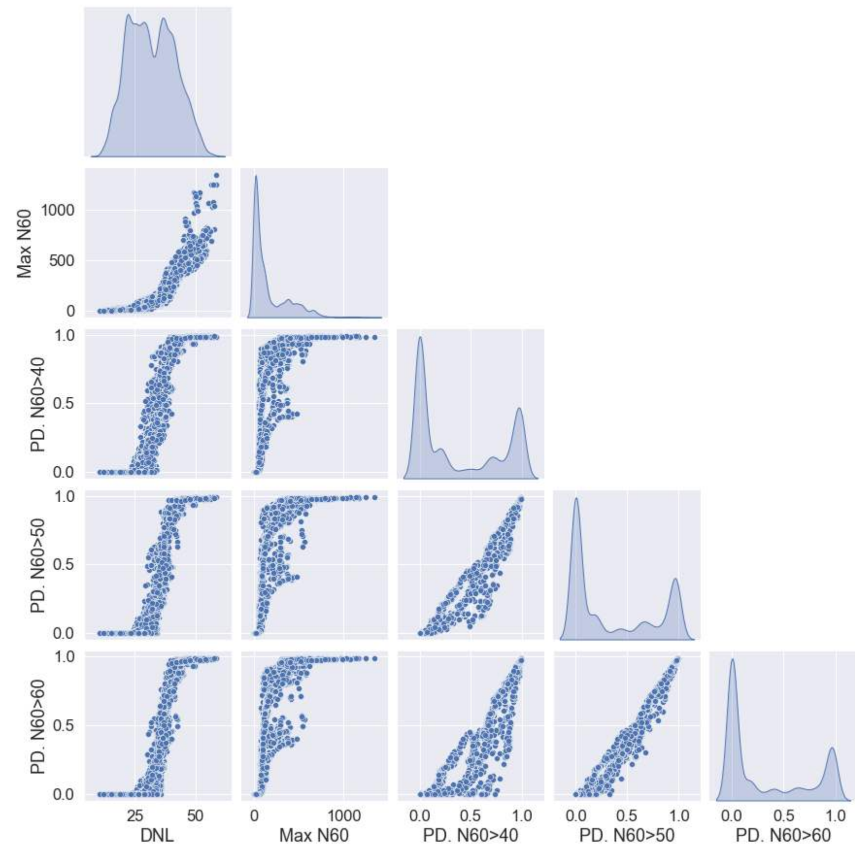
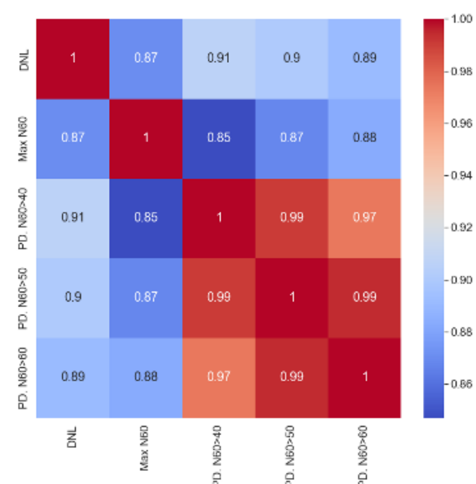


Figure A4: Correlation Among Noise Metrics in Seattle

(a) Pairplot



(b) Correlation Heatmap



Supplemental Appendix A.2 Data Details: Housing Transaction and Assessment Data

We restrict the transaction data in several ways. First, we collect transaction-level housing prices and characteristic data in three urban areas in 2011 and 2016. We focus on single- and multi-family residential properties within 20X20 nautical square miles of geospace around three airports. To restrict the sample to specific types of properties, we utilize information from both property land-use descriptions and standard codes. For example, for transactions that we cannot identify from the land-use descriptions, we use “RR101”, “RR999”, “RR000”, and “RR102” in standard code to find single- and multi-family residential houses. We then follow Currie et al. (2015) and restrict our sample to homes that sold for above \$50,000 but below \$2M to remove the effect of outliers on our econometric results. Previous studies followed a similar strategy by eliminating very high-priced (above the 99th percentile) and low-priced (below the 1st percentile) homes to remove the effect of outliers on the econometric results.

Second, we restrict our sample to the fair market value transactions by ruling out arm’s length transactions, intra-family transactions, transactions under distress (e.g., foreclosures), transactions below market value from public actors (e.g., by a targeted sale to veterans), and listed prices referring to monetary amounts other than the full property value (e.g., loans, mortgages, partial interests). Specifically, we exclude all the transactions with data type F, which are identified as foreclosures. We remove all the sales price amounts, standard type with “NA” to exclude all the potential arm’s length transactions. Zillow data also provide an intra-family flag code that identifies intra-family and gift transfers. We remove any transactions with an indicator of the intra-family flag. We also remove all loan types classified as US Department of Veterans Affairs loans and state veteran loans to ensure the transaction prices are not below market value from public actors. We remove all partial interest transfer types with “M” to exclude all the potential listed prices. Lastly, we remove the least confident document codes for fair market value transactions by excluding the document types with “NFCM”, “NTSL”, “FCDE”, and “LDCR”.

Third, we drop properties that share the same transaction ID with other properties, were sold more than once within a calendar year, were sold more than five years before being built, or have missing sale prices. There are a few cases in which a transaction contains multiple houses after merging the transaction data with assessment data. We exclude these properties from our samples. Houses bought more than five years before being built or sold multiple times within a year are considered investments rather than intended for residential purposes. We remove these houses from our samples as well. Finally, we remove all transactions with missing sale prices.

Another issue about the Zillow transaction and assessment data (ZTRAX) is that some transactions have missing and inaccurate geo-locations. The ZTRAX latitude and longitude coordinates appear to have been derived using various geodesic datasets, but the information is not provided in the datasets. Nolte et al. (2021) selects several houses and matches the assessor parcel number between the transaction data and state parcel maps. They find most of the houses in our sample towards NAD83/WGS84. We conducted similar exercises, where we matched the assessor parcel numbers of homes in our samples with state parcel maps. We find the distance between the house geolocation under the WGS84 datum and the centroid of the parcel mostly within 140 meters, and a small number of properties were assigned to the wrong geo-locations. We first complement properties with missing geolocations from the assessment data and then use the GeoCoder API to improve the completeness of this location information in our samples. If we still have missing geolocations, we drop these transaction samples.

ZTRAX data contain a significant number of missing values for house attributes. For example, the size of the property is defined by several variables: "Living Building Area"(BAL), "Gross Building Area"(BAG), or "Total Building Area"(BAT). The "Living Building Area" is usually taken as the property area. However, only about 70% of arm's length transactions have this information available in our selected areas. To supplement this information, we impute the missing value of the living building area by utilizing the information of other total area types. Specifically, we calculate the ratio of BAL to other total areas from available properties and fill in the missing value with other total areas adjusted by this ratio. Similarly, we impute the number of stories and bedrooms by accounting for the living area of the houses. For those observations that still have missing values, we fill them in with the median value of the variable in the sample. To address the outlier issue of house attributes, we also cut property characteristics: dropping properties with square footage $\geq$ 20,000, # bedrooms or bathrooms $\geq$ six, or # stories $\geq$ three.

To link noise grids with house addresses, for each 1/4-by-1/4 nautical square miles noise grid, we create the centroid of each noise grid and calculate the distance between each centroid to house addresses in our sample. We then find the nearest noise grid for a house address and assign its noise output to this house. Previous studies have attempted to use the kriging method to interpolate the value between centroids. Given the spatial resolution of our noise grids, we believe that the differences in noise outputs from different methods do not have significant impacts on our econometric results.

Supplemental Appendix A.3 Additional Evidence on Spatial FES and Housing Attributes

Table A1: Log of DNL Variance Explained by Sets of Fixed Effects (Adj. R^2)

	Zip-by-year FEs	Grid-by-year FEs	Tract-by-year FEs	Zip-by-year Time Trends	Grid-by-year Time Trends	Grid-by-year Time Trends
Without Block Group FEs						
Boston	.853	.942	.968	.792	.876	.902
Chicago	.908	.961	.978	.877	.925	.942
Seattle	.94	.982	.982	.939	.981	.98
With Block Group FEs						
Boston	.979	.987	.985	.937	.927	.985
Chicago	.985	.99	.99	.96	.958	.99
Seattle	.994	.996	.993	.993	.994	.993

Notes: Each column and row represents a separate regression. We regress the log of DNL on different sets of fixed effects and report the adjusted R^2. The bottom panel includes additional census-block-group fixed effects.

Table A2: Additional Summary Statistics for Housing, Noise, Neighborhoods

	Boston Logan			Chicago O'Hare			Seattle Tacoma		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Age	80.59	80.42	80.51	60.94	60.14	59.93	36.25	36.70	36.58
No Of Stories	2.06	2.05	2.04	1.49	1.49	1.49	1.58	1.56	1.57
Total Bath	2.43	2.38	2.38	1.78	1.79	1.79	1.99	2.00	2.01
Total Bedrooms	3.90	3.86	3.85	3.23	3.24	3.25	3.12	3.13	3.13
Lot Size (ft^2)	9853.56	9387.46	9340.25	7745.63	7796.98	7869.75	12347.06	11853.61	12005.99
Basement Dummy	0.44	0.44	0.45	0.03	0.03	0.03	0.30	0.31	0.31
Fireplace Dummy	.	.	.	.	.	.	0.40	0.40	0.40
Average Condition	0.60	0.61	0.61	.	.	.	0.36	0.37	0.36
Excellent Condition	0.04	0.03	0.03	.	.	.	0.01	0.01	0.01
Fair Condition	0.02	0.02	0.02	.	.	.	0.10	0.11	0.10
Pool Dummy	0.03	0.03	0.03	.	.	.	.	.	.
Block group median income ($K)	94.89	94.83	95.35	88.33	89.26	89.96	84.60	84.77	86.18
Block group under 18 (%)	19.03	19.06	19.04	21.62	21.59	21.65	19.04	19.01	18.87
Block group non-white (%)	24.37	23.63	23.22	26.52	25.06	24.66	37.69	37.74	37.45
City Hall	0.86	0.86	0.86	0.02	0.02	0.02	0.01	0.01	0.01
Road	0.31	0.31	0.31	0.22	0.22	0.21	0.16	0.16	0.16
Rail	0.17	0.17	0.17	0.15	0.15	0.15	0.03	0.03	0.03
Shopping Mall	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
Open Space	0.11	0.10	0.10	0.04	0.03	0.03	0.09	0.09	0.09
Coastal Line	0.02	0.02	0.02	0.00	0.00	0.00	0.03	0.03	0.03
Observations	24854	23450	21989	37752	36302	33913	36336	34726	30136

Notes: This table reports additional summary statistics for the key variables included in the analysis for Boston Logan, Chicago O'Hare, and Seattle Tacoma Airports. Column (1) shows the statistics without trimming the sale prices and excluding houses with multiple transactions in a year; column (2) reports the statistics without excluding houses with multiple transactions in a year; column (3) depicts the final sample.

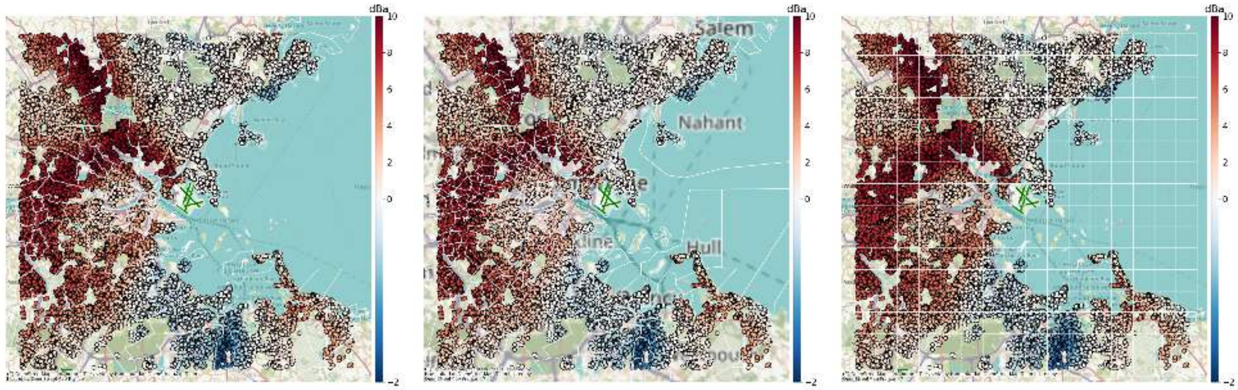
Supplemental Appendix A.4 Additional Evidence On Spatial Resolution of Three Localities

To better understand the plausible spatial scale, we conduct a series of analyses using different sets of spatial fixed effects across three localities. We consider three types of spatial resolution: zip code, census tract, and 2x2 mile grid. Figure A1 shows the scale of three resolutions with DNL changes over our study period in three localities. The average size of the zip code in the Boston sample is around 12 square miles, varying from 1.5 to 57 square miles. Chicago has a similar average size of 12 square miles, while the average size in Seattle is around 32 square miles. This is likely due to the lower population density in the Seattle area. In terms of census tracts, the average size in Boston and Chicago is around 2.6 square miles, while the average size in Seattle is 5 square miles. Given the quarter-by-quarter nautical square miles resolution in noise output, it is possible that little variation in airplane noise remains for small census tracts in Boston and Chicago after controlling for spatial fixed effects.

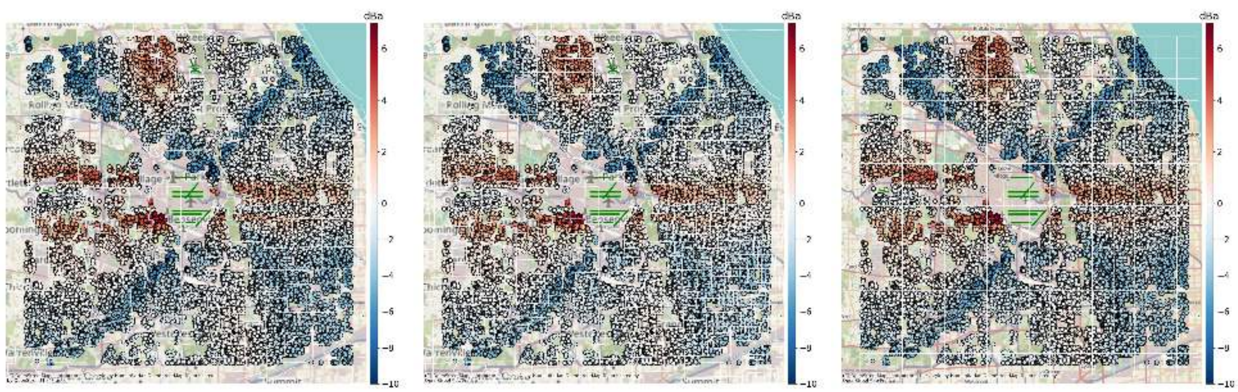
We plot the variation in noise measures after controlling for spatial fixed effects, the variation in housing prices, and the number of observations by three resolutions in Boston in Figure A6. The geographic areas were discarded if they contained fewer than 30 transactions in 2011 and 2016. In figure A6g-A6i, we find some evidence that using census tracts as the spatial resolution in Boston might be problematic, as no variation in airplane noise exposure remains in a significant number of areas after controlling for spatial fixed effects. In contrast, zip code and grid resolutions allow more variation and cover more geographic areas than census tract spatial resolution. Similarly, taking a closer look at Figure A7 in Chicago, we find the census tracts in urban areas were discarded due to the limited transactions for analysis. In contrast, zip code and grid resolutions provide better sample coverage and more variation in noise measures. For the Seattle sample, a closer look at Figure A8 suggests similar coverage of the sample and variation in noise measures across three resolutions. Therefore, using zip codes in Boston and Chicago and the census tracts in Seattle seems like a plausible spatial resolution to address the omitted variable bias in our setting.

Figure A5: DNL Changes with Geography Boundary

(a) Zip codes (Boston) (b) Census Tract (Boston) (c) 2x2 Mile Grid (Boston)



(d) Zip codes (Chicago) (e) Census Tract (Chicago) (f) 2x2 Mile Grid (Chicago)



(g) Zip codes (Seattle) (h) Census Tract (Seattle) (i) 2x2 Mile Grid (Seattle)

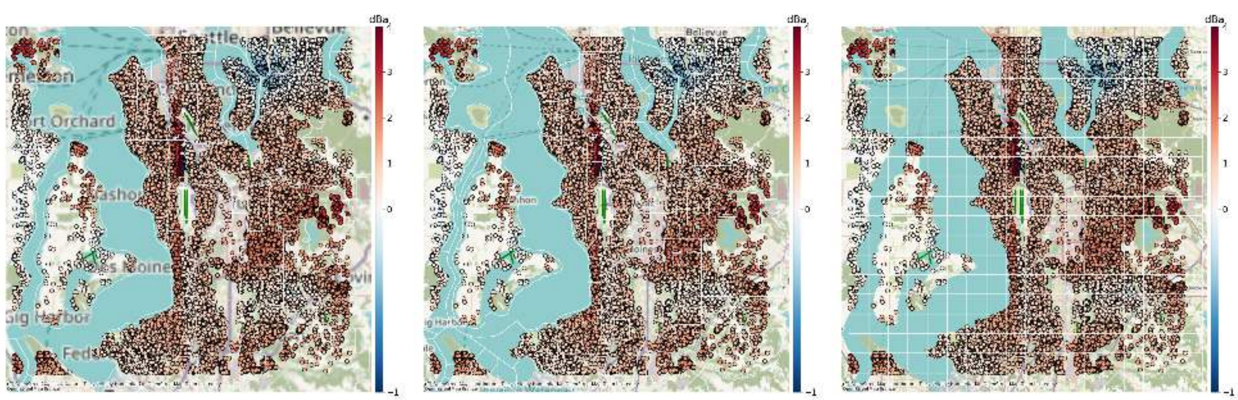
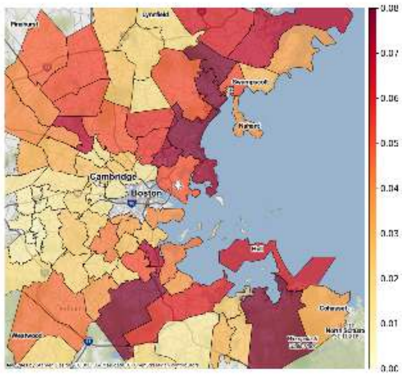
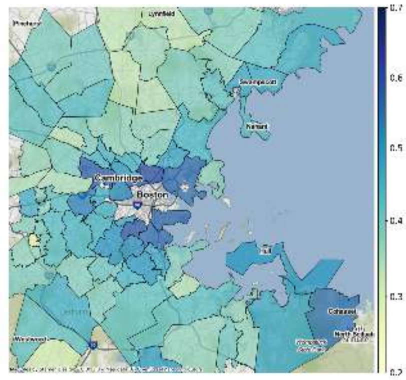


Figure A6: Within-Geography Variation in DNL, Property Prices, and Number of Observations in Boston

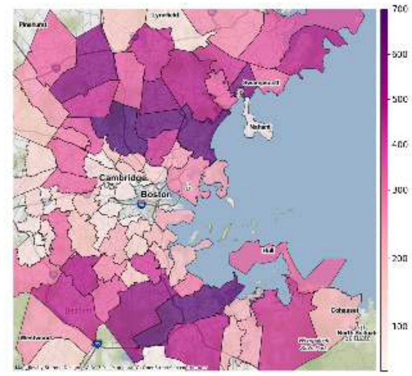
(a) DNL Variation (Zip)



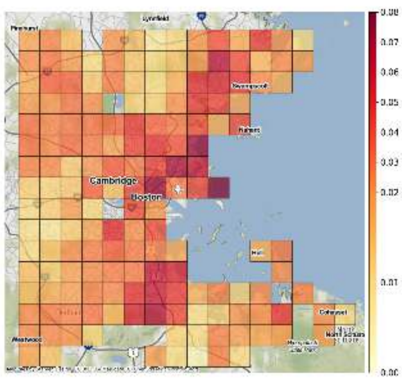
(b) Price Variation (Zip)



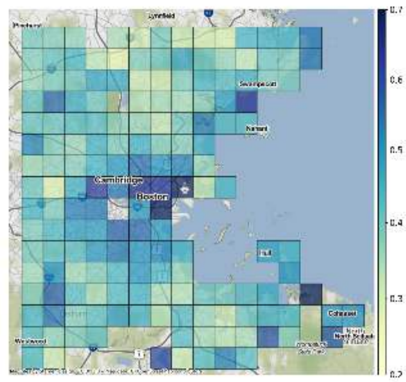
(c) Observations (Zip)



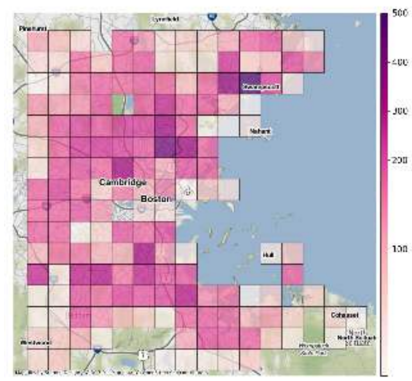
(d) DNL Variation (Grid)



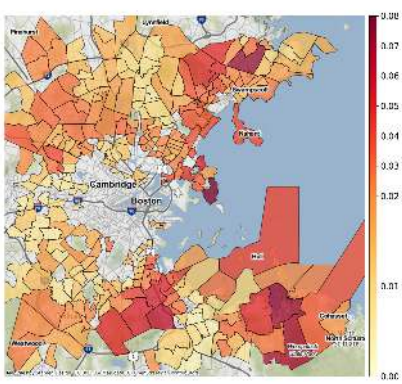
(e) Price Variation (Grid)



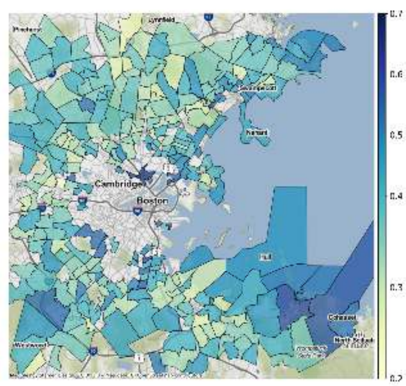
(f) Observations (Grid)



(g) DNL Variation (Tract)



(h) Price Variation (Tract)



(i) Observations (Tract)

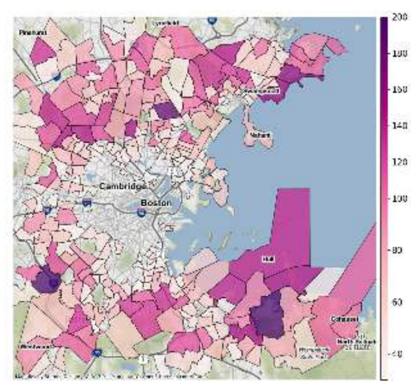
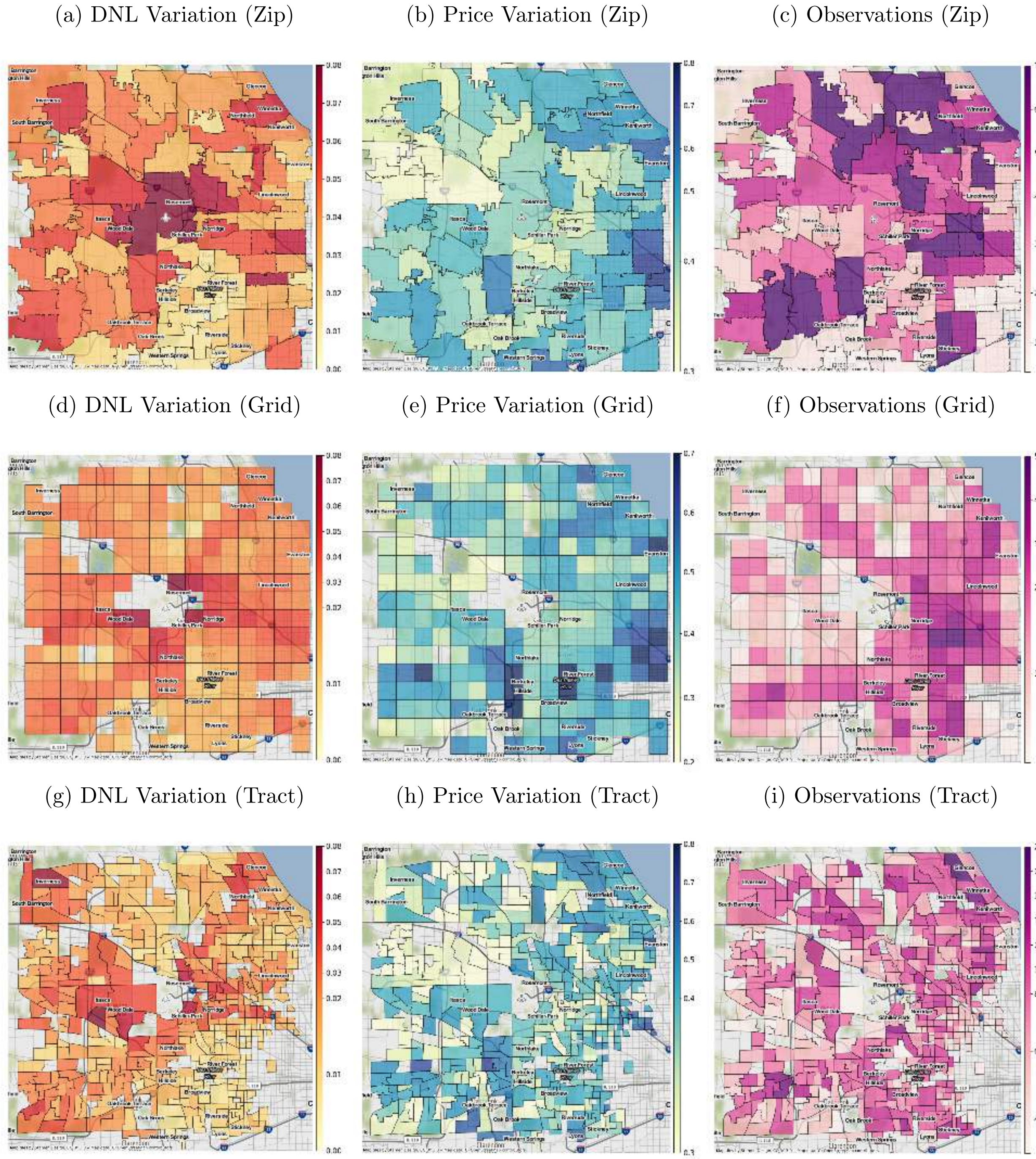


Figure A7: Within-Geography Variation in DNL, Property Prices, and Number of Observations in Chicago



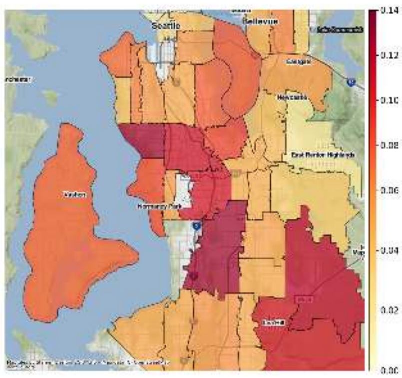
(a) DNL Variation (Zip) (b) Price Variation (Zip) (c) Observations (Zip)

(d) DNL Variation (Grid) (e) Price Variation (Grid) (f) Observations (Grid)

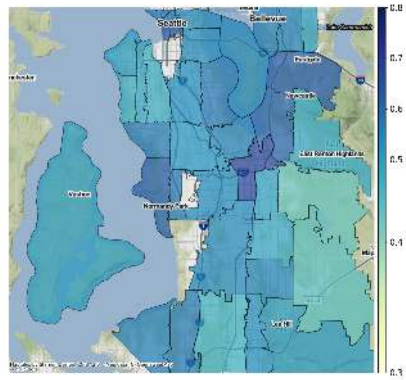
(g) DNL Variation (Tract) (h) Price Variation (Tract) (i) Observations (Tract)

Figure A8: Within-Geography Variation in DNL, Property Prices, and Number of Observations in Seattle

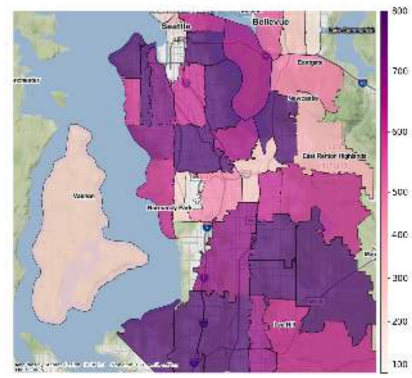
(a) DNL Variation (Zip)



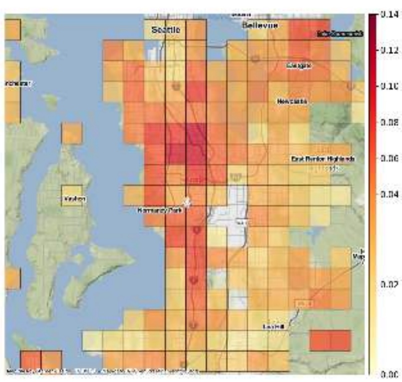
(b) Price Variation (Zip)



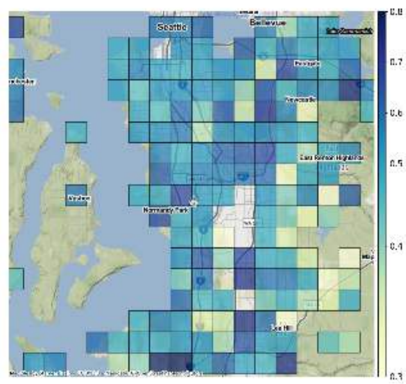
(c) Observations (Zip)



(d) DNL Variation (Grid)

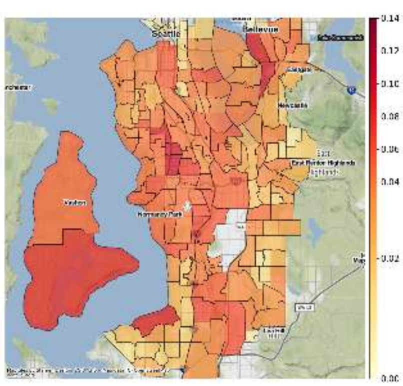


(e) Price Variation (Grid)

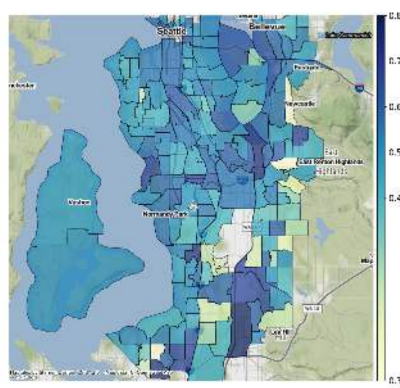


(f) Observations (Grid)

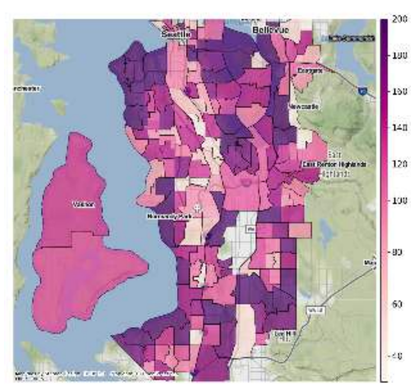
(g) DNL Variation (Tract)



(h) Price Variation (Tract)



(i) Observations (Tract)



Supplemental Appendix B Robustness Checks and Sensitivity Tests

Table B1: Robustness Checks: Alternative Function Forms

Function form	semi-log	log-log	Box-Cox transformation			
			lhs-only	rhs-only	both-same	both-diff
	(1)	(2)	(3)	(4)	(5)	(6)
Boston Logan Airport						
DNL	-0.004***		-0.060***	-5466.789	-0.518**	-0.957**
	(0.001)		(0.014)	(5887.310)	(0.050)	(0.578)
ln(DNL)		-0.262***				
		(0.048)				
θ			0.210***		0.192***	0.205***
			(0.012)		(0.007)	(0.010)
λ				0.241***	0.192***	0.055*
				(0.052)	(0.007)	(0.032)
Observations	20835	20835	20835	20835	20835	20835
Log likelihood	-267126	-262003	-262311	-266706	-261649	-261627
LR		10246	9630	840	10954	10998
Chicago O'Hare Airport						
DNL	-0.006***		-0.061***	-80.995***	-1.778***	-1.075***
	(0.001)		(0.001)	(3.831)	(0.117)	(0.035)
ln(DNL)		-0.224***				
		(0.044)				
θ			0.116***		0.118***	0.111***
			(0.006)		(0.006)	(0.006)
λ				2.035***	0.118***	0.231***
				(0.036)	(0.006)	(0.024)
Observations	33326	33326	33326	33326	33326	33326
Log likelihood	-425203	-413792	-413813	-424965	-413580	-413627
LR		22822	22780	476	23046	23152
Seattle Tacoma Airport						
DNL	-0.012***		-0.023***	-228.519***	-0.411***	-0.611***
	(0.002)		(0.000)	(17.773)	(0.079)	(0.051)
DNL^2		-0.299***				
		(0.062)				
θ			0.050***		0.030***	0.034***
			(0.006)		(0.006)	(0.007)
λ				1.865***	0.030***	-0.083**
				(0.093)	(0.006)	(0.028)
Observations	29882	29882	29882	29882	29882	29882
Log likelihood	-364322	-354258	-354520	-364306	-354247	-354239
LR		20056	19944	148	19970	19970

Notes: Column (1) uses a semi-log model, and column (2) uses a log-log model. We apply various restrictions to demonstrate the performance of the Box-Cox transformation. For instance, columns (3) and (4) permit transformations only on the left-hand side and right-hand side, respectively. Columns (5) and (6) allow transformations on both sides, with column (6) permitting different parameters for each side. The dependent variable is the property transaction prices in 2011 and 2016. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. All regressions use Eicker-White standard errors. * p<0.10, ** p<0.05, *** p<0.01.

Table B2: DNL Impacts: Alternative Fixed Effects or Trends

	(1)	(2)	(3)	(4)	(5)	(6)
Boston Logan Airport						
ln(DNL)	-0.262***	-0.327***	-0.252**	-0.251***	-0.217***	-0.086
	(0.048)	(0.073)	(0.102)	(0.040)	(0.050)	(0.056)
Observations	20835	20831	20800	20837	20836	20819
Chicago O'Hare Airport						
ln(DNL)	-0.224***	-0.222***	0.152*	-0.138***	-0.093*	0.121**
	(0.044)	(0.068)	(0.086)	(0.039)	(0.050)	(0.055)
Observations	33326	33334	33267	33326	33338	33316
Seattle Tacoma Airport						
ln(DNL)	-0.179***	-0.520***	-0.299***	-0.184***	-0.457***	-0.260***
	(0.037)	(0.063)	(0.062)	(0.036)	(0.060)	(0.059)
Observations	29472	29861	29882	29476	29878	29885
ZipXYear FEs	Yes					
GridXYear FEs		Yes				
TractXYear FEs			Yes			
ZipXYear Trends				Yes		
GridXYear Trends					Yes	
TractXYear Trends						Yes

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016 in three localities. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. All specifications include month fixed effects, house and neighborhood characteristics controls, and distance to the nearest city hall, highway, railroad, shopping mall, coastal line, and open space. All regressions use Eicker-White standard errors. * p<0.10, ** p<0.05, *** p<0.01.

Table B3: Robustness Checks: Alternative Housing Samples

	1 Year	2 Years	3 Years	4 Years	5 Year
Boston Logan Airport					
ln(DNL)	-0.262***	-0.223***	-0.219***	-0.200***	-0.197***
	(0.048)	(0.033)	(0.026)	(0.023)	(0.020)
Observations	20835	41850	62805	83249	103891
Chicago O'Hare Airport					
ln(DNL)	-0.224***	-0.202***	-0.182***	-0.200***	-0.226***
	(0.044)	(0.031)	(0.025)	(0.021)	(0.018)
Observations	33326	66942	98917	130487	165398
Seattle Tacoma Airport					
ln(DNL)	-0.299***	-0.256***	-0.262***	-0.295***	-0.288***
	(0.062)	(0.044)	(0.036)	(0.031)	(0.027)
Observations	29882	59376	85629	112565	147864

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. In the three localities, we extended our samples by multiple years (1-5 years) before 2011 and after 2016. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and spatial FEs. All regressions use Eicker-White standard errors. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table B4: Robustness Checks: Alternative Sales Price Bounds

	(1)	(2)	(3)	(4)	(5)
Boston Logan Airport					
ln(DNL)	-0.262***	-0.248***	-0.260***	-0.246***	-0.241***
	(0.048)	(0.046)	(0.045)	(0.043)	(0.043)
Observations	20835	20734	20766	20497	20323
Chicago O'Hare Airport					
ln(DNL)	-0.224***	-0.213***	-0.213***	-0.192***	-0.183***
	(0.044)	(0.043)	(0.042)	(0.041)	(0.041)
Observations	33326	32936	32539	32052	31594
Seattle Tacoma Airport					
ln(DNL)	-0.299***	-0.306***	-0.313***	-0.275***	-0.256***
	(0.062)	(0.060)	(0.059)	(0.058)	(0.056)
Observations	29882	29692	29442	29185	28838
Lower Bound	50K	60K	70K	80K	90K
Upper Bound	2M	1.9M	1.8M	1.7M	1.6M

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and spatial FEs. All regressions use Eicker-White standard errors. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table B5: Robustness Checks: Clustered at fixed effects level

	Boston	Chicago	Seattle
ln(DNL)	-0.246**	-0.238*	-0.291**
	(0.090)	(0.110)	(0.106)
Observations	20755	33214	29748

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and spatial FEs. Standard errors are clustered at the fixed effects level. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table B6: Heterogeneous effects of DNL across different housing price quantiles

	(1)q25	(2)q50	(3)q75
Boston Logan Airport			
ln(DNL)	-0.266***	-0.109	-0.132
	(0.091)	(0.070)	(0.122)
Observations	20,835	20,835	20,835
Chicago O'Hare Airport			
ln(DNL)	-0.111	-0.068	-0.140*
	(0.115)	(0.075)	(0.073)
Observations	33,326	33,326	33,326
Seattle Tacoma Airport			
ln(DNL)	-0.383***	-0.278***	-0.126
	(0.111)	(0.081)	(0.129)
Observations	29,882	29,882	29,882
House Characteristics	Yes	Yes	Yes
Distance Index	Yes	Yes	Yes
Neighborhood	Yes	Yes	Yes

Notes: We conduct quantile regressions at the housing price distribution's 25th, 50th, and 75th percentiles to examine how the effects vary across different price levels. The dependent variable is the log of property transaction prices in 2011 and 2016. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and Zip(Tract)-by-year fixed effects. All regressions use Eicker-White standard errors. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table B7: DNL Impacts across different airplane noise intervals

	Boston Logan Airport		Chicago O'hare Airport		Seattle Tacoma Airport	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(DNL)	-0.269***		-0.220***		-0.282***	
	(0.048)		(0.044)		(0.063)	
X I{Noise $\leq 40dB$}		-0.114		-0.068		-0.166**
		(0.101)		(0.059)		(0.073)
X I{Noise $\in (40dB, 50dB]$}		-0.218***		-0.299***		-0.590***
		(0.076)		(0.075)		(0.192)
X I{Noise $>$ *50dB*}		-0.262**		-0.011		-1.201
		(0.131)		(0.294)		(0.741)
I{Noise $\in (40dB, 50dB]$}		0.370		0.820**		1.572**
		(0.400)		(0.323)		(0.767)
I{Noise $>$ *50dB*}		0.530		-0.312		3.951
		(0.641)		(1.168)		(2.949)
Observations	20835	20835	33326	33326	29882	29882
R-sq	.644	.644	.675	.675	.543	.543
AIC	14069.6	14073.1	26745.4	26733.3	33380.8	33373.2
BIC	14204.6	14239.8	26888.4	26910	33521.9	33547.5

Notes: We employ a piece-wise linear specification to allow for non-constant marginal effects across the range of airplane noise exposure. The airplane noise variable is segmented into three intervals: $\{[\min - 40), (40 - 50], (50 - \max]\}$ dB. We interact the log of noise with these intervals to determine if the elasticities vary among them. The dependent variable is the log of property transaction prices in Illinois in 2011 and 2016. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. The dataset was min-max normalized before any analysis to deal with the different units and orders of magnitude. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and Zip(Tract)-by-year fixed effects. All regressions use Eicker-White standard errors. * p<0.10, ** p<0.05, *** p<0.01.

Supplemental Appendix C Additional Findings

Supplemental Appendix C.1 Alternative Noise Metrics

Table C1: Impacts of Alternative Noise Metrics, Boston Logan Airport

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(DNL)	-0.227***					-0.213**	-0.223**	-0.194**
	(0.042)					(0.097)	(0.097)	(0.097)
ln(MaxN60)		-0.137***				-0.107	-0.076	0.001
		(0.027)				(0.073)	(0.072)	(0.072)
ln(%D(N60>40))			-0.032**			0.068***		
			(0.015)			(0.024)		
ln(%D(N60>50))				-0.043***			0.048**	
				(0.015)			(0.024)	
ln(%D(N60>60))					-0.065***			-0.016
					(0.014)			(0.023)
Observations	20835	20835	20835	20835	20835	20835	20835	20835
AIC	13314.82	13320.01	13342.14	13337.74	13324.35	13310.04	13314.61	13318.22
BIC	13489.60	13494.79	13516.91	13512.52	13499.13	13500.71	13505.28	13508.89

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016 in Massachusetts. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. DNL, MaxN60, and %D(N60>40/50/60) represent average noise level, the number of noise events above 60 dBA at the peak day, and the percentage of days having the number of noise events above 60 dBA more than 40/50/60 times, respectively. The dataset was min-max normalized before any analysis to deal with the different units and orders of magnitude. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and Zip-by-year fixed effects. All regressions use Eicker-White standard errors. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table C2: Impacts of Alternative Noise Metrics, Chicago O'Hare Airport

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(DNL)	-0.235***					-0.139*	-0.221***	-0.291***
	(0.046)					(0.079)	(0.079)	(0.079)
ln(MaxN60)		-0.179***				-0.080	-0.120*	-0.178***
		(0.038)				(0.063)	(0.063)	(0.064)
ln(%D(N60>40))			-0.079***			-0.009		
			(0.022)			(0.029)		
ln(%D(N60>50))				-0.029			0.068***	
				(0.020)			(0.026)	
ln(%D(N60>60))					0.003			0.029***
					(0.004)			(0.005)
Observations	33326	33326	33326	33326	33326	33326	33326	33326
AIC	26899.65	26901.37	26911.73	26923.28	26925.12	26901.75	26894.49	26867.72
BIC	27042.69	27044.41	27054.77	27066.31	27068.16	27061.62	27054.36	27027.59

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016 in Illinois. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. DNL, MaxN60, and %D(N60>40/50/60) represent average noise level, the number of noise events above 60 dBA at the peak day, and the percentage of days having the number of noise events above 60 dBA more than 40/50/60 times, respectively. The dataset was min-max normalized before any analysis to deal with the different units and orders of magnitude. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and Zip-by-year fixed effects. All regressions use Eicker-White standard errors. * p<0.10, ** p<0.05, *** p<0.01.

Table C3: Impacts of Alternative Noise Metrics, Seattle Tacoma Airport

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(DNL)	-0.300***					-0.426***	-0.430***	-0.433***
	(0.062)					(0.089)	(0.089)	(0.089)
ln(MaxN60)		-0.022**				0.025	0.022	0.020
		(0.010)				(0.015)	(0.015)	(0.015)
ln(%D(N60>40))			-0.003			0.002		
			(0.004)			(0.004)		
ln(%D(N60>50))				-0.001			0.005	
				(0.004)			(0.005)	
ln(%D(N60>60))					0.000			0.007
					(0.004)			(0.004)
Observations	29882	29882	29882	29882	29882	29882	29882	29882
AIC	33216.79	33237.90	33242.52	33243.38	33243.51	33216.46	33215.25	33213.69
BIC	33382.89	33404.00	33408.62	33409.48	33409.61	33399.17	33397.96	33396.40

Notes: The dependent variable is the log of property transaction prices in 2011 and 2016 in Seattle. All prices are deflated to 2011 dollars using the US Bureau of Labor Statistics Consumer Price Index. DNL, MaxN60, and %D(N60>40/50/60) represent average noise level, the number of noise events above 60 dBA at the peak day, and the percentage of days having the number of noise events above 60 dBA more than 40/50/60 times, respectively. The dataset was min-max normalized before any analysis to deal with the different units and orders of magnitude. All specifications include month fixed effects, house and neighborhood characteristics controls, distance to the nearest city hall, highway, railroad, shopping mall, coastal line, open space, and Zip-by-year fixed effects. All regressions use Eicker-White standard errors. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.