

Supplementary Materials for

**Sensing the Environmental Inequality of PM<sub>2.5</sub>  
Exposure Using Fine-scale Measurements of Social  
Strata and Citizenship Identity**

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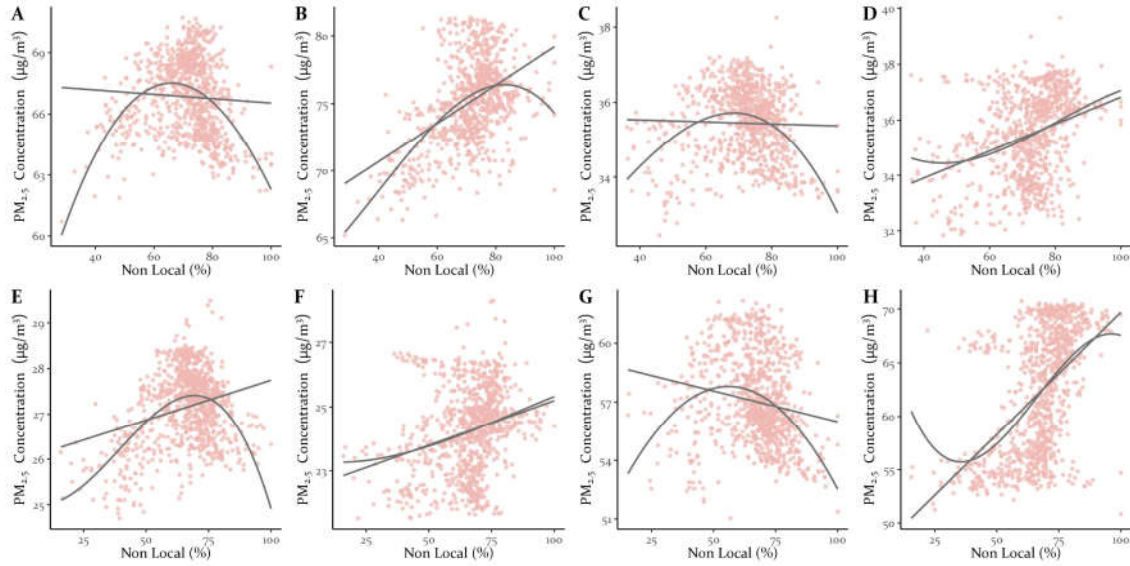
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**The PDF file includes:**

Figure S1

Tables S1 to S2

# 1 SUPPLEMENTARY FIGURES



**Figure S1.** Bivariate relationship between  $PM_{2.5}$  concentration and the percentage of non-local population. **(A)** Daytime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 1; **(B)** Nighttime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 1; **(C)** Daytime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 2; **(D)** Nighttime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 2; **(E)** Daytime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 3; **(F)** Nighttime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 3; **(G)** Daytime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 4; **(H)** Nighttime  $PM_{2.5}$  concentration  $\sim$  the percentage of non-local in quarter 4. Smooth lines are fitted using linear regression and polynomial regression, respectively. The “daytime” spans from 9 am to 6 pm; and nighttime spans from 0 am to 6 am.

2 SUPPLEMENTARY TABLES

Table S1. Parameter and goodness of fit of selected models.

		GWR Model Parameters			Moran's I for GWR Model		Moran's I for Linear Model		Square Sum of Residual			F Test			
Independent Variable	Relationship between Variables	Adapt Bandwidth	Method	Geographical Weighting Function	Moran's I	P Value	Moran's I	P Value	OLS Model	GWR Model	Improvement	F1	P Value	F2	P Value
% of Non-local, daytime	Linear	Yes	CV	Gaussian	-0.006	0.000	0.928	0.000	1433.400	2.838	1430.562	0.009	0.000	1.280	0.000
% of Non-local, daytime	Linear	Yes	CV	bisquare	0.425	0.000	0.928	0.000	1433.400	95.109	1338.292	0.074	0.000	8.984	0.000
% of Non-local, daytime	Linear	Yes	CV	tricube	0.428	0.000	0.928	0.000	1433.400	96.648	1336.753	0.075	0.000	9.002	0.000
% of Non-local, daytime	Linear	Yes	AIC	Gaussian	0.025	0.000	0.928	0.000	1433.400	9.903	1423.497	0.013	0.000	2.107	0.000
% of Non-local, daytime	Linear	Yes	AIC	bisquare	0.415	0.000	0.928	0.000	1433.400	90.646	1342.754	0.071	0.000	8.913	0.000
% of Non-local, daytime	Linear	Yes	AIC	tricube	0.416	0.000	0.928	0.000	1433.400	90.725	1342.675	0.071	0.000	8.915	0.000
% of Non-local, daytime	Linear	No	CV	Gaussian	-0.001	0.000	0.928	0.000	1433.400	4.520	1428.880	0.010	0.000	1.463	0.000
% of Non-local, daytime	Linear	No	CV	bisquare	0.507	0.000	0.928	0.000	1433.400	105.348	1328.052	0.078	0.000	15.286	0.000
% of Non-local, daytime	Linear	No	CV	tricube	0.507	0.000	0.928	0.000	1433.400	105.349	1328.051	0.078	0.000	15.286	0.000
% of Non-local, daytime	Linear	No	AIC	Gaussian	0.021	0.000	0.928	0.000	1433.400	9.522	1423.878	0.013	0.000	2.062	0.000
% of Non-local, daytime	Linear	No	AIC	bisquare											
% of Non-local, daytime	Linear	No	AIC	tricube											
% of Non-local, daytime	Quadratic	Yes	CV	Gaussian	0.036	0.000	0.796	0.000	1057.173	11.164	1046.009	0.021	0.000	1.978	0.000
% of Non-local, daytime	Quadratic	Yes	CV	bisquare	0.388	0.000	0.796	0.000	1057.173	114.452	942.720	0.120	0.000	9.332	0.000
% of Non-local, daytime	Quadratic	Yes	CV	tricube	0.392	0.000	0.796	0.000	1057.173	117.719	939.454	0.123	0.000	9.451	0.000
% of Non-local, daytime	Quadratic	Yes	AIC	Gaussian	0.037	0.000	0.796	0.000	1057.173	11.442	1045.731	0.021	0.000	2.004	0.000
% of Non-local, daytime	Quadratic	Yes	AIC	bisquare	0.447	0.000	0.796	0.000	1057.173	137.728	919.445	0.140	0.000	12.634	0.000
% of Non-local, daytime	Quadratic	Yes	AIC	tricube	0.329	0.000	0.796	0.000	1057.173	90.643	966.530	0.096	0.000	8.573	0.000
% of Non-local, daytime	Quadratic	No	CV	Gaussian	0.050	0.000	0.796	0.000	1057.173	13.697	1043.476	0.023	0.000	2.218	0.000
% of Non-local, daytime	Quadratic	No	CV	bisquare	0.612	0.000	0.796	0.000	1057.173	235.186	821.986	0.231	0.000	21.326	0.000
% of Non-local, daytime	Quadratic	No	CV	tricube	0.618	0.000	0.796	0.000	1057.173	244.698	812.475	0.240	0.000	21.821	0.000
% of Non-local, daytime	Quadratic	No	AIC	Gaussian	0.043	0.000	0.796	0.000	1057.173	12.363	1044.810	0.022	0.000	2.091	0.000
% of Non-local, daytime	Quadratic	No	AIC	bisquare											
% of Non-local, daytime	Quadratic	No	AIC	tricube											
% of Non-local, daytime	Cubic	Yes	CV	Gaussian	0.058	0.000	0.804	0.000	1037.398	18.813	1018.584	0.034	0.000	2.078	0.000
% of Non-local, daytime	Cubic	Yes	CV	bisquare	0.586	0.000	0.804	0.000	1037.398	249.591	787.806	0.251	0.000	17.939	0.000
% of Non-local, daytime	Cubic	Yes	CV	tricube	0.586	0.000	0.804	0.000	1037.398	249.556	787.841	0.251	0.000	17.937	0.000
% of Non-local, daytime	Cubic	Yes	AIC	Gaussian	0.041	0.000	0.804	0.000	1037.398	13.229	1024.169	0.026	0.000	1.968	0.000
% of Non-local, daytime	Cubic	Yes	AIC	bisquare	0.446	0.000	0.804	0.000	1037.398	135.772	901.626	0.142	0.000	10.715	0.000
% of Non-local, daytime	Cubic	Yes	AIC	tricube	0.446	0.000	0.804	0.000	1037.398	135.662	901.736	0.142	0.000	10.705	0.000
% of Non-local, daytime	Cubic	No	CV	Gaussian	0.187	0.000	0.804	0.000	1037.398	44.513	992.884	0.054	0.000	4.722	0.000
% of Non-local, daytime	Cubic	No	CV	bisquare	0.630	0.000	0.804	0.000	1037.398	298.729	738.669	0.298	0.000	20.418	0.000
% of Non-local, daytime	Cubic	No	CV	tricube	0.632	0.000	0.804	0.000	1037.398	302.410	734.988	0.302	0.000	20.557	0.000
% of Non-local, daytime	Cubic	No	AIC	Gaussian	0.052	0.000	0.804	0.000	1037.398	15.447	1021.951	0.027	0.000	2.150	0.000

		GWR Model Parameters			Moran's I for GWR Model		Moran's I for Linear Model		Square Sum of Residual			F Test			
Independent Variable	Relationship between Variables	Adapt Bandwidth	Method	Geographical Weighting Function	Moran's I	P Value	Moran's I	P Value	OLS Model	GWR Model	Improvement	F1	P Value	F2	P Value
% of Non-local, daytime	Cubic	No	AIC	bisquare											
% of Non-local, daytime	Cubic	No	AIC	tricube											
% of Non-local, nighttime	Linear	Yes	CV	Gaussian	0.041	0.000	0.848	0.000	4925.337	12.576	4912.761	0.005	0.000	2.247	0.000
% of Non-local, nighttime	Linear	Yes	CV	bisquare	0.423	0.000	0.848	0.000	4925.337	98.866	4826.471	0.022	0.000	9.610	0.000
% of Non-local, nighttime	Linear	Yes	CV	tricube	0.427	0.000	0.848	0.000	4925.337	102.468	4822.868	0.023	0.000	9.744	0.000
% of Non-local, nighttime	Linear	Yes	AIC	Gaussian	0.038	0.000	0.848	0.000	4925.337	12.121	4913.216	0.005	0.000	2.191	0.000
% of Non-local, nighttime	Linear	Yes	AIC	bisquare	0.416	0.000	0.848	0.000	4925.337	91.621	4833.715	0.021	0.000	9.397	0.000
% of Non-local, nighttime	Linear	Yes	AIC	tricube	0.416	0.000	0.848	0.000	4925.337	91.481	4833.856	0.021	0.000	9.393	0.000
% of Non-local, nighttime	Linear	No	CV	Gaussian	0.033	0.000	0.848	0.000	4925.337	11.520	4913.817	0.004	0.000	2.121	0.000
% of Non-local, nighttime	Linear	No	CV	bisquare	0.561	0.000	0.848	0.000	4925.337	126.971	4798.366	0.027	0.000	16.074	0.000
% of Non-local, nighttime	Linear	No	CV	tricube	0.561	0.000	0.848	0.000	4925.337	126.972	4798.364	0.027	0.000	16.074	0.000
% of Non-local, nighttime	Linear	No	AIC	Gaussian	0.039	0.000	0.848	0.000	4925.337	12.462	4912.875	0.005	0.000	2.236	0.000
% of Non-local, nighttime	Linear	No	AIC	bisquare											
% of Non-local, nighttime	Linear	No	AIC	tricube											
% of Non-local, nighttime	Quadratic	Yes	CV	Gaussian	0.057	0.000	0.850	0.000	4920.048	18.052	4901.997	0.006	0.000	2.327	0.000
% of Non-local, nighttime	Quadratic	Yes	CV	bisquare	0.562	0.000	0.850	0.000	4920.048	239.372	4680.676	0.051	0.000	19.383	0.000
% of Non-local, nighttime	Quadratic	Yes	CV	tricube	0.562	0.000	0.850	0.000	4920.048	239.424	4680.624	0.051	0.000	19.384	0.000
% of Non-local, nighttime	Quadratic	Yes	AIC	Gaussian	0.054	0.000	0.850	0.000	4920.048	15.712	4904.336	0.006	0.000	2.250	0.000
% of Non-local, nighttime	Quadratic	Yes	AIC	bisquare	0.468	0.000	0.850	0.000	4920.048	152.229	4767.819	0.033	0.000	13.698	0.000
% of Non-local, nighttime	Quadratic	Yes	AIC	tricube	0.473	0.000	0.850	0.000	4920.048	154.287	4765.761	0.034	0.000	13.867	0.000
% of Non-local, nighttime	Quadratic	No	CV	Gaussian	0.084	0.000	0.850	0.000	4920.048	19.557	4900.491	0.006	0.000	2.638	0.000
% of Non-local, nighttime	Quadratic	No	CV	bisquare	0.719	0.000	0.850	0.000	4920.048	356.655	4563.393	0.075	0.000	26.062	0.000
% of Non-local, nighttime	Quadratic	No	CV	tricube	0.729	0.000	0.850	0.000	4920.048	384.357	4535.692	0.081	0.000	27.343	0.000
% of Non-local, nighttime	Quadratic	No	AIC	Gaussian	0.060	0.000	0.850	0.000	4920.048	16.351	4903.697	0.006	0.000	2.315	0.000
% of Non-local, nighttime	Quadratic	No	AIC	bisquare											
% of Non-local, nighttime	Quadratic	No	AIC	tricube											
% of Non-local, nighttime	Cubic	Yes	CV	Gaussian	0.047	0.000	0.864	0.000	4825.909	16.155	4809.754	0.007	0.000	2.009	0.000
% of Non-local, nighttime	Cubic	Yes	CV	bisquare	0.692	0.000	0.864	0.000	4825.909	411.742	4414.167	0.089	0.000	24.406	0.000
% of Non-local, nighttime	Cubic	Yes	CV	tricube	0.692	0.000	0.864	0.000	4825.909	411.803	4414.106	0.089	0.000	24.408	0.000
% of Non-local, nighttime	Cubic	Yes	AIC	Gaussian	0.046	0.000	0.864	0.000	4825.909	15.105	4810.804	0.006	0.000	1.987	0.000
% of Non-local, nighttime	Cubic	Yes	AIC	bisquare	0.496	0.000	0.864	0.000	4825.909	159.151	4666.758	0.036	0.000	11.921	0.000
% of Non-local, nighttime	Cubic	Yes	AIC	tricube	0.495	0.000	0.864	0.000	4825.909	158.982	4666.927	0.036	0.000	11.911	0.000
% of Non-local, nighttime	Cubic	No	CV	Gaussian	0.082	0.000	0.864	0.000	4825.909	20.081	4805.828	0.007	0.000	2.393	0.000
% of Non-local, nighttime	Cubic	No	CV	bisquare	0.774	0.000	0.864	0.000	4825.909	668.784	4157.125	0.142	0.000	31.518	0.000
% of Non-local, nighttime	Cubic	No	CV	tricube	0.775	0.000	0.864	0.000	4825.909	675.252	4150.657	0.144	0.000	31.702	0.000
% of Non-local, nighttime	Cubic	No	AIC	Gaussian	0.074	0.000	0.864	0.000	4825.909	18.969	4806.940	0.007	0.000	2.302	0.000
% of Non-local, nighttime	Cubic	No	AIC	bisquare											
% of Non-local, nighttime	Cubic	No	AIC	tricube											

		GWR Model Parameters			Moran's I for GWR Model		Moran's I for Linear Model		Square Sum of Residual			F Test			
Independent Variable	Relationship between Variables	Adapt Bandwidth	Method	Geographical Weighting Function	Moran's I	P Value	Moran's I	P Value	OLS Model	GWR Model	Improvement	F1	P Value	F2	P Value
Housing Price	Linear	Yes	CV	Gaussian	0.145	0.000	0.971	0.000	4865.450	15.865	4849.585	0.005	0.000	3.159	0.000
Housing Price	Linear	Yes	CV	bisquare	0.723	0.000	0.971	0.000	4865.450	244.160	4621.291	0.052	0.000	28.162	0.000
Housing Price	Linear	Yes	CV	tricube	0.723	0.000	0.971	0.000	4865.450	244.234	4621.216	0.052	0.000	28.168	0.000
Housing Price	Linear	Yes	AIC	Gaussian											
Housing Price	Linear	Yes	AIC	bisquare											
Housing Price	Linear	Yes	AIC	tricube											
Housing Price	Linear	No	CV	Gaussian											
Housing Price	Linear	No	CV	bisquare	0.881	0.000	0.971	0.000	4865.450	805.024	4060.426	0.168	0.000	66.356	0.000
Housing Price	Linear	No	CV	tricube	0.881	0.000	0.971	0.000	4865.450	805.938	4059.512	0.168	0.000	66.403	0.000
Housing Price	Linear	No	AIC	Gaussian											
Housing Price	Linear	No	AIC	bisquare											
Housing Price	Linear	No	AIC	tricube											
Housing Price	Quadratic	Yes	CV	Gaussian											
Housing Price	Quadratic	Yes	CV	bisquare	0.718	0.000	0.953	0.000	4721.395	292.276	4429.120	0.064	0.000	25.740	0.000
Housing Price	Quadratic	Yes	CV	tricube	0.719	0.000	0.953	0.000	4721.395	292.973	4428.422	0.064	0.000	25.777	0.000
Housing Price	Quadratic	Yes	AIC	Gaussian											
Housing Price	Quadratic	Yes	AIC	bisquare											
Housing Price	Quadratic	Yes	AIC	tricube											
Housing Price	Quadratic	No	CV	Gaussian											
Housing Price	Quadratic	No	CV	bisquare	0.858	0.000	0.953	0.000	4721.395	1024.373	3697.022	0.220	0.000	59.707	0.000
Housing Price	Quadratic	No	CV	tricube	0.858	0.000	0.953	0.000	4721.395	1032.149	3689.247	0.221	0.000	59.974	0.000
Housing Price	Quadratic	No	AIC	Gaussian											
Housing Price	Quadratic	No	AIC	bisquare											
Housing Price	Quadratic	No	AIC	tricube											
Housing Price	Cubic	Yes	CV	Gaussian	0.309	0.000	0.941	0.000	4663.443	51.241	4612.202	0.013	0.000	5.694	0.000
Housing Price	Cubic	Yes	CV	bisquare	0.727	0.000	0.941	0.000	4663.443	392.231	4271.212	0.087	0.000	25.042	0.000
Housing Price	Cubic	Yes	CV	tricube	0.733	0.000	0.941	0.000	4663.443	413.437	4250.006	0.092	0.000	25.684	0.000
Housing Price	Cubic	Yes	AIC	Gaussian											
Housing Price	Cubic	Yes	AIC	bisquare											
Housing Price	Cubic	Yes	AIC	tricube											
Housing Price	Cubic	No	CV	Gaussian											
Housing Price	Cubic	No	CV	bisquare	0.884	0.000	0.941	0.000	4663.443	1457.132	3206.310	0.316	0.000	64.774	0.000
Housing Price	Cubic	No	CV	tricube	0.888	0.000	0.941	0.000	4663.443	1533.703	3129.739	0.332	0.000	66.661	0.000
Housing Price	Cubic	No	AIC	Gaussian											
Housing Price	Cubic	No	AIC	bisquare											
Housing Price	Cubic	No	AIC	tricube											

**Table S2.** Parameter and goodness of fit of selected models.

		GWR Model Parameters			Moran's I for GWR Model		Moran's I for Linear Model		Square Sum of Residual			F Test			
Independent Variable	Relationship between Variables	Adapt Bandwidth	Method	Geographical Weighting Function	Moran's I	P Value	Moran's I	P Value	OLS Model	GWR Model	Improvement	F1	P Value	F2	P Value
% of Non-local, daytime	Linear	Yes	CV	Gaussian	-0.006	0.000	0.928	0.000	1433.400	2.838	1430.562	0.009	0.000	1.280	0.000
% of Non-local, nighttime	Linear	No	CV	Gaussian	0.033	0.000	0.848	0.000	4925.337	11.520	4913.817	0.004	0.000	2.121	0.000
Housing Price	Linear	Yes	CV	Gaussian	0.145	0.000	0.971	0.000	4865.450	15.865	4849.585	0.005	0.000	3.159	0.000