

Supporting Information

Ten pages: two figures (S1, S2a-b) and two tables (S1a-c, S2)

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Assessing Sustainability in Real Urban Systems: The Greater Cincinnati Metropolitan Area in Ohio, Kentucky and Indiana

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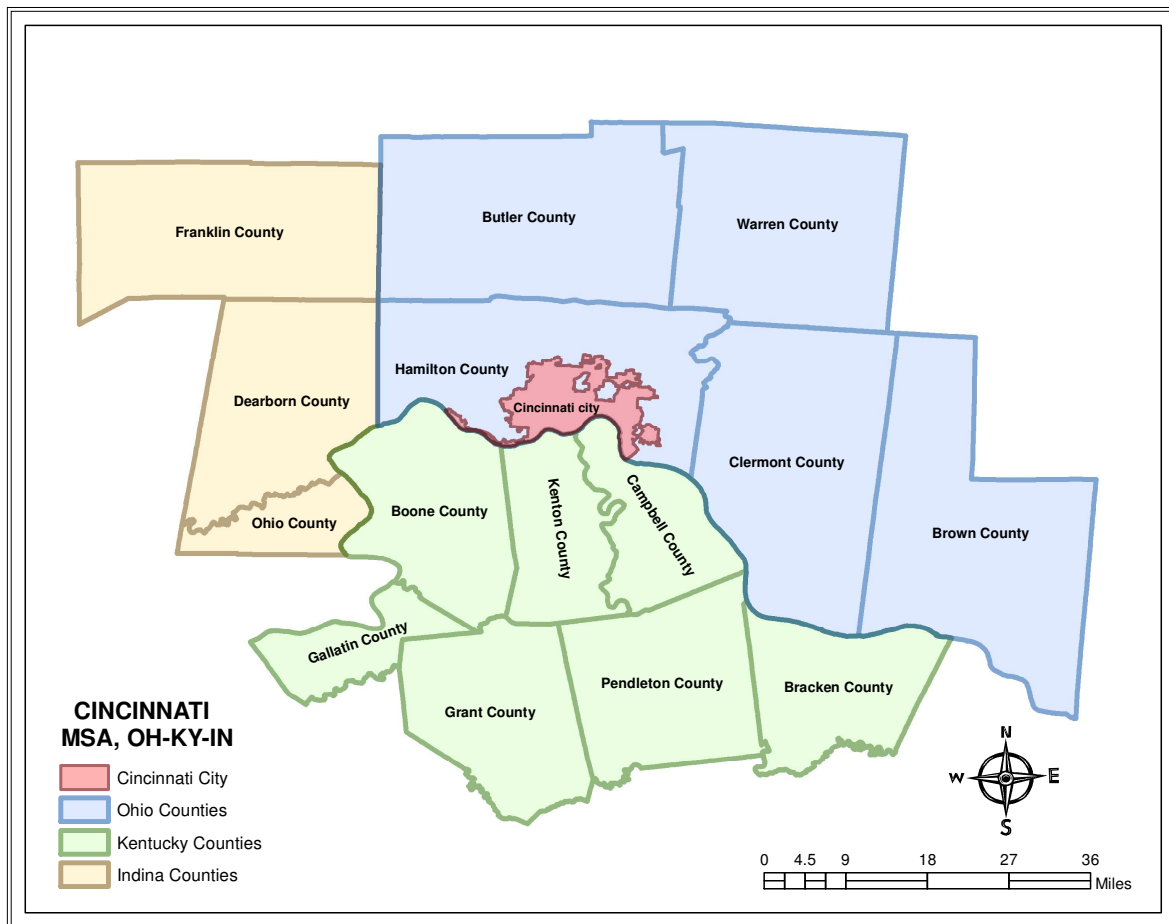
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Figure S1 – Area of study: Cincinnati Metropolitan Statistical Area OH-KY-IN, suburbs, and city boundaries



Please note that the area outside of the City of Cincinnati's perimeter (red line) within the boundaries of the MSA is considered the suburbs.

Figure S2a – Goodness of the fit for social and economic components of Cincinnati MSA

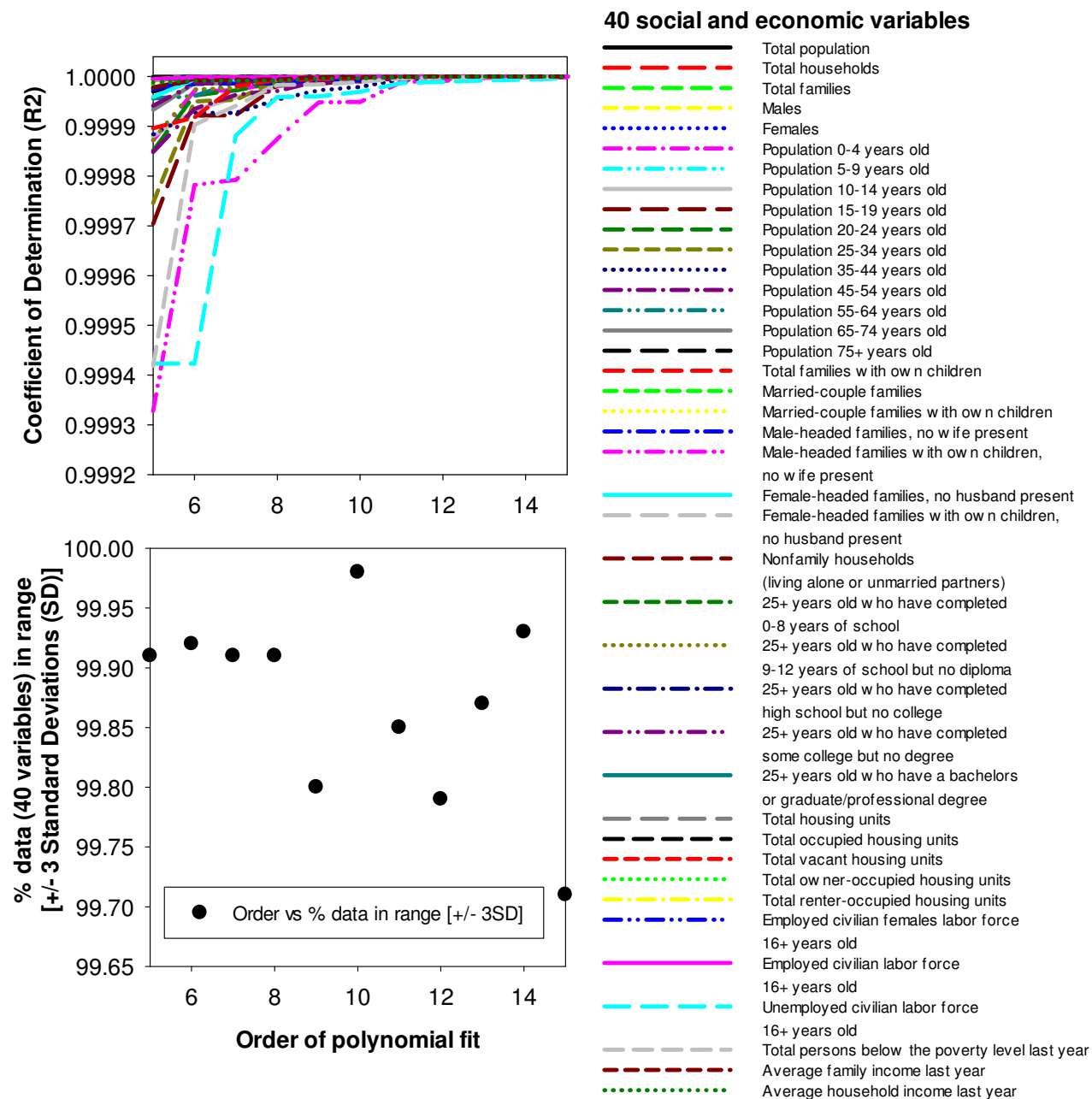


Figure S2b – Goodness of the fit for air quality variables of Cincinnati MSA

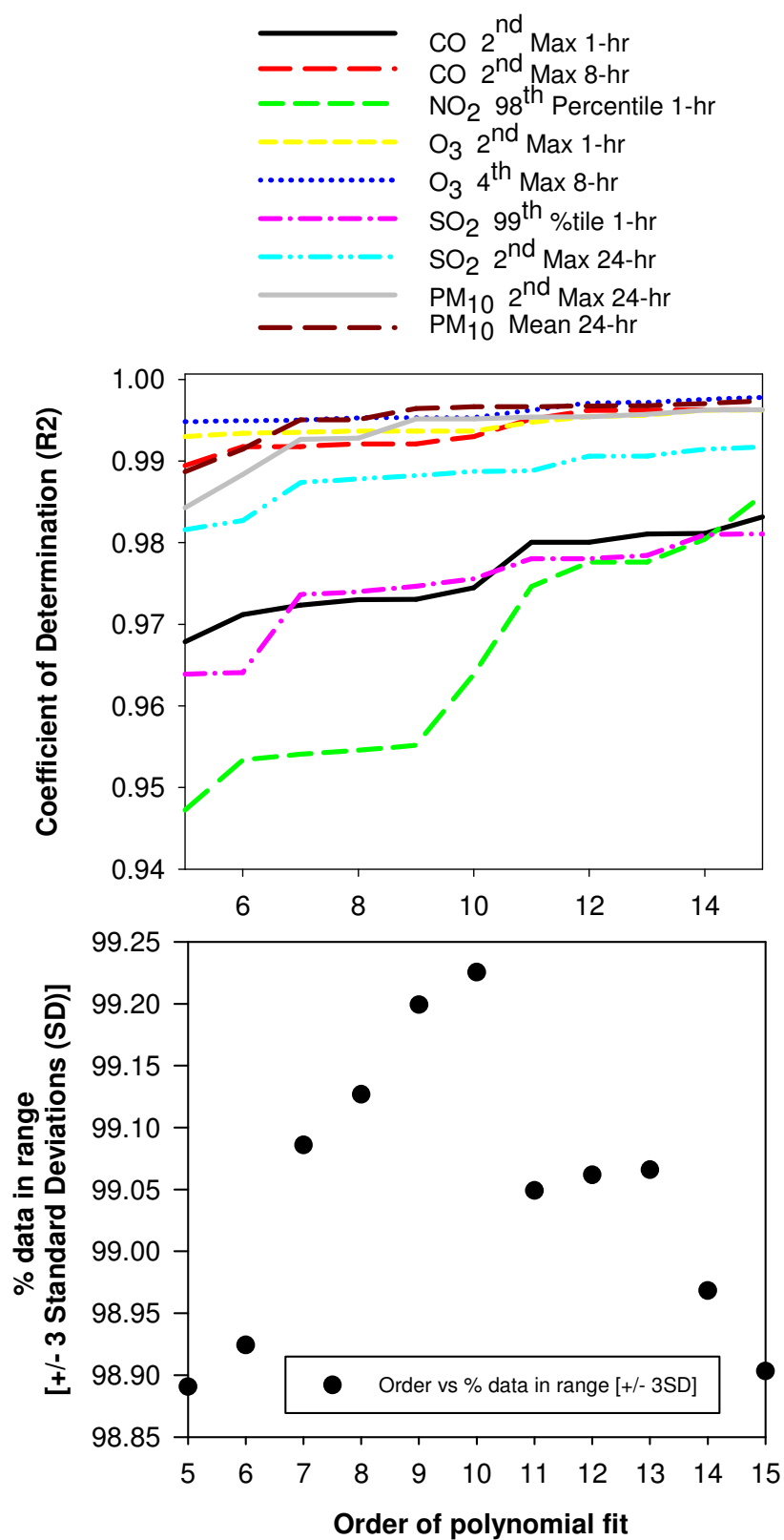


Table S1a – Social, economic characteristics describing Cincinnati MSA

			Cincinnati-Middletown, OH-KY-IN MSA				
		SOCIAL COMPONENT	1,970	1,980	1,990	2,000	2,009
SOCIAL DISTRIBUTION	1	Total population	1,603,304	1,659,795	1,844,793	2,009,632	2,170,828
	2	Total households	495,772	587,616	688,102	779,534	816,646
	3	Total families	399,168	432,832	488,694	528,257	540,998
	4	Males	770,200	796,734	886,932	976,123	1,060,510
	5	Females	833,117	863,069	957,870	1,033,509	1,110,318
AGE DISTRIBUTION	6	Population 0-4 years old	142,195	125,330	143,023	141,143	147,949
	7	Population 5-9 years old	165,738	126,696	143,404	149,461	148,208
	8	Population 10-14 years old	171,891	137,692	132,341	152,871	146,326
	9	Population 15-19 years old	152,643	159,420	132,286	144,835	152,208
	10	Population 20-24 years old	124,057	160,743	137,365	133,837	136,452
	11	Population 25-34 years old	193,003	268,486	322,779	280,935	299,744
	12	Population 35-44 years old	186,428	183,092	274,185	335,658	300,554
	13	Population 45-54 years old	175,557	169,972	184,468	270,330	331,425
	14	Population 55-64 years old	140,657	152,995	157,580	165,331	243,080
	15	Population 65-74 years old	92,855	105,572	125,839	127,897	139,388
	16	Population 75+ years old	58,293	69,805	91,532	107,334	125,494
HOUSEHOLD TYPE	17	Total families with own children	237,307	241,403	262,487	280,151	253,046
	18	Married-couple families	344,466	358,468	387,973	409,070	402,552
	19	Married-couple families with own children	201,140	189,756	189,864	194,893	171,613
	20	Male-headed families, no wife present	10,999	12,787	19,178	27,813	31,489
	21	Male-headed families with own children, no wife present	3,778	4,957	8,740	15,092	14,476
	22	Female-headed families, no husband present	43,709	61,579	81,540	91,374	106,957
	23	Female-headed families with own children, no husband present	23,517	37,427	48,203	57,218	66,957
	24	Nonfamily households (living alone or unmarried partners)	98,076	154,121	199,409	251,277	275,648
EDUCATIONAL ATTAINMENT	25	Persons 25+ years old who have completed 0-8 years of school	254,075	175,770	108,569	65,339	52,308
	26	Persons 25+ years old who have completed 9-12 years of school but no diploma	183,172	170,628	186,925	160,677	126,554
	27	Persons 25+ years old who have completed high school but no college	248,892	333,080	368,381	410,581	455,199
	28	Persons 25+ years old who have completed some college but no degree	73,124	122,347	201,885	253,198	294,936
	29	Persons 25+ years old who have a bachelors or graduate/professional degree	87,509	148,105	225,691	319,469	410,853

Table S1a - Social and economic characteristics describing Cincinnati MSA

			Cincinnati-Middletown, OH-KY-IN MSA				
HOUSING TENURE	ECONOMIC COMPONENT		1,970	1,980	1,990	2,000	2,009
	30	Total housing units	519,401	622,996	732,526	833,067	917,060
	31	Total occupied housing units	495,772	586,792	688,607	779,226	816,646
	32	Total vacant housing units	23,628	36,210	43,922	53,841	100,414
	33	Total owner-occupied housing units	311,590	385,394	445,714	524,084	557,021
	34	Total renter-occupied housing units	184,192	212,527	242,894	255,142	259,625
EMPLOYMENT STATUS & POVERTY	35	Employed civilian females labor force, 16+ years old	221,529	298,274	403,411	462,721	503,313
	36	Employed civilian labor force, 16+ years old	604,489	711,662	872,197	982,727	1,034,562
	37	Unemployed civilian labor force, 16+ years old	23,689	53,645	47,790	43,624	111,175
	38	Total persons below the poverty level last year	163,461	165,930	206,999	186,697	273,524
INCOME	39	Average family income last year(\$)	11,526	24,212	44,179	68,543	81,871
	40	Average household income last year (\$)	10,326	19,758	38,000	58,407	68,762

Each area under study (i.e., MSA, suburbs, and city of Cincinnati) is divided by component (i.e., social and economic) and corresponding sub-components (e.g., social distribution, housing occupancy, etc.)

Table S1b - Social and economic characteristics describing the City of Cincinnati

			Cincinnati City, OH				
		SOCIAL COMPONENT	1,970	1,980	1,990	2,000	2,009
SOCIAL DISTRIBUTION	1	Total population	452,060	390,166	368,120	336,966	333,013
	2	Total households	159,589	159,331	155,760	150,268	138,857
	3	Total families	109,313	92,653	84,597	74,577	63,054
	4	Males	210,514	180,764	172,378	159,681	161,344
	5	Females	244,020	211,514	197,749	178,988	171,669
AGE DISTRIBUTION	6	Population 0-4 years old	38,471	29,094	30,753	24,219	24,821
	7	Population 5-9 years old	39,022	25,734	27,100	23,778	19,490
	8	Population 10-14 years old	41,204	25,934	22,174	22,852	17,566
	9	Population 15-19 years old	40,586	34,255	24,837	23,680	26,097
	10	Population 20-24 years old	44,597	47,046	34,442	31,509	30,282
	11	Population 25-34 years old	53,141	67,129	72,013	56,413	59,504
	12	Population 35-44 years old	43,887	33,391	48,205	51,009	37,877
	13	Population 45-54 years old	46,845	35,102	29,423	39,621	47,443
	14	Population 55-64 years old	47,740	37,596	29,179	23,429	31,013
	15	Population 65-74 years old	35,259	32,802	26,986	20,708	17,715
	16	Population 75+ years old	23,782	24,195	25,015	21,451	21,205
HOUSEHOLD TYPE	17	Total families with own children	57,229	48,224	47,280	41,805	29,545
	18	Married-couple families	85,787	64,572	51,795	41,547	33,873
	19	Married-couple families with own children	41,950	28,719	22,800	17,599	12,590
	20	Male-headed families, no wife present	3,753	3,968	4,522	5,519	5,050
	21	Male-headed families with own children, no wife present	1,100	1,341	1,937	2,780	2,027
	22	Female-headed families, no husband present	19,772	24,114	28,281	27,511	24,131
	23	Female-headed families with own children, no husband present	11,154	15,158	18,141	18,704	14,928
	24	Nonfamily households (living alone or unmarried partners)	50,508	66,660	71,162	75,691	75,803
EDUCATIONAL ATTAINMENT	25	Persons 25+ years old who have completed 0-8 years of school	452,060	390,166	368,120	336,966	333,013
	26	Persons 25+ years old who have completed 9-12 years of school but no diploma	159,589	159,331	155,760	150,268	138,857
	27	Persons 25+ years old who have completed high school but no college	109,313	92,653	84,597	74,577	63,054
	28	Persons 25+ years old who have completed some college but no degree	210,514	180,764	172,378	159,681	161,344
	29	Persons 25+ years old who have a bachelors or graduate/professional degree	244,020	211,514	197,749	178,988	171,669

Table S1b - Social and economic characteristics describing the City of Cincinnati

			Cincinnati City, OH				
		ECONOMIC COMPONENT	1,970	1,980	1,990	2,000	2,009
HOUSING TENURE	30	Total housing units	83,079	50,328	23,617	12,141	9,456
	31	Total occupied housing units	56,864	46,036	46,012	36,749	26,101
	32	Total vacant housing units	60,127	63,396	57,483	54,983	53,511
	33	Total owner-occupied housing units	20,546	28,961	39,424	39,905	44,529
	34	Total renter-occupied housing units	28,482	40,101	50,702	56,453	68,688
EMPLOYMENT STATUS & POVERTY	35	Employed civilian females labor force, 16+ years old	173,039	174,856	171,559	169,024	172,434
	36	Employed civilian labor force, 16+ years old	160,479	159,903	156,748	150,982	138,857
	37	Unemployed civilian labor force, 16+ years old	12,560	14,953	14,811	18,042	33,577
	38	Total persons below the poverty level last year	66,269	64,123	61,592	60,186	55,270
INCOME	39	Average family income last year(\$)	94,214	96,722	95,160	90,796	83,587
	40	Average household income last year (\$)	73,757	74,643	79,700	76,632	76,801

Table S1c - Social and economic characteristics describing the Suburbs of Cincinnati

			Cincinnati suburbs, OH-KY-IN				
		SOCIAL COMPONENT	1,970	1,980	1,990	2,000	2,009
SOCIAL DISTRIBUTION	1	Total population	1,151,244	1,269,629	1,476,673	1,672,666	1,837,815
	2	Total households	336,183	428,285	532,342	629,266	677,789
	3	Total families	289,855	340,179	404,097	453,680	477,944
	4	Males	559,686	615,970	714,554	816,442	899,166
	5	Females	589,097	651,555	760,121	854,521	938,649
AGE DISTRIBUTION	6	Population 0-4 years old	103,724	96,236	112,270	116,924	123,128
	7	Population 5-9 years old	126,716	100,962	116,304	125,683	128,718
	8	Population 10-14 years old	130,687	111,758	110,167	130,019	128,760
	9	Population 15-19 years old	112,057	125,165	107,449	121,155	126,111
	10	Population 20-24 years old	79,460	113,697	102,923	102,328	106,170
	11	Population 25-34 years old	139,862	201,357	250,766	224,522	240,240
	12	Population 35-44 years old	142,541	149,701	225,980	284,649	262,677
	13	Population 45-54 years old	128,712	134,870	155,045	230,709	283,982
	14	Population 55-64 years old	92,917	115,399	128,401	141,902	212,067
	15	Population 65-74 years old	57,596	72,770	98,853	107,189	121,673
	16	Population 75+ years old	34,511	45,610	66,517	85,883	104,289
HOUSEHOLD TYPE	17	Total families with own children	180,078	193,179	215,207	238,346	223,501
	18	Married-couple families	258,679	293,896	336,178	367,523	368,679
	19	Married-couple families with own children	159,190	161,037	167,064	177,294	159,023
	20	Male-headed families, no wife present	7,246	8,819	14,656	22,294	26,439
	21	Male-headed families with own children, no wife present	2,678	3,616	6,803	12,312	12,449
	22	Female-headed families, no husband present	23,937	37,465	53,259	63,863	82,826
	23	Female-headed families with own children, no husband present	12,363	22,269	30,062	38,514	52,029
	24	Nonfamily households (living alone or unmarried partners)	47,568	87,461	128,247	175,586	199,845
EDUCATIONAL ATTAINMENT	25	Persons 25+ years old who have completed 0-8 years of school	1,151,244	1,269,629	1,476,673	1,672,666	1,837,815
	26	Persons 25+ years old who have completed 9-12 years of school but no diploma	336,183	428,285	532,342	629,266	677,789
	27	Persons 25+ years old who have completed high school but no college	289,855	340,179	404,097	453,680	477,944
	28	Persons 25+ years old who have completed some college but no degree	559,686	615,970	714,554	816,442	899,166
	29	Persons 25+ years old who have a bachelors or graduate/professional degree	589,097	651,555	760,121	854,521	938,649

Table S1c - Social and economic characteristics describing the Suburbs of Cincinnati

			Cincinnati suburbs, OH-KY-IN					
HOUSING TENURE		ECONOMIC COMPONENT	1,970	1,980	1,990	2,000	2,009	
		30	Total housing units	170,996	125,442	84,952	53,198	42,852
		31	Total occupied housing units	126,308	124,592	140,913	123,928	100,453
		32	Total vacant housing units	188,765	269,684	310,898	355,598	401,688
		33	Total owner-occupied housing units	52,578	93,386	162,461	213,293	250,407
		34	Total renter-occupied housing units	59,027	108,004	174,989	263,016	342,165
EMPLOYMENT STATUS & POVERTY	35	Employed civilian females labor force, 16+ years old	346,362	448,140	560,967	664,043	744,626	
	36	Employed civilian labor force, 16+ years old	335,293	426,889	531,859	628,244	677,789	
	37	Unemployed civilian labor force, 16+ years old	11,068	21,257	29,111	35,799	66,837	
	38	Total persons below the poverty level last year	245,321	321,271	384,122	463,898	501,751	
INCOME	39	Average family income last year(\$)	89,978	115,805	147,734	164,346	176,038	
	40	Average household income last year (\$)	147,772	223,631	323,711	386,089	426,512	

Time series for the suburban area of Cincinnati, OH-KY-IN were obtained subtracting the City values from the MSA.

Table 2 - Air quality variables for Cincinnati, OH-KY-IN

Year	CO 2 nd Max 1-hr (ppm)	CO 2 nd Max 8-hr (ppm)	NO ₂ 98 th Percentile 1-hr (ppb)	O ₃ 2 nd Max 1-hr (ppm)	O ₃ 4 th Max 8-hr (ppm)	SO ₂ 99 th Percentile 1-hr (ppb)	SO ₂ 2 nd Max 24-hr (ppb)	PM ₁₀ 2 nd Max 24-hr (µg/m ³)	PM ₁₀ Mean 24-hr (µg/m ³)
1980	10.0	6.0	144	0.160	0.110	496	105		
1981	13.5	9.6	110	0.130	0.096	359	106		
1982	13.7	7.7	145	0.130	0.101	438	96		
1983	10.5	6.9	265	0.150	0.115	432	91	32	24
1984	13.5	7.4	110	0.140	0.100	302	78	76	30
1985	12.5	7.2	100	0.120	0.094	214	88	80	45
1986	16.0	6.1	90	0.130	0.097	345	76	88	47
1987	10.0	6.1	100	0.150	0.109	353	76	107	45
1988	7.5	4.6	115	0.170	0.130	286	61	124	44
1989	10.0	5.3	93	0.120	0.100	287	84	116	50
1990	7.4	4.8	88	0.150	0.104	303	75	108	41
1991	6.3	4.9	85	0.140	0.106	491	99	87	40
1992	11.3	4.9	72	0.100	0.081	275	55	82	36
1993	7.0	4.8	75	0.120	0.096	249	65	90	35
1994	7.1	4.7	82	0.130	0.103	237	52	90	35
1995	8.6	4.0	89	0.130	0.101	148	27	99	39
1996	6.0	3.3	79	0.120	0.095	206	45	78	32
1997	4.6	3.1	80	0.120	0.094	226	45	94	41
1998	5.8	4.4	93	0.120	0.099	161	40	84	36
1999	4.9	3.0	89	0.120	0.096	134	30	85	31
2000	4.9	2.4	72	0.110	0.093	179	53	70	32
2001	4.5	2.9	65	0.120	0.088	168	42	68	30
2002	5.7	2.6	72	0.130	0.102	245	43	59	26
2003	3.0	1.9	61	0.120	0.095	181	40	63	29
2004	5.8	2.8	57	0.100	0.081	237	51	53	25
2005	3.2	1.8	71	0.120	0.092	166	36	59	28
2006	9.9	3.0	56	0.110	0.086	108	28	55	24
2007	4.1	2.8	61	0.110	0.091	99	22	55	26
2008	5.1	2.7	58	0.110	0.086	83	19	47	23
2009	1.9	1.1	50	0.090	0.077	60	18	48	22

Values in red are above the maximum limit established in the National Ambient Air Quality Standards – NAAQS.