Table 4.8

Simple Correlation Matrix for Air Quality Variables

	AM66	NI66	SU66	NO69	PA66	PA70	SO70	NI70	NI90	LEAD	CO74	SU70	SU90
AM66	1.00	-0.16	0.78	0.28	0.51	0.32	0.52	-0.15	-0.08	0.04	0.14	0.66	0.64
NI66	-0.16	1.00	0.07	0.36	0.24	0.08	0.04	0.48	0.44	0.51	0.19	0.07	-0.01
SU66	0.78	0.07	1.00	0.34	0.68	0.43	0.72	0.08	0.11	0.07	0.28	0.86	0.73
NO69	0.28	0.36	0.34	1.00	0.30	0.09	0.35	0.31	0.33	0.40	0.21	0.37	0.21
PA66	0.51	0.24	0.68	0.30	1.00	0.69	0.50	0.11	0.12	0.19	0.36	0.53	0.53
PA70	0.32	0.08	0.43	0.09	0.69	1.00	0.25	0.17	0.11	-0.00	0.36	0.37	0.31
SO70	0.52	0.04	0.72	0.35	0.50	0.25	1.00	0.20	0.28	0.10	0.50	0.74	0.56
NI70	-0.15	0.48	0.08	0.31	0.11	0.17	0.20	1.00	0.92	0.18	0.24	0.19	0.04
NI90	-0.08	0.44	0.11	0.33	0.12	0.11	0.28	0.92	1.00	0.20	0.24	0.22	0.14
LEAD	0.04	0.51	0.07	0.40	0.19	-0.00	0.10	0.18	0.20	1.00	0.20	0.00	-0.08
CO74	0.14	0.19	0.28	0.21	0.36	0.36	0.50	0.24	0.24	0.20	1.00	0.34	0.25
SU70	0.66	0.07	0.86	0.37	0.53	0.37	0.74	0.19	0.22	0.00	0.34	1.00	0.85
SU90	0.64	-0.01	0.73	0.21	0.53	0.31	0.56	0.04	0.14	-0.08	0.25	0.85	1.00

Table 4.9

Simple Correlation Matrix for Included Variables

	NONW	MAGE	IN69	EDUC	DENS	COLD	CI68	XPRO	XCAR	6SFT	N069	S070	PA70
NONW	1.00	0.02	-0.26	-0.22	0.40	-0.04	0.02	0.02	0.23	0.02	0.22	0.29	0.03
MAGE	0.02	1.00	0.08	-0.14	-0.30	0.01	-0.05	0.22	-0.24	0.32	0.21	0.25	0.13
IN69	-0.26	0.08	1.00	0.49	-0.32	0.02	0.05	0.20	-0.23	-0.05	0.12	-0.12	-0.25
EDUC	-0.22	-0.14	0.49	1.00	-0.22	0.04	-0.28	0.26	-0.35	-0.13	-0.16	-0.34	-0.24
DENS	0.40	-0.30	-0.32	-0.22	1.00	-0.38	-0.08	0.03	0.39	-0.26	0.08	-0.03	-0.07
COLD	-0.04	0.01	0.02	0.04	-0.38	1.00	0.33	-0.60	-0.38	0.34	-0.03	0.35	0.34
CI68	0.02	-0.05	0.05	-0.28	-0.08	0.33	1.00	-0.24	-0.01	0.09	0.17	0.23	-0.08
XPRO	0.02	0.22	0.20	0.26	0.03	-0.60	-0.24	1.00	-0.01	0.16	0.11	-0.08	-0.31
XCAR	0.23	-0.24	-0.23	-0.35	0.39	-0.38	-0.01	-0.01	1.00	-0.66	-0.18	-0.33	-0.03
6SFT	0.02	0.32	-0.05	-0.13	-0.26	0.34	0.09	0.16	-0.66	1.00	0.16	0.59	0.12
N069	0.22	0.21	0.12	-0.16	0.08	-0.03	0.17	0.11	-0.18	0.16	1.00	0.35	0.09
S070	0.29	0.25	-0.12	-0.34	-0.03	0.35	0.23	-0.08	-0.33	0.59	0.35	1.00	0.25
PA70	0.03	0.13	-0.25	-0.24	-0.07	0.34	-0.08	-0.31	-0.03	0.12	0.09	0.25	1.00

Table 4.10
Complete Listing of Data Used

			MO70	VA70	HA70	PN70	EM70
			11.283	1.566	4.216	0.375	0.178
			2.161	0.395	1.078	0.114	0.059
1	BIRMG	AL	14.008	2.758	3.925	0.349	0.216
2	MONTG	AL	10.136	1.619	2.954	0.195	0.127
3	PHOEN	AZ	8.598	1.040	2.884	0.359	0.279
4	TUCSN	AZ	10.151	1.327	3.347	0.373	0.422
5	LROCK	AR	11.480	1.927	4.155	0.271	0.098
6	LONGB	CA	12.074	1.782	5.106	0.332	0.212
7	OAKLD	CA	11.792	1.628	4.500	0.281	0.195
8	SANDI	CA	7.658	1.214	2.728	0.165	0.148
9	SFRAN	CA	13.112	1.808	4.618	0.440	0.187
10	HARTF	CT	11.246	1.329	4.025	0.405	0.171
11	NEWHA	CT	11.111	1.314	4.597	0.392	0.116
12	WATER	CT	11.219	1.814	4.897	0.324	0.176
13	WASHG	DC	11.700	1.249	3.845	0.590	0.132
14	ATLAN	GA	11.809	1.636	3.596	0.515	0.157
15	CHICA	IL	12.317	1.363	5.555	0.413	0.117
16	ECHIG	IN	12.239	1.894	4.300	0.447	0.128
17	INDIA	IN	8.171	1.280	2.889	0.247	0.117
18	SBEND	IN	10.814	1.847	3.735	0.334	0.127
19	DESMO	IO	11.117	1.685	4.517	0.314	0.239
20	DUBUQ	IO	10.945	1.685	4.718	0.658	0.128
21	TOPEK	KA	9.247	1.528	3.720	0.264	0.168
22	WICHI	KA	8.393	1.276	3.052	0.253	0.199
23	LEXNG	KY	9.377	1.443	3.588	0.342	0.065
24	LOUIS	KY	13.539	2.150	5.057	0.387	0.293
25	NEWOR	LA	12.408	1.523	4.829	0.361	0.158
26	BALTI	MD	12.614	1.242	4.921	0.350	0.152
27	DETRO	MI	12.184	1.375	4.615	0.436	0.197
28	GDRAP	MI	11.986	1.771	4.604	0.385	0.182
29	MINNE	MN	12.661	2.125	4.784	0.414	0.193
30	KCITY	MO	11.513	1.668	3.431	0.333	0.199
31	STLOU	MO	15.602	2.134	6.130	0.546	0.222
32	OMAHA	NB	9.513	1.417	3.501	0.328	0.204
33	CAMDN	NJ	12.696	1.307	5.383	0.439	0.224
34	JCITY	NJ	12.946	1.305	5.703	0.526	0.196
35	NEWRK	NJ	11.616	1.043	4.712	0.382	0.133
36	ALBUQ	NM	8.230	0.993	2.162	0.308	0.205
37	NYORK	NY	11.526	1.148	4.710	0.514	0.119
38	AKRON	OH	10.609	1.503	3.805	0.240	0.200
39	CINNC	OH	13.385	1.686	5.299	0.522	0.214
40	COLUM	OH	9.489	1.416	3.378	0.302	0.187
41	DAYTN	OH	11.925	1.646	4.425	0.427	0.250
42	TOLED	OH	11.141	1.701	4.343	0.380	0.221
43	YTOWN	OH	13.063	1.953	4.929	0.486	0.186
44	TULSA	OK	8.561	1.345	2.943	0.244	0.148
45	PLAND	OR	13.517	2.287	4.843	0.384	0.243
46	PHILA	PN	12.553	1.376	4.486	0.405	0.148
47	PITTS	PN	14.062	1.873	6.127	0.498	0.115
48	REDDG	PN	15.198	2.407	6.412	0.297	0.160
49	PROVI	RI	13.727	1.663	5.731	0.379	0.156
50	CHATT	TN	15.141	2.242	5.895	0.554	0.202
51	MEMPH	TN	9.358	1.536	3.222	0.269	0.159
52	DALLS	TX	8.423	1.108	2.834	0.261	0.159
53	HOUST	TX	7.803	1.001	2.614	0.266	0.119
54	PASSA	TX	5.018	0.526	1.613	0.202	0.112
55	SANAN	TX	8.131	1.217	2.606	0.266	0.125
56	SALTC	UT	11.246	1.478	3.684	0.273	0.262
57	NFOLK	VA	8.008	1.085	2.939	0.260	0.094
58	RICHM	VA	12.503	1.899	4.627	0.501	0.140
59	SEATT	WA	12.047	1.850	4.372	0.377	0.213
60	CHARL	WV	14.321	1.510	6.028	0.727	0.280

Table 4.10
(continued)

			CT70	NE70	C\B%	I\B%	CA70
			0.238	0.058	0.473	1.294	1.958
			0.106	0.027	0.105	0.333	0.402
1	BIRMG	AL	0.116	0.116	0.465	1.327	2.343
2	MONTG	AL	0.112	0.112	0.243	1.335	1.732
3	PHOEN	AZ	0.205	0.029	0.246	0.975	1.499
4	TUCSN	AZ	0.198	0.027	0.688	0.995	1.719
5	LROCK	AK	0.188	0.045	0.478	1.299	1.942
6	LONGB	CA	0.290	0.028	0.482	1.045	2.049
7	OAKLD	CA	0.358	0.047	0.401	1.250	2.090
8	SANDI	CA	0.191	0.030	0.467	1.058	1.316
9	SFRAN	CA	0.646	0.049	0.368	0.934	2.493
10	HARTF	CT	0.329	0.032	0.506	1.519	1.987
11	NEWHA	CT	0.211	0.022	0.513	1.758	2.004
12	WATER	CT	0.333	0.037	0.396	1.189	1.999
13	WASHG	DC	0.489	0.081	0.401	1.937	2.000
14	ATLAN	GA	0.213	0.131	0.355	1.539	1.789
15	CHICA	IL	0.289	0.062	0.430	1.612	2.038
16	ECHIG	IN	0.298	0.106	0.561	1.794	2.022
17	INDIA	IN	0.140	0.058	0.441	1.254	1.573
18	SBEND	IN	0.159	0.080	0.549	1.450	2.142
19	DESMO	IO	0.130	0.020	0.619	1.381	1.919
20	DUBUQ	IO	0.096	0.064	0.413	1.570	1.894
21	TOPEK	KA	0.104	0.024	0.392	0.940	1.568
22	WICHI	KA	0.116	0.036	0.506	1.465	1.454
23	LEXNG	KY	0.176	0.037	0.359	0.934	1.517
24	LOUIS	KY	0.288	0.055	0.436	1.237	2.304
25	NEWOR	LA	0.189	0.091	0.609	1.497	2.158
26	BALTI	MD	0.394	0.063	0.456	1.417	2.228
27	DETRO	MI	0.413	0.067	0.470	1.320	2.126
28	GDRAP	MI	0.187	0.035	0.579	1.183	2.155
29	MINNE	MN	0.214	0.028	0.544	1.258	2.281
30	KCITY	MO	0.187	0.049	0.384	1.318	1.871
31	STLOU	MO	0.268	0.090	0.475	1.449	2.562
32	OMAHA	NB	0.184	0.043	0.486	1.362	1.776
33	CAMDN	NJ	0.419	0.068	0.319	1.716	2.048
34	JCITY	NJ	0.426	0.111	0.412	1.687	2.241
35	NEWRK	NJ	0.290	0.092	0.489	1.997	1.663
36	ALBUQ	NM	0.254	0.025	0.518	1.132	1.276
37	NYORK	NY	0.352	0.055	0.424	1.245	2.151
38	AKRON	OH	0.160	0.051	0.430	1.291	1.968
39	CINNC	OH	0.190	0.053	0.474	1.040	2.510
40	COLUM	OH	0.143	0.041	0.456	0.946	1.740
41	DAYTN	OH	0.177	0.078	0.506	1.224	2.048
42	TOLED	OH	0.190	0.044	0.506	0.127	1.964
43	YTOWN	OH	0.243	0.086	0.865	1.259	2.389
44	TULSA	OK	0.130	0.036	0.491	1.188	1.586
45	PLAND	OR	0.314	0.044	0.588	0.874	2.425
46	PHILA	PN	0.219	0.066	0.535	1.713	2.170
47	PITTS	PN	0.277	0.071	0.490	1.510	2.426
48	READG	PN	0.251	0.023	0.676	1.149	2.818
49	PROVI	RI	0.262	0.084	0.600	1.327	2.690
50	CHATT	TN	0.218	0.076	0.556	2.105	2.469
51	MEMPH	TN	0.154	0.056	0.572	1.143	1.644
52	DALLS	TX	0.165	0.034	0.512	1.297	1.397
53	HOUST	TX	0.166	0.039	0.436	1.264	1.311
54	PASSA	TX	0.101	0.011	0.526	0.789	0.941
55	SANAN	TX	0.194	0.064	0.377	1.182	1.373
56	SALTC	UT	0.222	0.080	0.296	0.765	1.558
57	NFOLK	VA	0.146	0.052	0.411	1.447	1.322
58	RICHM	VA	0.248	0.072	0.377	1.684	1.959
59	SEATT	WA	0.266	0.053	0.416	1.075	2.174
60	CHARL	WV	0.392	0.098	0.421	0.843	2.671

Table 4.10
(continued)

			MAGE	C168	MDUC
			28.820	165.798	162.807
			2.737	23.247	54.226
1	BIRMG	AL	29.700	136.604	142.000
2	MONTG	AL	27.700	136.604	80.400
3	PHOEN	AZ	27.500	128.693	148.500
4	TUCSN	AZ	26.800	128.693	166.600
5	LROCK	AK	29.600	150.591	229.800
6	LONGB	CA	32.700	157.477	186.800
7	OAKLD	CA	31.400	157.477	239.600
8	SANDI	CA	25.800	157.477	149.400
9	SFRAN	CA	34.200	157.477	239.600
10	HARTF	CT	27.800	201.869	195.100
11	NEWHA	CT	27.800	201.869	327.300
12	WATER	CT	31.300	201.869	377.300
13	WASHG	DC	28.400	137.765	203.400
14	ATLAN	GA	27.200	159.601	159.500
15	CHICA	IL	29.600	189.522	161.400
16	ECHIG	IN	27.700	191.140	68.700
17	INDIA	IN	27.100	191.140	141.400
18	SBEND	IN	29.600	191.140	120.300
19	DESMO	IO	28.600	158.907	175.500
20	DUBUQ	IO	25.000	158.907	105.300
21	TOPEK	KA	28.000	146.046	127.500
22	WICHI	KA	27.000	146.046	111.500
23	LEXNG	KY	24.600	203.395	98.900
24	LOUIS	KY	30.100	203.395	159.500
25	NEWOR	LA	27.900	182.361	209.100
26	BALTI	MD	28.700	166.384	200.400
27	DETRO	MI	29.300	202.620	152.700
28	GDRAP	MI	27.100	202.620	125.900
29	MINNE	MN	29.100	166.797	156.800
30	KCITY	MO	29.500	166.797	156.600
31	STLOU	MO	31.400	164.695	144.800
32	OMAHA	NB	26.700	152.560	160.100
33	CAMDN	NJ	27.500	148.636	158.200
34	JCITY	NJ	30.700	148.636	101.900
35	NEWRK	NJ	25.900	148.636	195.400
36	ALBUQ	NM	25.100	157.395	188.100
37	NYORK	NY	32.400	152.273	250.200
38	AKRON	OH	28.500	183.177	143.400
39	CINNC	OH	28.800	183.177	157.000
40	COLUM	OH	25.400	183.177	186.300
41	DAYTN	OH	27.800	183.177	113.500
42	TOLED	OH	28.700	183.177	128.600
43	YTOWN	OH	31.600	183.177	128.600
44	TULSA	OK	28.700	111.392	143.400
45	PLAND	OR	32.600	170.820	186.200
46	PHILA	PN	30.900	147.692	207.000
47	PITTS	PN	33.400	147.692	144.300
48	REDDG	PN	36.900	147.692	112.400
49	PROVI	RI	32.100	191.745	157.000
50	CHATT	TN	31.100	160.097	120.700
51	MEMPH	TN	26.100	160.097	167.900
52	DALLS	TX	27.200	171.593	154.800
53	HOUST	TX	26.000	171.593	144.500
54	PASSA	TX	24.400	171.593	144.500
55	SANAN	TX	24.800	171.593	119.600
56	SALTC	UT	27.700	100.734	193.600
57	NFOLK	VA	24.000	172.618	93.600
58	RICHM	VA	29.500	172.618	231.100
59	SEATT	WA	31.900	143.939	185.300
60	CHARL	WV	34.600	181.301	89.700

Table 4.10
(continued)

			DENS	NONW	INC7	EDUC	COLD
			0.022	0.226	10762.895	55.298	86.900
			0.013	0.154	1059.562	7.439	47.654
1	BIRMG	AL	0.037	0.422	8692.000	45.400	48.000
2	MONTG	AL	0.037	0.336	9933.000	51.600	29.000
3	PHOEN	AZ	0.027	0.067	11329.000	60.100	13.000
4	TUCSN	AZ	0.032	0.052	9922.000	63.100	22.000
5	LROCK	AK	0.017	0.251	10438.000	56.500	51.000
6	LONGB	CA	0.013	0.082	11804.000	62.000	1.000
7	OAKLD	CA	0.023	0.407	11279.000	66.100	7.000
8	SANDI	CA	0.019	0.111	11664.000	65.300	0.0
9	SFRAN	CA	0.027	0.286	12507.000	66.100	11.000
10	HARTF	CT	0.029	0.292	10011.000	59.100	147.000
11	NEWHA	CT	0.015	0.274	10444.000	56.800	102.000
12	WATER	CT	0.015	0.105	11500.000	49.900	102.000
13	WASHG	DC	0.048	0.723	12189.000	68.500	114.000
14	ATLAN	GA	0.034	0.516	10656.000	53.400	45.000
15	CHICA	IL	0.026	0.344	13527.000	53.900	132.000
16	ECHIG	IN	0.047	0.284	10068.000	53.600	132.000
17	INDIA	IN	0.017	0.184	12260.000	56.000	122.000
18	SBEND	IN	0.010	0.147	11431.000	54.200	131.000
19	DESMO	IO	0.010	0.062	11350.000	68.000	151.000
20	DUBUQ	IO	0.018	0.003	11274.000	54.600	152.000
21	TOPEK	KA	0.011	0.096	10830.000	64.800	122.000
22	WICHI	KA	0.013	0.107	10940.000	63.200	122.000
23	LEXNG	KY	0.026	0.174	10033.000	60.100	94.000
24	LOUIS	KY	0.019	0.241	9980.000	46.900	91.000
25	NEWOR	LA	0.055	0.045	10246.000	45.800	13.000
26	BALTI	MD	0.017	0.470	10035.000	44.600	90.000
27	DETRO	MI	0.016	0.445	11015.000	52.100	126.000
28	GDRAP	MI	0.007	0.120	11242.000	54.000	157.000
29	MINNE	MN	0.010	0.064	11127.000	66.100	167.000
30	KCITY	MO	0.017	0.228	11306.000	60.100	106.000
31	STLOU	MO	0.044	0.413	9268.000	48.000	118.000
32	OMAHA	NB	0.013	0.106	11605.000	62.700	144.000
33	CAMDN	NJ	0.018	0.402	8627.000	50.600	89.000
34	JCITY	NJ	0.026	0.222	10285.000	36.300	79.000
35	NEWRK	NJ	0.040	0.560	8637.000	55.100	84.000
36	ALBUQ	NM	0.022	0.043	10926.000	66.200	122.000
37	NYORK	NY	0.029	0.234	11632.898	51.800	79.000
38	AKRON	OH	0.007	0.178	11152.000	55.600	133.000
39	CINNC	OH	0.028	0.281	10435.000	48.400	100.000
40	COLUM	OH	0.010	0.190	10848.000	60.700	114.000
41	DAYTN	OH	0.015	0.309	10329.000	56.200	125.000
42	TOLED	OH	0.001	0.143	11590.000	51.700	157.000
43	YTOWN	OH	0.011	0.258	9928.000	52.100	150.000
44	TULSA	OK	0.010	0.134	11642.000	58.200	82.000
45	PLAND	OR	0.008	0.078	11377.000	62.900	42.000
46	PHILA	PN	0.013	0.344	10431.000	50.600	89.000
47	PITTS	PN	0.013	0.207	10536.000	53.400	124.000
48	READG	PN	0.006	0.068	9695.000	43.300	89.000
49	PROVI	RI	0.010	0.100	10208.000	45.900	128.000
50	CHATT	TN	0.026	0.360	8336.000	47.600	70.000
51	MEMPH	TN	0.049	0.392	10104.000	49.200	61.000
52	DALLS	TX	0.028	0.258	12474.000	54.800	34.000
53	HOUST	TX	0.032	0.266	11737.000	51.700	21.000
54	PASSA	TX	0.018	0.005	11822.000	51.700	21.000
55	SANAN	TX	0.062	0.086	9027.000	46.800	23.000
56	SALTC	UT	0.015	0.032	10812.000	68.500	110.000
57	NFOLK	VA	0.021	0.302	9236.000	48.300	31.000
58	RICHM	VA	0.018	0.424	10620.000	47.100	68.000
59	SEATT	WA	0.010	0.126	12557.000	67.800	32.000
60	CHARL	WV	0.012	0.108	10865.000	52.800	95.000

Table 4.10
(continued)

			6SFT	XCAR	APRO
			16314.051	123491.313	39844.547
			975.743	3618.011	706.747
1	BIRMG	AL	15079.500	129119.000	39517.699
2	MONTG	AL	15030.398	128765.000	39264.801
3	PHOEN	AZ	16116.699	120959.000	40696.199
4	TUCSN	AZ	16054.102	120957.000	40395.500
5	LROCK	AK	15186.500	129263.000	39630.301
6	LONGB	CA	16079.102	120519.000	41050.398
7	OAKLD	CA	16030.898	120345.000	41306.898
8	SANDI	CA	16090.398	120865.000	40788.801
9	SFRAN	CA	16030.898	120345.000	41306.898
10	HARTF	CT	18240.500	121166.000	40740.000
11	NEWHA	CT	18118.801	120707.000	40348.500
12	WATER	CT	18255.801	120882.000	40413.301
13	WASHG	DC	16219.500	126710.000	40232.000
14	ATLAN	GA	15737.398	128113.000	40143.199
15	CHICA	IL	16404.699	121525.000	39337.301
16	ECHIG	IN	16295.000	121512.000	39144.000
17	INDIA	IN	16261.102	121447.000	39100.199
18	SBEND	IN	16198.398	121453.000	39005.500
19	DESMO	IO	16244.699	121511.000	39096.000
20	DUBUQ	IO	16153.102	121495.000	38978.102
21	TOPEK	KA	16070.801	121291.000	38877.500
22	WICHI	KA	16040.102	121060.000	38827.102
23	LEXNG	KY	15555.602	128726.000	39981.301
24	LOUIS	KY	15563.398	128982.000	40212.000
25	NEWOR	LA	15119.199	128678.000	39532.602
26	BALTI	MD	15724.500	128374.000	40248.398
27	DETRO	MI	16419.898	121501.000	39346.500
28	GDRAP	MI	16266.801	121560.000	39095.500
29	MINNE	MN	16431.801	121751.000	39322.000
30	KCITY	MO	16217.199	121345.000	39047.199
31	STLOU	MO	16175.398	121333.000	39030.199
32	OMAHA	NB	16177.398	121345.000	38997.801
33	CAMDN	NJ	17976.199	119345.000	39194.500
34	JCITY	NJ	18157.500	120490.000	39916.699
35	NEWRK	NJ	18148.801	121000.000	40602.398
36	ALBUQ	NM	16052.102	120684.000	40456.801
37	NYORK	NY	18028.102	120486.000	40287.301
38	AKRON	OH	16307.500	121535.000	39152.102
39	CINNC	OH	16160.301	121335.000	39006.602
40	COLUM	OH	16194.898	121321.000	39035.602
41	DAYTN	OH	16349.199	121493.000	39215.699
42	TOLED	OH	16273.801	121546.000	39135.398
43	YTOWN	OH	16232.602	121441.000	39032.500
44	TULSA	OK	15467.898	129016.000	39958.602
45	PLAND	OR	16006.199	121115.000	40881.301
46	PHILA	PN	18187.398	120737.000	40271.699
47	PITTS	PN	18287.898	120748.000	39978.602
48	READG	PN	18399.699	121050.000	40029.699
49	PROVI	RI	18237.699	120540.000	39969.000
50	CHATT	TN	15181.398	129289.000	39708.500
51	MEMPH	TN	15129.301	128846.000	39551.301
52	DALLS	TX	15717.000	128359.000	40155.199
53	HOUST	TX	15626.500	128489.000	40134.500
54	PASSA	TX	15947.398	128755.000	40795.199
55	SANAN	TX	15080.699	129045.000	39443.699
56	SALTC	UT	16013.500	121539.000	40791.102
57	NFOLK	VA	15177.000	128966.000	39734.602
58	RICHM	VA	15640.699	128727.000	40184.699
59	SEATT	WA	16040.199	120738.000	41333.699
60	CHARL	WV	15233.301	129243.000	39718.398

Table 4.10
(continued)

			NU69	FA70	SO70
			0.076	102.300	26.917
			0.034	30.107	22.197
1	BIRMG	AL	0.093	138.000	10.000
2	MONTG	AL	0.016	91.000	7.000
3	PHOEN	AZ	0.089	117.000	9.000
4	TUCSN	AZ	0.028	104.000	7.000
5	LROCK	AK	0.012	71.000	8.000
6	LONGB	CA	0.182	102.000	35.000
7	OAKLD	CA	0.053	69.000	10.000
8	SANDI	CA	0.106	88.000	10.000
9	SFRAN	CA	0.095	52.000	9.000
10	HARTF	CT	0.077	67.000	57.000
11	NEWHA	CT	0.072	100.000	40.000
12	WATER	CT	0.037	95.000	17.000
13	WASHG	DC	0.069	99.000	28.000
14	ATLAN	GA	0.096	88.000	20.000
15	CHICA	IL	0.160	58.000	73.000
16	ECHIG	IN	0.086	189.000	87.000
17	INDIA	IN	0.079	96.000	51.000
18	SBEND	IN	0.031	99.000	10.000
19	DESMO	IO	0.033	134.000	11.000
20	DUBUQ	IO	0.072	194.000	16.000
21	TOPEK	KA	0.023	97.000	8.000
22	WICHI	KA	0.064	95.000	6.000
23	LEXNG	KY	0.062	71.000	12.000
24	LOUIS	KY	0.096	117.000	23.000
25	NEWOR	LA	0.061	79.000	7.000
26	BALTI	MD	0.099	136.000	54.000
27	DETRO	MI	0.116	128.000	38.000
28	GDRAP	MI	0.090	77.000	13.000
29	MINNE	MN	0.076	88.000	38.000
30	KCITY	MO	0.045	84.000	6.000
31	STLOU	MO	0.135	120.000	42.000
32	OMAHA	NB	0.075	132.000	12.000
33	CAMDN	NJ	0.128	114.000	69.000
34	JCITY	NJ	0.065	108.000	75.000
35	NEWRK	NJ	0.092	111.000	37.000
36	ALBUQ	NM	0.048	102.000	6.000
37	NYORK	NY	0.142	109.000	45.000
38	AKRON	OH	0.038	68.000	70.000
39	CINNC	OH	0.099	95.000	18.000
40	COLUM	OH	0.087	97.000	22.000
41	DAYTN	OH	0.057	102.000	25.000
42	TOLED	OH	0.096	111.000	13.000
43	YTOWN	OH	0.083	134.000	30.000
44	TULSA	OK	0.033	110.000	8.000
45	PLAND	OR	0.058	60.000	14.000
46	PHILA	PN	0.024	144.000	78.000
47	PITTS	PN	0.113	137.000	57.000
48	READG	PN	0.081	121.000	30.000
49	PROVI	RI	0.087	93.000	67.000
50	CHATT	TN	0.042	127.000	18.000
51	MEMPH	TN	0.078	86.000	17.000
52	DALLS	TX	0.074	105.000	7.000
53	HOUST	TX	0.105	90.000	10.000
54	PASSA	TX	0.050	80.000	9.000
55	SANAN	TX	0.065	58.000	8.000
56	SALTC	UT	0.060	88.000	9.000
57	NFOLK	VA	0.077	83.000	26.000
58	RICHM	VA	0.088	89.000	24.000
59	SEATT	WA	0.095	58.000	22.000
60	CHARL	WV	0.092	183.000	27.000

have most previous investigators) some unknown contribution from these pollutants may be included in estimated coefficients on NO_2, SO_2, and particulates.

A complete correlation matrix for our choice of included variables is presented in Table 4.9 with the exception of the doctors per capita variable for which we use two-stage least squares. Several interesting collinearity issues are apparent here as well, not necessarily as a multicollinearity problem since the highest simple correlation is 0.66 within the data set, but rather as an indication of problems of exclusion of variables in previous studies. For example, SO_2 (S070) shows a correlation of 0.59 with animal fat consumption (6SFT) and a correlation of 0.23 with cigarette consumption. In other words, air pollution as measured by SO_2 might not be orthogonal with respect to diet and smoking. The implication is that diet and smoking probably must be included to obtain unbiased estimates of the effect of SO_2 on human health.

The final data set used in the analysis is presented is its entirely in Table 4.10. [Qualified investigators wishing to know about the additional data collected may obtain a complete listing by contacting the authors].

4.5 Empirical Analysis

The first step in estimating the model of human health we have specified is to attempt to account for human adjustments to disease in the form of medical care (doctors per capita). Thus, we first estimate a reduced form equation which has as the dependent variable doctors per capita and as independent, exogenous explanatory variables: median age, % non-white, density, cold, per capita consumption of cigarettes, protein, carbohydrates, and animal fat (all exogenous variables from the dose response function); as well as per capita income and education level (exogenous variables in the determination of the demand for doctors). This estimated equation is shown in Table 4.12 below.

Note that we have chosen linear specifications throughout the analysis. The linear form has several advantages. First, the entire modeling framework can be interpreted as providing a set of first-order approximations of the slopes (the effects) of the variables in the model. As a linear approximate system, the estimated effects, if unbiased, only hold true for the neighborhood of the estimate -- that is for values of the variables near the means of our sample. Since we do not know the precise form (presumably nonlinear) which our functions take, we are at least not implying more about our knowledge of effects than the data can support. However, if significant nonlinearities do exist over the range of the data in our sample (and some of the estimated effects seem to imply this), then we have introduced a specification error by choosing linear estimates.

The second step in our analysis, then, is to generate, from the estimated reduced form equation and from data on exogenous variables in the model, an estimated doctors per capita variable (DOCH) to replace actual data on doctors per capita(MDOC) in the estimation of specific dose-response functions. Table 4.11 summarizes our results, while Tables 4.13-4.22 give

Table 4.11

Summary of Two-Stage Linear Estimates of Factors in Human Mortality
Hypotheses not Rejected at the 97.5% Confidence Level
(One-tailed t-test, $t \geq 2.0$)

Variable Sign of Hypothetical Effect)		Total Mortality Rate	Vascular Disease	Heart Disease	Pneumonia and Influenza	Emphysema and Bronchitis	Cirrhosis	Kidney Disease	Congenital Birth Defects	Early Infant Diseases	Cancer
Doctors/Capita*	(-)	-	-	-		-		-			-
Median Age	(+)	+	+	+	+		+	+			+
% Nonwhite	(+)	+		+			+	+		+	+
Cigarettes	(+)	+	+	+							+
Room Density	(+)	+			+		+	+			
Cold	(+)	+			+						+
Animal Fat	(+)			+							
Protein	(+)	+				+					+
Carbohydrates	(?)					-					
NO_2	(+)										
SO_2	(+)									+	
Particulate	(+)				+						
R^2		.82	.60	.77	.54	.39	.64	.54	.22	.55	.86

* Two-stage estimator employed.

individual linear estimated dose-response functions where the first equation reported excludes the air quality variables and the second (for comparison) includes these variables. Note that the basic model actually excludes air quality. This reflects the approach taken; to first develop a model of human health based on variables which are hypothesized to have large effects -- age, medical care, smoking, diet, etc. Once a basic model of satisfactory explanatory power is specified, it then may be appropriate to test for variables such as air pollution which are hypothesized to have small effects.

We choose a 97.5% confidence level ($t \geq 2.0$) for the entire analysis. It should be noted that if actual doctors 2per capita are employed, the variable is highly nonsignificant both when used in total mortality or when used in any of the component diseases. However, as indicated in our summary of results shown in Table 4.11 the estimated two-stage doctors per capita variable is highly significant and has a uniform negative effect on mortality rates in total mortality, vascular disease, heart disease, emphysema and bronchitis, kidney disease, and cancer. We conclude, then, from a properly structured hypothesis test, that we cannot reject the hypothesis that medical care has a.highly important effect on human mortality.

Both the median age and % nonwhite variables are widely significant across the estimated equations and show up with uniformly positive effects on mortality rates.

Cigarette consumption shows significant positive partial correlations with total mortality, vascular disease, heart disease and cancer, while room density and cold both show significant positive partial correlations with total mortality and pneumonia and influenza. Room density also shows significant positive correlations for cirrhosis and kidney disease.

The dietary variables show significance in total mortality, heart disease, and cancer -- correlations between heart disease and saturated fats and between cancer and meat consumption (note the positive association for protein) have long been recognized -- as well as in emphysema and bronchitis.

Again, however, it must be stressed, especially for the dietary variables, that collinearity abounds and the estimated effect may really not be related to the specified variable but to a highly collinear one. Similarly, an estimated effect may include the sum of the effects of several collinear variables. In other words, causality is not established by correlation. However, we cannot reject the hypotheses that doctors, cigarettes, and diet are all highly important in determining human mortality rates. Unfortunately, these variables have typically been excluded from previous aggregate epidemiological studies [Schwing, *et. al.* (1974) do, however, include a smoking variable].

Turning to the air quality variables, only two significant partial correlations appear -- between particulates and the pneumonia and influenza variable, and between SO_2 and the early infant disease variable. The latter of these effects is consistent with the work of Lave and Seskin (1977).