

Supplementary Materials

S1 – The list of cities analyzed in this study

Echoing Figure 3 in the manuscript, this study also provides the list of 290 Chinese cities for analysis as the following table shows.

Table S1. List of 290 Chinese cities for analysis

#	city	province	#	city	province	#	city	province
1	Beijing	Beijing	93	Hefei		188	Guangzhou	
2	Tianjin	Tianjin	94	Wuhu		189	Shaoguan	
3	Shijiazhuang		95	Bengbu		190	Shenzhen	
4	Tangshan		96	Huainan		191	Zhuhai	
5	Qinhuangdao		97	Ma'anshan		192	Shantou	
6	Handan		98	Huaibei		193	Foshan	
7	Xingtai		99	Tongling		194	Jiangmen	
8	Baoding	Hebei	100	Anqing	Anhui	195	Zhanjiang	
9	Zhangjiakou		101	Huangshan		196	Maoming	
10	Chengde		102	Chuzhou		197	Zhaoqing	
11	Cangzhou		103	Fuyang		198	Huizhou	Guangdong
12	Langfang		104	Suzhou		199	Meizhou	
13	Hengshui		105	Lu'an		200	Shanwei	
14	Taiyuan		106	Bozhou		201	Heyuan	
15	Datong		107	Chizhou		202	Yangjiang	
16	Yangquan		108	Xuancheng		203	Qingyuan	
17	Changzhi		109	Fuzhou		204	Dongguan	
18	Jincheng		110	Xiamen		205	Zhongshan	
19	Shuozhou	Shanxi	111	Putian		206	Chaozhou	
20	Jinzhong		112	Sanming		207	Jieyang	
21	Yuncheng		113	Quanzhou	Fujian	208	Yunfu	
22	Xinzhou		114	Zhangzhou		209	Nanning	
23	Linfen		115	Nanping		210	Liuzhou	
24	Lvliang		116	Longyan		211	Guilin	
25	Hohhot		117	Ningde		212	Wuzhou	
26	Baotou		118	Nanchang		213	Beihai	
27	Wuhai		119	Jingdezhen		214	Fangchenggang	
28	Chifeng		120	Pingxiang		215	Qinzhou	Guangxi
29	Tongliao	Inner Mongolia	121	Jiujiang		216	Guigang	
30	Ordos		122	Xinyu		217	Yulin	
31	Hulun Buir		123	Yingtian	Jiangxi	218	Baise	
32	Bayan Nur		124	Ganzhou		219	Hezhou	
33	Ulanqab		125	Ji'an		220	Hechi	
34	Shenyang		126	Yichun		221	Laibin	
35	Dalian	Liaoning	127	Fuzhou		222	Chongzuo	
36	Anshan		128	Shangrao		223	Haikou	Hainan

37	Fushun		129	Jinan		224	Sanya	
38	Benxi		130	Qingdao		225	Chongqing	Chongqing
39	Dandong		131	Zibo		226	Chengdu	
40	Jinzhou		132	Zaozhuang		227	Zigong	
41	Yingkou		133	Dongying		228	Panzhihua	
42	Fuxin		134	Yantai		229	Luzhou	
43	Liaoyang		135	Weifang		230	Deyang	
44	Panjin		136	Jining		231	Mianyang	
45	Tieling		137	Taian	Shandong	232	Guangyuan	
46	Chaoyang		138	Weihai		233	Suining	
47	Huludao		139	Rizhao		234	Neijiang	Sichuan
48	Changchun		140	Laiwu		235	Leshan	
49	Jilin		141	Linyi		236	Nanchong	
50	Siping		142	Dezhou		237	Meishan	
51	Liaoyuan	Jilin	143	Liaocheng		238	Yibin	
52	Tonghua		144	Binzhou		239	Guang'an	
53	Baishan		145	Heze		240	Dazhou	
54	Songyuan		146	Zhengzhou		241	Ya'an	
55	Baicheng		147	Kaifeng		242	Bazhong	
56	Harbin		148	Luoyang		243	Ziyang	
57	Qiqihar		149	Pingdingshan		244	Guiyang	
58	Jixi		150	Anyang		245	Liupanshui	
59	Hegang		151	Hebi		246	Zunyi	Guizhou
60	Shuangyashan		152	Xinxiang		247	Anshun	
61	Daqing	Heilongjiang	153	Jiaozuo		248	Bijie	
62	Yichun		154	Puyang	Henan	249	Tongren	
63	Jiamusi		155	Xuchang		250	Kunming	
64	Qitaihe		156	Luohe		251	Qujing	
65	Mudanjiang		157	Sanmenxia		252	Yuxi	
66	Heihe		158	Nanyang		253	Baoshan	Yunnan
67	Suihua		159	Shangqiu		254	Zhaotong	
68	Shanghai	Shanghai	160	Xinyang		255	Lijiang	
69	Nanjing		161	Zhoukou		256	Pu'er	
70	Wuxi		162	Zhumadian		257	Lincang	
71	Xuzhou		163	Wuhan		258	Lasa	Tibet
72	Changzhou		164	Huangshi		259	Shigatse	
73	Suzhou		165	Shiyan		260	Xi'an	
74	Nantong	Jiangsu	166	Yichang		261	Tongchuan	
75	Lianyungang		167	Xiangyang	Hubei	262	Baoji	
76	Huai'an		168	Ezhou		263	Xianyang	Shaanxi
77	Yancheng		169	Jinmen		264	Weinan	
78	Yangzhou		170	Xiaogan		265	Yan'an	
79	Zhenjiang		171	Jinzhou		266	Hanzhong	
80	Taizhou		172	Huanggang		267	Yulin	

81	Suqian		173	Xianning		268	Ankang	
82	Hangzhou		174	Suizhou		269	Shangluo	
83	Ningbo		175	Changsha		270	Lanzhou	
84	Wenzhou		176	Zhuzhou		271	Jiayuguan	
85	Jiaxing		177	Xiangtan		272	Jinchang	
86	Huzhou		178	Hengyang		273	Baiyin	
87	Shaoxing	Zhejiang	179	Shaoyang		274	Tianshui	
88	Jinhua		180	Yueyang		275	Wuwei	Gansu
89	Quzhou		181	Changde	Hunan	276	Zhangye	
90	Zhoushan		182	Zhangjiajie		277	Pingliang	
91	Taizhou		183	Yiyang		278	Jiuquan	
92	Lishui		184	Chenzhou		279	Qingyang	
			185	Yongzhou		280	Dingxi	
			186	Huaihua		281	Longnan	
			187	Loudi		282	Xining	Qinghai
						283	Haidong	
						284	Yinchuan	
						285	Shizuishan	
						286	Wuzhong	Ningxia
						287	Guyuan	
						288	Zhongwei	
						289	Urumqi	Xinjiang
						290	Karamay	

S2 – The general trends of changes in environmental pollution and urban scale of different cities

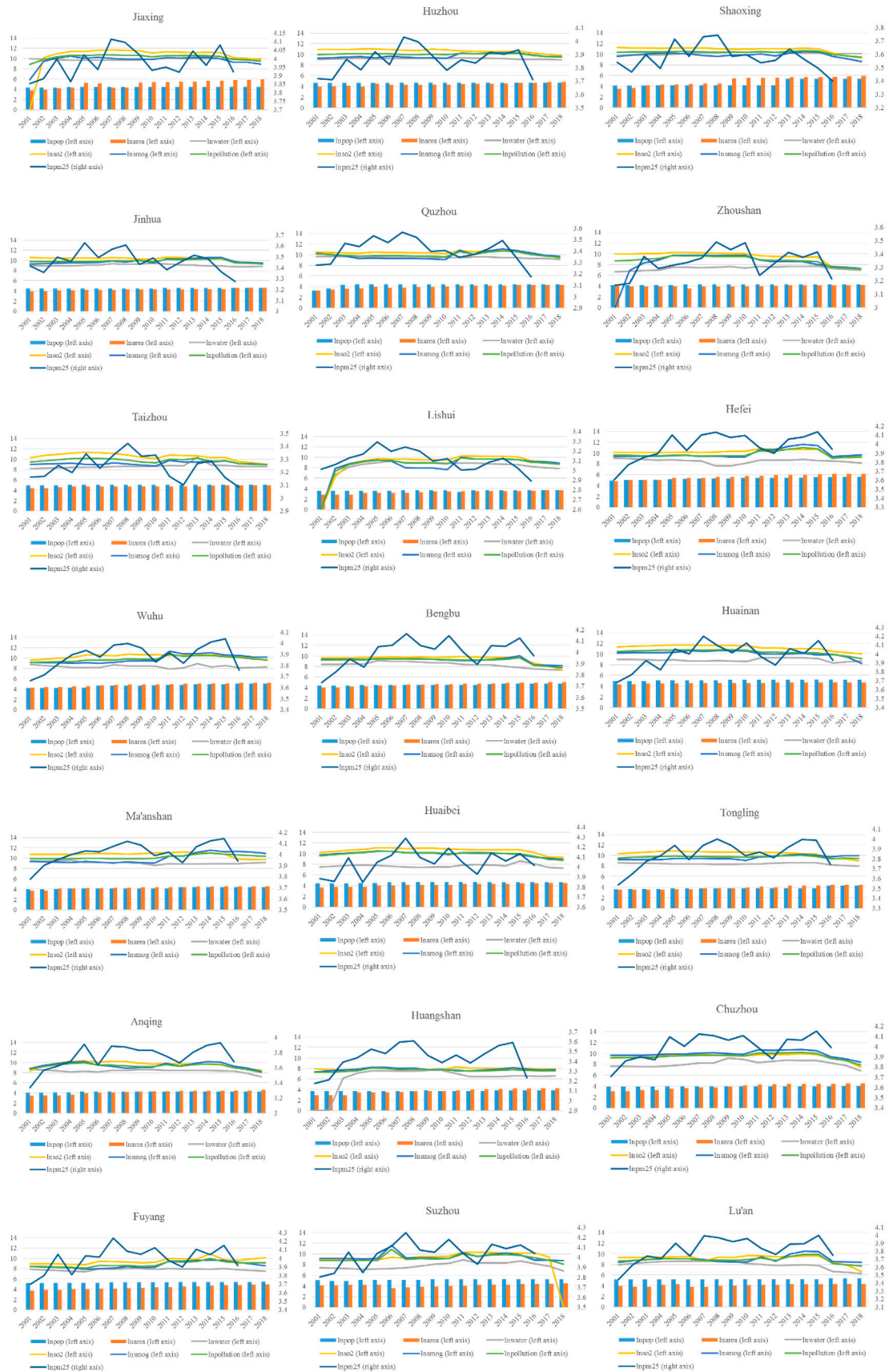
According to the reviewers' comments, more graphical representations with the data sets of 290 different cities are presented as follows.

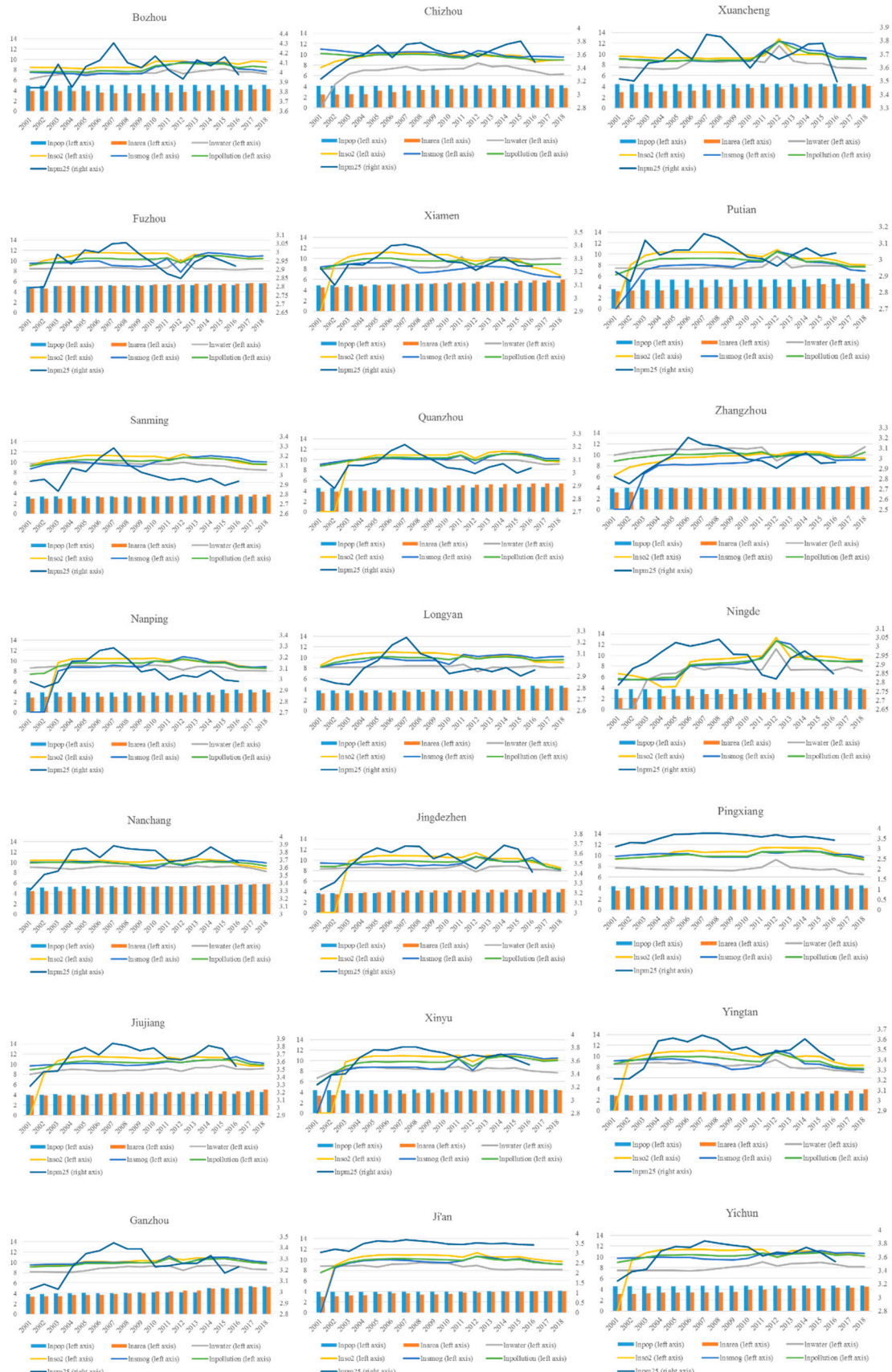














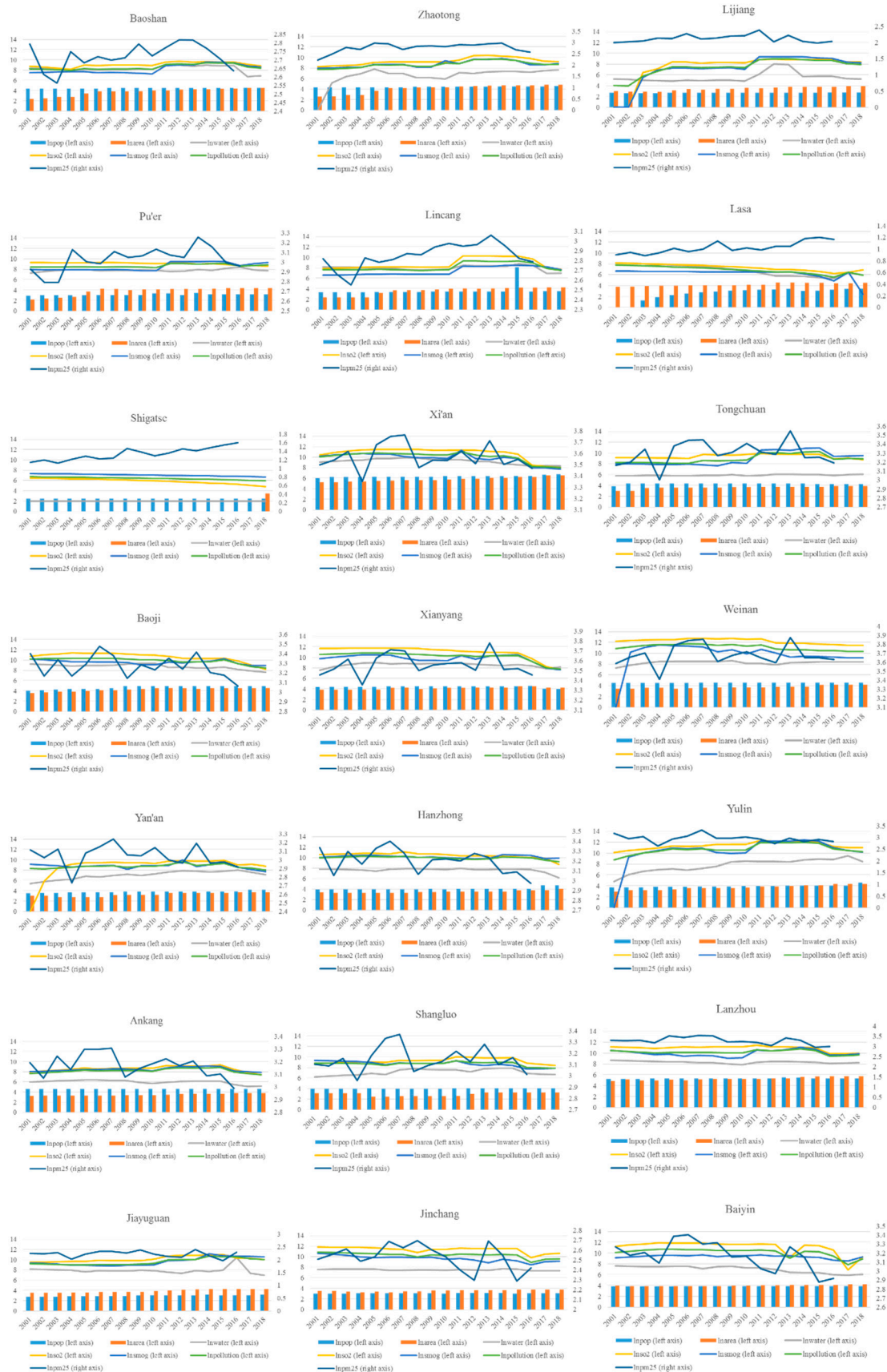














The above figures demonstrate that, there is a commonly-observed trend of growing urban scale in terms of both population and built-up land across Chinese cities over the years (depicted by the bars in the figures). Nevertheless, since the bi-directional impacts between the urban scale and environmental pollution, the patterns of their correlations differ. In most graphs, pollution (in particular the industrial pollution) appears to grow with the urban growth.

S3 – results of the tests for multicollinearity problems

It is acknowledged that, the variance inflation factor (VIF) is the most frequently used indicator for detecting multicollinearity in multiple linear regression models [90]. Thus, this study conducted relevant tests based upon VIF and results are given as follows.

Table S2. VIF of variables for baseline regressions

Models	(1)	(2)	(3)	(4)
	Table 3&4-(2)	Table 3&4-(4)	Table 3&4-(6)	Table 3&4-(8)
<i>lnpollution</i>		1.23		1.31
<i>lnpm25</i>			1.30	1.33
<i>lnwater</i>	1.87			
<i>lnso2</i>	1.76			
<i>lnsmog</i>	1.74			
<i>lnurban_r</i>	1.30	1.26	1.33	1.33
<i>fiscgap</i>	1.09	1.08	1.07	1.07
<i>lnprod_labor</i>	6.74	6.74	6.78	6.82
<i>lnprod_land</i>	3.09	2.99	3.14	3.15
<i>lnwage</i>	5.84	5.82	5.51	5.64
<i>lnmedi</i>	1.88	1.87	2.07	2.12
<i>lnroad</i>	1.54	1.54	1.65	1.65
<i>lnreal</i>	2.47	2.30	2.35	2.43
<i>lnis</i>	1.18	1.18	1.14	1.16
<i>lnedu</i>	1.27	1.26	1.29	1.29

Table S3. VIF of variables for mechanism analysis

Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Table 6&7-(1)	Table 6&7-(2)	Table 6&7-(3)	Table 6&7-(4)	Table 6&7-(5)	Table 6&7-(6)	Table 6&7-(7)	Table 6&7-(8)
<i>lnpollution</i>		1.23		1.32		1.29		1.40
<i>lnpm25</i>			1.30	1.33			1.35	1.37
<i>lnwater</i>	1.87				1.87			
<i>lnso2</i>	1.76				1.77			
<i>lnsmog</i>	1.75				1.76			
<i>lnhealth_d</i>	1.08	1.07	1.07	1.08				
<i>lnhealth_cost</i>					3.01	2.97	2.90	3.11
<i>lnurban_r</i>	1.30	1.26	1.33	1.33	1.38	1.34	1.41	1.43
<i>fiscgap</i>	1.10	1.09	1.07	1.07	1.15	1.14	1.12	1.13
<i>lnprod_labor</i>	6.74	6.74	6.78	6.82	6.85	6.84	6.84	6.92
<i>lnprod_land</i>	3.12	3.02	3.17	3.19	3.55	3.46	3.65	3.66
<i>lnwage</i>	5.87	5.86	5.54	5.68	6.05	6.03	5.60	5.81
<i>lnmedi</i>	1.90	1.88	2.10	2.14	1.92	1.90	2.08	2.15
<i>lnroad</i>	1.57	1.57	1.70	1.70	1.55	1.54	1.66	1.66
<i>lnreal</i>	2.48	2.30	2.35	2.43	2.84	2.69	2.69	2.71
<i>lnis</i>	1.18	1.18	1.14	1.16	1.25	1.24	1.19	1.23

<i>lnedu</i>	1.27	1.27	1.30	1.30	1.29	1.29	1.33	1.33
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When the VIF value is greater than 10, the set is often deemed to have collinear problems [90]. In this sense, results in Tables S2 and S3 indicate that there is no significant multicollinearity issue, which warrant the reliability of the empirical analysis.