The impact of eco-industrial parks on urban haze pollution: evidence from China

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Online Appendix

Detailed description of EIPs

According to the National Eco-Industrial Demonstration Park Management Measures, the EIPs' construction includes the process of application for EIPs development, approval for construction and being certified as EIPs. Specifically, first, industrial parks that are eager to construct EIPs need to submit their development plan and environment commitment statement to the EIPs administrative office. The environment commitment statement should include that: (1) there were no major pollution accidents or catastrophic ecological damage incidents in this industrial park in the past three years; (2) meeting mandatory standards for the discharge of key pollutants in the past three years; (3) all enterprises in the park had achieved total emissions control targets set by national and local government in the past three years. Second, the industrial park can begin the EIP construction after its EIP development plan has been approved by the administrative office. Within 5 years after the approval of the EIPs development plan, industrial parks under EIP construction are allowed to apply for EIPs approval. Only those industrial parks with all the EIP standards qualified can finally be certified as EIPs. Besides, three years after certification, the government will randomly select some EIPs for follow-up examination. Industrial parks found to be in breach of the standard of EIPs will have their EIP certification revoked.

High-polluting enterprises and high-tech enterprises are both located in industrial parks. The high-tech enterprises can share environmental protection experience and technology with polluting enterprises, thus promoting the green transformation of traditional industries and minimizing waste while improving product quality and reducing cost. For example, in Nanchang National High-tech Industrial Development Zone (NNHIDZ, a certified EIP), there are about 500 production-oriented enterprises and most of them are high-polluting enterprises. Meanwhile, NNHIDZ also has many high-tech enterprises and 25 of them were selected into the list of high-growth technology-based enterprises in the year 2022. With the construction of environmental protection platforms and advanced environmental protection technologies, NNHIDZ significantly improves local air quality. In Beijing Economic and Technological Development Area (BETDA, a certified EIP), there are not only high-tech industries including electronic information industry, high-end equipment manufacturing industry and pharmaceutical industry, but also the high-polluting and energy-intensive enterprises. BETDA constructed the public technology service platform to promote the green transformation of traditional industries and promote deep integration of industrial chain and innovation chain. In 2021, the concentration of fine particulate matter (PM2.5) in Beijing was 35 micrograms per cubic meter, a year-on-year decrease of 5.4 percentage points. [1] In addition, Changsha Economic and Technological Development Zone (CETDZ, a certified EIP) gathers energy-intensive enterprises and innovative enterprises. These innovative enterprises were successfully selected into the list of first batch of “innovative small and medium-sized enterprises” in Hunan Province in 2022.[2] CETDZ established environmental protection special funds to encourage high-tech enterprises to drive green innovation in the industrial

[1] See https://www.gmpsp.org.cn/portal/article/index/id/33505/cid/4.html.

[2] See https://m.voc.com.cn/rmt/article/5789539.html.

chain of the park. In 2021, the industrial volatile organic compounds (VOC) emissions in CETDZ were 321 tons, accounting for 30% of total emission reduction in Changsha.[3] Enterprises in EIPs, on the one hand, can use the special funds lunched by EIPs for environmental protection, increasing the investment in scientific research (Wu *et al*., 2023), promoting green technology innovation and achieve emissions reduction targets. On the other hand, enterprises in EIPs can reduce emissions by sharing environmental protection technology and learning green technology from each other.

Once EIPs were established, they would receive strong support from the national and local governments, and achieve remarkable results in the efficient use of resources, energy recycling and pollutant emission reduction. After EIPs were established, freshwater consumption per unit of industrial value-added fell by 66%; the emissions of COD and SO_2 fell by 81% and 87%, respectively; the average industrial water reuse rate in the park reached more than 90%; the average comprehensive utilization rate of industrial solid waste reached 94.1%.

Reference

Wu J, Nie X, Wang H and Li W (2023) Eco-industrial parks and green technological progress: evidence from Chinese cities. *Technological Forecasting and Social Change* **189**, 122360.

[3] See http://sthjt.hunan.gov.cn/ztzl/wrfz2018/szxd/202211/t20221114_29125065.html.

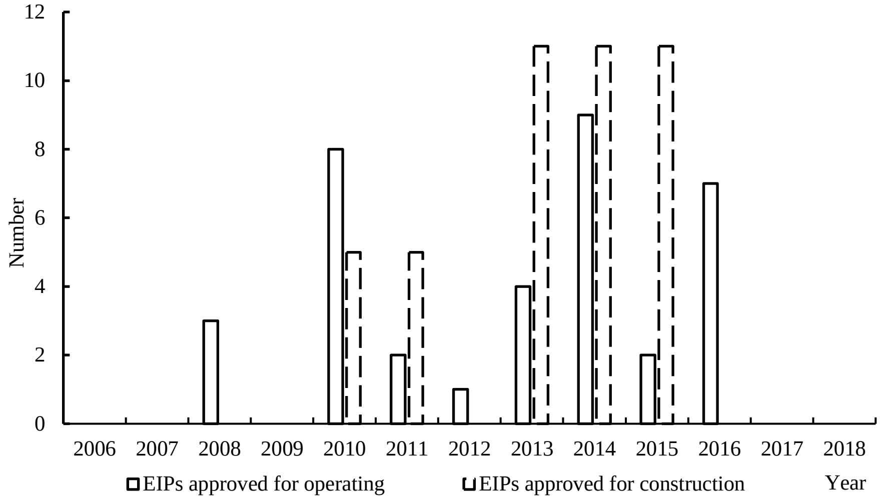

Figure A1. The number of newly- added EIPs every year.

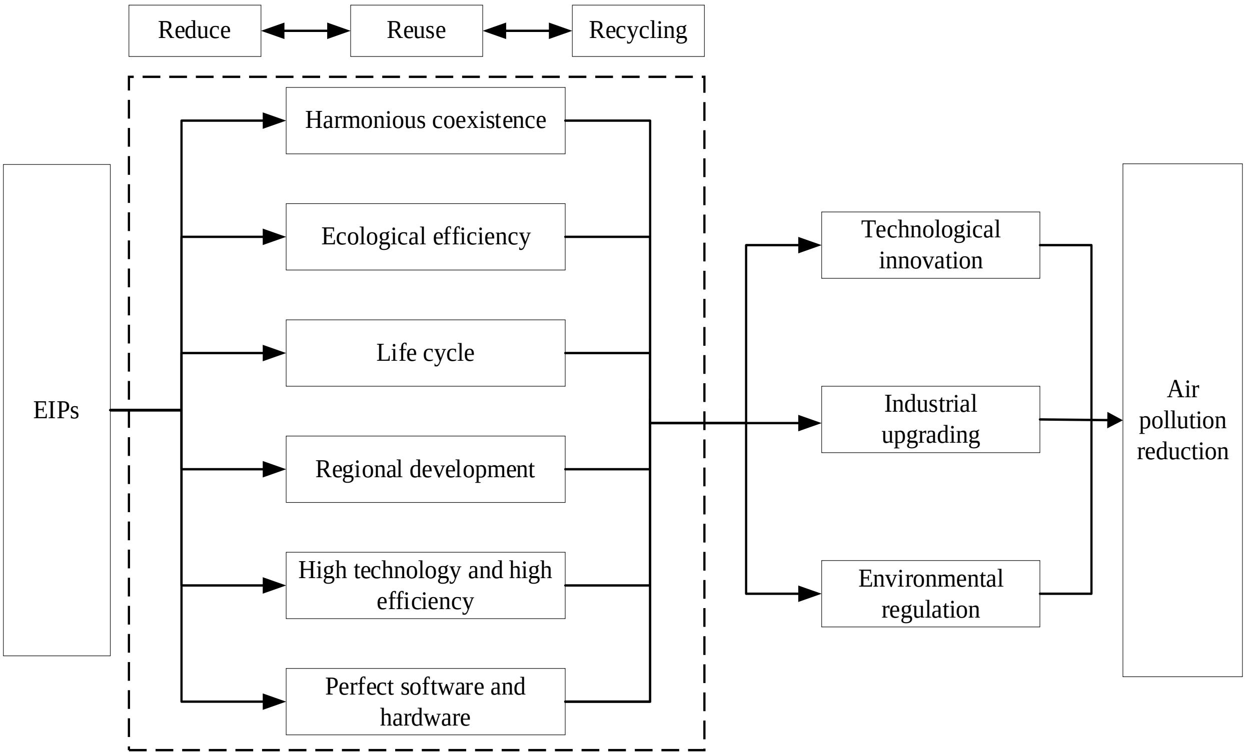

Figure A2. The analysis of influence mechanism.

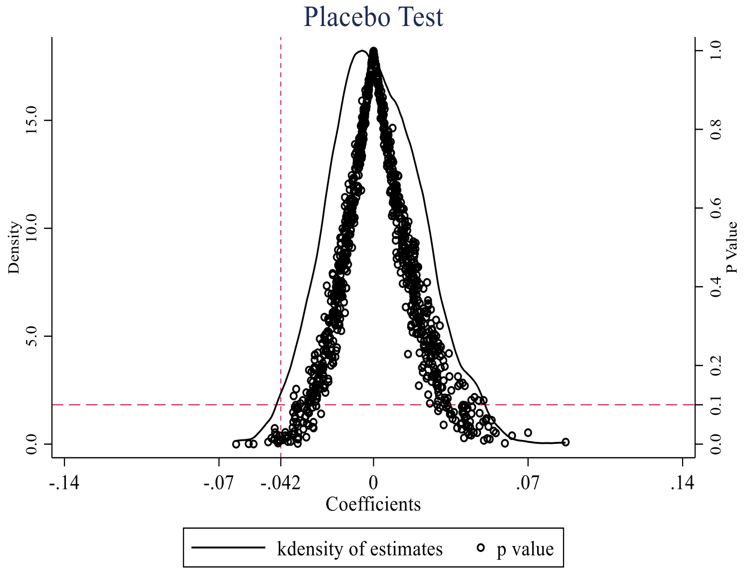

Figure A3. Placebo test.

Table A1. Regression estimates for hosting an EIP based on local geographic

	(1)	(2)	(3)
	Whether to set up an EIP		
	2007-2011	**2012-2016**	**2017-2018**
Barren	-0.011	0.053	0.099
	(0.010)	(0.040)	(0.082)
Cropland	-0.011	0.053	0.099
	(0.010)	(0.040)	(0.082)
Forest	-0.011	0.054	0.099
	(0.010)	(0.040)	(0.082)
Grassland	-0.011	0.054	0.100
	(0.010)	(0.040)	(0.082)
Impervious	-0.008	0.067	0.114
	(0.010)	(0.039)	(0.081)
Shrub	-0.006	0.065	0.110
	(0.010)	(0.039)	(0.081)
Water	-0.020	0.471	0.543
	(0.013)	(0.125)	(0.238)
Constant	1.079	-5.379	-9.941
	(1.023)	(3.997)	(8.200)
Observations	1,375	1,100	550
R-squared	0.087	0.204	0.223

Notes: Standard errors in parentheses.

Table A2. Excluding expectation effects and resetting regression sample

	(1)	(2)	(3)	(4)
EIP	-0.035	-0.046	-0.046	-0.058
	(0.017)	(0.016)	(0.015)	(0.027)
Before1	0.039			
	(0.026)			
Control variables	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Constant	4.916	4.870	4.995	4.761
	(0.091)	(0.091)	(0.083)	(0.097)
Observations	2,842	2,803	2,388	2,510
R^2 within	0.103	0.100	0.122	0.094

Notes: Before1 equals one if the observation year is for one year before the EIP construction and zero otherwise. Standard errors in parentheses.

Table A3. Excluding other policy interference

Variable	(1) **lnPM2.5**	(2) **lnPM2.5**	(3) **lnPM2.5**	(4) **lnPM2.5**
EIP	-0.049	-0.041	-0.038	-0.049
	(0.015)	(0.016)	(0.015)	(0.015)
EPA	-0.099			-0.106
	(0.010)			(0.010)
LCCP		-0.005		0.017
		(0.011)		(0.011)
CETP			-0.140	-0.157
			(0.016)	(0.016)
Time FE	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Control variable	YES	YES	YES	YES
Constant	6.313	6.456	6.088	5.937
	(0.327)	(0.335)	(0.331)	(0.327)
Observations	3,264	3,264	3,264	3,264
R^2 within	0.251	0.228	0.247	0.274

Notes: EPA, LCCP, CETP represent the “environmental laws”, the “low carbon city pilot policy” and the “carbon emission trading pilot policy”, respectively. Standard errors in parentheses.

Table A4. Alternative measure of the explained variable

	(1)	(2)	(3)
	Intensity	**SO_2**	**SO_2**
EIP	-0.047	-0.734	-0.257
	(0.011)	(0.064)	(0.079)
Control variables	YES	NO	YES
Constant	4.833	10.403	17.693
	(0.089)	(0.006)	(3.054)
Observations	2,900	3,186	3,155
R^2 within	0.105	0.045	0.270

Notes: Standard errors in parentheses.

Table A5. Heterogeneity analysis

Variable	(1)	(2)	(3)	(4)	(5)
	Resource Endowments		**Geographic**		
	Resource-based lnPM2.5	**Non-resource-based lnPM2.5**	**Eastern lnPM2.5**	**Central lnPM2.5**	**Western lnPM2.5**
EIP	-0.082	-0.045	-0.072	-0.019	-0.068
	(0.044)	(0.016)	(0.018)	(0.056)	(0.087)
Control variables	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Empirical p-value	0.000		0.000(Eastern VS Central) 0.000(Eastern VS Western) 0.050(Central VS Western)		
Constant	4.453	5.177	5.134	4.411	4.899
	(0.140)	(0.108)	(0.224)	(0.267)	(0.226)
Observations	1,198	1,760	1,008	1,057	791
R^2 within	0.053	0.151	0.201	0.055	0.131

Notes: Standard errors in parentheses.