

Online Appendix

Sample

The list of 113 cities was based on a list of key point cities for environmental protection created by the State Council. Originally, 47 cities were placed on this list in 2000. Each city was a province-level municipality, a provincial capital, a special economic zone, an open coastal city, or a designated tourism key point. The cities were selected based on three criteria: city development plans, municipal environmental quality targets, and municipal environmental conditions. While the list included a mix of cities, some of which were safely within environmental standards, it specifically included cities that were heavily polluted, or that risked becoming heavily polluted in the near future based on their development plans. These cities were required to provide the State Environmental Protection Agency with additional information about their air pollution on a regular basis (NPC 2002).

This list was later expanded to include 66 additional cities, bringing the total to 113. At the same time, the focus was broadened from air pollution to environmental quality more generally (MEP 2003). The final list included all of China's provincial-level municipalities, provincial capitals, open coastal cities, and Special Economic Zones as well as a selection of other major cities viewed as polluted or at risk of pollution. The PITI index compilers dropped three cities from this original list (Haikou and Sanya on Hainan island, and Lhasa in Tibet) because they had very low levels of industrialization. They were replaced by three other cities the index compilers felt were important industrial cities in their regions (Dongguan, Ordos, and Yancheng).

Additional Work Cited:

Ministry of Environmental Protection (MEP). 2003. Guanyu Jixu Shishi Huanjing Baohu Zhongdian Chengshi Huanjing Gongnengqu Dabiao Gongzuo Jibao Zhidu de Tongzhi. Huanban No. 54.
http://www.mep.gov.cn/gkml/zj/bgt/200910/t20091022_173840.htm (March 24, 2012).

National People's Congress (NPC). (2002). Daqiwaran Fangzhi de Jiandu Guanli in Zhonghuarenmingongheguo Daqiwaran Fangzhifa Shiyi. 2.2.
http://www.npc.gov.cn/npc/flsyywd/xingzheng/2002-07/11/content_297385.htm (March 24, 2012).

Data Sources

Variable	Source(s)
Firm location, employment, and industry (1999, 2007)	National Bureau of Statistics of China. 2000. <i>China Yearbook of Large-Scale Industrial Enterprises 2000</i> (中国大型工业企业年鉴). China Statistics Press. China State Council Development Research Center Enterprise Research Bureau. 2008. <i>Annual Report on the Development of China's Large Enterprise Groups 2008</i> (中国企业集团年度发展报告). Beijing: China Development Press. ¹
Categorization of heavily polluting industries	Article 15 of: Ministry of Environmental Protection (MEP). 2010. "Guidelines for Environmental Information Disclosure for Exchange-Listed Firms (上市公司环境信息披露指南)." http://wfs.mep.gov.cn/gywrfz/hbhc/zcfg/201009/t20100914_194483.htm (July 19, 2013).
PITI Index	Institute for Public and Environmental Affairs and the Natural Resources Defense Council. 2012. "Pollution Information Transparency Index (PITI): 2011 Annual Assessment Results." http://www.ipe.org.cn/en/about/notice_de.aspx?id=10616 (July 19, 2013).
Coastal province	Author coding
Provincial capital or centrally-administered municipality	Author coding
Designated Tourism City	National Tourism Administration. "Excellent Tourism Cities." http://www.cnta.gov.cn:8000/Forms/ExcellentDes/ExcellentDesList.aspx?newsID=061959655597&classID=157263434837&imgOn=2&menuType=ExcellentDes
Tsinghua Fiscal transparency index (Municipal)	Tsinghua School of Public Policy and Management. 2012. "China Municipal Fiscal Transparency Research Report 2010-2011." (中国市级政府透明度研究报告). http://www.sppm.tsinghua.edu.cn/eWebEditor/UploadFile//20120827103224378.pdf (July 19, 2013).
Fiscal transparency index (Provincial)	Deng, Shulian, Danfan Yang, and Junping Zeng. 2011. "The Evaluation of China's Provincial Fiscal Transparency in 2011." <i>Journal of Shanghai University of Finance and Economics</i> .
OGI Watch transparency index (Provincial)	Peking University Center for Public Participation Studies and Supports. 2011. "China Administrative Transparency Report 2010 (中国行政透明度观察报告2010年度)."
OGI Watch transparency index (Municipal)	Peking University Center for Public Participation Studies and Supports. 2011. "China Administrative Transparency Report 2010 (中国行政透明度观察报告2010年度)." Data Request.
Website transparency index	"2010 Provincial Government Website Grade Evaluation Results. (2010年省级政府网站绩效评估结果)." The 9 th China Government Website Evaluation Results Presentation and Exchange Symposium. (第九届中国政府网站绩效评估结果发布经验交流会). http://2010wzpg.cstc.org.cn/fbh2010/pgjg/2213.shtml
Pollution data	See below.
All other variables	National Bureau of Statistics of China. 2008. "China City Statistical Yearbook 2008 (中国城市统计年鉴)." China Statistics Press. http://www.infobank.cn (July 19, 2013).

¹ Seven cities with no firms listed in this report were assumed to have a non-polluting firm equal in size to the smallest firm in the sample in order to enable use of logs. Any biases from this procedure should diminish coefficient estimates.

Surface Particulate (PM_{2.5}) and Surface Nitrogen Dioxide (NO₂) estimates were obtained from the “Annual Mean Satellite-Derived PM_{2.5}, 2001-2006, at 35% and 50% RH [$\mu\text{g}/\text{m}^3$]” and the “Annual Global Mean Ground-Level NO₂ mixing ratio at OMI overpass time (~1:30 PM), 2005-2007” compiled by the Atmospheric Composition Group at Dalhousie University [<http://fizz.phys.dal.ca/~atmos/g47.swf>]. (Lamsal et al. 2009; van Donkelaar et al. 2010). Our variable PM_{2.5} is based in 35% relative humidity (RH) data. In order to obtain measures by Chinese municipality, we merged PM_{2.5} and NO₂ observations into a geo-referenced file for the PRC that assigns each half arc-minute (point data) to its county unit and municipal administrative code.² The municipality-level value used in our analysis is the arithmetic mean of these observations.

SO₂ data were derived from the NASA project “Aura OMI Sulphur Dioxide Level 3 Best Pixel Global (0.25 deg Lat/Lon grids) Data Product-OMSO_{2e}” [http://disc.sci.gsfc.nasa.gov/Aura/data-holdings/OMI/omso2e_v003.shtml]. Since these data have not yet been smoothed over the entire period of observation, we drew a systematic sample by downloading data for the 15th day and the last day of each month from October 30, 2004 through May 31, 2007. Following the suggestion of Nickolay Krotkov, principal investigator of the NASA project, we restricted attention to data from the summer months, which is more reliable, using averages from 2005 through 2007. These data were then merged with our grid of the PRC at the half arc-minute with administrative codes and averaged within each municipality. Further discussion of this data is available in Fioletov et al. (2011).

Industrial water pollution was measured as the annual level of Chemical Oxygen Demand (COD) for industrial wastewater in 2007. The data comes from a database compiled by the non-governmental Institute of Public and Environmental Affairs, based in Beijing, China. This database draws from public Chinese government sources such as municipal environmental condition bulletins (*huanjing zhuangtai gongbao*) and national environmental statistics annual reports (*zhongguo huanjing tongji nianbao*). In order to be comparable across cities of different size, we divided this figure by GDP for the same year.

Additional Work Cited:

Fioletov, V. E., C. A. McLinden, N. Krotkov, M. D. Moran, and K. Yang. 2011. “Estimation of SO₂ Emissions Using OMI Retrievals.” *Geophysical Research Letters* 38, L21811.

Lamsal, L. N., R. V. Martin, A. van Donkelaar, E. A. Celarier, R. K. Boersma, R. Dirksen, C. Luo, and Y. Wang. 2010. “Indirect Validation of Tropospheric Nitrogen Dioxide Retrieved from the OMI Satellite Instrument: Insight into the Seasonal Variation of Nitrogen Oxides at Northern Midlatitudes.” *Journal of Geophysical Research*, 115, D05302.

Van Donkelaar, Aaron, Randall V. Martin, Michael Brauer, Ralph Kahn, Robert Levy, Carolyn Verduzco, and Paul J. Villeneuve. 2010. “Global Estimates of Exposure to Fine Particulate Matter Concentrations from Satellite-based Aerosol Optical Depth.” *Environmental Health Perspectives* 118(6): 847-855.

² We are grateful to the BOCD project at the Universities Service Center for China studies at the Chinese University of Hong Kong for making county-shape files available and to Wu Puzhou for his advice and assistance with the process of creating the geo-referenced grid with administrative codes.

Additional Robustness Checks and Descriptive Analyses

In Table A1, we explore how the PITI score changed over time using three separate OLS models. Column 1 shows that without taking into account any other variables, there is no significant relationship between the initial PITI score and its rate of change over the following two years. Column 2 shows that on the one-year horizon, there is some evidence that city governments may have been surprised at their scores and subsequently adjusted their performance either up or down, with the initial PITI score a negative predictor of change in the following year. This may suggest that cities that did poorly may have taken steps to improve their scores, but cities that did unexpectedly well also may have coasted, improving less or backsliding in following years. Column 3 suggests a similar story, with cities that improved more in the first year improving less over the second year. Essentially, it seems that city governments aimed to be in the middle of the pack, although this could also just be classic regression to the mean resulting from measurement error.

Table A1: Change over time

	(1) piti2011- piti2009	(2) piti2010- piti2009	(3) piti2011- piti2010
piti2009	-0.0342 (0.0685)	-0.131* (0.0581)	0.0600 (0.0495)
piti2010-piti2009			-0.281** (0.0911)
Constant	10.14*** (2.129)	9.153*** (1.709)	3.563* (1.705)
Observations	113	113	113

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A2: Pairwise correlations among pollution indicators

	SO ₂ (log)	NO ₂ (log)	PM _{2.5} (log)	Industrial water pollution/GDP (log)
SO ₂ (log)	1.00			
NO ₂ (log)	0.46	1.00		
PM _{2.5} (log)	0.41	0.73	1.00	
Industrial water pollution/GDP (log)	-0.02	-0.16	0.10	1.00

Table A3 demonstrates that results are robust to inclusion of each measure of air pollution included one-by-one, and that none has a significant coefficient in any specification.

Table A3: Alternate specifications for pollution data

	(1) Pollution transparency score	(2) Pollution transparency score	(3) Pollution transparency score	(4) Pollution transparency score
Large Firm Dominance	-6.366*** (1.598)	-5.730*** (1.595)	-5.919*** (1.627)	-5.686*** (1.561)
Budget revenue (log)	5.290*** (1.485)	5.603*** (1.609)	6.089*** (1.600)	6.390*** (1.566)
Ratio of budget expenditures to revenues (log)	-16.91** (5.802)	-14.22* (6.478)	-17.23** (5.900)	-16.88** (6.229)
Ratio of serv. in GDP	-14.11 (10.64)	-11.06 (10.69)	-12.60 (11.12)	-11.38 (10.52)
Air pollution (principal components)	1.081 (0.745)			
NO2 (log)		2.640 (1.563)		
Industrial water pollution/gdp (log)		0.545 (1.313)	0.767 (1.343)	0.959 (1.402)
SO2 (log)			3.171 (3.281)	
PM2.5 (log)				-0.223 (1.999)
Constant	9.175 (21.63)	0.971 (22.14)	1.274 (22.57)	-2.940 (23.50)
Observations	112	106	106	106

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Alternate Transparency Measures

Chinese transparency experts we spoke with often attributed variation among cities to the general reform-mindedness of the city or provincial leaders. Following a reviewer's suggestion, we examined the relationship of the PITI pollution transparency score with other transparency indices aimed at measuring non-environmental domains. Three measures have been created at the municipal level. Tsinghua's School of Public Policy and Management has rated the level of fiscal transparency across 81 cities. Another index, created by scholars at the Chinese Academy of Social Sciences (CASS) in 2010, assesses the implementation of the broader OGI regulations across 43 Chinese cities. The OGI Watch Alliance, a collaboration between then Center for Public Participation Studies and Support at Peking University Law School, the Ford Foundation, and the China Law Center of Yale Law School, has conducted a pilot study of OGI compliance in all sub-provincial units in five provinces and Shanghai, producing ratings for 34 of the cities in our sample. Two more measures have been compiled at the provincial level. The Fiscal Transparency Index (FTI) was compiled by scholars at the Shanghai University of Finance and Economics. The OGI Watch alliance has also created rating for provincial governments.

Table A4 presents their correlations. The province-level Financial Transparency Index surprisingly has a negative correlation with three of the other indices. However the other correlations are positive even though they each emphasize different forms of transparency and measure them in different ways on sometimes-small samples that only partially overlap. This suggests that they may indeed be capturing some underlying propensity toward transparency.

Table A4: Pairwise correlations among transparency indicators

	PITI (municipal)	OGI Watch Index (provincial)	FTI (provincial)	CASS Index (municipal)	Tsinghua Index (municipal)	OGI Watch Index (municipal)
PITI (municipal)	1.00					
OGI Watch Index (provincial)	0.16	1.00				
FTI (provincial)	-0.07	-0.09	1.00			
CASS Index (municipal)	0.59	0.03	0.13	1.00		
Tsinghua Index (municipal)	0.32	0.30	-0.32	0.34	1.00	
OGI Watch Index (municipal)	0.33	0.51	0.19	0.57	0.53	1.00

In Tables A5 and A6 we include these other transparency measures as independent variables on the assumption that they might measure the underlying propensity to transparency of a municipality. Most importantly, in no case does including one of these indices as a control significantly reduce the coefficients on Large Firm Dominance. In addition, transparency in these other arenas does not have a significant association with pollution transparency in the regression specifications, despite the pairwise correlation.

Table A5: Controlling for other forms of transparency (municipal level)

	(1) Pollution transparency score	(2) Pollution transparency score	(3) Pollution transparency score	(4) Pollution transparency score
Large Firm Dominance	-6.344*** (1.593)	-7.359* (2.973)	-6.041* (2.960)	-5.971** (1.936)
Budget revenue (log)	5.525*** (1.488)	5.435** (2.027)	9.870** (3.787)	6.265* (2.625)
Ratio of budget expenditures to revenues (log)	-18.54*** (5.364)	-18.94* (7.891)	-5.112 (10.91)	-14.23 (11.35)
Ratio of services in GDP	-14.18 (10.68)	-25.82 (14.99)	-22.32 (16.63)	-13.37 (21.91)
Tsinghua Index		1.815 (1.377)		
CASS Index			0.0380 (0.143)	
OGI Watch Index (municipal)				-0.0728 (0.205)
Constant	6.559 (21.44)	10.99 (28.89)	-56.20 (55.64)	-3.887 (34.35)
Observations	112	63	40	34
R ²	0.4543	0.3766	0.4353	0.5362
df_m	4	5	5	5
df_r				

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6: Controls for fiscal and overall transparency (province level)

	(1) Pollution transparency score	(2) Pollution transparency score
Large Firm Dominance	-6.334*** (1.624)	-6.223*** (1.581)
Budget revenue (log)	5.001** (1.642)	5.204*** (1.488)
Ratio of budget expenditures to revenues (log)	-17.80** (5.820)	-17.42** (5.643)
Ratio of services in GDP	-13.46 (10.67)	-12.71 (10.23)
Air pollution (principal components)	1.050 (0.725)	1.266 (0.710)
OGI Watch Index (provincial)	0.0960 (0.123)	
Fiscal Transparency Index (provincial)		-0.0233 (0.0123)
Constant	6.765 (21.89)	15.75 (21.31)
Observations	112	112

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A7 examines whether Large Firm Dominance undermines other forms of transparency. Our belief is that there should be some effect, but it should probably be smaller, as other aspects of transparency have less of a direct impact on a firm's bottom line. We find there is some negative association between Large Firm Dominance and these other forms of transparency, although it depends on the index and is less robust to alternate specifications. Also, the sample sizes for these other indices are smaller, so it is hard to say for sure whether there is an association.

Table A7: Effect of LFD on other forms of transparency

	(1) Tsinghua Index	(2) CASS Index	(3) OGI Watch Index (municipal)
Large Firm Dominance	-0.520 (0.322)	-5.823* (2.424)	-0.741 (2.175)
Budget revenue (log)	0.318* (0.148)	6.769** (2.580)	3.353** (1.101)
Ratio of budget expenditures to revenues (log)	0.905 (0.793)	-24.91** (8.778)	9.227 (6.548)
Ratio of services in GDP	-1.052 (1.733)	-19.76 (21.82)	4.102 (12.35)
Constant	2.033 (2.571)	-2.422 (33.22)	15.72 (22.98)
Observations	63	40	34

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A8: Consistent impact of LFD over time

	(1) PITI 2011	(2) PITI 2010	(3) PITI 2009
Large Firm Dominance	-6.718*** (2.035)	-6.319*** (1.622)	-5.995*** (1.766)
Budget revenue (log)	6.775*** (1.673)	5.224** (1.656)	4.577** (1.470)
Ratio of budget expenditures to revenues (log)	-16.93** (6.289)	-20.33*** (5.373)	-18.37** (6.006)
Ratio of services in GDP	-14.41 (13.73)	-22.03* (10.73)	-6.103 (11.09)
Constant	-3.943 (24.86)	14.66 (23.98)	8.956 (22.04)
Observations	112	112	112

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table shows that the negative association of Large Firm Dominance with the PITI score does not change much over time.

Table A9: Complementary transparencies? Predictors of improvement in PITI score to 2011

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: PITI 2011 minus PITI 2009				
Large Firm Dominance	-2.245 (1.702)	-2.228 (1.700)	-2.963 (3.191)	-1.688 (2.944)	-2.329 (2.402)
2009 PITI Score	-0.271** (0.0890)	-0.247** (0.0864)	-0.423** (0.155)	-0.276** (0.105)	-0.195 (0.184)
Budget revenue (log)	3.405** (1.157)	3.536** (1.215)	5.135 (4.434)	3.067* (1.405)	4.664* (2.288)
Ratio of budget expenditures to revenues (log)	-4.070 (4.555)	-2.512 (4.625)	4.599 (8.832)	-2.254 (5.560)	-6.628 (11.10)
Ratio of services in GDP	-9.007 (9.612)	-10.27 (9.902)	-12.88 (25.75)	-13.22 (14.15)	-20.91 (21.97)
Financial Transparency Index (2011)	-0.0160 (0.0126)				
OGI Watch Index (provincial)		-0.0668 (0.0917)			
CASS Index			0.0507 (0.141)		
Tsinghua Index				1.369 (1.376)	
OGI Watch Index (municipal)					-0.0947 (0.235)
Constant	-6.260 (18.62)	-9.060 (18.16)	-30.17 (54.56)	-12.51 (24.71)	-15.92 (33.23)
Observations	112	112	40	63	34

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table tests the hypothesis raised by one reviewer that other forms of transparency might be complementary over time, forcing cities to improve their pollution disclosures. The results here offer no support for that hypothesis, at least over the first two years of the OGI regulations.

Table A10: First-stage regressions for Table 1 (DV=Large Firm Dominance in 2007)

	(1)	(2)	(3)	(4)
Large Firm Dominance (1999)	0.559*** (0.0689)	0.538*** (0.0736)	0.557*** (0.0664)	0.490*** (0.0799)
Budget revenue (log)		-0.0750 (0.114)	-0.223 (0.121)	0.122 (0.245)
Ratio of budget expenditures to revenues (log)		0.0329 (0.449)	0.0201 (0.437)	0.540 (0.532)
Ratio of services in GDP		-0.326 (0.796)	-0.247 (0.836)	0.225 (1.041)
Air pollution (principal components)		0.0747 (0.0541)		
SO2 (log)			-0.0111 (0.237)	0.0132 (0.225)
NO2 (log)			0.417* (0.204)	0.394 (0.210)
PM2.5 (log)			-0.249 (0.249)	-0.170 (0.255)
Industrial water pollution/gdp (log)			-0.133 (0.0876)	-0.0964 (0.0842)
GDP/cap (log)				0.215 (0.346)
Population (log)				-0.483 (0.289)
Prov. Capital or Central Municipality				-0.0473 (0.341)
Coastal province				-0.191 (0.223)
Designated tourism city				-0.155 (0.179)
Constant	2.128*** (0.344)	3.338* (1.463)	4.914* (1.909)	0.676 (3.288)
Observations	112	112	106	106

Standard errors in parentheses
 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A11: Results of F -test for weak instrument in Table 1 specifications

Specification	(1)	(2)	(3)	(4)
Distribution	F(1,110)	F(1,106)	F(1,97)	F(1,92)
Test statistic	65.69	53.41	70.35	37.64