

Why Are Power Plants in India Less Efficient than Power Plants in the United States?

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Appendix: Data Sources

Detailed information about Indian power plant data can be found in Malik et al. (2013). For US plants, we obtained capacity and vintage data from EIA Form 860 and ownership information from EIA Form 861. Net operating heat rate is defined as the ratio of total heat input (in MMBtu) to net generation. Total heat input and net generation are gathered from EIA Form 906/923 for data post 2001, Forms 767 and 759 respectively for data before 2001. The heating value (heat content) of coal burned is gathered from EIA Form 767 (superseded by Form 923 in 2007). In all analyses in the paper, we exclude combined heat and power plants, industrial or commercial plants as well as plants with less than 25 MW capacity.

We rely on the Continuous Emissions Monitoring System (CEMS) to compute auxiliary consumption as CEMS reports gross generation at the boiler level. However, CEMS data on gross generation are available only after 1997 and for the subset of boilers regulated under the Acid Rain Program (ARP). To compare auxiliary consumption with Indian plants, we exclude non-ARP units and aggregate all the above-mentioned variables from the generator level to the plant level.

Table A1: Model to Explain Log(Net Heat Rate)

Variable	(1)	(2)
India	0.094 ^{***} (0.020)	
India × Year 1988		0.104 ^{***} (0.027)
India × Year 1989		0.126 ^{***} (0.022)
India × Year 1990		0.143 ^{***} (0.023)
India × Year 1991		0.173 ^{***} (0.027)
India × Year 1997		0.105 ^{***} (0.025)
India × Year 1998		0.104 ^{***} (0.025)
India × Year 1999		0.096 ^{***} (0.027)
India × Year 2000		0.097 ^{***} (0.028)
India × Year 2001		0.093 ^{***} (0.025)
India × Year 2002		0.074 ^{***} (0.028)
India × Year 2003		0.080 ^{***} (0.027)
India × Year 2004		0.079 ^{***} (0.026)
India × Year 2005		0.078 ^{***} (0.025)
India × Year 2006		0.066 ^{***} (0.023)
India × Year 2007		0.053 ^{**} (0.023)
India × Year 2008		0.056 ^{***} (0.020)
India × Year 2009		0.056 ^{**} (0.024)
Age	0.010 ^{***}	0.011 ^{***}

	(0.002)	(0.002)
Age ² #	-0.337***	-0.361***
	(0.080)	(0.082)
Age ³ #	0.004***	0.004***
	(0.001)	(0.001)
Capacity #	-0.229***	-0.228***
	(0.019)	(0.019)
Capacity ² \$	0.062***	0.062***
	(0.007)	(0.007)
IOU	-0.033***	-0.033***
	(0.010)	(0.011)
IOU x Deregulated	-0.026***	-0.027***
	(0.009)	(0.009)
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Year Dummies	Yes	Yes
Number of Observations	9800	9800
Adjusted R ²	0.372	0.375

Note: Dependent variable is Log(Heat Rate). Standard errors, clustered at the plant level, are reported in parentheses. ***, **, * indicate 99%, 95% and 90% statistical significance respectively. Variables marked ‘#’ and ‘\$’ are multiplied by 1/1,000 and 1/1,000,000 respectively.

Table A2: Treatment Effects on Operating Heat Rate, using Matching Estimators

Year	ATT	Standard Error	p-value
1988	0.117***	0.027	0.000
1989	0.142***	0.022	0.000
1990	0.165***	0.024	0.000
1991	0.183***	0.029	0.000
1997	0.118***	0.028	0.000
1998	0.098***	0.033	0.003
1999	0.125***	0.030	0.000
2000	0.119***	0.029	0.000
2001	0.092***	0.030	0.002
2002	0.087***	0.032	0.007
2003	0.096***	0.031	0.002
2004	0.093***	0.029	0.001
2005	0.088***	0.031	0.005
2006	0.075***	0.028	0.007
2007	0.057**	0.028	0.039
2008	0.058*	0.027	0.031
2009	0.051*	0.031	0.099

Note: Dependent variable is Log(Heat Rate). ***, **, * indicate 99%, 95% and 90% statistical significance respectively. Coefficients indicate the bias-adjusted average treatment effects on the treated (ATT). 5 nearest neighbors are matched to each Indian plant (by year) using a Mahalanobis distance metric. Matching variables include nameplate capacity, age of the plant and whether a plant is investor-owned or not.

Table A3: Treatment Effects on Auxiliary Consumption, using Matching Estimators

Year	ATT	Standard Error	p-value
1997	2.393***	0.298	0.000
1998	3.898***	0.454	0.000
1999	3.548***	0.439	0.000
2000	3.377***	0.560	0.000
2001	4.146***	0.425	0.000
2002	2.789***	0.536	0.000
2003	2.905***	0.410	0.000
2004	3.123***	0.377	0.000
2005	2.986***	0.413	0.000
2007	3.617***	0.420	0.000
2008	4.119***	0.467	0.000
2009	4.893***	0.695	0.000

Note: Dependent variable is auxiliary consumption in % term. ***, **, * indicate 99%, 95% and 90% statistical significance respectively. Coefficients indicate the bias-adjusted average treatment effects on the treated (ATT). Matching is performed for all state-owned Indian plants with data on Operating Heat Rate. 5 nearest neighbors are matched to each Indian plant (by year) using a Mahalanobis distance metric. Matching variables include nameplate capacity, age of the plant and whether a plant is investor-owned or not.