Supplementary Material

Pricing for a low-carbon energy future: How China’s Carbon Emissions Trading System drives eco-efficient power generation in China’s coal-fired power industry.

**List of the supporting information:**

**Supplementary Table S1.** TFPGE values for China’s provincial coal-fired power industry.

**Supplementary Table S2.** Comparison of sample means before and after matching.

**Supplementary Table S2**. TFPGE values for China’s provincial coal-fired power industry

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Region | Province | Total Factor Power Generation Efficiency | | | | | | | | | | | | |
| 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Mean |
| East | Beijing | 1.0029 | 1.0002 | 1.0001 | 1.0002 | 1.0112 | 1.0145 | 1.0165 | 1.0494 | 1.0552 | 1.0897 | 1.0836 | 1.0943 | 1.03483 |
|  | Guangdong | 0.9714 | 0.9843 | 0.9852 | 0.9783 | 0.9950 | 1.0000 | 1.0001 | 1.0004 | 1.0001 | 1.0049 | 1.0004 | 1.0006 | 0.99340 |
|  | Shanghai | 1.0028 | 1.0031 | 1.0011 | 1.0001 | 0.9907 | 1.0015 | 1.0024 | 1.0005 | 1.0005 | 1.0006 | 1.0006 | 1.0007 | 1.00037 |
|  | Tianjin | 0.9957 | 0.9945 | 1.0047 | 1.0002 | 0.9904 | 1.0002 | 1.0004 | 1.0012 | 1.0004 | 1.0005 | 1.0006 | 1.0008 | 0.99913 |
|  | Fujian | 0.9810 | 0.9851 | 0.9850 | 1.0006 | 1.0000 | 0.9910 | 0.9876 | 0.9736 | 1.0139 | 0.9719 | 0.9655 | 0.9636 | 0.98490 |
|  | Hainan | 1.0089 | 1.0087 | 1.0038 | 1.0180 | 1.0113 | 1.0061 | 1.0064 | 1.0049 | 1.0026 | 1.0061 | 1.0071 | 1.0127 | 1.00805 |
|  | Hebei | 0.9686 | 1.0189 | 0.9745 | 1.0025 | 0.9792 | 0.9852 | 0.9853 | 1.0006 | 0.9806 | 1.0003 | 1.0009 | 1.0005 | 0.99144 |
|  | Jiangsu | 1.0089 | 1.0152 | 1.0199 | 1.0196 | 1.0116 | 1.0151 | 1.0174 | 1.0049 | 1.0087 | 1.0155 | 1.0098 | 1.0072 | 1.01283 |
|  | Liaoning | 0.9688 | 0.9683 | 0.9656 | 0.9507 | 0.9637 | 0.9695 | 0.9702 | 0.9586 | 0.9595 | 0.9749 | 0.9512 | 0.9517 | 0.96271 |
|  | Shandong | 0.9847 | 1.0191 | 1.0004 | 0.9787 | 0.9804 | 0.9872 | 0.9871 | 1.0496 | 1.0355 | 1.0899 | 1.0838 | 1.0945 | 1.02424 |
|  | Zhejiang | 0.9837 | 0.9917 | 0.9938 | 0.9868 | 1.0001 | 1.0005 | 0.9889 | 0.9974 | 0.9866 | 0.9956 | 0.9847 | 0.9845 | 0.99119 |
| Central | Hubei | 0.9652 | 0.9682 | 0.9691 | 0.9631 | 0.9590 | 0.9662 | 0.9824 | 1.0005 | 0.9918 | 0.9486 | 0.9530 | 0.9821 | 0.97076 |
|  | Anhui | 0.9850 | 0.9913 | 1.0001 | 0.9935 | 0.9913 | 0.9923 | 1.0000 | 1.0001 | 0.9860 | 1.0000 | 0.9881 | 0.9903 | 0.99318 |
|  | Heilongjiang | 0.9442 | 0.9596 | 0.9577 | 0.9444 | 0.9572 | 0.9468 | 0.9493 | 0.9372 | 0.9267 | 0.9295 | 0.9398 | 0.9374 | 0.94416 |
|  | Henan | 0.9718 | 0.9774 | 0.9739 | 0.9775 | 0.9741 | 0.9818 | 0.9794 | 0.9682 | 0.9687 | 0.9753 | 0.9686 | 0.9875 | 0.97536 |
|  | Hunan | 0.9648 | 0.9680 | 0.9676 | 0.9747 | 0.9629 | 0.9611 | 0.9591 | 0.9422 | 0.9311 | 0.9396 | 0.9431 | 0.9638 | 0.95650 |
|  | Jiangxi | 0.9679 | 0.9658 | 0.9687 | 0.9631 | 0.9726 | 0.9747 | 0.9650 | 0.9504 | 0.9517 | 0.9630 | 0.9643 | 0.9550 | 0.96353 |
|  | Jilin | 0.9599 | 0.9656 | 0.9567 | 0.9502 | 0.9636 | 0.9585 | 0.9530 | 0.9393 | 0.9318 | 0.9567 | 0.9363 | 0.9346 | 0.95052 |
|  | Shanxi | 0.9915 | 0.9944 | 1.0001 | 0.9878 | 0.9896 | 0.9947 | 0.9902 | 0.9794 | 0.9756 | 0.9851 | 0.9781 | 0.9756 | 0.98684 |
| West | Chongqing | 0.9703 | 0.9838 | 0.9574 | 0.9593 | 0.9745 | 0.9759 | 1.0004 | 1.0131 | 1.0050 | 1.0003 | 1.0160 | 0.9912 | 0.98727 |
|  | Gansu | 1.0001 | 0.9760 | 0.9696 | 0.9710 | 1.0009 | 0.9741 | 0.9613 | 0.9516 | 0.9376 | 0.9483 | 0.9395 | 0.9703 | 0.96669 |
|  | Guangxi | 0.9658 | 0.9726 | 0.9802 | 0.9847 | 0.9765 | 0.9753 | 0.9682 | 0.9462 | 0.9378 | 0.9798 | 0.9543 | 0.9541 | 0.96628 |
|  | Guizhou | 0.9886 | 0.9937 | 0.9889 | 0.9652 | 0.9778 | 0.9646 | 0.9633 | 0.9537 | 0.9457 | 0.9581 | 0.9589 | 0.9748 | 0.96944 |
|  | Nei Mongol | 1.0030 | 1.0013 | 0.9894 | 0.9862 | 0.9862 | 1.0003 | 1.0016 | 1.0001 | 0.9803 | 1.0000 | 0.9852 | 0.9853 | 0.99324 |
|  | Ningxia Hui | 0.9951 | 0.9937 | 0.9890 | 1.0194 | 1.0114 | 1.0149 | 1.0135 | 1.0125 | 1.0114 | 1.0136 | 1.0164 | 1.0204 | 1.00928 |
|  | Qinghai | 1.0087 | 1.0144 | 1.0197 | 1.0114 | 1.0111 | 1.0132 | 1.0172 | 1.0207 | 1.0085 | 1.0022 | 1.0144 | 1.0200 | 1.01346 |
|  | Shaanxi | 0.9925 | 0.9803 | 1.0003 | 0.9905 | 0.9796 | 1.0017 | 1.0014 | 0.9698 | 1.0011 | 1.0001 | 0.9654 | 0.9680 | 0.98757 |
|  | Sichuan | 0.9490 | 0.9561 | 0.9551 | 0.9401 | 0.9618 | 0.9526 | 1.0003 | 0.9261 | 1.0014 | 1.0010 | 1.0000 | 1.0002 | 0.97031 |
|  | Xinjiang Uygur | 0.9757 | 1.0002 | 0.9774 | 0.9665 | 0.9737 | 0.9807 | 1.0114 | 1.0128 | 1.0032 | 1.0042 | 1.0044 | 1.0113 | 0.99344 |
|  | Yunnan | 0.9634 | 0.9733 | 0.9667 | 0.9477 | 0.9590 | 0.9607 | 0.9554 | 1.0004 | 0.9598 | 1.0004 | 0.9324 | 0.9137 | 0.96108 |
| East mean |  | 0.9888 | 0.9990 | 0.9940 | 0.9942 | 0.9940 | 0.9973 | 0.9966 | 1.0037 | 1.0040 | 1.0136 | 1.0080 | 1.0101 | 1.000282 |
| Central mean | 0.9688 | 0.9738 | 0.9742 | 0.9693 | 0.9713 | 0.9720 | 0.9723 | 0.9647 | 0.9579 | 0.9622 | 0.9589 | 0.9658 | 0.967605 |
| West mean | 0.9829 | 0.9859 | 0.9812 | 0.9765 | 0.9830 | 0.9831 | 0.9904 | 0.9825 | 0.9811 | 0.9916 | 0.9806 | 0.9827 | 0.98346 |

**Supplementary Table S2.** Comparison of sample means before and after matching

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Status  Matched  Unmatched | Mean\_  Treated | Mean\_  Control | %Bias | %Reduction | t\_stat | p\_value | Var\_Ratio |
| EC | M | 3.181 | 3.212 | -9 | -21.6 | -0.41 | 0.681 | 1.26 |
| EC | U | 3.1254 | 3.148 | -7.4 | NA | -0.57 | 0.567 | 0.88 |
| GDP | M | 4.3239 | 4.3561 | -9 | 84.8 | -0.41 | 0.68 | 1.29 |
| GDP | U | 4.3327 | 4.1159 | 59.5 | NA | 4.95 | 0 | 0.56 |
| IS | M | 0.9707 | 0.9706 | 0.4 | 99.1 | 0.02 | 0.984 | 0.64 |
| IS | U | 0.9649 | 0.9695 | -47.6 | NA | -3.2 | 0.002 | 2.63 |
| POPN | M | 3.6294 | 3.6564 | -9.4 | 36.9 | -0.43 | 0.669 | 2.5 |
| POPN | U | 3.5206 | 3.5677 | -14.9 | NA | -1.15 | 0.253 | 0.89 |

Note: t\_stat, and Var\_ratio are abbreviations for t statistics and variance ratio