

Online Appendix

Examination of Firms not Primarily Operating in the Chemical Manufacturing Sector

In order to tighten the link from regulatory stringency to profitability, the empirical analysis focuses exclusively on firms that primarily operate in the chemical manufacturing sector. Nevertheless, to enhance the conclusions drawn from our exploration, for this appendix, we separately analyze the firms not primarily operating in the chemical manufacturing sector. Based on our initial premise, these alternative results should demonstrate a weaker statistical link from regulatory stringency to profitability. In general, we draw this conclusion. Recall that we explore three model sets and three models. Models A, B, and C include the more important measure of regulatory stringency: discharge limits. We assess Model D at the end.

Model Set 1 uses the composite limit index. Regardless of the model, the limit coefficient loses its statistical significance and the inspection coefficient remains insignificant. Model Set 2 uses dual measures of limits: concentration limit and quantity limit. In our preferred model of Model C, which includes an interaction between the two limit measures and inspections, both the quantity limit coefficient and the inspection coefficient lose their statistical significance, while the level of significance for the concentration limit coefficient slips from 0.6 % to 8 %. In Models A and B, the quantity limit coefficient again loses its significance, yet the concentration limit coefficient *gains* statistical significance ($p=0.06$), while the inspection coefficient remains insignificant. Model Set 3 uses four measures of limits: BOD concentration and quantity limits and TSS concentration and quantity limits. Regardless of the model, both the BOD quantity coefficient and the TSS concentration coefficient lose their statistical significance; the other primary coefficients remain insignificant.

Lastly, Model D includes only the inspection measure. As in the primary estimation results, the inspection coefficient is never statistically significant.

Online Appendix Table A-1

Distribution of Pollutant-Basis-specific Discharge Limit Levels

| Percentile | BOD Concentration (mg/L) | BOD Quantity (lbs/day) | TSS Concentration (mg/L) | TSS Quantity (lbs/day) |
|-------------|--------------------------|------------------------|--------------------------|------------------------|
| 0 % (min) | 10 | 1 | 10 | 29 |
| 1 % | 10 | 1 | 10 | 45 |
| 5 % | 10 | 43 | 12 | 84 |
| 10 % | 13 | 52 | 23 | 105 |
| 25 % | 20 | 134 | 25 | 249 |
| 50 % | 27 | 491 | 39 | 750 |
| 75 % | 30 | 1,151 | 54 | 2,185 |
| 90 % | 45 | 4,452 | 86 | 4,847 |
| 95 % | 164 | 6,546 | 161 | 8,558 |
| 99 % | 164 | 16,237 | 195 | 11,238 |
| 100 % (max) | 283 | 16,237 | 195 | 17,711 |

Online Appendix Table A-2

Fixed Effects Estimation of Return on Sales: Dual Discharge Limit Measures – Concentration Limit and Quantity Limit with Preference Given to Concentration Limit (Model Set 2A)

Model A includes only discharge limit levels as the single measure of regulatory stringency.

Model B includes both discharge limit levels and government monitoring inspections as dual measures of regulatory stringency.

Model C also includes an interaction between the two measures of regulatory stringency.

| Independent Variable ^a | Model A | | Model B | | Model C | |
|-----------------------------------|---------|---------|---------|---------|---------|---------|
| | Coeff | p-value | Coeff | p-value | Coeff | p-value |
| Concentration Limit Level | -0.0192 | 0.415 | -0.0194 | 0.394 | -0.0681 | 0.003 |
| Quantity Limit Level | -0.0110 | 0.009 | -0.0116 | 0.005 | -0.0109 | 0.038 |
| Inspections | | | 0.0024 | 0.719 | -0.0288 | 0.007 |
| Concentration Limit × Inspections | | | | | 0.0320 | 0.000 |
| Quantity Limit × Inspections | | | | | -0.0006 | 0.545 |
| Sales Growth | 0.0743 | 0.137 | 0.0739 | 0.142 | 0.0751 | 0.132 |
| Capital Intensity | 0.0952 | 0.338 | 0.0958 | 0.336 | 0.0915 | 0.362 |
| Age of Assets | -0.1015 | 0.116 | -0.0982 | 0.120 | -0.1230 | 0.093 |
| Firm Size | -0.0411 | 0.104 | -0.0422 | 0.107 | -0.0357 | 0.178 |
| Market Share | -0.3587 | 0.025 | -0.3579 | 0.025 | -0.3641 | 0.021 |
| Industry Concentration | 0.0615 | 0.655 | 0.0612 | 0.657 | 0.0575 | 0.668 |
| R&D Intensity | -0.1177 | 0.795 | -0.1095 | 0.812 | -0.1271 | 0.783 |
| F-test of Zero Slopes | 4.46 | 0.000 | 4.14 | 0.000 | 12.55 | 0.000 |
| F-test of Fixed Effects | 2.73 | 0.000 | 2.73 | 0.000 | 2.63 | 0.000 |
| Hausman Test: Random Effects | 30.08 | 0.012 | 26.61 | 0.046 | 27.58 | 0.069 |
| Number of Observations | 790 | | 790 | | 790 | |
| Number of Firms | 53 | | 53 | | 53 | |

^a Regression also includes a constant term, year-specific indicators, and limit replacement indicators that are specific to a pollutant (BOD, TSS) and measurement form (concentration, quantity).

P-values reflect standard errors clustered on an individual firm.