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The effect of competition on toxic pollution releases

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ABSTRACT

We examine how competition affects toxic industrial releases, using five years of data from thousands of facilities across hundreds of industries. Our main result indicates that competition reduces toxic releases at the facility level. On average, each percentage-point reduction in the Herfindahl Index (HHI) results in a nearly two-percent reduction in a facility's toxic releases. At the same time, we find no evidence that competition increases aggregate pollution. Further analysis sheds some light on the mechanisms through which firms reduce pollution releases due to increased competition. In particular, we find suggestive evidence that this relationship is due to both reduced output and increases in abatement. We find no evidence that our result is driven by: consumer aversion to pollution, regulations changing with competition, or technologies introduced by new firms. Taken together, our results indicate that competition may be good, at least for public health in areas near polluting facilities, and fail to provide support for the hypothesis that competition leads to more socially undesirable behavior.

Introduction

Industrial pollution is a major societal concern. Every year, US firms release billions of pounds of toxic pollutants into the air, water, and ground. In developing economies, like China, increasing air pollution is a major and growing public health issue. Even in the United States, recent research has demonstrated links between pollution and a variety of health outcomes.[3]

This paper explores the influence of competition on firms' pollution releases, and to our knowledge, is the first paper to empirically examine this relationship. In particular, we investigate the impact of competition on facility-level pollution. We do this by merging data on facilities' toxic pollution releases from the Toxics Release Inventory (TRI) with industry concentration data from the Census of Manufacturers. Using these data, we estimate panel-data models of facility toxic releases as a function of industry concentration. In our baseline analysis, we control for industry output, and we include fixed effects to control for unobserved industry and state-year variation. Additional analyses also include facility-industry, and county-year fixed effects, as well as some additional controls for regulatory stringency, technological advancements, and local green preferences.[4]

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[3] These health outcomes include infant health and mortality (Currie and Schmieder, 2008; Agarwal et al., 2010; Joyce, Grossman and Goldman, 1986; Chay and Greenstone, 1999; Currie et al., 2009), childhood asthma (Neidell, 2004), and most recently, autism and other respiratory and cardiovascular conditions (Lleras-Muney, 2010; Beatty and Shimshack, 2011, 2014; Rzhetsky et al., 2014).

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By using facility-level (rather than industry-level) pollution data, we are able to resolve a basic theoretical ambiguity, as to the net effect of competition on firm-level emissions. This ambiguity stems from the tension between the negative effect of competition on firm-level production (and thus the negative effect on emissions) and the possibly negative effect on abatement (and thus the positive effect on emissions). Further, our focus on pollution releases, rather than abatement, is important because of the local health effects of facility-level pollution.

Our primary result indicates that competition reduces industrial pollution releases at the facility level. As industry concentration falls, facility releases fall, even after controlling for industry output. Quantitatively, we find that each percentage point reduction in the HHI causes a roughly two percent reduction in toxic releases, and the negative effect of competition on releases increases with the level of concentration in the market. The effect persists when we focus only on carcinogenic chemicals – a category of pollutants that pose a particularly acute public health concern. It also persists when using a toxicity-weighted measure of facility releases, though the coefficient is marginally statistically insignificant.

Beyond this primary result, we find no evidence that aggregate industry pollution increases with competition. The negative effect of competition on facility-level releases combined with the absence of a positive effect at the aggregate level is suggestive evidence that abatement increases with competition. Consistent with this insight, we find that abatement as a share of total pollution increases with competition. However, we find no evidence that competition causes a reduction in the toxicity of the releases.

Through a battery of additional analyses, we are able to explore whether additional factors contribute to our main finding. We first consider the possibility that regulations depend on the competition level, and this relationship could be a driver of our main result. We find no evidence that controlling for the local regulatory environment or for Clean Air Act (CAA) regulations weakens our main result. Second, we note that entry of new firms could be associated with greater competition, and new firms may bring in cleaner technologies. While this may be occurring, we find that our main result holds even if we restrict our sample to incumbents. Lastly, we examine whether consumer green preferences or local community pressure is contributing to our finding. We find no evidence that the effect of competition is affected by these sentiments.

Our findings have several implications. First, our robust finding that facility-level pollution falls with competition helps to resolve a theoretical ambiguity. While even a relatively simple theory model shows this relationship may be positive or negative, our empirics clearly point to a negative relationship in practice. Second, our main finding suggests that competition may be good for local public health, particularly if detrimental health outcomes have a convex relationship with local pollutants. To the extent that pollutants have mainly local impact, our results may be informative for competition policy. Lastly, our findings fail to support the notion that “bad behavior” – in our case, less pollution abatement – follows increased competition.

The impact of competition on pollution releases

Literature review

Prior theoretical work suggests a natural tension at the facility (or at least firm) level as to how pollution depends on competition. Specifically, it is well established (e.g., Farber and Martin, 1986) that increased competition lowers production per firm, and thus, at least lowers average production per facility. If pollution increases with production ceteris paribus, this competition effect would tend to lower pollution per facility. On the other hand, there is some theoretical work suggesting that pollution abatement will decline with competition. For example, within a theoretical model of production and pollution abatement, Farber and Martin (1986) shows that abatement declines with competition, although only after making additional assumptions. More broadly, Shleifer (2004) posits that competition may increase firms' propensity to engage in unethical behavior (which may or may not be efficient) because it reduces costs (and competition increases the incentives to reduce costs in order to reduce prices). This same intuition applies to pollution control; firms can reduce costs, and therefore reduce prices, by reducing pollution control activities. Similarly, Branco and Villas-Boas (2012) argues that competition leads to firms being less likely to follow the rules of the market because competition reduces the cost of being caught violating the rules (because profits are lower where competition is higher). As a result, the net effect of an increase in competition on facility-level pollution is ambiguous: lower production reduces pollution while presumed lower abatement increases facility-level pollution. This ambiguity is only enhanced by the fact that theory does not provide a conclusive prediction about the relationship between abatement and competition. In other words, not only is the relationship between competition and pollution ambiguous, but so is the relationship between competition and abatement.

Prior work in the trade literature, e.g., Antweiler et al. (2001), provides evidence that free trade can lead to lower pollution. As freer trade generally implies an increase in competition, such a finding is relevant to our setting. However, there are important differences between the setting of Antweiler et al. (2001) and what we do in this paper. Specifically, Antweiler et al. (2001) considers macroeconomic changes, such as changes in income, which generate a “technique” effect;

[4] With these controls we are able to address endogeneity concerns arising from the correlation between industry structure and regulation, as well as from unobserved changes in abatement technology. We discuss this more below in Endogeneity threats and additional mechanisms.