How Firms Respond to Mandatory Information Disclosure

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When new institutional pressures arise, which organizations are particularly likely to resist or acquiesce? When subjected to new information disclosure mandates, an increasingly popular form of market-based government regulation, which types of organizations are more likely to subsequently improve their performance in ways that meet policy makers' objectives? This study addresses these questions. We build on institutional theory to propose that several organizational characteristics moderate how organizations respond to institutional pressure, and provide among the first evidence characterizing organizations' heterogeneous responses to information disclosure regulations. We hypothesize that establishments more proximate to their headquarters will have greater access to their capabilities and be subjected to increased monitoring, both of which will cause these establishments be more responsive to institutional pressures. We also hypothesize that establishment size and ownership structure increase the salience of institutional pressures, which increases organizations' responsiveness to institutional pressures. We test our hypotheses in the context of one of the most prominent disclosure programs, the U.S. Environmental Protection Agency's Toxic Release Inventory. We examine how thousands of establishments responded to the regulator's requiring them to publicly disclose emissions of hundreds of toxic chemicals, and take advantage of an exogenous shock that occurred when the agency expanded the number of chemicals required to be reported. We find that establishments that improved more rapidly were more proximate to their headquarters, smaller than average, and were owned by private firms. We also found that establishments near their headquarters and private firms more aggressively reduced particularly harmful emissions. Finally, we found that large firms reduced their overall emissions, do not significantly reduce particularly harmful emissions, relative to smaller firms. These results may provide evidence for the characteristics of "good citizen" or "green washing" firms. We highlight the important implications of our results both for the further development of institutional theory and for information disclosure policy makers as well as those who use such disclosed information.

1. Introduction

Organizations are required to respond to a diverse set of external pressure from a number of constituencies and stakeholders. One source of external pressure materializes from market-based mandatory information disclosure programs imposed by regulators. The requirement to disclose information about firm behavior results in outside stakeholders utilizing the information to pressure the firm to change undesired behaviors. In recent years, there has been a significant increase in the use of

information disclosure as a regulatory mechanism. For example, information disclosure has been used to force firms to reveal details of their use and disposal of toxic chemicals, to require food manufacturers to post nutritional information about their products, and to force restaurants to reveal their hygiene scores.

Most research on the effectiveness of information disclosure has focused on average effects across the population of firms affected, on examining the aspects of the disclosure program that influence whether it is successful (Fung et al., 2009) or on variation in the external environment of the firm affects response (Delmas and Toffel, 2011). However, the structure and nature of the organizations themselves may also result in differential responses to external pressure. Thus, our research question is: When new institutional pressures arise, which organizations are particularly likely to resist or acquiesce? Similarly, when subjected to new information disclosure mandates, which types of organizations are more likely to subsequently improve their performance in ways that meet policy makers' objectives?

In this paper, we argue that the degree to which organizations improve their performance following information disclosure will depend, in part, upon features of the organizations themselves. Specifically, we hypothesize that greater improvement will be seen among those establishments that have greater internal and external pressures to improve, as well as those that have greater access to the capabilities needed to do so. We test our hypotheses using data from the Toxic Release Inventory (TRI), which is one of the most famous instances of information disclosure legislation, and one that is often lauded for bringing about significant improvements (Hart, 2010). We examine how thousands of organizations responded to this regulatory requirement to publicly disclose emissions of hundreds of toxic chemicals, and take advantage of an exogenous shock that occurred when the agency expanded the number of chemicals required to be reported. Our research is especially important given the prominence of the TRI program, and the importance of achieving improved environmental performance.

We examine the differential performance of facilities based on three organizational moderators—proximity to the firm headquarters, facility size and firm ownership structure, namely whether the parent firm is public or private. We find that facilities located close to their headquarters improve their emissions

more than those farther away. Larger facilities also improve emissions relative to those that are smaller. Facilities whose owner is a public firm perform relatively more poorly compared to those belonging to private firms.

The remainder of our paper proceeds as follows: In the next section, we review the pertinent literature on institutional theory and information disclosure responses. We then develop theory and hypotheses relating organizational characteristics to responses to this new institutional pressure, followed by detailed description of our data and the methods we use to test our hypotheses. We conclude with a discussion of our results and their implications.

2. Literature Review

2.1 Institutional theory

Institutional theory provides the basis for studying how external pressures affect organizational behavior. Several studies have investigated various stakeholder pressures and firm responses, particularly with respect to a firm's environmental policies and practices. Stakeholders that exert pressure include regulators (Henriques and Sadorsky, 1996; Khanna and Anton, 2002; Reid and Toffel, 2009) communities (Florida and Davison, 2001; Henriques and Sadorsky, 1996), customers (Delmas and Montiel, 2008), competitors (Darnall, 2009) and shareholders (Reid and Toffel, 2009). Some studies have investigated the firm response in different external environments. Different local socio-economic conditions result in different levels of pollution production (Arora and Asundi, 1999; Brooks and Sethi, 1997; Khanna and Vidovic, 2001; Kassinis and Vafeas, 2006). Varying political conditions, including rates of voting (Hamilton, 1999) and environmental activism (Maxwell et al., 2000) also indicate higher levels of external pressure. The nature of the industry, namely its environmental impact, will also affect the degree to which firms respond to environmental pressure (Lyon and Maxwell, forthcoming; Cho and Patten, 2007).

These studies, like most in the institutional theory domain, tend to focus on average organizational responses to pressures emanating from different sources. In contrast, much less is known

about why firms respond differently when facing common sets of institutional pressures, despite theory-based predictions that external pressures and organizational structure should result in varying firm responses to institutional pressures (Oliver, 1991; Hoffman, 2001). A recent review of empirical literature based on institutional theory concluded that there exists a "lack of understanding of the conditions under which institutional pressures and organizational characteristics explain the adoption of beyond compliance strategies" (Delmas and Toffel, 2011). A few recent studies have found evidence that organizational responses to institutional pressures are moderated by organizational structure (Delmas and Toffel, 2008), marginal operating costs and perceived benefits (Chatterji and Toffel, 2010). By theorizing and empirically testing hypotheses that several organizational factors moderate how organizations respond to institutional pressure, we contribute to this nascent literature examining heterogeneous responses to institutional pressures.

2.2 Responses to information disclosure

Our research also builds on the literature that has examined how information disclosure affects organizations. One stream within this literature has focused on how a firm's stakeholders including journalists, investors, and customers respond to information disclosed about the firm. For example, prior studies have found that information disclosed about firms' pollution levels can stimulate media coverage and depress market valuations of the firms (Hamilton, 1995) and their neighboring houses (Oberholzer-Gee and Mitsunari, 2006). Others have found that mandatory corporate financial disclosures can generate excess returns (Greenstone, Oyer and Vissing-Jorgensen, 2006), and that disclosure of nutrition information can lead customers to reduce their caloric consumption (Bollinger, Leslie and Sorensen, forthcoming). Other studies examining voluntary information disclosure have found that regulators have responded by reducing scrutiny over companies that came forward and self-disclosed compliance violations (Toffel and Short, 2011).

While most of these studies examined average treatment effects, a few recent studies have identified heterogeneous effects of information disclosure. For example, the disclosure of nutritional

information was particularly effective in reducing calorie consumption among consumers who had typically consumed more calories and who lived in wealthier and more highly educated areas (Bollinger, Leslie and Sorensen, forthcoming).

More closely related to our research are studies that have investigated how the organizations themselves have responded to information disclosed about them. For example, two studies examined how graduate and professional schools responded to school rankings. They found that officials within lower ranked schools reacted defensively by focusing on their respective strengths and reallocated resources strategically to influence future rankings (Elsbach and Kramer, 1996; Espeland and Sauder, 2007). Several studies concluded that government programs requiring companies to disclose performance information spurred companies to improve environmental performance (Blackman, Afsah, and Ratunanda, 2004; Konar and Cohen, 1997; Scorse, 2007), food and water safety (Bennear and Olmstead, 2008; Jin and Leslie, 2003), and surgical outcomes (Cutler, Huckman, and Landrum, 2004; Hannan et al., 1994; Peterson et al., 1998).

While most of these studies estimated average effects, a few studies have identified factors associated with particularly acute organizational responses to information disclosed about them. For example, studies have found organizations to be especially likely to improve their performance if they received particularly poor ratings (Blackman, Afsah, and Ratunanda, 2004; Chatterji and Toffel, 2010; Scorse 2007), and especially if they faced additional external pressure of being in a highly regulated industry (Chatterji and Toffel, 2010). Others found greater improvement among franchised establishments that an information disclosure program revealed to be performing substantially below their company-owned counterparts (Jin and Leslie, 2009).

While the prior literature has identified several attributes of institutional environments that moderate organizations' responses to information disclosure, much less is known about how organizational attributes influence their responses. Some of the limited research in this domain has found that firms facing lower-cost opportunities to improve were especially likely to do so after a third-party

rated them poorly (Chatterji and Toffel, 2010). And while a cross-sectional analysis found an association between family ownership and lower pollution levels (Berrone et al., 2010) ours is among the first studies to explore how organizational attributes moderate how firms respond to information disclosure to our knowledge. We propose that three organizational attributes moderate how companies respond to local environmental pressures associated with the disclosure of these companies' pollution levels. Specifically, we hypothesize privately owned, more geographically concentrated, and larger facilities will be particularly responsive to these pressures by exhibiting greater environmental performance improvement.

3. Theory and Hypotheses

3.1 Information disclosure, pressure, and performance

Mandatory information disclosure policies are premised on the notion that revealing information spurs stakeholder pressure for firms to change their behavior. For example, a primary policy objective of the Nutrition Labeling and Education Act (1990) requiring food producers to disclose nutritional information on retail packages and of various municipal regulations requiring restaurants to report calories along menu items is to enable consumers to make more informed choices and thereby pressure producers and retailers of less healthy foods to respond by offering more nutritional offerings (Bollinger, Leslie and Sorensen, forthcoming; Fung et al., 2002). Several studies across several industries have found that mandatory information disclosure policies have been particularly likely to spur improvement among organizations that performing poorly on the new revealed dimension (Blackman et al., 2004; Chatterji and Toffel, 2010).

Pressures to improve, however, are not uniformly distributed. The prior literature has shown that such pressures differ by location and industry, and depend on the information disclosed. For example, environmental concerns are more salient in some locations than others (McConnell and Schwab, 1990; Sine and Lee, 2009). Similarly, there are regional differences in health concerns and enactment of health-related policies; for example, tobacco control policies in universities are more prevalent in some regions of the United States than others (Halperin and Rigotti, 2003).

Another geographic dimension that leads to differential response is proximity to competitors. For example, consumers were more likely to alter their buying behavior in markets that face competition, which enables consumers to more easily switch to new suppliers from those selling products revealed to be worse-performing according to the newly revealed information (Bollinger, Leslie and Sorensen, forthcoming). Firms in different industries also have been shown to respond differently to mandatory information disclosure. For example, firms in sectors historically associated with environmental problems have been found to be more responsive to information disclosure via ratings agencies (Chatterji and Toffel, 2010).

We build on this prior literature, which largely focuses on external institutional factors associated with differential responses to information disclosure, by theorizing that particular organizational attributes also affect the degree to which organizations alter their performance in response to information disclosure mandates. The effectiveness of information disclosure in changing firms' (and individuals') behaviors centers on the perceived costs and benefits of those changes (Chatterji and Toffel, 2010; Fung, Graham, and Weil, 2009; Jin and Leslie, 2009). Jin and Leslie (2009), for example, model restaurants' hygiene changes as a function of the marginal cost of improvement and the benefit of increased business stemming from the improved hygiene. Chatterji and Toffel (2010) argue that firms that are in environmentally sensitive industries incur higher costs from disclosure of poor environmental performance, due to increased potential for inspections and greater intensity of public scrutiny. They find that firms in such industries are thus more likely to improve their performance after receiving poor environmental ratings. This illustrates a common issue with information disclosure, as the aim of disclosure is to "reduce risks or performance problems" (Fung, Graham, and Weil, 2009: 5). That is, information disclosure, whether mandated by government or enacted by private parties such as ratings agencies, is intended to shine a light on previously hidden dimensions of performance, and by doing so, spur improvements on the part of the actors who disclose the information.

We suggest that information disclosure is particularly likely to lead to improved performance among those establishments that attract particularly salient pressures from their internal or external stakeholders, and when they have preferential access to intra-organizational expertise. The degree to which concerns about these internal and external pressures prompts managerial responses depends upon particular characteristics of the establishment and its parent company. Below, we hypothesize that proximity to the firm's headquarters increases the motives to improve performance and provides establishments the means with which to do so. In addition, we hypothesize that several organizational characteristics will lead particular establishments to perceive heightened external pressure following information disclosure mandates, which will lead them to be particularly likely to respond by improving their performance.

3.2 Improving performance due to internal pressures and ease of capability transfer

Information that reveals poor operational performance of an establishment such as a restaurant (Jin and Leslie, 2009), factory (King and Lenox, 2002), or vehicle service station (Pierce and Toffel, 2011) can affect the reputation of its parent and sibling organizations. Information disclosure requirements that reveal poor performance can harm organizations' reputations and stock prices (Hamilton, 1995; Konar and Cohen, 1997), which can theoretically lead to investments in internal monitoring or capital equipment to facilitate improved performance. We consider how poor performance revealed about an establishment creates pressure on the establishment to improve, and how its proximity to its headquarters affects its improvement rate.

Some dimensions of organizational performance, such as employment and pollution levels, are of particular relevance to the communities in which they operate. Establishments performing poorly along these dimensions risk provoking community pressure. When these establishments are located in the community in which they are headquartered, these community pressures are magnified by pressures from their headquarters. This dynamic ensues because organizations are particularly embedded in the communities in which they are headquartered (Marquis and Battilana, 2009), which leads them to act in

ways to preserve relationships with these communities. For example, firms are particularly reluctant to lay off workers in the communities in which they are headquartered (Diaz, Greenwood, Li, and Lorente, 2007) and are more likely to source from local firms in these communities than in other areas in which they operate (Audia and Rider, 2010). Therefore, when an establishment proximate to its headquarters is revealed to be performing poorly, the information is particularly visible and salient to its firm's top management, who are themselves members of the community. These senior managers have strong incentives and the authority to pressure these establishments to improve their performance.

Beyond exerting greater pressure, because distance increases the complexity and expense of transferring capabilities, headquarters can more easily transfer capabilities required to improve performance to proximate subsidiaries. An organization's ability to transfer capabilities to improve another's performance is less likely when the two organizations are separated by larger distances (Berchicci, Dowell, and King 2011). Overall, then, proximity to headquarters should increase both the pressure on the establishment to improve, and its ability to do so.

> **H1: When information is disclosed about operational performance, establishments in the same geographic area as the company's headquarters will improve to a greater degree than establishments outside of the headquarters' area.**

3.3 Improving performance to mitigate external pressures

In addition to affecting internal pressures, organizational characteristics affect the salience of external pressures. We hypothesize that, among establishments facing common institutional pressures and whose poor performance is revealed simultaneously, two organizational characteristics will affect the speed with which establishments respond, though in both cases, it is unclear whether the characteristics will speed improvement or slow it down. First, we propose that establishment size relative to others within its institutional field will affect the pressure that the establishment experiences and thus its response. Second, establishments that are part of publicly-owned firms will face different pressures than those owned by private firms, and thus will also differ in their responses.

Size. An establishment's size has two countervailing effects on its response to information disclosure. There are many reasons to expect larger establishments to be under greater scrutiny than smaller ones. Larger organizations are generally more visible in their communities, are more likely to attract media attention, and are held to higher standards than smaller organizations (Ingram and Simons, 1995). Larger organizations are also under greater pressure to enact changes to maintain their legitimacy (Goodstein, 1994). For example, some regulations target only larger establishments, such as the Worker Adjustment and Retraining Notification Act's requiring only establishments with more than 100 employees, but not smaller establishments, to provide notice prior to mass layoffs (Fung et al., 2009).

With respect to pressure to improve performance following information disclosure, the increased visibility of larger establishments may be exacerbated by the need for relatively simple metrics to facilitate comparison by consumers and other interested parties (Fung et al., 2009). For example, reports of toxic release inventory data generally emphasize total releases (Scorse, 2010). With such metrics that are not normalized to account for establishment size, larger establishments are likely to score poorly, even if their size-adjusted performance is superior due to economies of scale. For example, larger establishments will fare poorly on such metrics (e.g., pollution levels) even if they are more efficient (e.g., release less pollution per employee or per dollar of sales) than smaller establishments.

H2a: Improvement following information disclosure is greater for establishments that are large relative to others in their geographic area.

Whereas larger establishments are more visible and their performance may be under greater scrutiny, they may also be better positioned to resist local pressures, and therefore less sensitive to information disclosure. Larger establishments can accrue political power through superior political access, and can more easily afford to lobby agencies or donate to politicians to influence governments (Drope and Hansen 2006; Hansen, Mitchell, and Drope 2005; Schuler 1996). Larger establishments may also possess greater leverage due to their providing employment for greater numbers of individuals. Larger establishments have both the resources and the incentives to attempt to exert such influences. In

the case of information disclosure, their efforts can be directed at reducing the pressures that local regulators place on them to improve performance once sub-standard performance is revealed. Larger establishments, therefore, may have greater ability to withstand the pressure that disclosure of poor performance creates, and may demonstrate less improvement in the wake of information disclosure.

H2b: Improvement following information disclosure is lesser for establishments that are large relative to others in their geographic area.

Public ownership. Similar to the arguments made regarding establishment size, ownership structure has two competing potential effects on improvement following information disclosure. First, publicly traded firms are more visible than private firms and are more likely to be targeted by pressure groups. Second, information disclosed about publicly traded firms can affect their stock price (Konar and Cohen, 1997), which could bring increased pressure from corporate managers on subsidiary establishments to improve performance.

In contrast, the absence of stock price concerns make private firms less sensitive to pressures to improve following disclosure. In private firms, owners have discretion to pursue non-financial goals without fear of reprisals from shareholder resolutions or the discipline imposed by the market for corporate control (Schulze, Lubatkin, Dino, and Buchholtz, 2001). Thus, private firms may demonstrate greater immunity to pressures created from outside the firm.

H3a: Improvement following information disclosure is greater for establishments owned by publicly traded firms.

Conversely, the fact that public firms' shareholders are concerned principally with share prices may actually reduce these firms' sensitivity to information disclosure. Improvement in the dimensions measured by information disclosure may require investments that have relatively long payback periods, such as purchase of capital equipment or development of new capabilities. In some cases, the financial return from improvements on the dimension of disclosure being disclosed may not even be well-established. For example, while under some circumstances improvements in environmental performance

can be made profitably, not all such improvements will improve profits (Christmann 2000; King and Lenox 2002).

If the payoff from improvements are unclear or are manifested only over a longer time horizon, publicly traded firms that are under pressure to maintain short term profits and stock prices may be less likely to make such investments. Managers in private firms, however, are not as affected by short-term financial results, and therefore may be more willing to make the investments needed to improve on the dimension on which information is disclosed.

H3b: Improvement following information disclosure is greater for establishments owned by privately held firms.

4. Data, Measures, and Empirical Approach

We empirically test our hypotheses by taking advantage of an exogenous shock that occurred when the US Environmental Protection Agency (EPA) expanded the scope of the Toxic Release Inventory (TRI). Created by the US Emergency Planning and Community Right-to-Know Act of 1986, TRI requires facilities to publicly report their annual waste, transfers, and releases of certain toxic chemicals. Reporting is required by facilities (1) that operate within particular industry sectors including manufacturing, mining, electric utilities, hazardous waste treatment, and chemical distribution; (2) employ ten or more individuals; and (3) manufacture, import, process, or otherwise use any of the listed toxic chemicals in amounts that exceed reporting thresholds (U.S. EPA 2004). Since TRI became operational in 1987, EPA has periodically expanded the list of chemicals to be reported. We leverage this fact in our identification strategy, as described below. As of 2011, the EPA requires the disclosure of 593 individual chemicals and 30 chemical categories (US EPA, 2011). To construct our database, we supplement facilities' annual TRI reports with Dun and Bradstreet data obtained from the National Establishment Time-Series (NETS) database, as described below. Our resulting panel dataset consists of 38,086 facilities over the years 1995 to 2000 (216,828 facility-years), the six year period that followed EPA's largest expansion of the list of chemicals required to be reported to TRI.

4.1 Measures

4.1.1 Dependent variable: Environmental performance

We measure environmental performance based on data from the TRI database, an approach widely used in the literature (e.g., Toffel and Marshall, 2004; King and Lenox, 2000; King and Shaver, 2001; Berrone et al., 2010; Chatterji and Toffel, 2010). We consider only those 243 chemicals that were added to the TRI chemical list in 1995. Our primary measure is *total releases*, which includes the total pounds of toxic chemical emissions each firm reported to TRI as production waste, transfers, and releases. We also calculated *air emissions* as the subset of these emissions that were released to air (including stack emissions and fugitive emissions). We also calculated *air hazard* by weighting each chemical by its Inhalation Toxicity Weight (ITW), a comprehensive weighting scheme that accounts for the enormous variation in toxicity and fate properties of the TRI chemicals (Toffel and Marshall 2004; US EPA 2010). We obtained TRI data and ITW values from the EPA's Risk-Screening Environmental Indicators (RSEI) Model (versions 2.1.2 and 2.1.3) (US EPA 2010). In our models, we employ the log of these annual values after adding one.

4.1.2 Moderators

Headquarter proximity. We measure headquarter proximity as a dichotomous variable, coded "1" for facilities located in the same city as their headquarters, and "0" otherwise.

Large facilities. We measured a facility's relative size by comparing its employment to that of other TRI facilities in its state. Specifically, we created large facilities as a dichotomous variable, coded "1" for facilities whose employment exceeded the state's median TRI facility employment. We obtained facility employment from NETS.

Public ownership. We categorized facility ownership by creating public ownership as dichotomous variable coded "1" when a facility's owner was a publicly traded firm, and "0" when the facility was privately owned. We obtained ownership information on facilities' parent companies from NETS.

4.1.3 Controls

Facility size. We control for changes in facility size in two ways. First, we obtained annual facility employment from NETS, which we log in our models. Second, we control for changes in production volumes by obtaining annual production ratios from the TRI database (Berrone and Gomez-Mejia, 2009). Production ratios are the ratio of a facility's production level that year to its production level the prior year. TRI requires facilities to provide a production ratio for each chemical reported to the TRI database, each year. We winsorized the mean production ratios at the 99th percentile so as not to skew the distribution by outliers and when the data allowed us to, we interpolated missing values during the years of our analysis. We calculated relative production level for each facility-year relative to 1994 (our baseline year) using the following equation for facility *i* in year *t*, with *t* starting in 1995, and with $relative\ production\ level_{i,1994}$ normalized to "1". In our regressions, we use the log of relative production level to match our log dependent variable.

$$relative\ production\ level_{i,t} = production\ ratio_{i,t} \times relative\ production\ level_{i,t-1}$$

Summary statistics and correlations are reported in Table 1.

4.2 Empirical approach

We estimate the following model for facility *i* in year *t*:

$$Y_{i,t} = \beta_1 M_i \times \gamma_t + \beta_2 X_{i,t} + \beta_3 \gamma_t + \beta_4 M_i + \beta_5 X_{i,t} + \beta_6 \alpha_i + \varepsilon_{i,t}$$

where $Y_{i,t}$ is log environmental performance, M_i represents each time invariant moderator described above, γ_t is an annual counter (0 in 1995, 1 in 1996, etc.) to capture the secular trend, $X_{i,t}$ represents control variables (e.g., external environmental pressure, relative production levels), and α_i represents facility-level fixed-effects. In our estimations, because M_i is time invariant and measured at the facility-level, it is absorbed by the facility-level fixed effects.

Our identification strategy relies on the exogenous policy shock that occurred in 1995 when EPA dramatically expanded the number of chemicals that were required to be reported to TRI, increasing the number by 243 chemicals, from 363 to 606. Our analysis compares how various types of facilities

responded to this new requirement to disclose these newly listed chemicals. As such, we compare their performance trends during the period of 1995 to 2000.

5. Results

We estimate our models using ordinary least squares (OLS) with facility level fixed-effects, and include each interaction term in a separate regression. In all cases, we report standard errors clustered by facility. Our primary results are reported in Columns 1-3 of Table 3.

5.1 Primary results.

Results in Column 1 indicate that facilities in the same city as their headquarters experienced a superior environmental performance trend compared to facilities with more distant headquarters ($\beta = -0.044, p < 0.01$), which supports Hypothesis 1. The coefficient of the interaction term represents the average annual trend difference between facilities proximate to their headquarters and facilities farther from their headquarters. When considered alongside the positive annual trend of the latter group ($\beta = 0.114, p < 0.01$), our results indicate that over the six year period of our sample (1995-2000) the average headquarters-proximate facility increased their total releases by 0.42 log points ([0.114-0.044]*6) compared to an increase of 0.68 log points by facilities more distant from their headquarters. When viewed in light of the sample average environmental performance of 0.97 (Table 2), this difference is not only significant but also substantial, representing a 43% increase (0.42÷0.97) compared to a 70% increase (0.68÷0.97) beyond the mean.

Our results also indicate that larger facilities experienced a superior environmental performance trend than smaller facilities (Column 2: $\beta = -0.019, p < 0.01$), which supports Hypothesis 2a rather than Hypothesis 2b. When considered alongside the positive annual trend of the smaller facilities ($\beta = 0.094, p < 0.01$), our results indicate that on average over the six year sample period, larger facilities increased their total releases by 0.45 log points ([0.094-0.019]*6) compared to an increase of 0.56 log points among smaller facilities. Again, this distinction is substantial, representing an increase over the six-year sample period of 46% versus 58% beyond the mean.

As reported in Column 3, publicly owned facilities experienced worse environmental performance trends relative to private firms ($\beta = 0.058, p < 0.01$), which supports Hypothesis 3b rather than Hypothesis 3a. The average annual trend of publicly-owned facilities ($0.067 + 0.058 = 0.125$) was nearly double the average annual trend of privately-held facilities ($\beta = 0.067, p < 0.01$). Over the six year sample period, these average trends amount to publicly-owned facilities increasing total emissions by 0.75 log points ([0.067 + 0.058]*6) compared to privately-held facilities increasing by 0.40 log points (0.067*6), the equivalent of increases in 77% versus 41% beyond the mean.

5.2 Robustness tests

As a robustness test, we omitted controlling for relative production levels and log employees. The results, reported in Columns 4-6 of Table 3, yield nearly identical coefficients on our hypothesized interaction terms, indicates that our primary results are not sensitive to the inclusion or omission of these two control variables.

5.3 Extensions

Our primary analysis examined how our three hypothesized variables moderated environmental performance as defined by total releases, a metric commonly employed by the media. However, air emissions of toxic chemicals is a subset of total releases that is of particular importance to communities surrounding these facilities. And comparing total pounds of air emissions can be misleading, as the toxic chemicals reported to TRI vary substantially in their potential to cause harm (e.g., toxicity) on a per-pound basis. As such, while simply totaling pounds is a useful approach to mimic the way the media reports TRI emissions, a more appropriate way to measure the potential harm associated with toxic air emissions is to employ a weighted tally that accommodates the chemicals' varying harmfulness (Toffel and Marshall 2004). As an extension, we estimate our models using log pounds of air emissions and log weighted pounds of air emissions. The results of these models are provided in Table 4. The models that predict pounds of air emissions (Columns 1-3) and hazard-weighted air emissions (Columns 4-6) yield coefficients on the hypothesized interaction terms that are of the same sign and statistical significance as

our primary models. The one exception is that while larger facilities continue to exhibit superior performance trends compared to smaller facilities, the difference is not statistically significant when predicting hazard-weighted air emissions (Column 5).

6. Discussion

6.1 Contributions to institutional theory

Institutional theory is particularly well-suited to understand how external pressures affect organizations but to be of even greater use, it is important to further refine institutional theory to better explain why firms respond differently to common institutional pressures. For example, why, faced with similar institutional environments, do some firms go beyond compliance in their environmental strategies (Delmas and Toffel 2011)? In particular, what are the organizational attributes that moderate the effects of institutional pressures?

Our findings suggest that the effectiveness of institutional pressures depends upon the presence of internal pressures and capabilities. With regard to internal pressures, we find that establishments that are proximate to their headquarters and those that are privately held improve more rapidly. For both locally-headquartered and private firms, this suggests that specific internal pressures magnify the impact of institutional forces associated with information disclosure. For locally-headquartered firms, having establishments revealed to be poorly performing presents a particular embarrassment. Thus institutional pressures are supplemented by internal pressure to improve to avoid fracturing the firm's relationship with its home community. For private firms, institutional pressures associated with information disclosure may be more salient because the more concentrated owners in private firms can more readily be targeted and, once pressured, have the discretion to pursue the environmental improvements even if there is no short-term profit benefit.

With regard to capabilities, we find that larger establishments improve more rapidly than smaller ones. This result suggests that, in the current setting, larger establishments' greater resources and visibility appear to outweigh their potential ability to resist institutional pressures. Our finding extends

prior research on the size-responsiveness relationship (see, e.g. Goodstein 1994), as we employ a dynamic analysis and control for localized conditions and prior establishment performance.

Further research is necessary to more fully understand how organizational factors mediate institutional pressures. For example, while we find that larger establishments improve more rapidly, others have theorized that larger establishments are more likely to resist institutional pressures rather than acquiesce to them (Oliver 1991), and distinguish such circumstances remains open theoretical and empirical questions. Perhaps, for example, larger establishments are more likely to resist if they are located in areas of high unemployment. Similarly, establishments in a region's predominant industries may have greater leverage to resist local pressures. Overall, while our results suggest that internal pressures magnify external pressures, it is important to further investigate the conditions under which those internal pressures will be manifested.

6.2 Contributions to information disclosure

Despite the proliferation of mandatory information disclosure as a regulatory approach, few studies have examined the extent to which it actually changes organizational behavior in ways that policy makers intend (Fung et al. 2009). The need for evaluation is especially great in the field of environmental policy, where information disclosure is especially prevalent and often referred to as the "third wave" of policy instruments, following earlier eras of command-and- control (e.g., technological requirements) and market-based mechanisms (e.g., tradable permits) (Delmas, Montes-Sancho, and Shimshack, forthcoming; Tietenberg, 1998).

Our analysis of the degree of improvement in toxic releases focuses on establishment and firm-level factors that, in the face of revelation of poor performance, increase the pressure to improve and/or the capability to do so. We find three significant results. First, establishments that are located near their headquarters improve faster than other establishments. Second, larger establishments improve more slowly than small ones. Finally, establishments that belong to publicly-traded firms improve more slowly than those that are owned by privately-held firms.

With respect to the effect of proximity of headquarters, there are two potential explanations for our finding. First, it may be that firms are particularly careful to protect their images close to their homes. This is consistent with prior research that has argued that firms are embedded in their headquarters' communities, and therefore are more concerned with their reputations within those communities (Audia and Ryder 2009; Marquis and Battilana 2010). Our result could also, however, indicate that the establishments that are proximate to headquarters are benefiting from easier transfer of knowledge and thus can improve more readily than those that are distant from headquarters. Again, this is consistent with prior research on knowledge transfer (Szulanski 1996) and on the effect of distance on changes in environmental performance (Berchicci et al. 2010). We also find that firms close to their headquarters reduce their emissions of hazardous air emissions at a greater magnitude than total air emissions, which may demonstrate firms acting as "good citizens" in their local communities. Future work could attempt to untangle these two effects to see which one dominates, or if in fact both are present.

We do note that our result regarding headquarters proximity contradicts recent research in sociology. Grant, Jones, and Trautner (2004) find no difference in pollution rates between facilities that are in the same state as their headquarters and those that are not. Their analysis, however, did not consider improvement over time, but rather absolute levels of emissions, and the use of a broader geographic region may mute the effects of both community embeddedness and transfer of routines.

Our finding that larger establishments improve less rapidly than their smaller counterparts suggests that large facilities are more exposed or susceptible to local pressures that follow the revelation of poor performance. It follows from our theory that large facilities exhibit faster rates of improvement given that these establishments are more visible and thus are likely to be under greater scrutiny, and that they possess greater resources to invest in the necessary improvements. Again, research in sociology has addressed this question, arguing that large establishments have the ability to abuse their powerful positions within society, including the ability to create disproportionate levels of pollution (Freudenberg 2005; Grant, Bergesen, and Jones 2002). Our research extends the prior work by employing a dynamic

analysis that examines improvement over time, and by using the natural experiment provided by the addition of chemicals to the TRI to assess how initial performance affects subsequent improvement. Our findings are partially incongruous with the findings in sociology. Though larger establishments improve in total emissions, we find that there is no significant difference in the rate of improvement of hazardous air chemicals between large and small establishments, which may provide evidence for firm "green washing" behavior.

Finally, this is the first research of which we are aware that has compared the environmental performance of facilities that are owned by publicly-traded versus privately-held parent companies. We find that establishments owned by public firms improve significantly more slowly than their private counterparts. There are at least two reasons for this finding, which again, we are not yet able to fully untangle. First, public firms are generally expected to experience greater pressures to achieve growth (Mascarenhas 1989). This pressure may manifest itself in an unwillingness to undertake investment in environmental improvements as these projects may have less certain returns or longer payback periods. Second, private firms, which generally have more concentrated ownership, may be able to undertake projects that create other forms of utility to their owners, which Berrone et al. (2010) label "socioemotional wealth." We do find evidence that the magnitude of improving hazardous air emissions is much larger than total air emissions for private firms, which is suggestive of private firms acting as "good citizens" in their communities. These explanations, of course, are not mutually exclusive, as each of them is indicative of the tendency on the part of private firms to make investments in environmental improvement even if the financial returns are unclear. Future work, however, is needed in order to delve more deeply into not simply whether public or private firms are more environmentally friendly, but under what circumstances one type of ownership will be most likely to lead to greater environmental performance.

Beyond the narrow interpretation of our results in terms of what factors affect improvement in toxic releases, our findings extend prior work on strategic responses to institutional pressures (Oliver

1991). We have held the institutional change constant here by examining reactions to the post-1995 addition to the TRI chemicals, and have varied the pre-1995 performance and attributes of the establishments to assess how rapidly facilities improve once the new data are released. We find that a complex interplay of initial performance and internal and external pressures affects subsequent improvement. Policy makers, local pressure groups, and managers who want to bring about improvement in subsidiary performance need to understand such complexities and account for these complexities in their attempts to improve the effectiveness of information disclosure programs.

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Table 1. Sample description

SIC	Industry	Facilities	Percent
17	Construction special trade contractors	216	0.6%
20	Food and kindred products	2,786	7.3%
22	Textile mill products	693	1.8%
23	Apparel and other finished products made from fabrics and similar materials	107	0.3%
24	Lumber and wood products, except furniture	1,197	3.2%
25	Furniture and fixtures	820	2.2%
26	Paper and allied products	1,024	2.7%
27	Printing, publishing, and allied industries	551	1.5%
28	Chemicals and allied products	4,683	12.3%
29	Petroleum refining and related industries	502	1.3%
30	Rubber and miscellaneous plastics products	2,157	5.7%
31	Leather and leather products	133	0.4%
32	Stone, clay, glass, and concrete products	1,486	3.9%
33	Primary metal industries	2,637	6.9%
34	Fabricated metal products, except machinery and transportation equipment	4,348	11.4%
35	Industrial and commercial machinery and computer equipment	2,552	6.7%
36	Electronic and other electrical equipment and components, except computer equipment	2,591	6.8%
37	Transportation equipment	1,912	5.0%
38	Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks	875	2.3%
39	Miscellaneous manufacturing industries	607	1.6%
42	Motor freight transportation and warehousing	299	0.8%
49	Electric, gas, and sanitary services	668	1.8%
50	Wholesale Trade-durable Goods	971	2.6%
51	Wholesale Trade-non-durable Goods	1,526	4.0%
52	Building materials, hardware, garden supply, and mobile home dealers	124	0.3%
55	Automotive dealers and gasoline service stations	279	0.7%
59	Miscellaneous retail	130	0.3%
73	Business services	410	1.1%
76	Miscellaneous repair services	110	0.3%
87	Engineering, accounting, research, management, and related services	312	0.8%
	Other	1,343	3.5%
	Total	38,049	100%

Table 2. Sample statistics

Panel A. Summary Statistics

Variable	Obs	Mean	Std.	Min	Max
1. Toxic releases to all media of 1995 listed chemicals (log pounds)	216,828	0.97	3.09	0.00	18.62
2. Toxic releases to air of 1995 listed chemicals (log pounds)	216,610	0.56	2.28	0.00	16.90
3. Hazard associated with toxic releases to air of 1995 listed chemicals (log)	216,518	0.83	3.56	0.00	32.58
4. Public owner*	159,061	0.29	0.45	0.00	1.00
5. Same city as headquarters*	213,762	0.38	0.48	0.00	1.00
6. Greater than state median employment*	164,215	0.51	0.50	0.00	1.00
7. Relative production level (log)	216,828	0.10	0.57	-2.30	9.82
8. Employees (log)	216,828	3.67	2.11	0.00	10.09

Panel B. Correlations

Variable	1	2	3	4	5	6	7	8
1. Toxic releases to all media of 1995 listed chemicals (log pounds)	1.00							
2. Toxic releases to air of 1995 listed chemicals (log pounds)	0.77	1.00						
3. Hazard associated with toxic releases to air of 1995 listed chemicals (log)	0.65	0.84	1.00					
4. Public owner*	0.10	0.10	0.08	1.00				
5. Same city as headquarters*	-0.08	-0.07	-0.07	-0.41	1.00			
6. Greater than state median employment*	0.09	0.05	0.05	0.26	-0.21	1.00		
7. Relative production level (log)	0.12	0.09	0.07	0.03	-0.03	0.03	1.00	
8. Employees (log)	0.06	0.03	0.03	0.29	-0.08	0.73	0.04	1.00

Notes: * denotes dummy variable whose value is based on facility status in 1993-1994 (before the policy change).

Table 3. Primary OLS Regression Results: Total Releases

		(1)	(2)	(3)	(4)	(5)	(6)
		Including Controls			Omitting Controls		
	Dependent variable:	*Total releases*			*Total releases*		
H1	Same City as HQ × Annual counter	-0.044**			-0.048**		
		[0.006]			[0.006]		
H2	Greater than state median employment × Annual counter		-0.019**			-0.021**	
			[0.006]			[0.006]	
H3	Public owner × Annual counter			0.058**			0.059**
				[0.008]			[0.008]
	Annual counter	0.114**	0.094**	0.067**	0.100**	0.083**	0.055**
		[0.004]	[0.005]	[0.004]	[0.004]	[0.004]	[0.003]
	Relative production level	0.181**	0.175**	0.175**			
		[0.019]	[0.021]	[0.021]			
	Log employees	0.032**	0.045**	0.046**			
		[0.011]	[0.015]	[0.015]			
	Constant	0.974**	0.897**	0.888**	0.759**	0.779**	0.783**
		[0.051]	[0.070]	[0.070]	[0.007]	[0.008]	[0.008]
	Facility-level fixed effects	Included	Included	Included	Included	Included	Included
	Observations (facility-years)	213,762	164,215	159,061	213,762	164,215	159,061
	Number of firms	37,537	29,159	28,279	37,537	29,159	28,279

Notes: Brackets contain standard errors clustered by facility; ** p<0.01, * p<0.05, + p<0.10. The sample includes facility-years during 1995-2000 for all of these models, which are estimated using ordinary least squared (OLS). The dependent variable is log (plus 1) of total releases reported to TRI of the 243 toxic chemicals that were added to the TRI chemical list in 1995. These total releases include those reported as production waste, transfers, and releases to air, land, water, and underground injection.

Table 4. Extension OLS Regression Results: Air Emissions and Air Hazard (including controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	*Air emissions*			*Air hazard*		
Same City as HQ × Annual counter	-0.032**			-0.078**		
	[0.004]			[0.008]		
Greater than state median employment × Annual counter		-0.027**			-0.014	
		[0.005]			[0.009]	
Public owner × Annual counter			0.049**			0.132**
			[0.006]			[0.011]
Annual counter	0.074**	0.067**	0.039**	0.163**	0.125**	0.080**
	[0.003]	[0.004]	[0.003]	[0.006]	[0.006]	[0.005]
Relative production level	0.081**	0.071**	0.070**	0.100**	0.096**	0.093**
	[0.014]	[0.015]	[0.015]	[0.023]	[0.025]	[0.025]
Log employees	0.006	0.019	0.025*	-0.022	0.003	0.005
	[0.009]	[0.013]	[0.013]	[0.017]	[0.024]	[0.024]
Constant	0.617**	0.548**	0.519**	1.039**	0.935**	0.925**
	[0.039]	[0.057]	[0.057]	[0.074]	[0.110]	[0.108]
Facility-level fixed effects	Included	Included	Included	Included	Included	Included
Observations (facility-years)	213,551	164,065	158,911	213,459	164,012	158,858
Number of firms	37,508	29,148	28,268	37,498	29,145	28,265

Notes: Brackets contain standard errors clustered by facility; ** p<0.01, * p<0.05, + p<0.10. The sample includes facility-years during 1995-2000 for all of these models, which are estimated using ordinary least squared (OLS). In the models reported in Columns 1-3, the dependent variable is log (plus 1) of air emissions reported to TRI of the 243 toxic chemicals that were added to the TRI chemical list in 1995. In the models reported in Columns 4-6, the dependent variable is log (plus 1) of hazard-weighted air emissions reported to TRI of the 243 toxic chemicals that were added to the TRI chemical list in 1995, where each chemical was weighted by its Inhalation Toxicity Weight from the EPA's Risk-Screening Environmental Indicators (RSEI) Model.