EXPLAINING BUSINESS PARTICIPATION IN VOLUNTARY ENVIRONMENTAL PROGRAMS

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ABSTRACT

Robert A. Kagan has pioneered the study of business behavior in response to regulation, showing how both external threats, like inspections and enforcement, as well as internal factors, such as management styles, affect responses by regulated firms. In recent years, regulators have taken increasing interest in alternatives to regulations, inspections, and enforcement in order to shape business behavior, specifically by establishing programs designed to reward and recognize firms that adopt proactive measures on a voluntary basis. To explore the reasons that businesses join these voluntary programs and engage in such beyond-compliance behavior, we surveyed a stratified random sample of over 3,000 U.S. facilities to assess their participation in voluntary programs established by environmental regulators. Using simple means-comparison tests of our 678 respondents (23% response rate), as well as logit, Tobit, and Poisson regressions, we identify the factors associated with firm decision making about participation in voluntary programs. We find that facilities are more likely to join voluntary programs and go beyond compliance with environmental regulations if they are larger, have greater support for participation from top-level management, more frequently seek out the opinions of outside groups, and are aware of proposed regulations likely to affect them. Our results confirm, in this new context of regulatory policy, the findings of the literature on traditional compliance that both external and internal factors motivate business behavior -- even when it comes to adopting voluntary measures and participating in optional recognitions programs established by government regulators.

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Through his prodigious body of work, Robert A. Kagan has brilliantly illuminated our understanding of regulation and regulatory enforcement. One of his many important contributions to the field has been his continued observational emphasis on the variability of businesses' behavioral response to government regulation, and his ability to show how this variation depends not only on what regulators do but also on particular factors inside each business organization. For example, his path-breaking work with Eugene Bardach, *Going by the Book*, was premised on the fact that businesses respond differently to regulations and regulators (Bardach and Kagan 1982). Eschewing simple economic models that seek to explain businesses' response to regulation just in terms of the product of the probability of detection and the size of government fines, *Going by the Book* observed that businesses also varied in their "dispositions" toward compliance, with a spectrum of firms that ranged "from most to least compliant -- from 'good apples' to 'bad apples'" (Bardach and Kagan 1982: 64). Twenty years later, in his monumental study, with Neil Gunningham and Dorothy Thornton, of pulp and paper mills' responses to environmental regulatory requirements, Kagan again showed how firms' behavior could only partly be explained by the series of external regulatory, economic, and community pressures bearing down on the firm. Calling attention to something akin to firms' dispositions -- a "management style," consisting of a particular "combination of managerial attitudes and actions that mark the intensity and character of each management's 'commitment' to environmental compliance and improvement" (Gunningham, Kagan & Thornton 2003: 96-97) --

Kagan reported that management style turned out to be "a more powerful predictor of mill-level environmental performance than … regulatory regime" (Ibid. at 96; *see also* Kagan 2006).

The Gunningham, Kagan, and Thornton study of pulp and paper mills drew on a relatively small sample of facilities, but its core finding about the importance of factors internal to the business organization has been confirmed in further small-sample research of businesses in other sectors (Howard, Nash and Coglianese 2008). The question remains, though, whether the importance of such internal factors -- like a firm's disposition or style -- generalizes beyond the confines of small sample qualitative research. Perhaps what Kagan and others have noticed about firms' internal dispositions appears only when looking at businesses up close, and that external factors such as regulatory and economic pressures dominate when considering large numbers of firms across the entire economy.

To explore at a broader scale the determinants of business behavior, we developed a survey instrument that asked U.S. facility managers to report on their facilities' operations and participation in government-sponsored voluntary environmental programs.[1] In recent years, environmental regulators have taken increasing interest in voluntary programs to supplement traditional regulations for environmental protection. In the United States, programs such as National Environmental Performance Track and the 33/50 Program have attracted hundreds of industry participants who have voluntarily pledged to improve their environmental performance. To understanding the characteristics of facilities that engage in "beyond compliance" behavior by participating in these programs, and the factors affecting their decisions to do so, we report in this paper the findings from a survey of over 675 facilities. The goal of the survey was to identify the characteristics of facilities that are more likely to participate in voluntary

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environmental programs and go beyond compliance with existing environmental regulations and to explore their managers' perceptions about such choices. This paper presents our analyses of the survey data, including comparisons of the responses of different groups of facilities using both simple means tests and more sophisticated regression analysis.

We begin by briefly reviewing the literature on voluntary programs and beyond compliance behavior and outline theories of participation in voluntary programs. These theories guided the design of our survey, and we compare our results to their predictions. In Section 2, we describe our two samples and characterize our respondents. Section 3 presents the results of comparisons between facilities that participate in Performance Track, an important national voluntary program, and those that do not. We identify several key differences, including that Performance Track members report higher levels of internal support for environmental activities. In Section 4, we use regression analysis to explore the characteristics of facilities that make voluntary investments in environmental protection and their reasons for doing so. We identify several key factors associated with higher degrees of beyond compliance behavior, including size, awareness of impending regulations, and, once again, internal support for environmental activities. We conclude by highlighting our primary result: that internal, organizational factors are fundamental to explaining business facilities' beyond compliance behavior.

1. Theories of Participation in Voluntary Programs

Classic deterrence theory in economics suggests that firms will not control their pollution releases or otherwise take action to benefit the environment unless required by regulation and enforced through penalties for non-compliance. Nonetheless, in recent decades, many firms

have come to participate in voluntary programs for environmental protection or reduce pollution beyond what is required by law. For example, Mazurek (1998) reports that the U.S. EPA and industry trade organizations developed 42 nationwide voluntary programs between 1988 and 1998, and that OECD countries have about 350 such programs and initiatives. Nash and Coglianese (2006) note that about 575 facilities have joined the National Environmental Performance Track since its launch in 2000, and Borck, Coglianese, and Nash (2008a) analyze 17 of the many voluntary programs administered by U.S. states.

Participation in Performance Track or other similar programs is strictly voluntary -- but the voluntary nature of participation in these programs does not make business behavior here qualitatively different from behavior in response to regulatory commands. Much regulatory compliance is voluntary too. As government officials quoted by Bardach and Kagan (1982:65) opined, "at least 95 percent of compliance comes voluntarily." Moreover, as Gunningham, Kagan, and Thornton's (2004) study of pulp and paper mills showed, facilities often perform better than expected. In a separate analysis of U.S. pulp and paper plants over a nine-year period, Borck (2008) found that plants violated their water pollution discharge limits only about 2% of the time and reported discharges 58 percent below allowable pollution levels on average.

Although voluntary programs and initiatives are plentiful, the evidence on their effectiveness is mixed. Some studies in the literature document voluntary initiatives that have induced beyond-compliance behavior. For example, Bennear (2007) found that state-level management-based environmental regulations, which mandate pollution prevention planning but do not mandate pollution reductions, nonetheless was associated with reductions in the toxic releases of manufacturing facilities. Several recent case studies of voluntary programs in the

U.S., Europe, and Japan found that certain programs reduced energy use and greenhouse gas emissions around 5 percent (Morgenstern and Pizer 2007).

On the other hand, other studies have questioned the effectiveness of voluntary initiatives. For example, Bui (2005) reported that reductions of releases of toxic chemicals under the U.S. Toxic Release Inventory program – a program for which reporting emissions is mandatory, but reducing them is not – may not be a direct effect of the program itself but more likely an indirect effect of the enforcement of traditional regulations affecting non-toxic chemicals. Coglianese and Nash (2004) find that reductions under the Massachusetts version of the federal Toxics Release Inventory are less substantial than initially appears. In addition, Gamper-Rabindran (2005) finds that manufacturing plants that participated in the EPA's voluntary Industrial Toxics program did not reduce their toxic releases so much as transfer some of their releases offsite to recyclers.

Verifying the existence of beyond-compliance behavior and determining the effectiveness of voluntary initiatives require careful statistical analyses of the trends in pollution releases.[2] The studies cited above represent a start. But whether beyond-compliance behavior is widespread or limited, and whether voluntary programs do or do not yield demonstrable impacts on the environment, the conventional wisdom is that voluntary environmental stewardship among firms is occurring on both a nontrivial and increasing basis. Anyone interested in understanding business behavior in a regulatory setting would do well to consider why businesses would voluntarily join programs established by government regulators.

Reasons for Beyond-Compliance Behavior

[2] For an overview of the challenges inherent in estimating the effects of voluntary programs, see Borck, Coglianese, and Nash (2008b).

Studies such as Lyon and Maxwell (1999), Portney (2005), and Reinhardt (2005) synthesize current thinking about firms' reasons for voluntary environmental action. Much of the existing literature suggests that firms engage in beyond-compliance behavior for one or more of three general reasons:

(1) Beyond-compliance behavior benefits the firm.

(2) Beyond-compliance behavior benefits the decision maker in the firm.

(3) Going beyond compliance is the right thing to do.

Understanding each of these reasons in some detail will help clarify what researchers already know – and what we still need to learn – about business decision making related to voluntary environmental programs.

Reason 1: Beyond-compliance behavior benefits the firm.

Firms may voluntarily engage in beyond-compliance behavior to increase profits. A firm that goes beyond compliance may boost revenues by increasing buyers' willingness-to-pay for its goods or services, because buyers value environmental protection, or by increasing sales of its goods or services, because buyers who value environmental protection choose to purchase from firms that engage in it (Reinhardt 2000). Alternatively, a firm that goes beyond compliance may reduce costs. This could occur if the adoption of resource-efficient processes reduces input costs, but also through efficiencies in a business' relationships with workers, environmental

interest groups, and the government. For example, firms may cut costs by attracting more productive workers who value working for an environmentally friendly firm or by increasing the productivity of current workers who value working for an environmentally friendly firm. Firms may also cut costs by winning favorable treatment from the regulator in the enforcement of other, mandatory environmental regulations or by winning favorable treatment from the regulator in the development of future mandatory regulations (Lyon and Maxwell 2004). Conversely, firms may avoid costs by earning favorable treatment from interest groups with influence over customers and the regulator.

Reason 2: Beyond-compliance behavior benefits the decision maker in the firm.

The literature also suggests that facilities may participate in voluntary programs or go beyond compliance with environmental regulations because doing so is beneficial to the decision makers within firms or facilities. These decision makers may act in their own interest, even if doing so reduces the firm's profit. It is the classic principle-agent problem in economics. The firm's goal is to maximize profits, but a particular CEO, manager, environmental decision maker has discretion about how to achieve this goal (Elhauge 2005). He is, of course, influenced by economic incentives, because his compensation is likely tied to the firm's profits. But his personal and professional relationships with society or his own attitude about the environment may also affect his decision making (Vandenbergh 2003). Thus, his choice of how much pollution to release, how much to clean up, and how to act toward the environment in general may deviate from the profit-maximizing amount for the firm.

Reason 3: Going beyond compliance is the right thing to do.

CEOs, facility managers, and other decision makers within firms may respond to concerns other than their own interests and their firms' profits. In particular, they may choose to invest voluntarily in environmental protection because they believe, or are convinced, that it is simply the right and moral thing to do. Some academic work and the popular press accounts document numerous normative appeals to corporate responsibility(Jackson and Nelson 2004). Many activists believe that firms have a moral obligation to protect the environment. And perhaps some firms may do so, not because it increases their profits or their decision makers' levels of satisfaction, but because they see it as their responsibility.

A Complementary Framework: The "License to Operate"

An alternative way to understand beyond-compliance behavior and participation in voluntary environmental programs is to examine the pressures that influence facilities' environmental decision making. Each facility must respond to and balance these pressures; only by doing so can it maintain its "license to operate." Gunningham, Kagan, and Thornton (2003, 2004b) developed the concept of the "license to operate," and Howard-Grenville, Nash, and Coglianese (2008) expanded upon it.

Gunningham, Kagan, and Thornton (2003) identify three sources of external pressure on facilities: (1) economic or competitive pressure, (2) regulatory pressure, and (3) social or community pressure. These external factors all influence facility choices, including how much to pollute and how often to go beyond compliance. As already noted, Gunningham, Kagan, and

Thornton also emphasize the importance of "management style" as more of an internal disposition affecting firm behavior. Howard-Grenville, Nash, and Coglianese (2008) elaborate on management style by identifying specific internal factors such as managers' perceptions and incentives, organizational identity and culture, and organizational structure that help explain how facilities perceive and deal with environmental problems.

The three reasons for environmentally friendly behavior noted in the previous section overlap with the sources of external and internal pressures that make up the "license to operate." Facilities that make voluntary investments in environmental protection because it is profitable are certainly motivated by the economic or competitive pressure to make money and may be responding to regulatory pressure in hopes of earning economic carrots or avoiding economic sticks for good environmental behavior. Facilities that make voluntary investments in environmental protection because their managers support it are influenced by internal pressures and in particular the incentives their managers face. Facilities that make voluntary investments in environmental protection because it is the right thing to do may be responding to either social norms and pressure, or internal pressure from their managers or employees, or both. The mapping of the three reasons to the various types of pressures is not always one-to-one. Nevertheless, the two frameworks propose complementary explanations for why some firms go beyond compliance with regulations and participate in voluntary programs.

Testing the Theories

The empirical literature on beyond-compliance behavior and participation in voluntary environmental programs is growing but remains incomplete. A number of empirical studies

document the role of customers, managers, regulatory, and interest groups in inducing overcompliance with regulations and participation in voluntary programs. For example, Gunningham, Kagan, and Thornton (2003) interviewed managers at 14 pulp plants in four countries and found that social pressures and managers' attitudes toward the environment strongly affected plants' water pollution discharges. Moreover, the facilities seemed to make investments in pollution control technology in anticipation of pending regulatory rules. Their findings provide support for both external and internal pressures within the license to operate. Other studies have similarly found that social pressures matter (e.g., Winter and May 2000). By and large, existing research has investigated patterns of pollution within prominent industries or by looking deeply into the decision making in a handful of facilities (e.g., Prakash 2000). While important and insightful, these studies do not allow researchers to uncover broader patterns about the types of facilities that go beyond compliance or of the factors that influence facilities' decisions across industries.

This paper aims to use a large-sample survey to identify the factors that make businesses more likely to join voluntary programs and in this way to go beyond compliance. What kinds of facilities are more likely to join voluntary programs and go beyond compliance with existing environmental regulations? Which benefits and costs of voluntary programs seem to matter across a large sample of facilities? Are facilities' decisions regarding voluntary environmental protection driven simply by profit? By outside influences? By internal dynamics? Are the conclusions from the small-sample empirical literature to date reflected in larger, broader samples? The remainder of this paper addresses these questions.

2. Sample Selection, Responses, and Representativeness

In the initial stages of this study, we developed, distributed, and analyzed a survey of U.S. facilities asking their managers to report on their facilities' operations and environmental decisions. We mailed our surveys in four rounds on September 13, 2005, November 28, 2005, April 24, 2006, and June 15, 2006. We treated all responses as anonymous and confidential.

Our datasets in this study consist of the responses from two groups of facilities in our mailing: (1) 601 facilities that have applied to Performance Track, and (2) a stratified random sample of 3,346 facilities in four industry sectors that have large numbers of Performance Track members.

Sample 1: Sample of Facilities that Applied to Performance Track

Our first sample draws on Performance Track membership data current as of May 17, 2005. At that time, 601 facilities had applied to Performance Track. Of these, 343 facilities were active members and another 258 facilities had either been accepted into the program and subsequently withdrawn or had applied but had not been admitted. We obtained contact information for each facility from the application it submitted for membership in the Performance Track program. EPA posts the applications of active members on the Performance Track website. Industrial Economics, Inc., a consulting firm based in Cambridge, Massachusetts, and under contract with EPA to support the Performance Track program, provided us with the other applications. We sent the survey to 601 Performance Track facilities.

Sample 2: Stratified Random Sample of Facilities in Four SIC codes

Performance Track members come from a diverse set of industrial sectors. In their applications to the program, facility managers noted activity in 164 SIC codes (Booz Allen Hamilton 2005). Although membership in the program is diverse, the activity of nearly half of all members (45%) falls within sectors designated by just five 2-digit SIC codes: chemicals and allied products (SIC code 28), instruments and related products (SIC code 38), electronic and other electrical equipment (SIC code 36), paper and allied products (SIC code 26), and transportation equipment (SIC code 37) (Booz Allen Hamilton 2005).

Using EPA's Environmental Compliance History On-Line (ECHO) database, we constructed a stratified random sample of 3,280 facilities from four of these five sectors. We omitted sector 38 from our sample because fourteen Performance Track members in SIC 38 are owned by a single parent company, Johnson & Johnson. As of May 2005, Johnson & Johnson had 39 facilities in Performance Track, more than any other firm. Given the dominance of this one company in this SIC code, we concluded that we would not obtain as much explanatory variation by sampling this sector.

The EPA has compiled information about 18 industry sectors in "Sector Notebooks." The Notebooks describe industry characteristics such as size, geographic distribution, industrial processes, environmental practices, regulatory framework, and compliance history. Within the 2-digit SIC codes 26, 28, 36, and 37, we narrowed our sample to include facilities with the same 4-digit SIC codes that EPA had studied in a Sector Notebook. For SIC 28, for example, we drew our sample from SIC 2861, 2865, and 2869. Table 2.1 details our sample.

Of the 3,280 facilities in our stratified random sample, 66 had applied to Performance Track. We increased the size of our stratified random sample to make up for these Performance Track facilities. Thus, we distributed our survey to a stratified random sample of 3,346 facilities in the four sectors shown in Table 2.1. As noted in Table 2.1, we tried to sample 900 facilities from each sector. In the pulp-and-paper sector, however, there were only about 600 facilities in the entire population, so in that case we simply surveyed all of the listed firms.

Responses from Both Groups

We received completed responses from 678 facilities: 153 from Sample 1, the Performance Track-only sample, and 525 from Sample 2, the stratified random sample from four SIC codes, which included some Performance Track facilities. For convenience, we refer to the respondents from Sample 1 as the "Performance Track" sample or dataset and the respondents from Sample 2 as the "stratified random sample" or simply the "random sample." Of the Performance Track sample, 14% of our surveys were returned by the Post Office as undeliverable. Of the random sample, 26% of our surveys were undeliverable. Considering only those surveys that were delivered, then, our response rate was 33% for the Performance Track sample and 21% for the random sample. Table 2.2 shows response rates within each SIC code for Sample 2. Twenty-nine of the 525 respondents from the random sample had applied to Performance Track. Thus, our total responses from all 678 facilities included responses from 182 Performance Track facilities (153 from the Performance Track sample and 29 from the random sample), and 496 non-Performance Track facilities (all from the random sample). Table 2.3 summarizes these details.

Table 2.1. Details for Stratified Random Sample of Facilities

4-Digit SIC Codes	NAICS Equivalents	Sector Description	# of Facilities from ECHO (as of May 17, 2005)	Sample Size		
				Non-Performance Track Facilities	Performance Track Facilities	Total
2611, 2621, 2631	322110, 322121, 322122, 322130	Pulp & Paper	595	580	15	595
2861, 2865, 2869	325110, 325120 (part), 325132, 325188 (part), 325191, 325192, 325193, 325199 (part)	Organic Chemicals	1718	900	17	917
3671, 3672, 3674	334411, 334412, 334413	Electronics	1008	900	26	926
3711, 3713, 3714	336111, 336112, 336120, 336211, 336312, 336322 (part), 336330, 336340 (part), 336350, 336399 (part), 336992 (part)	Motor Vehicle Assembly	1653	900	8	908

Table 2.2. Response Rates within SIC Code for the Stratified Random Sample

Two-digit SIC codes		Original Random Sample Size	Surveys Undelivered	Surveys Completed and Returned	Response Rate
26	Total	580	136	108	24%
	Performance Track	15	0	7	47%
28	Total	900	212	132	19%
	Performance Track	17	0	7	41%
36	Total	900	304	110	18%
	Performance Track	26	1	12	48%
37	Total	900	228	146	22%
	Performance Track	8	0	3	38%
	Total	3346	881	525	21%

Table 2.3. Performance Track Facilities in Each Sample

	Performance Track Facilities	Non-Performance Track Facilities	Total
Performance Track Sample	153	0	153
Stratified Random Sample	29	496	525
Total	182	496	678

Characteristics of Facilities

The average facility that responded to our survey had been in operation for 30 years and had 300 full-time-equivalent employees. On average, 1.5 of these employees held responsibility for environmental management. About three quarters of the facilities across our samples had implemented an environmental management system (EMS). On average, respondent facilities had annual sales of $80 million. Most were owned by a parent company with operations both inside and outside the United States. The samples were roughly balanced between privately held facilities and publicly traded facilities. Table 2.4 shows summary statistics for the 678 facilities in our dataset.

Characteristics of Respondents

We asked that the survey be completed by the person at each facility knowledgeable about its environmental management. The typical respondent was a male with an average of 14 years of experience in environmental management and who reported spending about 20 hours per week on environmental management activities. Over 70 percent of the 678 respondents had the word “environment” or “environmental” in their job titles. Respondents from the Performance Track and random samples were generally the same. Table 2.5 summarizes the characteristics of the respondents.

Table 2.4. Characteristics of Facilities

Ownership of facility	49.6% privately held 46.6% publicly traded 3.0% government 0.9% blank or other
Is facility owned by a parent company?	84.1% yes 14.4% no 1.4% blank or other
If owned by a parent company, does it have operations outside the United States?	86.1% yes 13.0% no 0.9% blank
Age of physical facility (buildings and equipment) (median)	30 years (n = 665)
Annual sales (median)	$80 million (n = 384)
Buyers of product	51.6% to intermediary organizations 12.2% directly to consumers 28.3% to both 7.8% blank, other, or not applicable
Full-time-equivalent employees (FTEs) (median)	300 FTEs (n = 665)
Full-time-equivalent employees responsible for environmental management (median)	1.5 FTEs (n = 662)
Has the facility implemented an EMS?	74.8% yes 9.6% started 6.5% considering 6.8% no 2.4% blank or other

Table 2.5. Characteristics of Respondents in Each Sample

	Both Datasets	Performance Track Sample	Stratified Random Sample
Gender of respondent	76.3% male 20.4% female 3.4% blank	77.1% male 22.2% female 0.6% blank	76.0% male 19.8% female 4.19% blank
Years of experience of respondent (median)	14 years (n = 663)	14 years (n = 513)	14 years (n = 150)
Time spent on the environment (median)	20 hours per week (n = 665)	20 hours per week (n = 515)	20 hours per week (n = 150)
"Environment" in job title	71.8% yes 27.1% no 3.8% blank	73.2% yes 24.8% no 2.0% blank	69.1% yes 26.5% no 4.4% blank

Representativeness of Respondents from the Random Sample

We found no patterns that indicate that our respondents differ significantly from the underlying population of facilities, except possibly that our respondents may be somewhat larger facilities. Table 2.6 compares the mean, median, and distribution of full-time employees reported by our respondents from the random sample to those for the corresponding industrial sectors as a whole, using data taken from the 2002 Economic Census (U.S. Census Bureau 2005). It also compares the average annual sales reported by our respondents from the random sample with the average value of shipments overall for the corresponding industrial sectors.

Note that for all four general SIC codes from which we drew the random sample, the respondents to our survey are generally larger than typical facilities in the corresponding industrial sectors. For our respondents, the distributions of full-time employees skew higher, and the average numbers of employees per facility and annual sales per facility are higher. The median number of employees per facility is also higher, except possibly for SIC code 26, where the median for our respondents is 288 and for all facilities is some unknown number greater than 100. Overall, it appears that the facilities that responded to our survey are on the larger end of the distributions of facilities in those sectors.

That our respondents are on the larger end of the distribution of facilities in their overall sectors, however, does not tell us whether they are larger than the facilities that did not respond to our survey. This is because our random sample was drawn from the U.S. EPA's Enforcement and Compliance On-Line (ECHO) database. Not all facilities report to ECHO. For example, "minor" facilities under the Clean Air Act are not required to report to ECHO.[3] The EPA

[3] Section 112 of the Clean Air Act defines a "major source as any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering

cautions against the completeness and reliability of ECHO data from small facilities. However, these small facilities *are* part of the 2002 Economic Census data reported in Table 2.6. In other words, the statistics presented in Table 2.6 likely include many small facilities that were not part of the group from which we constructed our random sample. Unfortunately, ECHO provides no data on facility size or sales volume which we could compare our respondents with non-respondents. Thus, we used Census data for our comparisons, and so it should not be surprising that the responding facilities in the random sample drawn from ECHO are larger on average than the average facility in the more-inclusive Census dataset.

Another problem with the comparison presented in Table 2.6 is that ECHO and the Economic Census (both in 2002 and in 1997) classify facilities differently. ECHO classifies by Standard Industrial Classification (SIC) codes, whereas the Economic Census data are grouped by North American Standard Industrial Classification (NAICS) codes. Unfortunately, the older SIC codes do not always correspond in a simple way with the newer NAICS codes. Several individual NAICS codes overlap only in part with our sampled SIC codes. Thus, the statistics in Table 2.6 include all facilities in any NAICS code that overlaps, in full or in part, with one of our sampled SIC codes.

Ideally, we would like to compare the sizes of our respondent facilities in the random sample to the sizes of all facilities in ECHO in the same SIC subgroups. Unfortunately, despite our efforts to obtain data on facility size from ECHO, such data are unavailable. We can, however, compare our respondents with the facilities in ECHO by looking at the proportions of facilities that self-report having various environmental permits and identification numbers with government data from ECHO on the proportions of facilities with these permits and

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controls, in the aggregate, 10 tons per year or more of any hazardous air pollutant or 25 tons per year or more of any combination of hazardous air pollutants." Other facilities are "minor sources."

identification numbers. Table 2.7 shows the results of this comparison. Compared with facilities currently included in ECHO – which is itself a slightly different group of facilities included in ECHO when we first constructed our random sample – more of our respondents report that they hold air pollution and water permits, and fewer report havinghazardous waste ID numbers. These trends are consistent across all four SIC groups.

To the best of our knowledge, our survey does not provide any other ways to check the representativeness of our dataset. Although the data suggest that the facilities from the random sample that responded to the survey may be larger and somewhat different in the permit statuses than the rest of the facilities in their sectors, we have no compelling reason to conclude that our respondents are not typical of the non-respondents or that the results of our analysis are not generalizable.

Table 2.6. Facility Size: Comparing stratified random sample respondents with all facilities in Census in similar sectors

Sector	Sector (SIC Codes)	Group	Number of facilities	Facilities w/ 1-19 employees	Facilities w/ 20-99 employees	Facilities w/ 100+ employees	Facilities that did not report FTEs	Employees Per Facility	Value of Shipments/Annual Sales Per Facility ($1,000)
26	Pulp and Paper (2611, 2621, 2631)	2002 Economic Census	560	66 11.8%	163 29.1%	331 59.1%		284 (mean) 100+ (median)	125864
		Respondents from Random Sample	115	2 1.8%	12 10.5%	100 87.7%	1	390 (mean) 288 (median)	689000 (n = 59)
28	Organic Chemicals (2861, 2865, 2869)	2002 Economic Census	3390	2000 59.0%	963 28.4%	427 12.6%		58 (mean) 1-19 (median)	33211
		Respondents from Random Sample	139	4 3.0%	62 45.9%	69 51.1%	4	228 (mean) 100 (median)	452000 (n = 73)
36	Electronics (3671, 3672, 3674)	2002 Economic Census	2070	1161 56.1%	577 27.9%	332 16.0%		110 (mean) 1-19 (median)	34895
		Respondents from Random Sample	122	5 4.2%	20 16.7%	95 79.2%	2	914 (mean) 310 (median)	1090000 (n = 83)
37	Motor Vehicle Assembly (3711, 3713, 3714)	2002 Economic Census	5850	3362 57.5%	1272 21.7%	1216 20.8%		137 (mean) 1-19 (median)	69764
		Respondents from Random Sample	149	2 1.4%	8 5.4%	137 93.2%	2	784 (mean) 425 (median)	1110000 (n = 94)

Table 2.7. Environmental Permits: Comparing stratified random sample respondents with all facilities in ECHO in same sectors

	Sector	ECHO facilities (as of September 30, 2006)	Percentage of Facilities in ECHO	Facilities in Random Sample	Percentage of Facilities in Random Sample
Total number of facilities	Pulp and Paper (26)	581		115	
	Organic Chemicals (28)	1768		139	
	Electronics (36)	1010		122	
	Motor Vehicle Assembly (37)	1717		140	
Facilities with air pollution permits	Pulp and Paper (26)	540	92.9	115	100.0
	Organic Chemicals (28)	1375	77.8	129	92.8
	Electronics (36)	374	37.0	91	74.6
	Motor Vehicle Assembly (37)	1305	76.0	133	95.0
Facilities with water permits	Pulp and Paper (26)	365	62.8	100	87.0
	Organic Chemicals (28)	843	47.7	128	92.1
	Electronics (36)	136	13.5	99	81.1
	Motor Vehicle Assembly (37)	434	25.3	115	82.1
Facilities with hazardous waste ID numbers	Pulp and Paper (26)	515	88.6	96	83.5
	Organic Chemicals (28)	1534	86.8	112	80.6
	Electronics (36)	944	93.5	103	84.4
	Motor Vehicle Assembly (37)	1497	87.2	118	84.3

3. Comparing Performance Track Facilities with Non-Performance Track Facilities

Performance Track program has been viewed by some within the EPA as the agency's flagship effort to motivate private sector improvements without imposing prescriptive rules and sanctions (Nash and Coglianese 2006). By comparing facilities in our sample that applied to Performance Track ("Performance Track facilities") with facilities in our sample that did not apply to Performance Track ("non-Performance Track facilities"), we can identify the characteristics of facilities that participate in a major voluntary program and explore, at least in a preliminary way, their reasons for doing so.

Sample and Methods

The comparison groups in this section are slightly different from the respondents to the Performance Track sample and random sample described in Section 2. The "Performance Track facilities" group in this section includes all the 153 respondents from the Performance Track sample *plus* the 29 respondents from the stratified random sample of facilities that happened to also apply to Performance Track.[4] Thus, the "Performance Track facilities" dataset in this section includes 182 facilities in total. The "non-Performance Track facilities" dataset consists of the 496 respondents from the random sample that did not apply to Performance Track.

In the section below, we compare the responses of Performance Track facilities and non-Performance Track facilities across several broad categories: characteristics of the facilities,

[4] In this paper, we are most interested in understanding facilities' decisions to apply to Performance Track and other voluntary programs, not on the EPA's decisions of which facilities to admit to the program. Thus, we include in this group facilities that applied to Performance Track, not just facilities that applied and were accepted into the program. For an analysis of the EPA's selection process, see Yu and Coglianese (2006).

perceptions of benefits and costs of participating in voluntary programs, and the decision to join voluntary programs or engage in beyond-compliance behavior. Our primary method is to compare means of the variables between the groups. In most cases, we conduct t-tests of the equality of these means and report the p-value of the test. In the first half of Section 4, we repeat these tests on subsets of the stratified random sample of facilities. Readers interested in the Performance Track program specifically may be most interested in the results in this section. Readers more interested in voluntary programs in general may be more interested in the results in Section 4.

Results of Comparisons of Means

Table 3.1 compares descriptive characteristics of the Performance Track facilities and the non-Performance Track facilities. Performance Track facilities are less likely to be privately held companies and more likely to be government entities than non-Performance Track facilities. Performance Track facilities are more likely than non-Performance Track facilities to sell their product or service directly to consumers and not to intermediary organizations. On one measure, Performance Track facilities are larger: they employ more workers on average than non-Performance Track facilities. Their annual sales, however, are not significantly greater. Interestingly, Performance Track facilities have fewer permits and legal obligations (from a list of five major permits and legal obligations) than non-Performance Track facilities.[5]

[5] The survey asks respondents to indicate whether each facility has three types of permits: an air pollution permit, water discharge permit, and a hazardous waste discharge (or I.D.) number. In addition, the survey asks respondents whether each facility meets two types of legal requirements: whether it is a PRP at a Superfund site or a similar site and whether it is required to report to the Toxics Release Inventory. Thus, a facility could report up to five of these legal obligations.

Table 3.1. Descriptive Characteristics of Facilities

		Performance Track facilities		Non-Performance Track facilities		p-value*
		n	value	value	n	
ownership	% publicly traded	182	**50.0**	**45.8**	491	0.336
	% privately held	182	**40.1**	**53.6**	491	0.002
	% government	182	**9.3**	**0.6**	491	0.000
	% nonprofit	182	**0.6**	**0.0**	491	0.000
	% of facilities owned by a parent company	178	**86.5**	**84.9**	490	0.602
age	age of facility (mean)	177	**46.9**	**39.0**	486	0.260
	age of facility (median)	177	**30.0**	**30.0**	486	n.a.
size	annual sales (mean)	88	**1.7E+09**	**8.91E+08**	293	0.246
	annual sales (median)	88	**1.0E+08**	**8.00E+07**	293	n.a.
	total FTEs (mean)	177	**956.0**	**592.9**	488	0.000
	total FTEs (median)	177	**450.0**	**252.2**	488	n.a.
customers	% of facilities that sell product directly to consumers	157	**22.9**	**10.0**	468	0.000
	% of facilities that sell product to intermediaries	157	**36.9**	**62.4**	468	0.000
	% of facilities that sell product to both	157	**40.1**	**27.6**	468	0.003
other	FTEs in environment (mean)	174	**6.7**	**3.2**	488	0.065
	FTEs in environment (median)	174	**2.0**	**1.5**	488	n.a.
	number of permits and legal obligations (out of 5)	179	**3.2**	**3.6**	495	0.000

Note: * The p-value is for a t-test of the equality of means.

Table 3.2. Internal Attitudes and Perceptions of Facilities

	Performance Track facilities		Non-Performance Track facilities		p-value*
	n	value	value	n	
top-level management support for voluntary programs	181	**4.6**	**3.7**	492	0.000
level of human resources compared to other facilities	179	**2.9**	**2.5**	483	0.000
frequency of seeking opinions from community or environmental advocacy groups	180	**3.1**	**2.3**	491	0.000
importance of government recognition	181	**3.8**	**3.0**	491	0.000
% aware of new, proposed environmental regulation	179	**63.1**	**60.7**	489	0.575
likelihood of stringent regulation in the future	181	**3.5**	**3.6**	493	0.218

Note: * The p-value is for a t-test of the equality of means. All variables except "% aware of a new, proposed regulation" are measured on qualitative five-response scales that have been converted to a quantitative five-point scale.

Table 3.2 compares internal characteristics and attitudes of Performance Track facilities and non-Performance Track facilities. Respondents from Performance Track facilities report greater support from their top-level management for participating in voluntary programs and greater human resources available for environmental management than do respondents at other facilities. Performance Track facilities more frequently seek out the opinions of community or environmental advocacy groups about environmental issues and value government recognition more highly. A high, and statistically equivalent, percentage of both Performance Track and non-Performance Track facilities are aware of new, proposed environmental regulation that will affect their facilities, and both types of facilities believe that it is between "possibly" and "very likely" that they will be subject to more stringent environmental regulations in the next five years.

Table 3.3 compares the perceived influences outside actors have on the environmental management of responding facilities. We asked respondents to rate the importance of the influence of each actor. Responses ranged from "Not Important" (a numerical score of 1) to "Extremely Important" (a score of 5). Both Performance Track and non-Performance Track facilities rate the influences of government agencies and corporate or organizational headquarters as most important.[6] Least important among Performance Track facilities are the influences of competitors and suppliers, and least important among non-Performance Track facilities are the influences of competitors and environmental advocacy groups.

Performance Track facilities and non-Performance Track facilities differ in several ways in the importance they assign to the influences of several outside actors. Performance Track facilities rate the influences of corporate or organizational headquarters and environmental

[6] For example, the average importance of government agencies among Performance Track respondents is 4.20, or one-fifth of the way between "Very Important" and "Extremely Important".

advocacy groups as more than non-Performance Track facilities. Conversely, Performance Track facilities perceive the influence of government agencies to be less important. Performance Track facilities generally place greater importance, on average, on the influence of other outside actors, but these differences are not statistically significant.

Table 3.3. Importance of Various Influences on Environmental Management of Facilities

	Performance Track facilities		Non-Performance Track facilities		p-value*
	n	value	value	n	
importance of the influence of government agencies	178	**4.20**	**4.40**	491	0.011
importance of the influence of headquarters	180	**4.14**	**3.86**	489	0.003
importance of the influence of customers	179	**3.78**	**3.72**	491	0.532
importance of the influence of shareholders	164	**3.32**	**3.21**	446	0.389
importance of the influence of community groups	178	**3.15**	**2.99**	490	0.107
importance of the influence of environmental advocacy groups	175	**2.91**	**2.55**	489	0.000
importance of the influence of suppliers	177	**2.80**	**2.83**	491	0.757
importance of the influence of competitors	179	**2.54**	**2.47**	490	0.493

Note: * The p-value is for a t-test of the equality of means. All variables are measured on a qualitative five-response scale that has been converted to a quantitative five-point scale.

Performance Track and non-Performance Track facilities share beliefs about the most important and least important potential benefits of participating in voluntary programs. Table 3.4 summarizes perceptions among respondents of the importance of each of these benefits. We asked respondents to rate the importance of each of the benefits to their decision making. As with the list of influences, responses ranged from "Not Important" (a score of 1) to "Extremely Important" (a score of 5). Among both groups of facilities, the most important potential benefits are recognition as a top performer, regulatory help if they experience a compliance problem, flexibility to manage environmental issues, and shortening of the time for receiving permit approvals. Among both groups, the least important potential benefits are exemptions from

routine government inspections, ability to report information less frequently, boosting employee morale, and establishing a single point of contact with the regulator. As shown in Table 3.4, the groups place the benefits in a slightly different order but agree on these general categories.

Performance Track and non-Performance Track facilities provide statistically different responses for the importance of only two of the potential benefits of voluntary programs. Performance Track facilities consider recognition as a top performer and boosting employee morale to be substantially more important benefits of voluntary programs than non-Performance Track facilities do. Otherwise, the two groups of facilities have statistically indistinguishable perceptions of the importance of the benefits of participating in voluntary programs.

Respondents from the two groups of facilities, however, have markedly different perceptions of the costs of participating in voluntary environmental programs. Table 3.5 summarizes perceptions among respondents of different possible costs of participating in voluntary programs. We asked respondents to rate the importance of various potential costs in their decision making about whether to join a voluntary environmental program. As with benefits, responses to costs ranged from "Not Important" (a score of 1) to "Extremely Important" (a score of 5). Both Performance Track and non-Performance Track facilities reported that the most important potential costs are the all-encompassing "benefits do not outweigh costs" and that participating takes time away from other work. The least important costs for both Performance Track and non-Performance Track facilities are that government scrutinizes the facilities more closely and that information about their operations becomes available to the government or the public.

One of the most striking findings is that, on average, respondents from Performance Track facilities perceive each cost on our survey to be less important than non-Performance Track facilities do. Each of the differences shown in Table 3.5 is substantial and highly statistically

significant. Non-Performance Track facilities perceive each cost to be one-half point more important, on average. Each response is measured on a five-point scale, and standard deviations of each response range from 1.0 to 1.2. Thus, a one-half point difference corresponds to between two-fifths and one-half of a standard deviation.

Performance Track facilities report more beyond-compliance behavior and better environmental performance than non-Performance Track facilities do. Table 3.6 summarizes facilities' participation in voluntary programs, their degree of beyond-compliance behavior, and their perception of their environmental performance compared to others. Performance Track facilities are joiners: they more frequently report participation in one of six voluntary programs other than Performance Track and more frequently report participating in any voluntary program other than Performance Track, including voluntary programs listed by facilities themselves. Performance Track facilities report going beyond-compliance in more areas than non-Performance Track facilities do.[7] Moreover, Performance Track facilities have higher opinions of their own facilities' relative environmental performance. On a five-point scale, with 1 equal to "Well Below Average" and 5 equal to "Well Above Average," managers of Performance Track facilities consider their facilities' environmental performance to be close to "Well Above Average" compared to other similar facilities. Managers at non-Performance Track facilities also consider their plants to be above-average environmental performers, but not to the degree that managers at Performance Track facilities do.

[7] Our survey asks respondents whether they "go beyond what is required by existing environmental regulations" in nine areas: air emissions, water discharges, hazardous waste, solid waste, toxics, material use, land and habitat use, water or energy use, and other.

Table 3.4. Importance of the Potential Benefits of Participating in Voluntary Programs

	Performance Track facilities		Non-Performance Track facilities		p-value*
	n	value	value	n	
benefit: recognition as top performer	180	**4.19**	**3.55**	487	0.000
benefit: helps if compliance problem	181	**3.88**	**3.96**	485	0.270
benefit: flexibility to manage environmental issues	181	**3.86**	**3.77**	487	0.243
benefit: shortens time for permit approval	180	**3.70**	**3.87**	487	0.456
benefit: single point of contact with regulator	181	**3.58**	**3.45**	488	0.162
benefit: boosts employee morale	180	**3.50**	**3.00**	483	0.032
benefit: report information less frequently	182	**3.42**	**3.51**	489	0.269
benefit: exempt from inspections	182	**3.23**	**3.22**	488	0.885

Note: * The p-value is for a t-test of the equality of means. All variables are measured on a qualitative five-response scale that has been converted to a quantitative five-point scale.

Table 3.5. Importance of the Potential Costs of Participating in Voluntary Programs

	Performance Track facilities		Non-Performance Track facilities		p-value*
	n	value	value	n	
cost: benefits do not outweigh costs	178	**3.27**	**3.78**	483	0.000
cost: takes time away from other work	180	**3.09**	**3.49**	489	0.000
cost: paperwork takes time	180	**3.02**	**3.44**	489	0.000
cost: top management has other priorities	179	**2.85**	**3.34**	486	0.000
cost: government scrutinizes more closely	179	**2.55**	**3.24**	488	0.000
cost: information available to others	180	**2.52**	**3.12**	489	0.000

Note: * The p-value is for a t-test of the equality of means. All variables are measured on a qualitative five-response scale that has been converted to a quantitative five-point scale.

Table 3.6. Self-Reported Environmental Performance of Facilities

	Performance Track facilities		Non-Performance Track facilities		p-value*
	n	Value	value	n	
% active in one of six listed voluntary programs other than Performance Track	175	**57.7**	**15.5**	484	0.000
% active in any voluntary program other than Performance Track	182	**75.3**	**31.3**	496	0.000
total areas beyond compliance (maximum of 9)	181	**4.7**	**3.4**	495	0.000
environmental performance compared to others	181	**4.6**	**4.2**	495	0.000

Note: * The p-value is for a t-test of the equality of means. The variable "environmental performance compared to others" is measured on a qualitative five-response scale that has been converted to a quantitative five-point scale.

Discussion of Results

These comparisons show that Performance Track facilities differ from non-Performance Track facilities in four substantial ways related to their internal characteristics and their external behavior. Of course, our data do not permit us to assess whether these differences exist because joining Performance Track *causes* facilities to change, or because Performance Track and non-Performance Track facilities are fundamentally different types of facilities even before they apply to Performance Track. Nonetheless, the differences are worth noting.

First, Performance Track facilities are more likely to be connected with and visible to the public. They are larger in terms of the number of employees. A smaller percentage of facilities are privately held companies and a larger percentage are government entities. Fewer Performance Track facilities sell their products to intermediary organizations and more such facilities sell their products directly to consumers. Performance Track facilities place greater importance on the influence of environmental advocacy groups and more often seek the opinions of outside community and environmental advocacy groups. Moreover, Performance Track

facilities more highly value government recognition for their environmental performance, perhaps suggesting that they want others to know of their behavior.

This connection and visibility is consistent with the hypothesis that facilities that are closer to consumers and the public will participate more often in voluntary programs and more often go beyond compliance because consumers and the public pressure them, or provide incentives for them, to do so. This hypothesis – Gunningham, Kagan, and Thornton's (2003) "social pressure" hypothesis – suggests that facilities that are privately held and do not sell their products directly to consumers will not feel as much of this pressure to make voluntary investments in environmental protection.

Another explanation, also consistent with these results, is that some other characteristics of Performance Track facilities explain both their greater environmentalism and their connection to consumers and the public. For example, perhaps facilities that are more closely connected to the public choose to make voluntary investments in environmental protection because they share the public's values or think it is the right thing to do, independent of any pressure from consumers and the public. This explanation is more consistent with an emphasis on internal factors (Howard-Grenville, Nash, and Coglianese 2008).

Second, Performance Track facilities are "joiners." They are substantially more likely to participate in voluntary programs other than Performance Track and to report going beyond compliance in various areas. Moreover, they consider themselves to be outstanding environmental stewards. Again, these results are consistent with the "internal factors" theory, namely that internal characteristics of Performance Track facilities and their managers drive them to make greater voluntary investments in environmental protection. Joining Performance

Track could be just one specific manifestation of a larger effort to participate in voluntary programs and go beyond compliance with environmental regulations.

Third, Performance Track facilities report higher levels of internal support for their environmental activities. They consider the influence of corporate or organizational headquarters to be more important, receive greater management support for their efforts, and say that top management is less likely to have other priorities. They report higher levels of human resources available for environmental management activities, and although the difference is not quite statistically significant at a 5% level, they employ more workers for environmental management. Moreover, they report that the time necessary to complete paperwork and otherwise participate in voluntary programs is less important than non-Performance Track facilities do.

One explanation consistent with these results is that joining Performance Track and other voluntary programs forces facilities to devote more attention and resources to environmental activities. For example, once a facility decides to join Performance Track, its managers must allocate resources and personnel to manage its application and participation, and perhaps for that reason the perception of the costs of participating decrease. Another explanation, however, is that these results reflect the recurring hypothesis that internal characteristics of the facilities – here, support from upper-level management being an example – help determine participation in voluntary programs and beyond-compliance behavior. In other words, internal characteristics and perceptions help drive participation, not the other way around.

Fourth, Performance Track facilities perceive the costs of participating in voluntary programs to be substantially less important than non-Performance Track facilities do. The differences are striking. One hypothesis consistent with this result is that facilities that join

Performance Track and other voluntary programs learn that the programs are much less costly than they previously thought. Another hypothesis, more plausible to us, is that the facilities that join voluntary programs are those for which the costs of participating, for whatever reasons, are already lower or simply less important to them. For example, facilities that have supportive upper-level management and sufficient human resources may join because the costs of joining are not as much a concern. If so, non-Performance Track facilities that do not join voluntary programs may face higher costs to begin with and will not join unless these costs can be lowered (or unless they win the management support needed to cover those costs).

The differences in the perceptions of costs are all the more notable given the similarities in the perceptions of the benefits of participating in voluntary programs. Both Performance Track and non-Performance Track facilities have statistically equivalent perceptions of the importance of most potential benefits of voluntary programs, which suggests that facilities' perceptions may be established before joining Performance Track and do not change after. Two benefits more highly valued by Performance Track members are boosting employee morale and receiving government recognition as a top environmental performer. One explanation is that joiners learn upon joining that these two benefits are more important or valuable than they previously thought. If so, then more facilities would join voluntary programs if they could learn of the greater value of these two benefits. Another explanation is that facilities that join Performance Track value these two benefits already and join voluntary programs because of them. Again, the internal characteristics of facilities – specifically their organizational self-monitoring propensity – may explain why some facilities value government recognition and boosting employee morale more than others. Facilities that do not do not join may simply not consider these benefits to be as important to their operations. Consequently, highlighting these benefits – particularly the benefit

of government recognition, which the regulator itself provides – will not necessarily attract many new facilities to join the Performance Track or other voluntary programs.

4. Explaining Participation in Voluntary Programs and Beyond-Compliance Behavior

Generalizing the conclusions from the comparisons of Performance Track and non-Performance Track facilities in Section 3 must be done cautiously, because the two groups are not drawn from comparable random samples. An advantage of the comparison is that it draws on an independent and objective measure of beyond compliance behavior -- participation in Performance Track -- but a disadvantage is that, as with any voluntary behavior, facilities self-selected into the sample by the very fact of their application to the Performance Track program. These facilities were not chosen randomly. Moreover, the Performance Track facilities come from a broad range of industrial sectors, while the comparison group of non-Performance Track facilities is limited to just four industrial sectors, albeit four of the largest sectors represented in Performance Track. To strengthen the inferential validity of our survey analysis, this section analyzes our stratified random sample of facilities, which includes some facilities that joined voluntary programs and others that did not. All facilities come from the same four industrial sectors. Our aim in this section is to provide internally valid and generalizable conclusions about the factors associated with beyond-compliance behavior and participation in voluntary programs.

Sample and Methods

In Section 3, we compared the characteristics, attitudes, and perceptions of Performance Track facilities with non-Performance Track facilities from our stratified random sample. In this section, we rely solely on the responses from our stratified random sample (our "random sample") of facilities from four two-digit SIC codes. Table 4.1 shows summary statistics for these 525 facilities. We use two statistical methods to compare these facilities: means-comparison tests, analogous to those in the previous section, and regression analysis, both adjusted for the stratification in our survey design.

Table 4.2 shows the five dependent variables we have chosen to capture different aspects of beyond-compliance behavior. Three are binary variables, one is a continuous variable, and one is a count variable. The first binary variable captures whether a facility reports being an active member of one of seven major voluntary programs listed on the survey: Climate Leaders, Energy Star, National Environmental Performance Track, Project XL, WasteWise, the 33/50 Program, and OSHA's Voluntary Protection Program.[8] The second binary variable captures whether a facility reports being an active member of one of these seven programs or some other program not listed on the survey. The third binary variable reflects whether a facility reports going beyond what is required by existing regulations in five or more of nine areas listed on the survey: air emissions, discharges to water, hazardous waste, solid waste, toxics, material use, land and habitat use, water or energy use, and "other."

Though describing in slightly different ways what might be thought of as the same behavior, the variables identify different groups of facilities. Tables 4.3, 4.4, and 4.5 show cross-

[8] EPA implemented the first six of these programs; OSHA the seventh.

tabulations of the number of facilities in groups defined by the variables.[9] For example, as shown in Table 4.4, only 53 facilities are active in one or more listed voluntary programs *and* report going beyond existing regulations in five or more areas. 163 facilities do one or the other -- but not both. In other words, the dependent variables are not redundant.

The continuous variable is an index of each facility manager's knowledge of and receptivity to voluntary environmental programs. For each of the seven major voluntary programs listed on the survey – Climate Leaders, Energy Star, National Environmental Performance Track, Project XL, WasteWise, the 33/50 Program, and the OSHA Voluntary Protection Program – we asked respondents to indicate their familiarity with or participation in it. Possible responses were "never heard of program," "know a little about it," "considered joining," "applied to program," and "active member." We assigned each of these responses a numerical value, 1 (for "never heard of program") through 5 (for "active member"). To create the index, we simply summed up the numerical values of each facility's 7 responses. The index has a minimum value of 7 and a maximum value of 35. As such, it provides a rough proxy for each facility's engagement with voluntary environmental programs in general.

Our final dependent variable is a count variable that measures the degree to which each facility goes beyond what is required by existing regulations. To create this variable, we simply counted the total number of areas, out of the nine listed on the survey, in which each facility reportedly went beyond compliance. The variable ranges from a minimum of zero to a maximum of nine.

While these final two variables may seem to capture the same behavior, they are somewhat different. The correlation between the variables is 0.395, suggesting a strong, but not

[9] In each table, the total number of facilities does not equal 525, the number of facilities in the random sample, because of missing data on these variables for some surveys.

overwhelming, positive association. Of the 487 facilities that responded to these questions, 135 (28%) were at or *above* the median for the voluntary programs index but at or *below* the median for total beyond-compliance behavior. Moreover, 143 facilities (29%) were at or *below* the median for the voluntary programs index but at or *above* the median for total beyond-compliance behavior. Like the three binary dependent variables, these variables are not redundant.

We used two statistical methods to compare these facilities: means-comparison tests analogous to those in Section 3 and regressions. For the means-comparison tests, we divided the 525 facilities in our sample three times, once for each of the binary dependent variables described in Table 4.2, and repeated the means-comparison tests for each of these divisions. For the regression analyses, we use five models: logit regression models for each of the three binary dependent variables, a Tobit model for the continuous index variable, and Poisson regression model for the count variable. The explanatory variables in our regressions include measures of the facilities' descriptive characteristics, internal perceptions and attitudes, and engagement with external actors and situations.

Table 4.1. Characteristics of Facilities in the Stratified Random Sample

Ownership of facility	51.6% privately held 46.9% publicly traded 0.6% government 1.0% blank or other
Is facility owned by a parent company?	85.6% yes 14.1% no 1.3% blank or other
If owned by a parent company, does it have operations outside the United States?	86.5% yes 12.8% no 0.7% blank or other
Age of physical facility (buildings and equipment) (median)	30 years (n = 515)
Annual sales (median)	$80 million (n = 309)
Customers	58.9% sell to intermediary organizations 9.3% sell directly to consumers 26.1% sell to both 5.7% blank, other, or not applicable
Full-time-equivalent employees (FTEs) (median)	270 FTEs (n = 516)
Full-time-equivalent employees responsible for environmental management (median)	1.5 FTEs (n = 516)
Has the facility implemented an EMS?	68.8% yes 12.0% started 8.0% considering 8.4% no 2.8% blank or other

Table 4.2. Dependent Variables

Dependent variable	Type	Description
Active in one or more listed voluntary programs	Binary	Facility reports being an active member of one of seven major voluntary programs listed on the survey.
Active in any voluntary program	Binary	Facility reports being an active member of one of seven major voluntary programs listed on the survey or some other voluntary program not listed on the survey.
Facility goes beyond existing regulations in five or more areas	Binary	Facility reports going beyond existing environmental regulations in five or more of nine areas listed on the survey.
Index of knowledge of and receptivity to voluntary programs	Continuous	The sum of a facility's responses to questions about each of seven major voluntary programs listed on the survey. For each program, responses range from "never heard of program," which equals 1, to "active member," which equals 5. Thus, the index ranges from a minimum of 7 to a maximum of 35.
Number of areas in which facility goes beyond existing regulations	Count	The total number of areas, from a list of nine, in which a facility reports going beyond existing environmental regulations. For each facility, this variable ranges from a minimum of 0 to a maximum of 9.

Table 4.3. Cross-Tabulation of Membership in Different Types of Voluntary Programs

		Facilities Active in any Voluntary Program: Yes	Facilities Active in any Voluntary Program: No
Facilities Active in a Listed Voluntary Program	Yes	108	0
	No	78	328

Table 4.4. Cross-Tabulation of Membership in Listed Programs and Beyond-Compliance Behavior

		Facilities reporting going beyond existing regulations in five or more areas: Yes	Facilities reporting going beyond existing regulations in five or more areas: No
Facilities active in a listed voluntary program	Yes	53	55
	No	108	298

Table 4.5. Cross-Tabulation of Membership in any Program and Beyond-Compliance Behavior

		Facilities reporting going beyond existing regulations in five or more areas	
		Yes	No
Facilities active in any voluntary program	Yes	84	104
	No	80	257

Results of Means-Comparison Tests

In Section 3, we compared the characteristics and perceptions of Performance Track facilities with those of non-Performance Track facilities and presented five key results. Respondents at Performance Track facilities reported that they are more likely to be connected to and visible to the public, to make voluntary investments in the environment, and to experience high levels of internal support for their environmental activities. Respondents at Performance Track facilities generally did not differ in their perceptions of the importance of the benefits of voluntary programs but did assign substantially less importance to the costs of voluntary programs. This section explores whether these observations extend to the respondents from random sample of facilities.

Tables 4.6, 4.7, and 4.8 compare descriptive characteristics of facilities in our dataset. Each table divides facilities into two groups based on a particular definition of beyond-compliance behavior. Table 4.6 divides facilities into those that are active members in one or more listed voluntary programs and those that are not. Table 4.7 divides facilities into those that are active

members of any voluntary program and those that are not. Table 4.8 divides facilities into those that go beyond existing regulations in five of more areas listed on our survey and those that do not. The differences between groups of facilities, however, are generally consistent regardless of the type of voluntary environmental action.

Facilities that take voluntary environmental action tend to employ more people. They are more likely to be publicly held than privately owned, and they report having more permits and legal obligations (from a list of five major environmental permits and legal obligations). Facilities that participate in voluntary programs (but not those that go beyond existing regulations in five or more areas) are also more likely to be owned by a parent company, and facilities that participate in at least one of seven major voluntary programs are somewhat older. Other differences in descriptive characteristics are not statistically significant: these groups of facilities do not differ statistically in their annual sales, average number of employees dedicated to environmental functions, or in the type of customers they serve.

Tables 4.9, 4.10, and 4.11 show differences among facilities in their internal characteristics and perceptions and in the importance they assign to the influences of outside actors, the benefits of voluntary programs, and the costs of voluntary programs. The tables include only those variables with statistically different means between the groups of facilities.

Facilities differ in their internal characteristics and perceptions. Facilities that take voluntary environmental action report greater support from top-level management for voluntary programs and greater levels of human resources available for environmental management compared to other facilities they know.[10] They assign greater importance to government

[10] Note that facilities that appear to be environmentally "friendlier" or more receptive report greater levels of human resources available for environmental management compared to other facilities but do *not* report statistically greater numbers of employees dedicated to environmental activities. This apparent contradiction is even more striking because environmentally receptive facilities report employing substantially more people, on average. One

recognition for their behavior. They more often seek the opinions of outside community and environmental advocacy groups, and they foresee a greater likelihood of future regulations.

Facilities that take voluntary environmental action also assign greater importance to the influence of specific actors, but no particular difference is statistically significant in all three comparisons. In two out of the three comparisons, facilities that appear more inclined to take voluntary environmental action consider the influences of their corporate headquarters, shareholders, community groups, and environmentally advocacy groups to be more important than other facilities do. The differences in the importance of other influences are not statistically significant.

Facilities that take voluntary environmental action sometimes assign greater importance to the benefits of voluntary programs. One difference is statistically significant in all three comparisons: facilities that behave in environmentally friendly ways report that recognition as a top environmental performer is more important than other facilities do. Flexibility to address environmental issues and a shortened period of time for the approval of permits are also more important to environmentally receptive facilities in two out of the three comparisons.

Facilities that take voluntary environmental action generally perceive the costs of voluntary programs to be less important than other facilities do. Only one difference, though, is statistically significant in all three comparisons: respondents at more environmentally receptive facilities assign less importance to the concern that participating in voluntary programs will lead to greater government scrutiny of their facilities. In two out of three comparisons, facilities that take voluntary environmental action report that top management is less likely to have other

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explanation is that respondents' perceptions of the level of human resources at their facilities differ from reality. Facilities that appear to be more environmentally receptive may have the same number of employees with responsibilities in the environment, but they *perceive* that they have more. This could be because the employees they do have are empowered more by supportive top-level management.

priorities, and they assign less importance to the concern that the benefits of voluntary programs outweigh the costs.

Some of the differences between Performance Track facilities and non-Performance Track facilities reappear in these comparisons, but other differences from Section 3 are less striking. First, facilities that take voluntary environmental action, just like our sample of Performance Track facilities, seem more visible to and connected to the public. They employ more people, are more likely to be publicly held, and are more likely to be owned by a parent company. Moreover, they often consider the influence of shareholders, community groups, and environmental advocacy groups to be more important, and they more often seek the opinions of outside groups. Second, facilities that take voluntary environmental action, again as with Performance Track facilities, assign greater importance to government recognition for their behavior. Third, these facilities also assign greater importance to some of the benefits of participating in voluntary programs than other facilities do. More differences are statistically significant among facilities in these comparisons based purely on the random sample than were evident in the comparison of Performance Track and non-Performance Track facilities. Fourth, facilities that take voluntary environmental action perceive the costs of participating in voluntary programs to be less important than other facilities do. The comparisons are not as stark here as with the Performance Track-specific comparison, however, as fewer differences are statistically significant for facilities in these comparisons based on the random sample.

Table 4.6. Descriptive Characteristics of Facilities Divided by Participation in at Least One Listed Voluntary Program

		active in at least one of seven listed voluntary programs		not active in at least one of seven listed voluntary programs		p-value*
		n	value	value	n	
ownership	% publicly traded	108	**56.5**	**44.8**	402	0.028
	% privately held	108	**43.5**	**54.7**	402	0.036
	% government	108	**0**	**0.5**	402	0.158
	% nonprofit	108	**0**	**0**	402	n.a.
	% of facilities owned by a parent company	106	**96.2**	**83.1**	402	0.000
age	age of facility (mean)	105	**44.2**	**37.8**	400	0.042
	age of facility (median)	105	**39**	**30**	400	n.a.
size	annual sales (mean)	54	**3.2E+09**	**3.78E+08**	251	0.084
	annual sales (median)	54	**2.0E+08**	**7.0E+07**	251	n.a.
	total FTEs (mean)	105	**1117.7**	**436.4**	401	0.000
	total FTEs (median)	105	**450**	**250**	401	n.a.
customers	% of facilities that sell product directly to consumers	101	**11.9**	**9.6**	385	0.524
	% of facilities that sell product to intermediaries	101	**61.4**	**63.1**	385	0.750
	% of facilities that sell product to both	101	**26.7**	**27.3**	385	0.913
other	FTEs in environment (mean)	106	**4.0**	**3.1**	401	0.445
	FTEs in environment (median)	106	**2.25**	**1**	401	n.a.
	number of permits and legal obligations (out of 5)	107	**3.9**	**3.5**	406	0.000

Note: * The p-value is for an adjusted Wald test of the equality of means.

Table 4.7. Descriptive Characteristics of Facilities Divided by Participation in any Voluntary Program

		active in any voluntary program		not active in any voluntary program		p-value*
		n	value	value	n	
ownership	% publicly traded	188	**54.8**	**43.1**	332	0.010
	% privately held	188	**44.7**	**56.3**	332	0.011
	% government	188	**0.5**	**0.6**	332	0.918
	% nonprofit	188	**0**	**0**	332	n.a.
	% of facilities owned by a parent company	184	**92.4**	**82.0**	334	0.000
age	age of facility (mean)	184	**42.3**	**37.3**	331	0.070
	age of facility (median)	184	**35**	**30**	331	n.a.
size	annual sales (mean)	105	**1.8E+09**	**4.08E+08**	202	0.116
	annual sales (median)	105	**1.5E+08**	**6.0E+07**	202	n.a.
	total FTEs (mean)	184	**863.0**	**426.3**	332	0.000
	total FTEs (median)	184	**350**	**230**	332	n.a.
customers	% of facilities that sell product directly to consumers	178	**10.7**	**9.5**	317	0.671
	% of facilities that sell product to intermediaries	178	**60.7**	**63.4**	317	0.550
	% of facilities that sell product to both	178	**28.7**	**27.1**	317	0.719
other	FTEs in environment (mean)	185	**3.2**	**3.4**	331	0.884
	FTEs in environment (median)	185	**2**	**1**	331	n.a.
	number of permits and legal obligations (out of 5)	187	**3.7**	**3.5**	336	0.003

Note: * The p-value is for an adjusted Wald test of the equality of means.

Table 4.8. Descriptive Characteristics of Facilities Divided by Going Beyond Existing Regulations in Five or More Areas

		Facility goes beyond compliance in five or more of nine areas		Facility does not go beyond compliance in five or more of nine areas		p-value*
		n	value	value	n	
ownership	% publicly traded	163	**55.2**	**43.7**	357	0.014
	% privately held	163	**42.9**	**56.3**	357	0.004
	% government	163	**1.8**	**0**	357	0.081
	% nonprofit	163	**0**	**0**	357	n.a.
	% of facilities owned by a parent company	163	**89.0**	**84.2**	355	0.131
age	age of facility (mean)	162	**38.3**	**39.5**	353	0.679
	age of facility (median)	162	**30**	**32**	353	n.a.
size	annual sales (mean)	100	**1.9E+09**	**3.78E+08**	207	0.097
	annual sales (median)	100	**1.6E+08**	**6.6E+07**	207	n.a.
	total FTEs (mean)	163	**994.3**	**391.6**	353	0.000
	total FTEs (median)	163	**450**	**215**	353	n.a.
customers	% of facilities that sell product directly to consumers	152	**9.2**	**10.2**	343	0.728
	% of facilities that sell product to intermediaries	152	**61.8**	**62.7**	343	0.859
	% of facilities that sell product to both	152	**28.9**	**27.1**	343	0.677
other	FTEs in environment (mean)	160	**3.0**	**3.5**	356	0.654
	FTEs in environment (median)	160	**2**	**1**	356	n.a.
	number of permits and legal obligations (out of 5)	163	**3.7**	**3.5**	360	0.005

Note: * The p-value is for an adjusted Wald test of the equality of means.

Table 4.9. Differences in Perceptions among Facilities Divided by Participation in at Least One of Seven Listed Voluntary Programs

	Active in at least one of seven listed voluntary programs		Not active in at least one of seven listed voluntary programs		p-value*
	n	value	value	n	
top-level management support for voluntary programs	108	**4.4**	**3.6**	404	0.000
level of human resources compared to other facilities	104	**2.7**	**2.4**	399	0.014
frequency of seeking opinions from community or environmental advocacy groups	108	**2.9**	**2.2**	403	0.000
importance of government recognition	108	**3.6**	**2.9**	402	0.000
% aware of new, proposed environmental regulation	106	**79.2**	**58.5**	402	0.000
likelihood of stringent regulation in future	107	**3.9**	**3.6**	405	0.001
importance of the influence of headquarters	107	**4.08**	**3.79**	402	0.008
importance of the influence of shareholders	100	**3.44**	**3.12**	365	0.020
importance of the influence of environmental advocacy groups	108	**2.81**	**2.48**	401	0.003
importance of the influence of community groups	108	**3.22**	**2.92**	402	0.013
benefit: exempt from inspections	107	**3.44**	**3.18**	402	0.030
benefit: flexibility to manage environmental issues	107	**4.09**	**3.72**	401	0.000
benefit: recognition as top performer	108	**4.16**	**3.44**	400	0.000
benefit: shortens permit time	107	**4.04**	**3.72**	400	0.004
cost: government scrutinizes more closely	106	**2.96**	**3.27**	402	0.021

Note: * The p-value is for an adjusted Wald test of the equality of means. All variables except "% aware of a new, proposed regulation" are measured on qualitative five-response scales that have been converted to a quantitative five-point scale.

Table 4.10. Differences in Perceptions Among Facilities Divided by Participation in at Least One Voluntary Program

	Active in at least one voluntary program		Not active in at least one voluntary program		p-value*
	n	value	value	n	
top-level management support for voluntary programs	188	**4.1**	**3.5**	333	0.000
level of human resources compared to other facilities	183	**2.6**	**2.4**	329	0.006
frequency of seeking opinions from community or environmental advocacy groups	188	**2.7**	**2.1**	332	0.000
importance of government recognition	186	**3.4**	**2.9**	334	0.000
% aware of new, proposed environmental regulation	183	**76.5**	**54.5**	334	0.000
likelihood of stringent regulation in future	187	**3.8**	**3.5**	335	0.001
importance of the influence of environmental advocacy groups	188	**2.72**	**2.45**	330	0.006
importance of the influence of community groups	188	**3.12**	**2.91**	331	0.040
benefit: flexibility to manage environmental issues	187	**4.03**	**3.66**	329	0.000
benefit: recognition as top performer	187	**3.99**	**3.36**	329	0.000
benefit: shortens permit time	186	**3.94**	**3.68**	330	0.008
cost: information available to others	187	**2.91**	**3.20**	331	0.009
cost: government scrutinizes more closely	186	**3.02**	**3.32**	330	0.008
cost: top management has other priorities	185	**3.18**	**3.37**	329	0.038
cost: benefits do not outweigh costs	182	**3.61**	**3.84**	330	0.017

Note: * The p-value is for an adjusted Wald test of the equality of means. All variables except "% aware of a new, proposed regulation" are measured on qualitative five-response scales that have been converted to a quantitative five-point scale.

Table 4.11. Differences in Perceptions Among Facilities Divided by Going Beyond Existing Regulations in Five or More Areas

	Facility goes beyond compliance in five or more of nine areas		Facility does not go beyond compliance in five or more of nine areas		p-value*
	n	value	value	n	
top-level management support for voluntary programs	164	**4.1**	**3.5**	357	0.000
level of human resources compared to other facilities	161	**2.7**	**2.4**	351	0.000
frequency of seeking opinions from community or environmental advocacy groups	164	**2.7**	**2.2**	356	0.000
importance of government recognition	162	**3.4**	**2.9**	358	0.000
% aware of new, proposed environmental regulation	160	**75.0**	**56.6**	357	0.000
importance of the influence of headquarters	163	**4.01**	**3.79**	355	0.043
importance of the influence of customers	164	**3.86**	**3.63**	356	0.015
importance of the influence of shareholders	151	**3.38**	**3.10**	322	0.022
benefit: recognition as top performer	163	**3.91**	**3.44**	353	0.000
benefit: boosts employee morale	164	**3.48**	**3.20**	348	0.004
cost: paperwork takes time	162	**3.25**	**3.48**	355	0.005
cost: takes time away from other work	162	**3.21**	**3.59**	355	0.000
cost: government scrutinizes more closely	162	**2.99**	**3.30**	354	0.007
cost: top management has other priorities	161	**3.11**	**3.39**	353	0.005
cost: benefits do not outweigh costs	161	**3.58**	**3.84**	351	0.010

Note: * The p-value is for an adjusted Wald test of the equality of means. All variables except "% aware of a new, proposed regulation" are measured on qualitative five-response scales that have been converted to a quantitative five-point scale.

Regression Results

The tests for differences in means focus on only one explanatory variable at a time, even though for each facility variation exists across a range of internal and external variables. Multivariate regression allows us to isolate the effects of each variable on measures of beyond-compliance behavior, controlling for the effects of the others. We include as explanatory variables in our regressions all the variables for which there was at least one statistically significant difference in means in Tables 4.6 through 4.11, with a few exceptions. We exclude product type and shareholder influence because these variables were missing for many observations. We exclude facilities' perceived likelihood of a more stringent regulation in the near future because it was highly correlated with awareness of a proposed, new regulation. We also exclude the measures of the importance of all benefits and costs except a summary measure, the importance facilities ascribe to the possibility that costs exceed benefits. Finally, we include as an explanatory variable the number of FTEs responsible for environmental management at each facility. Tables 4.12 and 4.14 show the results of our regressions. Coefficients that are statistically significant at less than a 5% level appear in bold.

Regression 1 explores the factors associated with participation in one of seven listed voluntary programs. We estimate a logit model; results are shown in Table 4.12. Facilities that are older, employ more people, and report greater support from top-level management for voluntary programs are more likely to be active members of one of the seven voluntary programs. Compared with facilities in SIC code 26 (paper and allied products), facilities in SIC code 28 (chemicals and allied products) and SIC code 36 (electronics) are more likely to be active members of one of the seven programs. Interestingly, facilities that report that the

influence of customers is of *greater* importance to them are *less* likely to participate in one of the seven programs. The same coefficient is also significant in Regression 5 but is of the opposite sign: there, facilities that report that the influence of customer is of *greater* importance to them are *more* likely to report exceeding environmental regulations in general. The coefficient is not statistically significant in any of our other regressions. Perhaps these mixed results simply suggest that most customers are still basing their buying patterns primarily on factors such as product quality and cost, not on a producer's voluntary environmental actions. Note that many other coefficients – including the influences of several groups other than customers and whether the company is public or private – are not statistically different from zero in Regression 1.

Regression 2 investigates participation in any voluntary program, including but not limited to the seven listed voluntary programs used in Regression 1. We estimate a logit model; results are shown in Table 4.12. The results here are similar to those from Regression 1. Facilities that are older, employ more people, and report greater support from top-level management for voluntary programs are more likely to be active members of any voluntary program. The only other statistically significant variable of note is a facility's awareness about proposed regulations: facilities that are aware of proposed, new environmental regulations that will affect their facilities are more likely to participate in a voluntary program. Although the coefficient on the importance of the influence of customers is still negative, as in Regression 1, it is not statistically significant. Many other coefficients are not statistically significant either.

Regression 3 explores the factors associated with a high degree of beyond-compliance behavior. Once again, we estimate a logit model; results are shown in Table 4.12. The results are a bit different from those found in Regressions 1 and 2. Two effects from the earlier regressions are no longer statistically significant at the 5 percent level: facilities that are older

and employ more people are not more likely, statistically, to go beyond regulations in five or more areas. Two other effects from the earlier regressions remain important: facilities that report greater support from top-level management for environmental activities and that are aware of proposed, new environmental regulations that will affect their facilities are more likely to go beyond existing regulations in five or more areas. Finally, two effects are newly significant: facilities that more frequently seek the opinions of community or environmental advocacy groups are more likely to report high degrees of beyond-compliance behavior, and facilities that find it more important if costs exceed benefits are less likely to report high degrees of beyond-compliance behavior.

Regression models 1, 2, and 3 do a good job of accurately predicting facilities' behavior. At the bottom of Table 4.12, we list "percent correctly predicted."[11] To obtain this number for each regression, we used the estimated coefficients from each model to predict the probability that each facility in the sample would join at least one of the seven listed voluntary programs (for Regression 1), join any voluntary program (for Regression 2), or go beyond regulations in five or more areas (for Regression 3). The predicted result is a probability (a number between zero and one) that can be compared, for each facility, to its *actual* behavior represented by the value of the dependent variable (either zero or one). Our model was "successful" when either it produced a probability greater than 0.5 for any facility with a dependent variable equal to one, or it produced a probability less than 0.5 for any facility with a dependent variable equal to zero. We successfully predict over 83 percent of facilities' actual behavior in Regression 1, over 73 percent in Regression 2, and over 75 percent in Regression 3.

[11] For non-linear models such as logit, "percent correctly predicted" provides an alternative to goodness-of-fit statistics such as R-squared. See Wooldridge (2003), p. 560.

Because Regressions 1, 2, and 3 are estimated using non-linear logit models, we cannot interpret the strength of each variable's effect directly from the coefficients. Instead, we must use the estimated coefficients to simulate the effects of changing the explanatory variables on the probability of participating in a voluntary program or engaging in substantial beyond-compliance behavior. Our simulation method is straightforward. First, we calculate the predicted probabilities at the average values of each of the explanatory variables.[12] Then we change each variable of interest, one at a time, and recalculate the predicted probabilities. The change in each variable of interest depends on the characteristics of the variable itself. For binary variables, the change is from "no" (a value of zero) to "yes" (a value of one). For other variables, the change is either from one standard deviation below the mean to one standard deviation above the mean of that variable or from the 25th to the 75th percentile of the value of that variable. Finally, we subtract the predicted probabilities to determine the effects of changing each variable on the probability of interest. It is important to note that the effect of changing one explanatory variable depends on the values of the other explanatory variables. What we report is the effect when all the other explanatory variables are equal to their means, which provides an approximation of the effect on an "average" facility.[13]

Table 4.13 shows the results of our simulations of the effects of variables in our logit models. For example, if the age of an otherwise "average" facility increases from one standard deviation below the mean (8.2 years) to one standard deviation above the mean (71.2 years), the predicted probability that an "average" facility participates in at least one of the seven listed voluntary programs increases by 10.6 percentage points, and the predicted probability that an

[12] To be precise, we set the values of all variables equal to their means, except for FTEs responsible for environmental management. We set this variable equal to its median, which better represents the central tendency of a highly skewed variable. The results shown in Tables 4.13 and 4.15 are not substantially affected and in some cases are not affected at all.

[13] Again, the value of FTEs responsible for environmental management is set equal to its median.

"average" facility participates in any voluntary program increases by 13.9 percentage points. The variables that have the largest and most consistent effects are employment, degree of management support, and awareness of a proposed, new regulation likely to affect the facility.

Finally, we note that 441 of 525 facilities were used to estimate Regressions 1, and 446 of 525 facilities were used to estimate Regressions 2 and 3. The remaining facilities (around 15 percent of facilities in the stratified random sample) had missing values for one or more of the variables in the regressions. We compared the means of the explanatory variables for the facilities used to estimate Regressions 1, 2, and 3 with the means of the explanatory variables for the facilities from the random sample not used to estimate the regressions. The differences are few. Facilities used to estimate all three regressions are more likely to be aware of a proposed, new environmental regulation (a statistically significant variable in Regressions 2 and 3), to find it more important if costs exceed benefits (a statistically significant variable in Regression 3), and to have a parent company (not a statistically significant variable in the three regressions). Moreover, facilities used to estimate Regressions 2 and 3 have more permits and regulatory obligations (not a statistically significant variable in those regressions). For the other variables in the regressions, facilities used to estimate the models appear similar to those from the random sample not used to estimate the models. Data appear to be missing relatively randomly, and thus we are not greatly concerned that missing data are biasing our estimated coefficients.

Table 4.12. Results of Logit Regressions

		(1)	(2)	(3)
	Dependent variable	Active in at least one of seven listed voluntary programs	Active in any voluntary program	Facility goes beyond existing regulations in five or more areas
	method	logit	logit	logit
descriptive characteristics	facility is a publicly traded company	-0.239	0.0825	0.148
		(0.30)	(0.23)	(0.24)
	facility owned by a parent company	1.147	0.425	-0.378
		(0.72)	(0.41)	(0.43)
	age of facility	**0.0161*** **	**0.0101** **	0.000160
		(0.0058)	(0.0043)	(0.0046)
	natural log of total FTEs	**0.682*** **	**0.451*** **	0.211*
		(0.16)	(0.12)	(0.12)
	FTEs responsible for environmental management	-0.000801	-0.00696	-0.0322
		(0.0043)	(0.0046)	(0.037)
	number of permits and legal obligations	0.218	-0.00795	0.228
		(0.17)	(0.14)	(0.14)
	SIC code 28	**1.297** **	**0.787** **	-0.647
		(0.51)	(0.37)	(0.43)
	SIC code 36	**1.212** **	0.205	**1.019** **
		(0.57)	(0.41)	(0.41)
	SIC code 37	0.0903	0.171	0.509
		(0.58)	(0.39)	(0.41)
facility perceptions	level of support from top-level management for participating in voluntary programs	**0.957*** **	**0.560*** **	**0.399*** **
		(0.20)	(0.15)	(0.14)
	level of human resources available for environmental management, compared to other similar facilities	-0.0498	0.179	0.224*
		(0.16)	(0.13)	(0.13)
	frequency of seeking opinions of community or environmental advocacy groups	0.250*	0.227*	**0.344*** **
		(0.15)	(0.12)	(0.13)
	importance of government recognition	0.193	0.187	0.221*
		(0.14)	(0.11)	(0.12)
	facility is aware of a proposed, new regulation that will affect it	0.528	**0.652** **	**0.792*** **
		(0.38)	(0.28)	(0.30)
	importance of the influence of corporate or organizational headquarters	0.0367	-0.165	0.0710
		(0.15)	(0.12)	(0.11)
	importance of the influence of environmental groups	0.305	0.172	-0.0181
		(0.19)	(0.15)	(0.17)
	importance of the influence of community groups	-0.185	-0.221	-0.233
		(0.20)	(0.17)	(0.17)
	importance of the influence of customers	**-0.392** **	-0.193	0.0954
		(0.16)	(0.13)	(0.12)
	importance if costs exceed benefits	-0.168	-0.207*	**-0.244** **
		(0.15)	(0.12)	(0.12)
	constant	**-12.00*** **	**-6.001*** **	**-5.835*** **
		(1.82)	(1.14)	(1.17)
	observations	441	446	446
	percent correctly predicted	83.4	73.8	75.8

Note: Standard errors in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.001$.

Table 4.13. Simulations of Effects of Statistically Significant Coefficients in Logit Regressions

Variable	Change in Variable		Regression 1	Regression 2	Regression 3
			Predicted change in probability that		
	Description of change	Approximate numerical value of change	Facility is active in one of seven listed voluntary programs	Facility is active in any voluntary program	Facility goes beyond existing regulations in five or more areas
age of facility	One standard deviation below the mean to one standard deviation above the mean.	8.2 to 71.2	10.6	13.9	
natural log of total FTEs	One standard deviation below the mean to one standard deviation above the mean.	4.3 to 6.8	18.8	25.0	
level of support from top-level management for participating in voluntary programs	One standard deviation below the mean to one standard deviation above the mean.	2.7 to 4.8	21.9	25.5	18.4
frequency of seeking opinions of community or environmental advocacy groups	One standard deviation below the mean to one standard deviation above the mean.	1.2 to 3.5			16.8
facility is aware of a proposed, new regulation that will affect it	Facility is not aware to facility is aware.	0 to 1		13.7	16.6
importance of the influence of customers	One standard deviation below the mean to one standard deviation above the mean.	2.6 to 4.7	– 8.8		
importance if costs exceed benefits	One standard deviation below the mean to one standard deviation above the mean.				– 9.9

Note: All changes are calculated with FTEs responsible for environmental management at its median and all other variables at their means.

Table 4.14 shows the results from our second set of regressions. Regression 4 is estimated using a Tobit model to account for censoring at the minimum value of the voluntary programs index. For a sizeable number of observations (47 of 414), the index is equal to its minimum; the Tobit model corrects coefficient estimates in the presence of this censoring.[14] Regression 5 is estimated using a Poisson regression model, a standard model for a count variable such as the dependent variable, the number of areas in which a facility reports going beyond compliance.[15] Once again, coefficients that are statistically significant at less than a 5 percent level appear in bold in the table.

Regression 4, summarized in Table 4.14, shows the factors associated with a greater degree of knowledge about and receptivity toward voluntary programs. Facilities with a higher value of the index report greater knowledge of and perhaps even participation in seven major voluntary programs listed on our survey. Facilities that have more environmental permits or legal obligations score higher on the index of knowledge and receptivity. As in the logit models, facilities that employ more people, that are aware of proposed new regulations, that more often seek the opinions of outside community or environmental advocacy groups, and that report greater levels of support from management score higher on the index. Interestingly, facilities with more FTEs responsible for environmental management score lower on the index, although the effect is tiny.

[14] At values above the minimum value of the index, the index does not appear to have a normal distribution. Rather, it is skewed to the right with more values closer to the minimum. Thus, a Tobit model might not be an ideal choice. An alternative is the Poisson model used to estimate Regression 5. Thus, we re-estimated this model using the Poisson regression. The results are almost identical. The same coefficients are statistically significant, and the effects of changing the variables are about the same, relatively and absolutely. The primary difference is that the variable "parent company" is statistically significant in the Poisson model, but the magnitude of its effect is approximately the same in both models.

[15] A more general model for count variables is the negative binomial regression model. The Poisson model is a special case of the negative binomial model, and for the data in this paper, they produce equivalent results.

Regression 5, also summarized in Table 4.14, displays the factors associated with a greater number of areas in which a facility reports going beyond the requirements of environmental regulations. Facilities with a higher value of the dependent variable, a count variable, report going beyond existing environmental regulations in more areas. The results are similar to Regression 4, with a few exceptions. Facilities with more employees and those that more often seek the opinions of outside groups, report greater support from management, and are aware of proposed new regulations go beyond compliance in more areas. The same unexpectedly negative coefficient appears on the variable for employees responsible for environmental management, although the effect is once again miniscule.

Regression 5 has two other significant coefficients that are not significant in most other regressions. First, facilities that ascribe greater importance to the influence of customers go beyond compliance more often. This coefficient is insignificant in all regressions except Regression 1, and there it has the opposite sign. Second, facilities that find it more important that the benefits of voluntary programs exceed the costs engage in less beyond-compliance behavior. This variable is also negative in the other four regressions but is also statistically significant at the 5 percent level only in Regressions 3. The evidence that the economic factors summarized by this simple variable affects facilities' decision making is limited.

Table 4.15 provides interpretations for the effects of the statistically significant variables in Regressions 4 and 5. Regression 4 is a Tobit model. Although it resembles a linear model, we must adjust our interpretations of its coefficients to account for the censoring of the index variable.[16] As with the logit model, the effect of changing a variable in a Tobit model depends

[16] More specifically, the conditional expectation of the dependent variable Y given the explanatory variables *X* is $E[Y \mid X] = \Phi(X\beta/\sigma)X\beta + \sigma\phi(X\beta/\sigma)$, where β are the coefficients, σ is the standard deviation of the

upon the values of other variables. Thus, to evaluate the effect of changing a variable, we set all other variables equal to their means.[17] Recall that the dependent variable in Regression 4 ranges from 7 to 35, so the predicted changes in the value of the index should be interpreted accordingly. Since Regression 5 is a Poisson regression, we must interpret its coefficients in percentage terms. For a regressor x_k that changes by an amount Δx_k and its estimated coefficient $\hat{\beta}_k$, the proportionate change in the dependent variable is $\exp\left(\hat{\beta}_k \Delta x_k\right) - 1$ (Wooldridge 2003: 574). We multiply this by 100 to obtain the percentage change in the dependent variable shown in Table 4.15.

As in Regressions 1-3, the variables that have the largest and most consistent effects are employment, degree of management support, and awareness of a proposed, new regulation likely to affect the facility. A fourth variable with a large and consistent effect is the frequency of seeking opinions from outside groups. This variable was significant at the 10 percent level in Regressions 1 and 2 and at the 5 percent level in Regression 3, and it had a large effect in Regression 3. We will comment upon its importance later.

Note that 420 of 525 facilities were used to estimate Regression 4, and 445 of 525 facilities were used to estimate Regression 5. The remaining facilities had missing values for one or more of the variables in the regressions. We compared the means of the explanatory variables for the facilities used to estimate Regressions 4 and 5 with the means of the explanatory variables for the facilities in our stratified random sample not used to estimate the regressions. The 420 facilities used to estimate Regression 4 have statistically different means from the facilities left out of the estimation for four explanatory variables. Facilities used to estimate the regression, on average,

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distribution of the underlying (latent) variable, estimated along with β, Φ is the standard normal cumulative density function, and ϕ is the standard normal probability density function. See Wooldridge (2003), p. 566.

[17] With the exception, as before, that the number of FTEs responsible for environmental management is set equal to its median.

have fewer employees and are more likely to be aware of a proposed regulation, both of which are significant variables in Regression 4. They also are more likely to have a parent company and to find it more important that benefits exceed costs, neither of which is a significant explanatory variable in the regression. The 445 facilities used to estimate Regression 5 also have statistically different means from facilities left out of the estimate for four explanatory variables. Facilities used to estimate the regressions are, on average, more likely to be aware of a proposed, new environmental regulation and to find it more important that benefits exceed costs, both of which are statistically significant variables in Regression 5. They are also more likely to have a parent company and have more permits and obligations, neither of which is a statistically significant variable in Regression 5. Otherwise, the missing data appear to be random. We find little cause for concern that missing data are biasing our estimates.

Table 4.14. Results of Tobit and Poisson Regressions

		(4)	(5)
	Dependent variable	Index of knowledge and receptivity to voluntary programs	Number of areas in which facility goes beyond existing regulations
	method	Tobit	Possion
descriptive characteristics	facility is a publicly traded company	0.004	0.0557
		(0.41)	(0.051)
	facility owned by a parent company	1.200*	0.0356
		(0.64)	(0.11)
	age of facility	0.009	-0.0000384
		(0.0067)	(0.00100)
	natural log of total FTEs	**1.279*** **	**0.0868*** **
		(0.21)	(0.030)
	FTEs responsible for environmental management	**-0.026*** **	**-0.00102** **
		(0.0089)	(0.00042)
	number of permits and legal obligations	**0.506** **	0.0394
		(0.25)	(0.034)
	SIC code 28	0.584	-0.148*
		(0.63)	(0.087)
	SIC code 36	1.096	0.127
		(0.70)	(0.088)
	SIC code 37	-1.136*	0.0322
		(0.66)	(0.090)
facility perceptions	level of support from top-level management for participating in voluntary programs	**0.771*** **	**0.0927*** **
		(0.22)	(0.035)
	level of human resources available for environmental management, compared to other similar facilities	0.151	0.0247
		(0.21)	(0.026)
	frequency of seeking opinions of community or environmental advocacy groups	**0.675*** **	**0.116*** **
		(0.21)	(0.025)
	importance of government recognition	0.092	0.0434
		(0.20)	(0.029)
	facility is aware of a proposed, new regulation that will affect it	**1.457*** **	**0.244*** **
		(0.44)	(0.066)
	importance of the influence of corporate or organizational headquarters	-0.081	0.00752
		(0.19)	(0.024)
	importance of the influence of environmental groups	0.087	-0.0113
		(0.24)	(0.034)
	importance of the influence of community groups	0.011	-0.0188
		(0.24)	(0.031)
	importance of the influence of customers	-0.117	**0.0588** **
		(0.18)	(0.029)
	importance if costs exceed benefits	-0.323*	**-0.0626** **
		(0.19)	(0.024)
	constant	-2.641	-0.381
		(1.71)	(0.27)
	observations	420	445

Note: Linearized standard errors in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.001$.

Table 4.15. Simulations of Effects of Statistically Significant Coefficients in Tobit and Poisson Regressions

Variable	Description of Change in Variable	Regression 4		Regression 5	
		Numerical value of change	Predicted change in value of voluntary programs index	Numerical value of change	Predicted change in number of areas in which the facility goes beyond compliance
natural log of total FTEs	One standard deviation below the mean to one standard deviation above the mean.	4.2 to 6.8	3.2	4.3 to 6.8	24.9%
FTEs responsible for environmental management	25^{th} percentile to 75^{th} percentile	1 to 2.5	– 0.04	1 to 3	– 0.2%
number of permits and legal obligations	One standard deviation below the mean to one standard deviation above the mean.	2.7 to 4.5	1.0		
level of support from top-level management for participating in voluntary programs	One standard deviation below the mean to one standard deviation above the mean.	2.6 to 4.7	1.6	2.6 to 4.8	21.6%
frequency of seeking opinions of community or environmental advocacy groups	One standard deviation below the mean to one standard deviation above the mean.	1.2 to 3.4	1.5	1.2 to 3.5	29.6%
facility is aware of a proposed, new regulation that will affect it	Facility is not aware to facility is aware.	0 to 1	1.5	0 to 1	27.7%
importance of the influence of customers	One standard deviation below the mean to one standard deviation above the mean.			2.6 to 4.7	13.5%
importance if costs exceed benefits	One standard deviation below the mean to one standard deviation above the mean.			2.7 to 4.8	– 12.0%

Note: All changes are calculated with FTEs responsible for environmental management at its median and all other variables at their means.

Discussion of Regression Results

Several variables are statistically significant and meaningful in many or all of our regressions: the number of employees at the facility, the support from top-level management for voluntary programs, awareness of impending regulations, and the frequency of seeking opinions on environmental issues from community or environmental advocacy groups. Several of these recurring results match the results from the analysis of Performance Track facilities in Section 3 and our means-comparison tests earlier in Section 4. They suggest that facilities may be motivated to participate in voluntary programs and go beyond compliance because of both certain external pressures and – notably, in light of Gunningham, Kagan, and Thornton (2003) and Howard-Grenville, Nash, and Coglianese (2008) – a number of key internal factors.

First, facilities that are larger are more receptive to voluntary programs and more often report going beyond compliance. We proposed two explanations for this observation in Section 3. First, larger facilities may be more visible and connected to the public and may therefore face pressure from the public to be good environmental stewards. This would be an external social pressure. Second, larger facilities may simply have some inherent characteristic – perhaps a greater sense of corporate citizenship or simply the resources to devote to environmental programs – that accounts for their behavior, independent of external pressure.

Second, facilities that receive greater support from top-level management are more receptive to voluntary programs and more often go beyond compliance. It is perhaps not surprising that support from company leadership matters. The question our data cannot easily address is *why* top-level managers at some facilities are more supportive of voluntary environmentalism. One possibility is that top-level managers are responding to specific social, economic, or regulatory

pressures and support environmental activities to benefit the company's bottom line. Some simple correlations in the data are consistent with this explanation. Facilities with greater support from top-level management consider each of several potential benefits of voluntary programs to be more important and each of several potential costs to be less important. The correlations are not strong, however: none has an absolute value greater than 0.4 and most have absolute values less than 0.2. If top-level managers have opinions on the possible benefits and costs of voluntary programs driving their support for participation, their opinions are not strongly trickling downward to our survey respondents.

Another possibility is that some managers simply choose to encourage or support environment stewardship independent of the effects of stewardship on company profits. This would be an inherent characteristic of the facility, a part of its organizational culture, and is consistent with previous work suggesting that management commitment (Coglianese and Nash 2001) or style (Kagan 2006) matter in explaining businesses' environmental behavior.

Third, facilities that are aware of new, proposed regulations that are likely to affect them are also more receptive to voluntary programs and more often go beyond compliance. This result is consistent with the theoretical expectation that facilities make voluntary investments in the environment to influence or even preempt impending regulations (Johnston 2006; Lyon and Maxwell 2004). Facilities may hope to show, through their voluntary behavior, that new regulation is either unnecessary or does not need to be as strict. Another possibility is that facilities choose, for economic reasons, to comply with the proposed regulation before it even takes effect. Perhaps it is cheaper to go beyond compliance with current regulations now, on a scale and timetable the facilities choose themselves, than to wait for future regulations that might

disrupt production or impose significant costs. These explanations are consistent with Gunningham, Kagan, and Thornton's (2003, 2004b) economic and regulatory pressures.

Fourth, facilities that more often seek the opinions of community and environmental advocacy groups are also more receptive to voluntary programs and more often go beyond compliance. Again, at least two explanations are possible. Perhaps those facilities that solicit opinions from outsiders are encouraged or even pressured to join voluntary programs and go beyond compliance. This would reflect an external social pressure. Or perhaps there are some facilities that, for some reason, routinely look to the interests of others in society. This inherent characteristic, such as the degree of organizational self-monitoring, could manifest itself both in seeking outsiders' opinions and in joining voluntary programs and going beyond compliance. We believe the survey evidence we have analyzed here favors this latter explanation. The wording of the key survey question, which repeatedly proved to be statistically significant, asked respondents about the extent to which they *sought out* the opinions of outsiders. Survey questions worded with terms that better reflected external pressure, such as those about the degree of *influence of* environmental and community groups, were not significant in most of our regressions.

Another notable finding is the limited effect that facilities' perceived importance of benefits and costs of participation has on beyond-compliance behavior. In only two regressions is the importance that benefits exceed costs a statistically significant predictor of voluntary environmental behavior, and its effect is among the smallest of any statistically significant variable. In the other regressions, its estimated coefficient is negative, as expected, but not statistically different from zero at the 5 percent level. Moreover, in alternative specifications of the models, respondents' perceived importance of most of the individual benefits and costs of

participating are not significant, and an alternative aggregate index of the benefits and costs is not significant. In other words, consider two hypothetical facilities from the same industry, with the same number of employees and types of customer, and that are identical with respect to many other characteristics included in our regressions. Assume that the only difference between the two facilities is that one assigns greater importance to certain benefits or costs of participating in voluntary programs than the other. Our regressions suggest that these two facilities would be equally likely to participate in voluntary programs and engage in beyond-compliance behavior.

We can offer at least three explanations for this lack of a sizeable or statistical difference in the benefit- and cost-related variables in our regression models. First, the benefits and costs of voluntary programs may not really influence facilities' decisions about whether to join – though obviously this seems the least plausible explanation. Second, the importance that facilities actually assign to the benefits and costs of participating in voluntary programs may be imprecisely measured by the answers to our survey questions. This would reflect measurement error, and if it exists it could bias the coefficients toward zero, even if the perceived importance of the benefit and cost variables is an actual determinant of the overall organization's behavior. Finally, the actual benefits and costs of voluntary programs may well affect facilities' decisions to make voluntary investments in environmental protection, but the importance each facility assigns to these benefits and costs is uncorrelated with the actual magnitudes of the benefits and costs to it. Then the coefficients on the variables measuring differences in the "importance of" these benefits and costs would be insignificant, even though the actual levels of benefits and costs do still matter.

5. Conclusions

The literature on participation in voluntary programs and beyond-compliance behavior suggests that social pressures and concerns about future regulation drive businesses to take voluntary environmental action. Our results confirm – and, importantly, extend – the existing literature in a number of ways. Most notably, we find consistent support for the influence of internal factors and dispositions (Gunningham, Kagan, Thornton 2003; Howard-Grenville, Nash, and Coglianese 2008).

The most robust results of our analyses show that facilities with more employees and greater support from top-level management have greater knowledge of and receptivity toward voluntary programs and are more likely to report going beyond the requirements of environmental regulations. So are facilities that more often seek the opinions of outside community and environmental advocacy groups and those that expect new regulations to affect them in the future. While probably no survey can permit anyone to determine causality, the wording of our survey does suggest that organizations with some reason to *seek out* the opinions of outsiders are also more attracted to the idea of participating in some kind of voluntary environmental effort. The significance of this "seeking out" is consistent across all of our models and provides large-sample confirmation of results found in our smaller-sample study reported by Howard-Grenville, Nash, and Coglianese (2008). Interestingly, respondents' views about the influences of outside groups – a survey question more resonant with external pressure than with organizational identity or self-monitoring – does not turn out to be significantly associated with receptivity to voluntary action.

Our confidence in the robustness of the four factors identified as significant predictors of beyond-compliance behavior and participation in voluntary programs – namely, size, management support, community outreach, and regulatory pressure – is strengthened by the fact that these factors remain statistically significant in most or all alternative specifications of our regression models. We find confirmation, then, of the importance of some of the well-accepted outside pressures, such as regulation, that explain businesses' decision making. But we also find clear evidence of the importance of internal characteristics that have so far escaped much large-scale, systematic analysis.

Of course, more work remains in order to better understand how facilities make decisions to join voluntary programs or go beyond what is required by existing environmental regulations. The question of causality remains for further inquiry. Do facilities make voluntary investments in environmental protection because of the factors like those we have discussed in the sections above, or for some other reasons that correlate with those factors? We also cannot be sure that the perceptions of facility managers actually match up with their facility's actual behavior. When respondents report going beyond compliance, do their facilities actually do so? When they report that they regularly seek the opinions of community and environmental advocacy groups, do they? Nonetheless, we have identified key characteristics of facilities that engage in beyond compliance behavior, and importantly have found support for both internal and external reasons why they do so.

Robert Kagan's expansive scholarly contributions over the years, as well as the work of many other regulatory scholars, have closely scrutinized various external factors affecting business behavior, from governmental enforcement (Coglianese and Kagan 2007) to competitive pressures (Thornton, Kagan, Gunningham 2007). The results of our present study of business

participation in voluntary programs are consistent with the importance of the external factors that have been extensively studied. However, our research also confirms and elucidates, across an extensive sample and in a new regulatory context, the importance of the kinds of "intraorganizational" factors that Robert Kagan and Eugene Bardach called attention to over twenty-five years ago (Bardach and Kagan 1982: 61). Much like with individuals, the factors motivating the behavior of business organizations appear to operate as a complex interaction between both external pressures and internal dispositions.

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