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The Appeal of Voluntary Environmental Programs: Which Firms Participate and Why

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THE APPEAL OF VOLUNTARY ENVIRONMENTAL PROGRAMS

participating firms. These programs cover pollutants subject to regulations with different degree of stringency, and differ widely in their specific goals and requirements.

The success of voluntary environmental programs depends crucially on the programs' appeal to firms. While EPA traditionally emphasizes the publicity aspect of participation and the benefits of shared information about energy use or emissions reduction practices, earlier studies have proposed a number of other reasons for firms to join. These include: (i) to appeal to consumers who demand "green" products, and are willing to pay more for them (Arora and Gangopadhyay, 1995; Arora and Cason, 1995, 1996; Khanna and Damon, 1999); (ii) to preempt government regulation (Segerson and Miceli, 1998; Maxwell et al, 1998); (iii) to seek regulatory or compliance relief from the agency by showing the agency that the company has improved its environmental performance (or intends to); and (iv) to gain a competitive advantage over competitors.

In this paper, we examine the determinants of participation in voluntary environmental programs, focusing on testing hypotheses (i) and (iii). We also examine hypothesis (ii), the effect of the voluntary programs' regulatory stringency and the visibility of firm participation to regulators (and consumers), but in a different sense than in previous literature. Rather than focusing on one program, and controlling for the regulatory background of the *industry* the firm belongs to (as in Arora and Cason (1996)), we focus on a specified universe of firms (manufacturing firms among the large, publicly traded companies in the Standard and Poor 500), and analyze participation of these firms in each of *three* EPA voluntary programs covering differently regulated pollutants.

We proceed in this manner in order to separate the effect of the firm's environmental performance (hypothesis (iii)) from the impact of the program's regulatory background (hypothesis (ii)). In addition, this approach allows us to capture the importance of certain

aspects of the program, such as its age and prestige, by "exposing" the *same* firm to three *different* programs, 33/50, Green Lights and WasteWi$e. This paper also differs from previous literature in that we control for corporate concern for environmental performance.

Using data at the firm level from the Investor Responsibilities Research Center (IRRC) and Compustat, we fit several variants of probit models of participation. We find that (i) publicity is an important component of participation; (ii) the worse the environmental track record of the firm, the more likely is a firm to participate, but only in programs directly related to highly regulated pollutants; and that (iii) firms which scrutinize their environmental performance more carefully are wary of newer programs with uncertain benefits. We also find some evidence broadly consistent with the notion that firms value the information and technology transfer aspect of joining a program.

The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on self-regulation and environmental programs. Section 3 describes 33/50, Green Lights and WasteWi$e. We describe our data in section 4. In section 5 we present the econometric models, and in section 6 the choice of independent variables. Section 7 presents the results, and section 8 concludes.

II. THEORETICAL AND EMPIRICAL MODELS OF ENVIRONMENTAL SELF-REGULATION

Possible reasons why firms join voluntary environmental programs include: (i) to appeal to consumers who demand "green" products; (ii) to preempt government regulation; (iii) to seek regulatory or compliance relief from the agency, by showing the agency that they have improved their environmental performance (or intend to); and (iv) to gain a competitive advantage over competitors.

The first reason is modeled in Arora and Gangopadhyay (1995), using a model of vertical differentiation in which consumers have different marginal rates of substitution between income and quality. This results in environmental quality differentiation, with one firm overcomplying to attract wealthier consumers. Arora and Cason (1995, 1996) and Khanna and Damon (1999) indeed find that proximity to final consumers *is* a significant predictor of participation.

Preemption as a factor for environmental overcompliance is theoretically explored in Maxwell *et al.* (1998) who explain voluntary pollution abatement as a response to the threat of environmental regulation. Their results show that, under certain conditions, a stronger threat of regulation is expected to induce firms to self-regulate. In Segerson and Miceli (1998) the level of abatement under a voluntary program is directly related to the probability of the threat. The main positive implication from the Maxwell *et al.*, and Segerson and Miceli's models is that implementation and success of a voluntary agreement depend on the strength of the legislative threat. As a result, one would expect a weaker response to programs with looser regulatory background.

The empirical evidence is mixed for hypothesis (iii), that firms join environmental programs to obtain compliance or regulatory relief from the agency. Arora and Cason (1996) find that fines charged to firms for past violations of the Clean Air Act do not affect the likelihood of participation in 33/50, but Khanna and Damon (1999) report that chemical firms with a history as responsible parties at Superfund sites *are* more likely to participate in 33/50. (Khanna and Damon present their result as supporting hypothesis (ii)).

Finally, other streams of literature have examined the importance of corporate social and environmental concerns in setting environmental performance goals. Winn (1995) concludes that the incentives for self-regulation originate within the organization. Henriques and Sardosky

(1996) empirically test the impact of *internal* and *external* pressures on a firm's responsiveness to environmental issues.

To sum, these arguments suggest that empirical models of firm participation in EPA's voluntary programs should control for proximity to consumers, stringency of the regulatory background affecting firm operation, firm compliance record and environmental culture. As suggested by DeCanio and Watkins (1998), company size, profitability, and ability to innovate may also influence firm participation.

In this paper we report the results of empirical analyses of firm participation in voluntary programs that do control for these factors and specifically examine hypotheses (i) and (iii). We also examine the effect of the environmental regulatory background a firm is faced with (hypothesis (ii)), but in a different sense than in earlier literature: Specifically, we separately analyze participation in *three*

IRRC dataset documents the environmental performance of Standard & Poor 500, US-based firms over the years 1992-1998. Among other things, firms were queried about whether they (i) use environmental performance as a factor in senior or operating management compensation; (ii) consider environmental risks in its selection of contractors, business partners and clients; (iii) publish an environmental report; and (iv) conduct environmental audits. Details about participation in voluntary environmental programs, recycling and emissions were also obtained.

In practice, 255 of the S&P 500 companies regularly returned IRRC's annual mail survey. IRRC supplemented the responses provided by these firms with quantitative information on compliance with environmental statutes and on measures of environmental performance obtained from EPA databases. We merged the IRRC dataset with company-level variables contained in Standard & Poor's Compustat, such as number of employees, expenditure on research and development (R&D), and sales.

V. ECONOMETRIC MODELS

We assume the participation decision in a voluntary program depends on the percercerceIoIueci075 T

In practice, we need to pay attention to three potential problems. The first is that fitting probit models to the IRRC data is appropriate only if a firm's filling out and returning of the IRRC questionnaire is unrelated to its participation in a program. If the sample is affected by a selection bias, the standard probit coefficients will be biased. To address the selection bias problem, we assume that participation in the IRRC survey is driven by another unobservable variable, r_i^*, i.e., propensity to answer the survey questions:

(2) $$r_i^* = \mathbf{z}_i g + n_i .$$

The error term n_i is normally distributed with mean zero and variance equal to 1, and is allowed to be correlated with the error term ε of equation (1), as is appropriate if the same unobserved firm-specific factors influencing participation in the program also prompt the firm to agree to participate in the survey. The vector **z** includes variables thought to influence propensity to respond to the survey, such as firm size, R&D, and financial strength.

The IRRC data and the participation decision are observable only when $r_i^* > 0$ ($r_i = 1$), implying that the appropriate statistical framework is a bivariate probit model with a sample selection correction. The log-likelihood for year *t* is:

(3) $$\log L_t = \sum_{r=1, y=1} \ln \Phi(\mathbf{z}_i g, \mathbf{x}_i b, r) + \sum_{r=1, y=0} \ln\left[\Phi(\mathbf{z}_i g) - \Phi(\mathbf{z}_i g, \mathbf{x}_i b, r)\right] + \sum_{r=0} \ln\left[1 - \Phi(\mathbf{z}_i g)\right]$$

where $\Phi(\bullet, \bullet, r)$ denotes the bivariate standard normal cdf with coefficient of correlation equal to ρ. If consecutive years of observations are assumed to be independent, the log-likelihood for each of the programs under investigation is:

(4) $$\log L = \sum_{t=1}^{T} \log L_t .$$

The second problem is that, whether or not sample selection bias exists, unobserved firm-specific factors influencing participation in one program may also influence the decision to participate in another program. This suggests that we should experiment with and test the appropriateness of trivariate probit models of participation in the three programs.

Finally, since our dataset has the structure of a panel, whenever possible we incorporate random effects to help account for a firm's tendency to remain in a program, once it has decided to adhere to it, or to never join it.[i] We also experiment with a likelihood function in which a firm is deleted from the usable sample after it has joined the program.

VI. WHAT INFLUENCES PARTICIPATION IN A V

because they may be more able to identify opportunities for reducing pollutants, and adopt newer production processes at a lower cost. On the other hand, firms with more limited innovative ability might use the program to absorb pollution abatement information and technologies divulged by other participating firms or by the agency.

Finally, we include among the predictors dummies for different industrial groups to proxy for industry-specific characteristics (such as pollution intensity and regulatory burden), and the industry's increase in sales.

B. Corporate Environmental Culture

Winn (1995) and Henriques and Sardosky (1996) emphasize the importance of social corporate culture within a firm to explain firm sensitivity to environmental issues. In contrast to these authors, who capture corporate *attitudes* towards environmental issues, we include actual environmental *practices* conducted by the firms, since attitudes are not available in our dataset.

We include dummies for whether (i) the firm publishes environmental reports, (ii) conducts environmental auditing programs, (iii) regards environmental performance as a factor in senior and manager compensation, and (iv) considers environmental risks to select business partners, suppliers and customers.

C. Environmental Performance and Regulatory Background

It has been suggested (Arora and Cason, 1996) that firms with poor environmental compliance records may join voluntary environmental programs in hopes of obtaining relief from the EPA. If this hypothesis is correct, firms with poor environmental performance may be more likely to participate in a voluntary program. Furthermore, this effect is expected to be stronger the stricter the program's regulatory background (Maxwell *et al.*, 1998, and Segerson and Miceli,

1999). To test these hypotheses, we include among the independent variables in the program participation equations measures of environmental performance chosen among those most closely related to the program under investigation.

VII. RESULTS

Our regressions focus on 218 manufacturing firms among the S&P 500 companies, followed over 1993-98. Among these companies, the participation rate in 33/50 is 56 percent, 31 percent in Green Lights, and 34 percent for WasteWi$e. Clearly, not even among the large corporations that constitute the S&P 500 universe is participation in a voluntary pollution abatement program unanimous. The results of the bivariate probit model with selection (equation (4); results not reported) suggest that completion of the IRRC questionnaire *is* more likely among the larger firms of the Standard and Poor 500 group and among those firms that produce consumer goods. This is likely to be related to the firm's desire to maintain a favorable public image, to the extent that consumers and investors may consult the IRRC data.

Surprisingly, the correlation coefficient ρ between the survey participation and program participation decisions was *not* statistically significant, which suggests that for each program the likelihood function (4) can be separated out into two independent probit models, and that attention can be restricted to the determinants of participation in the program, without having to correct for participation in the survey.

Tables 2-4 present the results for participation in WasteWi$e, Green Lights, and 33/50, respectively, based on independent probit models. The specification in column (A) includes firm characteristics such as size, R&D expenditures, proximity to consumers, a measure of financial strength, industry dummies, and sales in the industry the firm belongs to. Column (B) adds variables proxying for environmental performance and compliance with environmental

regulation. Column (C) replace the latter two sets of variables with other variables describing the firm's environmental practices, and, finally, (D) is the broadest model, which includes the sets of variables examined in (A) through (C).

A. Participation in WasteWi$e

As shown in Table 2, column (A), larger firms *are* more likely to join WasteWi$e. However, participation in this program is not significantly affected by any of the financial health variables we experimented with. As expected, whether the firm produces consumer goods is a strong predictor of participation in WasteWi$e, increasing the likelihood of participation of the representative firm by 17 percent, all else equal. Finally, firms .75 -zso27.75 TD -0.0(g predrR&Dr thenditu

The coefficient of the sites at which the firm is a PRP is negative and significant. We were somewhat surprised by this result. It is possible that firms with a negative environmental track record (heavy involvement at hazardous waste sites) shun WasteWi$e, which they may see as neither improving their image nor promoting any actual pollution reductions. On the other hand, fines for violations of the RCRA law increase the likelihood of participation, a finding that is consistent with the hypothesis that firms join voluntary programs to improve their environmental image. However, both Superfund sites and penalty effects are small, and meaningful only for the most serious "offenders."[ii]

Perhaps the most thought-provoking results are those shown in column (C). The coefficient of the dummy for whether an environmental report is published by the company is positive, and statistically significant. Its magnitude implies that the average firm is 23 percent more likely to participate if it does publish an environmental report. Environmental reports are intended for the public and investors, rather than for the firm's internal use, suggesting that willingness to look good in the eyes of the public and investors provides a strong motivation to join a voluntary program.

We were surprised to note the negative association between compensation of upper management based on environmental performance and the likelihood of participation. However, conversations with EPA officials revealed that EPA does *not* regard participation in voluntary programs per se as a sign of good environmental performance. If the firm managers are aware of that, they may find joining WasteWi$e less attractive or useful, and they may prefer to concentrate on other goals, such as genuine emissions reductions. This provides further support for our explanation for the negative sign of the coefficient of the PRP variable.

When the model is re-run to include a dummy for the previous year's participation in WasteWi$e (a simple way to account for the firm's tendency to remain in the program after

joining it), the coefficient of most variables retain their signs and significance. Qualitatively similar results are seen when the likelihood function is modified to include only those firms who have not already joined the program in previous years. We also fitted random effects probit models (which allow for unobserved heterogeneity) following the specifications reported in table 3, with similar results.

B. Participation in Green Lights

Table 4 presents the results for participation in Green Lights from 1993 to 1998. Column (A) shows that among the variables related to firm size and financial performance, only firm size, measured as the number of employees, is related to participation in this program.

recognition is an important predictor of participation in a voluntary program and firm management might feel under pressure to join for the reputation effects.

C. Participation in 33/50

Table 5 reports the results of regressions explaining participation in 33/50. Column (A) shows that, once again, larger firms are more likely to join, and that firms who have recently incurred R&D expenditures are *less* attracted into the program. The latter result is broadly consistent with the possibility that firms that are less capable of innovating on their own might join in hopes of learning to reduce emissions from others. This interpretation also supports Khanna and Damon's finding that firms with *older* equipment are more likely to join 33/50.

In (B) we include measures of environmental performance, such as number of PRP nominations, corrective actions under RCRA, and TRI releases per employee. The former two variables are positively and significantly related to the likelihood of participating in the program, while the latter is insignificant (and is thus omitted from specification (D)). On the whole, big polluters would thus seem more likely to join 33/50.

We do not find that firms that produce consumer goods are more likely 33/50 participants, not even when attention is restricted to firms in the chemical sector. This result is in contrast with the Khanna and Damon (1999) findings. Perhaps this is due to the fact that Khanna and Damon explain participation for 1991-93, while we cover the years 1993-95, once the success of the program seemed secure and factors as technology transfers might have weighted more than publicity on the decision to participate and stay in the program.

Finally, of the variables measuring actual environmental practices, the coefficient of the dummy for whether the company publishes an environmental report is positive and significant. Furthermore, the coefficient for whether environmental performance is a factor in compensation

is positive and significant at the 5 percent level. This is in sharp contrast with the result for WasteWi$e. The difference is probably due to the broad endorsement and established reputation of 33/50.

D. Additional econometric issues

The results from the trivariate probit model (in which each participation indicator is a treated as a dependent variable in a system, and is allowed to be potentially correlated with the other two indicators) suggest that it is acceptable to model the decisions to participate in 33/50, Green Lights, and WasteWi$e as independent. The correlation coefficients between the programs are low and not significant at the conventional levels. In particular, the correlation between 33/50 and Green Lights was estimated to be .241, that between 33/50 and WasteWi$e 0.078, and that between Green Lights and WasteWi$e –0.003.

Of more concern is the possibility that the dummies capturing aspects of corporate environmental culture or activities might be endogenous with the dependent variables. Addressing this concern requires developing instruments for the mentioned activities, and implementing a two-stage estimation procedure (with a correction for the heteroskedasticity thus introduced). We considered several firm characteristics and past environmental performance as candidate instruments, but were disappointed to see that only number of employees was significantly (and positively) correlated with the dummies for the environmental culture practices. The quality of the prediction for each dummy variable was too poor for us to continue with our planned procedure. To sum, since it is difficult to find good instruments for the adoption of corporate environmental practices, we leave these indicators in the right-hand side of the probit equations for participation in the EPA programs, and continue to interpret the coefficients

of these dummies in the usual way, although we recognize that the true coefficients might be of greater absolute magnitude if one were able to remedy the endogeneity problem.

VIII. CONCLUSIONS

To examine the importance of different factors leading to participation in voluntary environmental programs, we have estimated models of participation in 33/50, Green Lights and WasteWi$e, three EPA programs that differ widely with respect to the reputation of the program, and the stringency of the regulations for the pollutants they address. The firms we examine belong to the Standard and Poor 500, and we check for possible sample selection bias and dependence among participation decisions.

Our results suggest that the possible publicity from joining a voluntary program *is* an important determinant of participation. Larger, and presumably more visible to consumers and regulator, firms *are* systematically more likely to join, regardless of the pollutant addressed by the program and the stringency of the regulations for that pollutant. In addition, firms who wish to show consumers about their environmental performance progress, and do so by publishing environmental reports, are typically more likely to join.

Our analysis suggests that although the publicity aspect of participation is highly valued, firms privately might be skeptical about the true impact on participation on their environmental performance. Firms that use environmental performance as one of the criteria for establishing manager compensation are less likely to participate in WasteWi$e, a program that deals with solid waste and recyclables, but does little in terms of the more pressing generation of hazardous waste and emissions into air and water. The opposite effect (very strong) is seen for 33/50, a program that does seek reductions in the releases and transfers of toxics, and (in a weak form) for Green Lights, probably because of the energy conservation emphasis of the latter.

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[i] In practice, amending the likelihood function (4) or the trivariate probit likelihood function to incorporate fixed or random effects is difficult. We attempt to control for the tendency of a firm to stay in a program or to never join it by fitting alternative specifications that include the lagged value of the program participation indicator among the right-hand side variables.

[ii] The coefficient of correlation between fines for violations of the RCRA regulations (normalized by employees) and nominations as PRP at Superfund sites is only .075. The coefficients of these regressors are robust to dropping one of these variables and keeping the other.

Table 1. Summary of features of the three programs analyzed.

Program	Pollutants covered	Regulatory Background	Age of the Program	Do Consumers recognize participation?	Can cost savings be realized through the program?
Green Lights	Greenhouse gases from fossil fuels used in power generation (only indirectly)	Weak	Since 1991; Well-established	Yes	Yes, on electricity bills (main appeal of the program)
WasteWi$e	Solid waste	Weak	Since 1994; relatively new	Unclear	Unclear
33/50	17 heavy metals and other toxic chemicals	Strong	Started in 1991 and closed in 1995	Yes, according to Arora and Cason (1996), and Khanna and Damon (1999). Also see Konar and Cohen (1997).	Maybe (if changes in production processes are possible that reduce releases and save on inputs)

Table 3. Determinants of participation in Green Lights from independent probit model (1993-1998) (t-statistics in parentheses)

Variable	Sample mean	A	B

Table 4. Determinants of participation in 33/50 (1993-1995) from probit model (t-statistics in parentheses)

Variable	Sample mean	A	B	C	D
Number of employees	38.047	5.663** (4.401)	4.075** (2.723)		2.401 (1.437)
Past Period Increase in Sales	0.066	-1.351** (-2.407)	-.942 (-1.579)		.204 (.253)
Past Period R&D Expenditures ($ 1,000 per employee)	10.140	-18.111** (-2.295)	-14.659* (-1.721)		-14.167 (-1.206)
The Firm Produces Consumer Goods	0.336	.190 (1.224)	-.014 (-.086)		-.315 (-1.371)
Industry Increase in Sales		.370 (.245)	-.833 (-1.671)		-.743 (-.360)
RCRA Corrective Actions	0.741		.292** (3.581)		.334** (4.076)
Potential Responsible Party Notifications	25.559		.014** (3.129)		.015** (3.053)
Past Period TRI Releases (pound per employee)	92.447		.0001 (.289)		
Environmental Performance is a Factor in Manager Compensation	0.629			.364** (2.358)	.497** (2.066)
Firm Publishes an Environmental Report	0.335			.694** (3.336)	.647** (2.242)
Firm Considers Environmental Risks to Select Partners, Suppliers, Customers	0.478			-.122 (-.693)	-.065 (-.264)
Firm Conducts Internal Env.					

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