

**Article review:**  
**EPA's Voluntary 33/50 Program:  
Impact on Toxic Releases  
and Economic Performance of Firms**

Madhu Khanna, and Lisa A. Damon\*

*Shaufique Sidique*

# Introduction

- What is 33/50 Program?
  - A Program launched by the EPA in 1991 to encourage firms to voluntarily reduce their emissions of 17 high-priority toxic chemicals to air, land, or water
  - Aims to reduce the aggregate releases of these chemicals by 33% by 1992 and by 50% by 1995
  - Reductions were evaluated relative to the level of releases reported in the Toxic Release Inventory TRI for 1988

# Objective

- This paper examines:
  - the motivations for firms participation in the voluntary 33/50 Program
  - the program's impact on the toxic releases and economic performance of firms in the U.S. chemical industry

# Conceptual Framework

- A rational firm chooses its levels of pollution generation at each point in time to maximize its discounted net benefits over a specified time horizon
- The level of pollution at each point in time is the level where the MC of generating pollution equal the MB of that pollution
- A firm will participate if the firm's expected discounted net benefits from production with participation are greater than its expected discounted net benefits from production without participation

# Conceptual Framework

- The program outcome model is specified as:

$$Y_{it} = X_{it}\beta_1 + \alpha D_{it} + \varepsilon_{it} \quad i = 1, \dots, I; t = 1, \dots, T,$$

- $Y_{it}$  -  $i$ th firm's pollution level at time  $t$
- $X_{it}$  - a vector of observed exogenous firm-specific variables, such as its production technology, level of output produced, and input and output prices
- $D_{it}$  - program participation decision (1=Yes, 0=No)
- $\varepsilon_{it}$  - random error term

# Conceptual Framework

- Participation decision of a firm at time  $t$  depends on the net benefits from participation  $D_{it}^*$

$$D_{it}^* = \mathbf{X}_{2it} \dot{\boldsymbol{\beta}}_2 + \dot{\varepsilon}_{2it}$$

- $\mathbf{X}_{2it}$  - vector of exogenous variables for the  $i$ th firm

# Conceptual Framework

- Since we do not observe  $D_{it}^*$ , we use the firm's
- decision variable  $D_{it} = 1$  if  $D_{it}^* > 0$ ,  $D_{it} = 0$  otherwise
- This can be represented by a Probit model:

$$D_{it} = F(X_{2it}\beta_2) + \mu_{it},$$

# Conceptual Framework: Motivations for Participation in the 33/50 Program

- Arora and Cason (1995)
  - participation is motivated by size, financial characteristics, and desire for public recognition
- This paper extends the above findings by hypothesizing that the incentives for participation arise from the following sources:
  - Program Features
  - Mandatory Environmental Regulations
  - Firm-Specific Characteristics

# Conceptual Framework: Motivations for Participation in the 33/50 Program

- Program Features
  - Participation in the program provides certain direct benefits to firms
  - Their efforts to protect the environment are given public recognition through press releases, newsletters, and awards.
  - This is expected to improve customer goodwill for participating firms

# Conceptual Framework: Motivations for Participation in the 33/50 Program

- **Mandatory Environmental Regulations**
  - The threat of the imposition of penalties under mandatory environmental regulations may motivate firms to participate in voluntary programs
- **Firm-Specific Characteristics**
  - Firm-specific characteristics such as innovativeness, age of existing equipment, membership in industry trade association, and volume of toxic releases are expected to influence the costs and benefits of participation and thus the participation decision

# Conceptual Framework: Impact of the 33/50 Program on a Firm's Economic Performance

- Large part of the cost of the participation is incurred immediately and many of the benefits will only be realized in the long-run
- Thus, current and long-run economic performance must be measured separately
- Current Economics performance is measured by ROI and EV/S

# Data and Analysis

- The study utilizes firm-level data on environmental and financial variables of publicly traded firms with SIC code 28 (chemical industry)
- Probit model with pooled time series and cross-sectional data was used to investigate the determinants of participation decision of firms over the period 1991-95
- 246 pooled observations

# Data and Analysis

- Firm specific explanatory variables:
  - **33/50 releases** - examines the direct effect of the volume of these releases (17 chemicals)
  - **Percent Prior Reduction** in 33/50 releases - measures the incentives provided by previously achieved reductions
  - **CMA** –dummy var. for CMA members
  - **Age of asset**
  - **R&D/Sales**
  - **First Invitation Group** – dummy for firms first invited by EPA to participate in program

# Data and Analysis

- Mandatory regulations explanatory variables:
  - **Number of Superfund Sites** – to proxy the impact of the Superfund Act
- Program features explanatory variables:
  - **Final Good** – dummy var. for firms selling final products

# Results: Motivations for Participation in the 33/50 Program

- Two alternative specifications for analyzing the factors motivating participation in the 33/50 Program
- Model I includes 33/50 Releases, while model II includes the First Invitation Group as an explanatory variable

# Results: Motivations for Participation in the 33/50 Program

Motivations for Participation in the 33/50 Program			
Motivating factors	Variable <sup>a</sup>	Model I	Model II
Program features	Final good	0.56 (0.25)**	0.48 (0.25)*
	Release–output ratio	0.15E-03 (.11)	0.13E-03 (.69E-04)*
Mandatory environmental regulations	No of Superfund sites	0.44E-01 (0.21E-01)**	0.35E-01 (0.2E-01)*
	No. of Superfund sites squared	–0.75E-03 (0.36E-03)**	–0.55E-03 (0.33E-03)*
	HAP–33/50 releases ratio	0.10 (0.69E-01)	0.13 (0.70E-01)*
	HAP–33/50 releases ratio squared	–0.27E-02 (0.24E-02)	–0.39E-02 (0.24E-02)*
Firm-specific characteristics	Age of assets	–1.93 (1.11)*	–1.16 (1.15)
	CMA	0.68 (0.26)***	0.48 (0.27)*
	R & D/sales	–0.56E-03 (0.96E-03)	0.39E-03 (0.98E-03)
	No. of facilities	0.31E-02 (0.90E-02)	0.37E-04 (0.86E-02)
	33/50 releases	0.13 (0.75E-01)*	
	33/50 releases squared	–0.35E-02 (0.20E-02)*	
	First invitation group		1.15 (0.24)***
	33/50–TRI releases ratio	–0.76 (.47)*	–0.81 (.47)*
	Percentage prior reductions in 33/50 releases	0.12E-01 (0.15E-01)	0.68E-02 (0.14E-01)
	Intercept	0.54E-01 (0.95)	–0.66 (0.99)
No. classified correctly with <i>N</i> = 246	Participants	43/75	53/75
	Nonparticipants	153/171	159/171
	Log likelihood values	–104.57	–95.86
	$\chi^2$ [14]	93.4 {0}	110.83 {0}
	$\chi^2_{\text{Het}}[1]$	3.46	1.01

*Note.* Dependent variable: Participation in the 33/50 Program.

<sup>a</sup>All explanatory variables are lagged by 1 year relative to the year, 1991–93, in which the dependent variable is observed. Standard errors are in parentheses. Degrees of freedom are in square brackets. *P* value is in curly brackets.  $\chi^2$  [14] is a chi-square test for all slope coefficients jointly equal to zero.  $\chi^2_{\text{HET}}[1]$  is a Davidson and Mackinnon [8] LM test for heteroskedasticity, using 33/50 releases as a regressor.  $\chi^2_{0.05}[1] = 3.84$ .

\*\*\*Statistically significant at the 1% level.

\*\*Statistically significant at the 5% level.

\*Statistically significant at the 10% level (all two-tailed tests).

# Results: Motivations for Participation in the 33/50 Program

- Both models show that the desire for public recognition and increased consumer goodwill provide statistically significant incentives for firms selling **final goods** to participate in the program
- **CMA** members are significantly more likely to participate than nonmembers
- The negative sign of **age of assets** indicates that firms with older assets are more likely to participate

# Results: Motivations for Participation in the 33/50 Program

- Firms with a high ratio of 33/50 releases to total toxic releases are less likely to participate in the program, because these firms would find it more difficult to substitute other chemicals for 33/50 chemicals
- Model I shows that firms with larger 33/50 releases are significantly more likely to participate
- A firm's inclusion in the first invitation group appears to be a better indicator of its participation decision

# Results

## Impact of Regulatory Variables and Program Features

Variable	% change in probability of participation
No. of Superfund sites	0.41 (0.25)*
HAP-33/50 release ratio	1.58 (0.96)*
Final good	8.98 (3.33)**
Release-output ratio	0.0017 (0.00092)*
First invitation group	29.93 (3.23)***

*Note.* Each entry indicates the percent change in probability due to a marginal change in the indicated variable from the median level in the case of continuous variables and from 0 to 1 in the case of dummy variables. Change is calculated using the estimates obtained in Table 2, model II. Standard errors are given in parentheses.

\*\*\*Significant at the 1% level.

\*\*Significant at the 5% level.

\*Significant at the 10% level.