

Sensitivity Analysis for, “Is Voluntary Pollution Abatement in the Absence of a Carrot or Stick Effective? Evidence from Facility Participation in the EPA's 33/50 Program”

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This is a supplement to Vidovic and Khanna and includes additional sensitivity analyses. Additional models include: (1) an analysis of the effectiveness of program participation using toxicity weighted facility emissions instead of aggregate facility emissions, (2) pooled probit model of facility participation in the Program conditional on parent firm participation in the Program where a parent firm and a facility is removed from the dataset once it participates. This is again followed by an evaluation of determinants of facility emissions using GMM; (3) Determinants of facility participation in the Program and facility emissions while ignoring firm participation where we follow the approach by Bi and Khanna and estimate facility participation using pooled probit and facility emissions using a two-step feasible GMM estimator.

Table I: Descriptive statistics (1990): Firm level means and standard deviations (in parentheses)

Variable	All firms	Participants	Non-participants
Final good ^a	32.07	30.96	33.33
R&D/sales	0.02 (0.03)	0.03 (0.03)	0.02 (0.043)
Newness of assets	0.77 (0.97)	0.76 (0.10)	0.79 (0.88)
33/50 releases/sales (lbs/million \$)	734.7 (15935.7)	810.3 (18725.0)	650.0 (1209.1)
Weighted 33/50 releases/sales	291854.9 (1739433)	319762.9 (1917629)	260644.1 (1520699)
33/50 releases (millions lbs)	1.28 (3.69)	2.13 (4.87)	0.29 (0.63)
Weighted 33/50 releases (millions)	410.39 (1538.29)	698.46 (2032.71)	78.53 (379.98)
Prior change in 33/50 releases (millions lbs)	-0.37 (1.168)	-0.66 (1.50)	-0.04 (0.29)
33/50 -TRI release ratio	0.51 (0.36)	0.48 (0.38)	0.55 (0.34)
HAP-TRI release ratio	0.62 (0.28)	0.61 (0.26)	0.64 (0.31)
Number of facilities	11.36 (15.26)	15.52 (18.15)	6.44 (8.79)
Number of Superfund sites	4.03 (7.76)	6.67 (9.72)	0.99 (1.92)
Number of inspections	3.16 (6.49)	4.80 (7.99)	1.27 (3.26)
Number of enforcement actions	2.82 (6.25)	4.30 (7.63)	1.13 (3.43)
State per capita Sierra club membership	0.23 (0.12)	0.22 (0.09)	0.24 (0.14)
State LCV score	59.26 (10.17)	58.81 (9.24)	59.78 (11.16)
First invitation group ^a	41.30	65.98	12.87
SIC 26: Paper ^a	3.26	4.06	2.34
SIC 28: Chemical ^a	18.21	25.88	9.36
SIC 29: Petroleum and coal ^a	3.53	6.09	0.58
SIC 30: Rubber ^a	2.44	3.55	1.17
SIC 33: Primary metal ^a	6.52	7.61	5.26
SIC 34: Fabricated metal ^a	7.07	4.57	9.94

SIC 35: Machinery and computer ^a	14.40	11.67	17.54
SIC 36: Electronics ^a	13.32	14.21	12.28
SIC 37: Transportation ^a	8.97	8.63	9.36
SIC 38: Instruments ^a	8.15	5.07	11.69
All other SIC codes ^a	14.13	8.66	20.48
Number of firms	368	197	171

Note: ^a This is a dummy variable for which the percentage of firms in each category is reported.

SECTION 1: ANALYSIS WITH TOXICITY WEIGHTED EMISSIONS

Table II: Determinants of firm participation in the 33/50 Program, 1991-1995

* This Table corresponds to appendix **Table A2** in the manuscript and shows the results for firm participation in the 33/50 Program using toxicity weighted emissions.

Variable	Model 1W	Model 2W
Final good	-0.142* (0.085)	-0.159* (0.089)
R&D/sales	8.275*** (1.468)	9.924*** (1.605)
Newness of assets	-0.564 (0.399)	-0.745* (0.419)
Weighted 33/50 releases/sales	-1.2E-08 (3.8E-08)	6.6E-09 (3.7E-08)
Weighted 33/50 releases	1.4E-04** (6.8E-05)	3.9E-05 (5.1E-05)
Prior change in 33/50 releases	-0.345*** (0.084)	-0.033 (0.089)
33/50 -TRI release ratio	0.286** (0.113)	0.114 (0.110)
HAP-TRI release ratio	-0.199 (0.130)	-0.205 (0.134)
Number of facilities	0.004 (0.004)	-0.011** (0.004)
Number of Superfund sites	0.190*** (0.018)	0.139*** (0.035)
Number of Superfund sites squared	-0.003*** (0.001)	3.7E-05 (0.003)
Number of enforcement actions	0.027 (0.025)	0.026 (0.027)
Number of inspections	0.016 (0.027)	0.014 (0.028)
Sierra club membership	-0.778** (0.367)	-0.932** (0.389)
State LCV score	-9.0E-04 (3.2E-03)	5.3E-05 (3.3E-03)
First invitation group	- (0.371)	1.317*** (0.101)
Constant	-0.270 (0.371)	-0.241 (0.378)

Log likelihood	-869.33	-776.68
Number of observations	1,787	1,787

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust standard errors are in parentheses. All models are estimated using a random effects panel probit model with two-digit SIC industry groups as cross sections.

Table III: Determinants of facility participation in the 33/50 Program, 1991-1995

*This table corresponds to **Table 3** in the manuscript, but reports results for toxicity weighted emissions.

Variable	Model 1W
First invitation group	-1.073 (1.326)
Weighted facility 33/50 emissions	3.68E-10 (8.67E-10)
Ratio of weighted facility to parent firm 33/50 releases	0.412 (0.659)
Pre-program change in 33/50 releases	-1.67E-07 (4.25E-07)
TRI releases	0.140*** (0.054)
HAP-TRI ratio	-1.97E-05 (0.003)
Number of inspections	-0.061 (0.095)
Number of enforcement actions	0.092 (0.096)
State LCV score	0.003 (0.006)
County non-attainment status	0.169 (0.152)
Sierra Club membership	0.672 (1.233)
Median household income	-8.50E-05 (5.19E-05)
% bachelor degree or higher	0.069 (0.037)
% age less than 5	0.162 (0.115)
% African American	-0.017 (0.019)
% below poverty	-0.097 (0.056)
Population per square mile	1.88E-04 (1.39E-04)
Voter participation rate	-0.304 (1.558)
Inverse Mills ratio	1.770***

	(0.639)
SIC 26: Paper	0.569
	(0.986)
SIC 28: Chemical	0.427
	(1.086)
SIC 30: Rubber	-0.137
	(8.609)
SIC 33: Primary metal	1.182
	(1.030)
SIC 34: Fabricated metal	0.946
	(1.017)
SIC 35: Machinery and computer	0.741
	(1.033)
SIC 36: Electronics	0.856
	(1.093)
SIC 37: Transportation	1.011
	(1.894)
Constant	-5.668**
	(2.770)
Likelihood ratio test ($H_0: \rho=0$)	1767.79
Likelihood ratio test – p value	0.000***
Number of observation	9,888

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Bootstrapped standard errors clustered on firms are in parentheses. Toxicity weighted 33/50 emissions and TRI emissions are measured in natural logs. All other variables are in levels.

Table IV: Determinants of facility 33/50 emissions, 1991 – 1995 (exogenous TRI and HAP-TRI)

*This table corresponds to **Table 4** in the manuscript, but reports results using toxicity weighted emissions.

Variable	Model 1W	Model 2W	Model 3W
Weighted facility 33/50 emissions _(t-1)	0.896*** (0.083)	0.771*** (0.074)	0.817*** (0.082)
TRI releases	0.370*** (0.056)	0.439*** (0.056)	0.430*** (0.055)
HAP-TRI ratio	0.007*** (0.001)	0.008*** (0.001)	0.009*** (0.001)
Number of enforcement actions	- -	-0.013 (0.009)	- -
Number of inspections	- -	- -	-0.024* (0.014)
Program participation	-2.050 (1.686)	-1.572 (1.575)	-2.507 (1.676)
State LCV score	0.005** (0.002)	0.005* (0.003)	0.003 (0.003)
County non-attainment status	0.158*** (0.055)	0.157*** (0.051)	0.175*** (0.051)
Sierra Club membership	-1.130** (0.484)	-0.904* (0.513)	-0.976* (0.509)
Median household income	-2.1E-05 (1.5E-05)	-3.8E-05** (1.8E-05)	-3.2E-05* (1.7E-05)
% bachelor degree or higher	-0.004 (0.013)	-0.005 (0.016)	-0.008 (0.016)
% age less than 5	0.038 (0.047)	0.043 (0.059)	0.060 (0.055)
% African American	-0.009** (0.005)	-0.009* (0.006)	-0.010* (0.006)
% below poverty	-0.014 (0.015)	-0.031* (0.017)	-0.031** (0.015)
Population per square mile	2.4E-06 (3.0E-05)	5.5E-06 (3.3E-05)	3.8E-06 (2.9E-05)
Voter participation rate	-0.418 (0.388)	-0.244 (0.472)	-0.529 (0.464)
Year 1991	-0.454*** (0.171)	-0.379* (0.206)	-0.282 (0.198)
Year 1992	-0.087 (0.170)	-0.114 (0.201)	-0.008 (0.190)
Year 1993	-0.097	-0.056	0.056

	(0.179)	(0.212)	(0.188)
Year 1994	0.014	-0.098	0.034
	(0.195)	(0.217)	(0.211)
Year 1995	-0.042	-0.124	0.006
	(0.211)	(0.236)	(0.219)
SIC 26: Paper	-1.262***	-1.366***	-1.1251**
	(0.342)	(0.357)	(0.337)
SIC 28: Chemical	-0.453**	-0.4901**	-0.4031*
	(0.191)	(0.219)	(0.212)
SIC 30: Rubber	-0.369	-0.552	-0.473
	(0.327)	(0.364)	(0.353)
SIC 33: Primary metal	0.434	0.569	0.603
	(0.369)	(0.394)	(0.451)
SIC 34: Fabricated metal	0.248	0.503	0.682*
	(0.321)	(0.422)	(0.386)
SIC 35: Machinery and computer	0.364**	0.377*	0.388*
	(0.163)	(0.208)	(0.198)
SIC 36: Electronics	-0.047	-0.072	-0.002
	(0.199)	(0.223)	(0.212)
SIC 37: Transportation	0.103	0.242	0.153
	(0.221)	(0.256)	(0.240)
Constant	-2.553**	-1.272	-1.849
	(1.085)	(1.144)	(1.138)
Observations	11,344	11,344	11,344
AR(1) – p value	0.000***	0.000***	0.000***
AR(2) – p value	0.291	0.338	0.311
Hansen J test – p value	0.422	0.203	0.343
Sargan test – p value	0.326	0.865	0.819

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust standard errors clustered on firms with Windemeijer's finite sample correction are in parentheses. Dependent variable is the natural log of toxicity weighted 33/50 emissions. In all models the number of enforcements and inspections are predetermined. The number of observations reflects that our dataset starts in 1988 to allow for lags. Toxicity weighted 33/50 emissions and TRI emissions are measured in natural logs. All other variables are in levels.

Table V: Determinants of facility 33/50 emissions, 1991 – 1995 (endogenous TRI and HAP-TRI).

*This table corresponds to **Table 4** in the manuscript, but reports results assuming that TRI releases and the HAP to TRI ratio are endogenous and also using toxicity weighted emissions. These results are referred to in section 6.2 of the paper, *Facility 33/50 Emissions*.

Variable	Model 1	Model 2	Model 3	Model 1W	Model 2W	Model 3W
Facility 33/50 emissions _(t-1)	0.781*** (0.087)	0.727*** (0.073)	0.700*** (0.073)	- -	- -	- -
Weighted facility 33/50 emissions _(t-1)	- -	- -	- -	0.830*** (0.067)	0.854*** (0.059)	0.858*** (0.063)
TRI releases	0.216** (0.108)	0.308*** (0.095)	0.320*** (0.100)	0.192** (0.095)	0.200** (0.092)	0.208** (0.101)
HAP-TRI ratio	0.006 (0.004)	0.008** (0.003)	0.007** (0.004)	0.003 (0.005)	0.003 (0.004)	0.004 (0.005)
Number of enforcement actions		0.003 (0.019)	- -	- -	-0.007 (0.018)	- -
Number of inspections		- -	-0.006 (0.017)	- -	- -	-0.007 (0.016)
Program participation	-0.103 (0.455)	-0.295 (0.433)	-0.375 (0.449)	-0.643 (1.709)	-0.046 (1.535)	-0.307 (1.556)
State LCV score	0.002 (0.002)	0.001 (0.002)	4.6E-04 (0.002)	0.003 (0.003)	0.004 (0.003)	0.003 (0.002)
County non-attainment status	0.062** (0.031)	0.064** (0.031)	0.063** (0.031)	0.102* (0.058)	0.081 (0.053)	0.101* (0.052)
Sierra Club membership	-0.442 (0.316)	-0.330 (0.312)	-0.353 (0.287)	-0.716 (0.458)	-0.669 (0.482)	-0.683 (0.451)
Median household income	-2.3E-05** (1.0E-05)	-2.7E-05** (1.1E-05)	-2.7E-05*** (9.9E-06)	-2.2E-05 (1.3E-05)	-2.1E-05 (1.4E-05)	-2.2E-05 (1.4E-05)
% bachelor degree or higher	0.005 (0.010)	0.008 (0.009)	0.008 (0.009)	-0.002 (0.012)	-0.004 (0.012)	-0.002 (0.013)
% age less than 5	0.038 (0.032)	0.050* (0.030)	0.050* (0.030)	0.020 (0.047)	0.032 (0.050)	0.041 (0.047)
% African American	-0.006 (0.004)	-0.007** (0.004)	-0.007** (0.003)	-0.008 (0.005)	-0.007 (0.005)	-0.007 (0.005)
% below poverty	-0.016 (0.012)	-0.019 (0.012)	-0.021* (0.011)	-0.012 (0.015)	-0.012 (0.014)	-0.014 (0.013)
Population per square mile	-1.2E-05 (2.0E-05)	-2.8E-06 (2.0E-05)	4.2E-06 (2.0E-05)	-1.1E-05 (3.2E-05)	-2.0E-05 (3.2E-05)	-1.7E-05 (3.1E-05)
Voter participation rate	0.196 (0.315)	0.201 (0.318)	0.167 (0.300)	0.032 (0.361)	0.115 (0.394)	-0.014 (0.411)
Year 1991	-0.375*** (0.125)	-0.302*** (0.115)	-0.255** (0.116)	-0.550** (0.214)	-0.534*** (0.201)	-0.430** (0.200)

Year 1992	-0.308*** (0.112)	-0.237** (0.101)	-0.238** (0.097)	-0.264 (0.199)	-0.257 (0.181)	-0.179 (0.181)
Year 1993	-0.420*** (0.123)	-0.340*** (0.107)	-0.341*** (0.106)	-0.422** (0.209)	-0.329* (0.183)	-0.235 (0.177)
Year 1994	-0.396*** (0.136)	-0.323*** (0.124)	-0.342*** (0.120)	-0.314 (0.215)	-0.258 (0.190)	-0.192 (0.193)
Year 1995	-0.467*** (0.142)	-0.407*** (0.119)	-0.436*** (0.119)	-0.481** (0.236)	-0.408** (0.203)	-0.319 (0.203)
SIC 26: Paper	-0.457 (0.343)	-0.655** (0.288)	-0.517* (0.271)	-0.547 (0.358)	-0.852** (0.330)	-0.699** (0.317)
SIC 28: Chemical	-0.202 (0.134)	-0.235* (0.125)	-0.232* (0.122)	-0.271* (0.140)	-0.268* (0.159)	-0.225 (0.150)
SIC 30: Rubber	-0.121 (0.245)	-0.167 (0.235)	-0.106 (0.226)	-0.485* (0.293)	-0.378 (0.298)	-0.285 (0.281)
SIC 33: Primary metal	0.025 (0.177)	0.055 (0.170)	0.029 (0.168)	0.460 (0.365)	0.350 (0.354)	0.442 (0.383)
SIC 34: Fabricated metal	-0.159 (0.335)	0.039 (0.339)	0.038 (0.309)	-0.107 (0.351)	0.003 (0.348)	0.163 (0.361)
SIC 35: Machinery and computer	-0.047 (0.169)	0.043 (0.164)	0.020 (0.157)	0.008 (0.185)	0.112 (0.191)	0.143 (0.195)
SIC 36: Electronics	-0.180 (0.142)	-0.116 (0.151)	-0.109 (0.140)	-0.289 (0.240)	-0.283 (0.226)	-0.148 (0.218)
SIC 37: Transportation	0.217* (0.117)	0.214* (0.114)	0.220** (0.102)	0.233 (0.174)	0.187 (0.174)	0.221 (0.167)
Constant	-0.403 (0.788)	-0.999 (0.670)	-0.776 (0.667)	0.461 (0.976)	-0.241 (0.923)	-0.504 (0.858)
Observations	11,344	11,344	11,344	11,344	11,344	11,344
AR(1) – p value	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(2) – p value	0.054*	0.05*	0.057*	0.273	0.27	0.273
Hansen J test – p value	0.195	0.452	0.418	0.189	0.238	0.284
Sargan test – p value	0.093*	0.406	0.428	0.009***	0.121	0.104

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust standard errors clustered on firms with Windemeijer's finite sample correction are in parentheses. Dependent variable is the natural log of aggregate 33/50 emissions in models 1-3 and the natural log of toxicity weighted 33/50 emissions in models 1W-3W. In all models the number of enforcements and inspections are predetermined and TRI and HAP-TRI are endogenous. The number of observations reflects that our dataset starts in 1988 to allow for lags. Aggregate and toxicity weighted 33/50 emissions and TRI emissions are measured in natural logs. All other variables are in levels.

Table VI: Determinants of facility participation in the 33/50 Program: Ignoring firm participation

*This table corresponds to **Table 5** in the manuscript, but reports results using toxicity weighted emissions.

Variable	Model 1W	Model 2W
First invitation group	-0.209 (0.144)	-0.095 (0.197)
Weighted facility 33/50 emissions	-6.9E-12 (5.4E-11)	-4.2E-11 (4.1E-11)
Ratio of facility to parent firm weighted 33/50 releases	1.534*** (0.166)	0.757*** (0.082)
Pre-program change in facility 33/50 releases	-5.0E-07** (2.3E-07)	-6.6E-07*** (1.1E-07)
TRI releases	0.040** (0.018)	0.104*** (0.011)
HAP-TRI ratio	-0.001 (0.001)	0.000 (0.001)
Number of inspections	0.014 (0.076)	0.001 (0.041)
Number of enforcement actions	0.003 (0.072)	0.036 (0.039)
State LCV score	0.005* (0.003)	0.006*** (0.002)
County un-attainment status	0.116* (0.065)	0.145*** (0.031)
Sierra Club membership	-0.063 (0.571)	0.045 (0.279)
Median household income	-3.9E-05** (1.9E-05)	-4.0E-05*** (8.9E-06)
% bachelor degree or higher	0.022 (0.019)	0.056*** (0.009)
% age less than 5	0.048 (0.062)	0.077 (0.029)
% African American	-0.003 (0.007)	-0.004 (0.003)
% below poverty	-0.055* (0.024)	-0.058*** (0.011)
Population per square mile	1.3E-05 (4.1E-05)	7.7E-05*** (1.8E-05)
Voter participation rate	0.324 (0.575)	0.521** (0.265)
SIC 24: Lumber and wood	-0.192	0.455*

	(0.374)	(0.263)
SIC 25: Furniture and fixtures	-0.636	-0.444
	(0.391)	(0.381)
SIC 26: Paper	0.224	2.018***
	(0.366)	(0.232)
SIC 28: Chemical	0.211	0.913***
	(0.213)	(0.153)
SIC 30: Rubber	-0.058	-0.157
	(0.268)	(0.192)
SIC 33: Primary metal	0.271	0.907***
	(0.233)	(0.153)
SIC 34: Fabricated metal	0.039	0.423***
	(0.215)	(0.147)
SIC 35: Machinery and computer	-0.127	0.527***
	(0.279)	(0.172)
SIC 36: Electronics	0.275	0.909***
	(0.280)	(0.168)
SIC 37: Transportation	0.055	0.418**
	(0.265)	(0.179)
SIC 38: Instruments	-0.052	1.083***
	(0.409)	(0.224)
Constant	-8.144***	-12.105***
	(0.987)	(0.474)
Log likelihood	-3122.86	-4469.16
Observations	41,662	41,662

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust standard errors are in parentheses. Model 1W is estimated using a random effects probit model with facilities as cross sections whereas Model 2W is estimated using a random effects probit model with firms as cross sections. Toxicity weighted 33/50 emissions and TRI emissions are measured in natural logs. All other variables are in levels.

Table VII: Determinants of facility toxicity weighted 33/50 emissions: Ignoring firm participation

*This table corresponds to **Table 6** in the manuscript, but reports results using toxicity weighted emissions.

Variable	Model 1W	Model 2W	Model 3W
Weighted facility 33/50 emissions _(t-1)	0.987*** (0.055)	0.836*** (0.061)	0.874*** (0.055)
TRI releases	0.403*** (0.027)	0.479*** (0.032)	0.464*** (0.029)
HAP-TRI ratio	0.011*** (0.001)	0.011*** (0.001)	0.011*** (0.001)
Number of enforcement actions	- -	0.002 (0.018)	- -
Number of inspections	- -	- -	-0.023 (0.014)
Program participation	-0.638 (0.685)	-2.850 (2.123)	-1.480 (1.749)
State LCV score	0.002 (0.001)	0.002* (0.001)	0.002* (0.001)
County non-attainment status	0.063** (0.026)	0.103*** (0.039)	0.083** (0.034)
Sierra Club membership	-0.328 (0.228)	-0.521** (0.237)	-0.490** (0.235)
Median household income	-9.5E-06 (6.0E-06)	-1.6E-05* (9.1E-06)	-1.2E-05 (8.1E-06)
% bachelor degree or higher	0.009 (0.006)	0.007 (0.007)	0.006 (0.007)
% age less than 5	-0.019 (0.019)	-0.024 (0.022)	-0.024 (0.021)
% African American	-0.006*** (0.002)	-0.008*** (0.002)	-0.007*** (0.002)
% below poverty	-0.002 (0.007)	-0.010 (0.011)	-0.004 (0.009)
Population per square mile	1.4E-05 (1.1E-05)	1.5E-05 (1.1E-05)	1.1E-05 (1.1E-05)
Voter participation rate	-0.222 (0.176)	0.141 (0.218)	0.008 (0.210)
Year 1991	-0.731*** (0.104)	-0.470** (0.199)	-0.608*** (0.174)
Year 1992	-0.447***	-0.265	-0.374**

	(0.095)	(0.195)	(0.170)
Year 1993	-0.267***	-0.108	-0.206
	(0.095)	(0.193)	(0.164)
Year 1994	-0.226**	-0.106	-0.206
	(0.098)	(0.194)	(0.169)
Year 1995	-0.383***	-0.266	-0.342**
	(0.103)	(0.188)	(0.166)
SIC 24: Lumber and wood	0.734***	0.902***	0.861***
	(0.151)	(0.165)	(0.164)
SIC 25: Furniture and fixtures	-0.361***	-0.466***	-0.428***
	(0.089)	(0.115)	(0.107)
SIC 26: Paper	-1.144***	-1.095***	-1.015***
	(0.145)	(0.147)	(0.137)
SIC 28: Chemical	-0.180**	-0.218**	-0.189**
	(0.081)	(0.091)	(0.087)
SIC 30: Rubber	-0.179	-0.384***	-0.346***
	(0.109)	(0.127)	(0.118)
SIC 33: Primary metal	0.453***	0.872***	0.742***
	(0.168)	(0.202)	(0.183)
SIC 34: Fabricated metal	0.412***	0.507***	0.456***
	(0.093)	(0.118)	(0.113)
SIC 35: Machinery and computer	0.394***	0.478***	0.470***
	(0.105)	(0.116)	(0.114)
SIC 36: Electronics	-0.047	-0.036	-0.050
	(0.096)	(0.113)	(0.111)
SIC 37: Transportation	-0.092	0.008	0.010
	(0.120)	(0.134)	(0.133)
SIC 38: Instruments	-0.148	-0.299	-0.197
	(0.153)	(0.185)	(0.172)
Constant	-4.000***	-2.998***	-3.336***
	(0.501)	(0.581)	(0.525)
Observations	48,393	48,393	48,393
AR(1) – p value	0.000***	0.005***	0.004***
AR(2) – p value	0.004***	0.066*	0.006***
Hansen J test – p value	0.645	0.577	0.195
Sargan test – p value	0.649	0.640	0.658

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust standard errors (facilities as cross sections) with Windemeijer's finite sample correction are in parentheses. Dependent variable is the natural log of toxicity weighted 33/50 emissions. In all models TRI and HAP-TRI ratio are treated as exogenous and the number of enforcements and inspections are

predetermined. Toxicity weighted 33/50 emissions and TRI emissions are measured in natural logs. All other variables are in levels.

SECTION 2: PARTICIPATION IS MODELED AS POOLED PROBIT INSTEAD OF RANDOM EFFECTS PROBIT

Table VIII: Determinants of facility participation in the Program, 1991-1995

*This table corresponds to **Table 3** in the manuscript. Participation is modeled as pooled probit model and a facility is removed from the dataset once it participates. Inverse Mills ratio calculated from firm level pooled probit model is included to correct for self-selection. Standard errors are bootstrapped.

Variable	Model 1	Model 2
First invitation group	-0.306 (0.314)	-0.425 (0.275)
Facility 33/50 emissions	-3.5E-07 (3.1E-07)	- -
Weighted facility 33/50 emissions	- -	-4.2E-11 (3.0E-10)
Ratio of facility to parent firm 33/50 releases	0.014*** (0.004)	- -
Ratio of weighted facility to parent firm 33/50 releases	- -	0.815*** (0.251)
Pre-Program change in 33/50 releases	3.3E-08 (2.1E-07)	-6.3E-08 (1.0E-07)
TRI releases	0.087*** (0.030)	0.083*** (0.027)
HAP-TRI ratio	0.001 (0.001)	0.002 (0.001)
Number of inspections	-0.008 (0.083)	0.003 (0.076)
Number of enforcement actions	-0.037 (0.084)	-0.054 (0.085)
State LCV score	0.003 (0.004)	0.004 (0.003)
County non-attainment status	0.171*** (0.061)	0.166*** (0.057)
Sierra Club membership	-0.858 (0.563)	-0.757 (0.505)
Median household income	-1.1E-05 (1.9E-05)	-1.1E-05 (1.9E-05)
% bachelor degree or higher	0.008 (0.020)	0.006 (0.019)
% age less than 5	0.082 (0.055)	0.075 (0.055)

% African American	-0.012 (0.008)	-0.012 (0.008)
% below poverty	-0.015 (0.028)	-0.015 (0.025)
Population per square mile	6.7E-06 (4.3E-05)	7.1E-06 (4.0E-05)
Voter participation rate	-1.004 (0.618)	-0.897 (0.608)
Inverse Mills ratio	0.303 (0.267)	0.337 (0.223)
SIC 26: Paper	0.148 (0.364)	0.045 (0.344)
SIC 28: Chemical	0.295 (0.344)	0.209 (0.328)
SIC 30: Rubber	0.395 (0.285)	0.313 (0.250)
SIC 33: Primary metal	0.997** (0.395)	0.909** (0.374)
SIC 34: Fabricated metal	0.465 (0.311)	0.450 (0.291)
SIC 35: Machinery and computer	0.279 (0.282)	0.288 (0.279)
SIC 36: Electronics	0.384 (0.261)	0.395 (0.252)
SIC 37: Transportation	0.450 (0.307)	0.337 (0.283)
Constant	-3.436*** (0.985)	-3.305*** (0.918)
Observations	9295	9295
Pseudo R - square	0.2296	0.2005

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Bootstrap standard errors clustered on firms are in parentheses.

Table IX: Determinants of facility 33/50 emissions, 1991 – 1995

*This Table corresponds to **Table 4** in the manuscript. Predicted probability of participation is from Table VIII in this supplement.

Variable	Model 1	Model 2	Model 3	Model 1W	Model 2W	Model 3W
Facility 33/50 emissions _(t-1)	0.747*** (0.110)	0.743*** (0.109)	0.746*** (0.109)	- -	- -	- -
Weighted facility 33/50 emissions _(t-1)	- -	- -	- -	0.894*** (0.079)	0.890*** (0.079)	0.892*** (0.079)
TRI releases	0.416*** (0.066)	0.422*** (0.065)	0.420*** (0.065)	0.373*** (0.052)	0.381*** (0.052)	0.380*** (0.051)
HAP-TRI ratio	0.011*** (0.002)	0.011*** (0.002)	0.011*** (0.002)	0.007*** (0.001)	0.007*** (0.001)	0.007*** (0.001)
Number of enforcement actions	- -	-0.060 (0.024)	- -	- -	-0.074** (0.037)	- -
Number of inspections	- -	- -	-0.053** (0.022)	- -	- -	-0.071** (0.033)
Program participation	-1.149*** (0.373)	-1.165*** (0.376)	-1.149*** (0.375)	-2.359*** (0.701)	-2.384*** (0.704)	-2.360*** (0.703)
State LCV score	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)
County non-attainment status	0.110*** (0.029)	0.117*** (0.028)	0.114*** (0.028)	0.164*** (0.046)	0.174*** (0.046)	0.171*** (0.046)
Sierra Club membership	-0.642** (0.321)	-0.676** (0.320)	-0.678** (0.320)	-1.145** (0.477)	-1.190** (0.478)	-1.195** (0.478)
Median household income	-2.3E-05** (1.1E-05)	-2.3E-05** (1.1E-05)	-2.2E-05** (1.1E-05)	-2.3E-05 (1.4E-05)	-2.3E-05 (1.4E-05)	-2.2E-05 (1.4E-05)
% bachelor degree or higher	0.004 (0.011)	0.002 (0.011)	0.002 (0.011)	-0.004 (0.013)	-0.006 (0.013)	-0.006 (0.013)
% age less than 5	0.039 (0.031)	0.040 (0.031)	0.040 (0.031)	0.043 (0.046)	0.045 (0.046)	0.045 (0.046)
% African American	-0.008** (0.004)	-0.008* (0.004)	-0.008* (0.004)	-0.009** (0.004)	-0.009** (0.004)	-0.008* (0.004)
% below poverty	-0.016 (0.012)	-0.017 (0.012)	-0.016 (0.012)	-0.014 (0.014)	-0.015 (0.015)	-0.014 (0.015)
Population per square mile	1.2E-05 (2.1E-05)	1.1E-05 (2.1E-05)	1.0E-05 (2.1E-05)	-6.2E-07 (2.8E-05)	-2.0E-06 (2.8E-05)	-2.4E-06 (2.8E-05)
Voter participation rate	-0.226 (0.300)	-0.179 (0.299)	-0.191 (0.297)	-0.476 (0.377)	-0.419 (0.377)	-0.428 (0.375)
Year 1991	-0.316***	-0.317***	-0.318***	-0.436***	-0.438***	-0.441***

	(0.103)	(0.103)	(0.103)	(0.153)	(0.153)	(0.153)
Year 1992	-0.208*	-0.206*	-0.207*	-0.075	-0.073	-0.076
	(0.111)	(0.112)	(0.111)	(0.152)	(0.152)	(0.151)
Year 1993	-0.273**	-0.271**	-0.271**	-0.084	-0.083	-0.083
	(0.124)	(0.124)	(0.124)	(0.168)	(0.168)	(0.168)
Year 1994	-0.221	-0.218	-0.218	0.038	0.043	0.041
	(0.181)	(0.182)	(0.182)	(0.188)	(0.188)	(0.187)
Year 1995	-0.248	-0.242	-0.241	-0.034	-0.025	-0.026
	(0.194)	(0.195)	(0.195)	(0.201)	(0.203)	(0.202)
SIC 26: Paper	-0.998***	-0.951***	-0.959***	-1.261***	-1.203***	-1.208***
	(0.298)	(0.299)	(0.297)	(0.350)	(0.359)	(0.357)
SIC 28: Chemical	-0.384***	-0.401***	-0.395***	-0.451**	-0.475**	-0.468**
	(0.145)	(0.145)	(0.144)	(0.193)	(0.191)	(0.190)
SIC 30: Rubber	-0.236	-0.256	-0.251	-0.423	-0.458	-0.448
	(0.229)	(0.229)	(0.228)	(0.338)	(0.335)	(0.334)
SIC 33: Primary metal	0.092	0.096	0.096	0.443	0.456	0.454
	(0.174)	(0.176)	(0.175)	(0.308)	(0.311)	(0.309)
SIC 34: Fabricated metal	-0.001	-0.018	-0.016	0.285	0.261	0.262
	(0.288)	(0.289)	(0.288)	(0.326)	(0.326)	(0.325)
SIC 35: Machinery and computer	0.227*	0.217	0.217	0.368**	0.354**	0.353**
	(0.131)	(0.132)	(0.132)	(0.165)	(0.165)	(0.165)
SIC 36: Electronics	-0.070	-0.086	-0.084	-0.018	-0.042	-0.040
	(0.134)	(0.134)	(0.135)	(0.197)	(0.198)	(0.197)
SIC 37: Transportation	0.161	0.156	0.152	0.079	0.070	0.066
	(0.146)	(0.146)	(0.147)	(0.216)	(0.216)	(0.216)
Constant	-2.287***	-2.328***	-2.334***	-2.551**	-2.575**	-2.588**
	(0.613)	(0.615)	(0.615)	(1.039)	(1.042)	(1.042)
Observations	11,278	11,278	11,278	11,278	11,278	11,278
AR(1) - p value	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(2) - p value	0.075*	0.077*	0.076*	0.288	0.293	0.291
Hansen J Test - p value	0.868	0.87	0.86	0.405	0.411	0.411
Sargan test - p value	0.852	0.857	0.873	0.322	0.329	0.328

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Robust standard errors clustered on firms with Windemeijer's finite sample correction are in parentheses.

In Models 1-3, the dependent variable is aggregate 33/50 emissions. In Models 1W-3W, the dependent variable is toxicity weighted 33/50 emissions.

SECTION 3: COMPARISON WITH BI AND KHANNA (2009)

Table X: Facility participation in the Program: Ignoring firm participation

*The models in this Table are not shown in the manuscript but discussed in section 6.3 *Sensitivity analysis*. We follow the approach by Bi and Khanna and estimate facility participation using pooled probit. For ease of comparison, the column labeled “Bi & Khanna” presents the results reported in Bi & Khanna (2009).

Variable	Bi&Khanna	Our data
First invitation group	0.456*** (0.05)	0.032 (0.026)
Ratio of facility to parent TRI releases	0.88*** (0.053)	0.010*** (2.58E-04)
Pre-program change in releases by parent firm	-0.119*** (0.018)	5.06E-08*** (9.03E-09)
HAP-TRI ratio	0 (0.001)	1.07E-03*** (2.34E-04)
Number of inspections	0.02 (0.014)	0.032*** (0.008)
State LCV score	0 (0)	0.001* (0.001)
Non-attainment status by county	0.038* (0.019)	0.040*** (0.010)
State per capita membership in Sierra club	-0.001** (0)	0.111 (0.089)
Median household income	0.251*** (0.093)	4.72E-06*** (1.50E-06)
SIC 24: Lumber and wood	- -	-0.177*** (0.057)
SIC 25: Furniture and fixtures	- -	-0.360*** (0.062)
SIC 26: Paper	0.13 (0.108)	0.109* (0.058)
SIC 28: Chemical	0.234*** (0.064)	0.073** (0.032)
SIC 29: Petroleum	-0.074 (0.135)	- -
SIC 30: Rubber	-0.128 (0.083)	-0.055 (0.042)
SIC 33: Primary metal	0.225*** (0.074)	0.164*** (0.036)
SIC 34: Fabricated metal	0.086 (0.065)	2.62E-04 (0.033)
SIC 35: Machinery and computer	-0.326***	-0.055

	(0.096)	(0.045)
SIC 36: Electronics	0.048	0.164***
	(0.079)	(0.041)
SIC 37: Transportation	0.142*	0.079*
	(0.074)	(0.044)
SIC 38: Instruments	-0.319*	-
	(0.151)	-
Constant	-4.612***	-2.242***
	(0.933)	(0.054)
AIC	20796.78	23190.47
% Correctly classified	90.36	91.05
Number of observations	35827	42915
Number of facilities	9028	8578
Log likelihood		-11575.2
Pseudo-R ²		0.104

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust standard errors clustered on firms are in parentheses.

Table XI: Determinants of facility 33/50 emissions, 1991 – 1995: Ignoring firm participation

*The models in this Table are not shown in the manuscript but discussed in section 6.3 *Sensitivity analysis*. We follow the approach by Bi and Khanna and estimate facility emissions using a two-step feasible GMM estimator.

Variable	<u>Bi&Khanna</u>		<u>Our models</u>	
	Model 1	Model 2	Model 1	Model 2
33/50 releases _(t-1)	0.488*** (0.029)	0.487*** (0.029)	0.255*** (0.038)	0.240*** (0.038)
Program participation	-0.167* (0.088)	-0.235** (0.097)	0.370* (0.190)	0.154 (0.184)
HAP-TRI ratio	-0.009*** (0.001)	-0.009*** (0.001)	-0.016*** (0.002)	-0.016*** (0.002)
Number of inspections	-0.007 (0.011)	-0.006 (0.011)	-0.002 (0.013)	-0.001 (0.013)
State LCV score	0 (0)	0 (0)	7.76E-05 (7.82E-04)	1.24E-04 (7.77E-04)
County non-attainment status	-0.007 (0.007)	-0.006 (0.007)	-0.006 (0.015)	-0.003 (0.015)
Sierra club	0 (0)	0 (0)	-0.203 (0.136)	-0.211 (0.135)
Median household income	-0.067** (0.032)	-0.068** (0.032)	-4.44E-06** (2.21E-06)	-4.41E-06** (2.20E-06)
Year 1991	0.459 (0.325)	0.476 (0.325)	-0.313*** (0.074)	-0.299*** (0.074)
Year 1992	0.602* (0.324)	0.622* (0.324)	-0.167** (0.073)	-0.159** (0.072)
Year 1993	0.516 (0.323)	0.537* (0.323)	-0.300*** (0.073)	-0.291*** (0.073)
Year 1994	0.615* (0.323)	0.637** (0.323)	-0.244*** (0.072)	-0.233*** (0.072)
Year 1995	0.519 (0.324)	0.542* (0.324)	-0.205*** (0.074)	-0.196*** (0.074)
SIC 24: Lumber and wood	- -	- -	0.055 (0.073)	0.059 (0.073)
SIC 25: Furniture and fixtures	- -	- -	0.226*** (0.074)	0.228*** (0.073)
SIC 26: Paper	0.034 (0.026)	0.034 (0.027)	0.025 (0.077)	0.019 (0.077)
SIC 28: Chemical	0.063*** (0.02)	0.065*** (0.02)	0.138*** (0.044)	0.138*** (0.044)
SIC 29: Petroleum	0.05 (0.031)	0.051 (0.031)	- -	- -

SIC 30: Rubber	0.013 (0.024)	0.007 (0.024)	-0.028 (0.062)	-0.031 (0.062)
SIC 33: Primary metal	0.018 (0.025)	0.02 (0.025)	0.128** (0.053)	0.137*** (0.053)
SIC 34: Fabricated metal	0 (0.023)	0.001 (0.023)	0.001 (0.051)	0.005 (0.051)
SIC 35: Machinery and computer	-0.074** (0.03)	-0.079** (0.03)	-0.055 (0.064)	-0.061 (0.064)
SIC 36: Electronics	-0.114*** (0.027)	-0.114*** (0.027)	-0.135** (0.064)	-0.135** (0.063)
SIC 37: Transportation	-0.004 (0.023)	-0.001 (0.023)	0.057 (0.059)	0.058 (0.058)
SIC 38: Instruments	-0.098** (0.048)	-0.095* (0.048)	- -	- -
Number of observations	34,339	34,339	39,487	39,487
Hansen's J	7.802*	12.01*	4.60	0.00***
Weak identification	66.56***	46.28***	125	210

Note: *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Standard errors are in parentheses.