Journal of Environmental Economics and Management **40**, 1–20 (2000)
doi:10.1006/jeem.1999.1095, available online at http://www.idealibrary.com on IDEAL

The Effects of Environmental Regulations on Foreign Direct Investment[1]

John A. List[2,3] and Catherine Y. Co[3]

Department of Economics, University of Central Florida, Orlando, Florida 32816-1400

Received June 24, 1997; revised July 6, 1999

This paper employs a conditional logit model to estimate the effects of state environmental regulations on foreign multinational corporations' new plant location decisions from 1986 to 1993. The relationship between site choice and state environmental regulations is explored, using four measures of regulatory stringency. We find evidence that heterogeneous environmental policies across states do matter. © 2000 Academic Press

Key Words: FDI location; environmental regulations

1. INTRODUCTION

As the global economy has become more integrated, flows of foreign direct investment (FDI) have increased. The United States alone has witnessed an eightfold increase in total FDI since 1975. Although FDI into the United States has been relatively stagnant in the early 1990s, global FDI is again on the rise, as major investing nations are overcoming banking crises, recessions, and major restructurings of their economies. Cognizant of this recent trend, state policymakers have expended considerable effort to attract FDI, while researchers have focused on determining which state attributes are instrumental when foreign multinational corporations (hereafter FMNCs) are making the investment decision (see, e.g., Friedman et al. [8], Woodward [26], and Coughlin et al. [6]).

For the most part these studies have generated relatively intuitive results; state attributes such as market size, infrastructure, and promotional expenditures to attract foreign investment are directly related to FDI, while input costs are inversely related. Surprisingly, an exogenous variable that is missing from the majority of these studies is the stringency of a state's environmental regulations.[4] Given that firm-level environmental control expenditures have steadily increased since the early 1970s, intuition suggests that FMNCs may be sensitive to spatial heterogeneity in pollution regulations. Accompanying this increase in abatement expenditures is a plethora of anecdotal evidence, from newspapers to policymakers, that suggests there is a tradeoff between the environment and jobs.

[1] We thank the editor and associate editor for their patience with the manuscript. Also, thanks to the editor and two anonymous referees for extremely thoughtful and thorough comments. Rajshree Agarwal provided some useful remarks on a very early version of this paper. The usual caveats apply.

[2] Address correspondence to: John A. List, Department of Economics, University of Central Florida, Orlando, FL 32816-1400.

[3] E-mail: john.list@bus.ucf.edu. E-mail: catherine.co@bus.ucf.edu.

[4] One exception is Friedman et al. [8], who use antipollution dollars in one version of their analysis.

0095-0696/00 $35.00

To test whether inbound FDI is sensitive to heterogeneity in state environmental regulations, we use four measures of environmental stringency in our empirical analysis. Given that all manner of federal, state, and local environmental regulations are currently in place, our four proxy variables are admittedly only a rough measure of two potential dimensions of a state's regulatory agenda: (1) how hard states are trying to regulate polluters, and (2) firms' perceptions of the stringency of environmental regulations. Estimation results from our conditional logit models suggest that new plant location decisions involving FDI are influenced by environmental regulations. For example, we find evidence that more stringent pollution regulations deter new firm entry in pollution-intensive and non-pollution intensive sectors. Indeed, the effects are found to be quite large—regulatory elasticities are in the 2–5% range for some states.

In the next section, we briefly review previous studies of FDI factor location and present our econometric approach and a data description. Empirical results are analyzed in Section 3, and Section 4 provides concluding remarks.

2. PREVIOUS WORK, THE LOCATION MODEL, AND THE DATA

Our study of FMNC location decisions is closest in spirit to those of Friedman et al. [8], Woodward [26], and Ondrich and Wasylenko [21], while our empirical methodology relates most closely to a recent domestic firm location study due to Levinson [15].[5] Although the firm location literature has thoroughly been catalogued by Tannenwald [23], among others, a brief summary of the important empirical results is worthwhile.

Friedman et al. [8] make use of the International Trade Administration (ITA) data on FMNC location decisions to determine which state factors affect the location of new foreign plants in the United States from 1977 to 1988. Results from their conditional logit models indicate that access to foreign markets and the U.S. domestic market, proxied by a dummy variable for access to a container port and a gravity-adjusted measure of personal income, significantly affect the location decision of foreign firms. Also, they find that the probability of choosing a state decreases with wages and increases with the available labor pool and the percentage of the work force unionized. Their results also suggest that the probability of attracting a new foreign entity decreases with the level of state and local taxes and increases with a state's effort to attract foreign investment. Finally, using one measure of environmental stringency, they find that pollution regulations do not significantly alter location patterns of foreign firms. As Friedman et al. [8] point out, this latter finding may be the result of industry aggregation, masking any effect that environmental regulations may have on certain industries.

Also using a conditional logit model, Woodward [26] investigates how state characteristics in 1980 affect the location decision of Japanese FDI in the United

[5] Coughlin et al. [6] also used a conditional logit model to investigate the factors that affect the location decision of foreign firms. They aggregate all types of FDI in their regressions, however. The FDI data set we use has also been used by studies with a different focus (e.g., Kogut and Chang [13], Blonigen and Feenstra [4], and Blonigen [3]). Kogut and Chang [3] use a counting approach to test whether Japanese FDI in the United States is drawn to industries intensive in research and development. Blonigen and Feenstra [4] use the same principle to test whether U.S. protectionist threats affect Japanese FDI in the United States and/or whether FDI is used to defuse protection. Blonigen [3] uses the approach to investigate whether exchange rate movements affect FDI in the United States.

States from 1980 to 1989. Woodward's empirical estimates suggest that the probability of attracting FDI increases with market size and state promotional efforts and decreases with the state's unionization rate. He examines the effects of a state's taxation policy by using several proxies: average unemployment insurance benefits, corporate profit taxes, and unitary taxes. Woodward finds that the first two measures are insignificant, while the latter tax proxy is negative and statistically significant.

To answer the same question, Ondrich and Wasylenko [21] use numerous empirical specifications to analyze 1978–1987 ITA data. They include several measures of state fiscal activity (e.g., property taxes, corporate income taxes, expenditures on education) and find that the probability of choosing a particular state decreases with corporate income taxes and increases with expenditures on education. They find, however, that input prices such as wages and energy costs do not affect firm location patterns at conventional significance levels.

Although it does not consider FMNC new plant location decisions, Levinson's [15] recent study of domestic firm location patterns should be mentioned, since the empirical methodology closely relates to our study. Levinson [15] uses six measures of environmental stringency, measured in 1982, to examine new domestic firm location patterns over the 1982–1987 period. For the most part, he finds that the probability of choosing a state declines with the strictness of environmental regulations. Levinson [15, p. 27] notes, however, that "the predicted effects... are... economically small, and do not appear to vary sensibly with the pollution intensity of the industry."

Location Model

The traditional approach to modeling the firm location problem is to assume that firm i will select location j if expected profits, π_{ij}, exceed the expected profits, π_{ik}, for all alternative K locations. We follow this approach and model the location decision, using McFadden's [19] conditional logit framework, where profits for plant i at location j are given by

$$\pi_{ij} = \beta' X_j + \mu_{ij}. \tag{1}$$

X_j is a vector of observable state characteristics that affect start-up costs, marginal production costs, and accrued revenues from product sales; β is a vector of estimated parameters; and μ_{ij} is the random error component. A well-known property of Eq. (1) is that if the μ_{ij} follow a Weibull distribution and are independently and identically distributed, the probability that plant i will locate at site j is given by[6]

$$P_{ij} = \exp(\beta' X_j) / \sum_{k=1}^{K} \exp(\beta' X_k), \tag{2}$$

[6] The strong assumption that the error terms (μ_{ij}) are independently and identically distributed imposes the "Independence of Irrelevant Alternatives" (IIA) restriction on the predicted values. This assumption poses problems since it stretches the bounds of credulity to assume that, for example, a foreign firm's decision not to locate in Wyoming is independent of its decision to reject Idaho and Montana. We mitigate this problem by including four Census region dummies (Levinson [15], McConnell and Schwab [18], and Bartik [2]). If the error terms are only correlated within regions and not across regions, the Census dummies will capture this correlation and reduce the IIA problem. But the equation will be misspecified if correlation exists between states across regions.

where K is the number of alternatives (the 48 contiguous states) and parameters, β, are estimated using maximum likelihood techniques.

When estimating Eq. (2) we follow previous studies of firm location (see, e.g., Woodward [26] and Levinson [15]) and analyze how exogenous parameters in time T affect location decisions from time $T \rightarrow T + \Phi$, where T equals 1986 and Φ equals 7. Independent variables (X_j) that influence a state's attractiveness can be split into two components $[X_{j1}, X_{j2}]$, where (X_{j1}) is a vector of observable state environmental regulatory attributes and (X_{j2}) represents other observable state characteristics that affect the location decision. As previously mentioned, only one study to date (Friedman et al. [8]) considers whether environmental regulations (X_{j1}) affect new FDI plant location decisions. Previous studies of domestic industrial location choice have revealed that measuring how direct regulatory activity varies across states has been a serious shortcoming of most location studies (see, e.g., Levinson [15] and Henderson [11]). To alleviate this problem, we use four different measures of environmental regulatory stringency in vector X_{j1}. Other state characteristics (X_{j2}) included in the econometric specification follow a rich literature (Carlton [5], Coughlin et al. [6], Friedman et al. [8], Woodward [26], and Ondrich and Wasylenko [21]) and are measures of, or proxies for, market size and accessibility, labor market characteristics, energy costs, tax climate, and the promotional effort the state puts forth to attract FDI.

Data Description

Data on FDI are taken from the International Trade Administration's (ITA) annual publication *Foreign Direct Investment in the United States*. Annually, the ITA summarizes information from publicly available sources, such as files from government agencies, to classify FDI according to (1) type of investment, (2) four-digit SIC code of the investment, (3) the investing country, (4) location of the investment, and (5) in some cases, the total cost of the completed investment.[7] Concerning investment type, the ITA uses six classifications: new plant, merger and acquisition, equity increase, joint venture, plant expansion, and real property purchase. Instead of focusing on all six types of investment, we analyze factors that affect the location of new plants for two primary reasons. First, new plants constitute the most important and coveted type of FDI because they create jobs (Friedman et al. [8]). Second, a new plant will have to comply with existing state environmental regulations, whereas other forms of investment, such as plant expansion or merger, may allow the existing plant to be grandfathered into less stringent regulations. Finally, we focus on more recent state-level FDI occurrences (1986–1993) because environmental compliance costs for firms in the United States represent a growing part of the manufacturer's total cost (see Jaffe et al. [12]); and President Reagan's policy of new federalism returned responsibility of carrying out many regulatory tasks to the states in the early 1980s, suggesting that more heterogeneity existed in state environmental regulations after the early 1980s (Nathan and Doolittle [20], Vig and Kraft [25], and Lester [14]).

Although our FDI data may appear to be a perfect measure of total investment from foreign entities into the United States, they are deficient in at least one

[7] The ITA defines FDI as "direct or indirect ownership of 10% or more of the voting securities of an incorporated business enterprise, or the equivalent interest in an unincorporated business enterprise."

important aspect: the level of investment for each FDI occurrence is not available. Ideally, for a more comprehensive study, we would like to model the total value of the completed foreign investment as a function of the regressors. During our sampling period, however, these figures are available for less than 50% of the new plant investments reported in the ITA publication. Consequently, we use a second best approach and track the number of new foreign plants that each state attracts. For example, if a foreign firm begins construction of a new plant in December of 1988 in state i, state i is credited with one FDI occurrence in 1988, whether the investment was 5 million or 50 million dollars. This approach is a familiar one, as previous location studies using ITA data have also chosen this technique (see, e.g., Friedman et al. [8], Woodward [26], and Coughlin et al. [6]).[8]

A first step in preparing the FDI new plant data for empirical estimation is to consider whether environmental regulations affect heterogeneous industries similarly. Economic intuition suggests that prospective firms in pollution-intensive sectors should be more sensitive to spatial variation in environmental rules and regulations than firms in non-pollution-intensive industries, *ceteris paribus*. To account for possible heterogeneity in the location decision, we estimate the empirical model for all manufacturing industries together as well as separately for two subsamples—a pollution-intensive subsample and a non-pollution-intensive subsample.[9]

Many facets of the complex pollution process need to be considered when labeling SICs as pollution-intensive or non-pollution-intensive. As such, we (1) analyzed firm-level pollution abatement operating expenditures to abate the media air, water, and solid/contained waste from the Current Industrial Report's *Pollution Abatement Costs and Expenditures*; (2) examined actual emissions, by industry, of the five criteria air pollutants from 1980 and 1990 from the *National Air Pollutant Emission Trends*, 1900–1994, published by the Environmental Protection Agency (EPA); and (3) reviewed the appropriate literature (e.g., Levinson [15] and Jaffe et al. [12]). In the end, we included SIC industry codes 26, 28, 29, 32, 33, 34, and 37 in the pollution-intensive group, and firms in the remaining two-digit SIC codes were classified as non-pollution-intensive. Table A1 in the Appendix provides an overview of the spatial location patterns of pollution-intensive and non-pollution-intensive plants from 1986–1993. In sum, a total of 651 occurrences of new plant FDI were identified from the ITA listing. Of this total, 296 occurrences were labeled as pollution-intensive and 355 occurrences were in non-pollution-intensive industries.

Regulatory Variables

We use four measures of environmental stringency to construct the regressor vector X_{j1}. The first two variables are actual monies spent by several agencies in a state to control media of three types: air, water, and solid waste. These data

[8] One other limitation of the ITA data is that they do not verify if the project was actually completed, although the ITA does not report the occurrence unless there are "signs" of project completion, for example, groundbreaking in the case of new plants.

[9] We would have preferred to split the data into finer categories; however, there were zero investments in many industries at the four-digit SIC level. One shortcoming of using two-digit classifications is the clustering that occurs—almost 53% of the new plant investments are in four two-digit SIC industries (SIC 28, 35, 36, and 37).

represent the cost to state governments to control, prevent, and abate pollution and are primarily composed of spending for environmental quality planning, regulation and enforcement, research and development, and technical and financial assistance. Data are taken from executive and/or legislative budget documents which listed the actual fiscal year 1986 expenditures. In those cases where budgetary documents were not available, information was gathered from appropriate agency officials. These Council of State Government (CSG) expenditure data are then put in per capita (CSG/Cap.) and per manufacturer (CSG/Man.) terms to adjust partially for geographic variation in manufacturing activity.

Although CSG data provide an indication of allocated resources to regulate polluters, they are deficient in at least two important respects. First, the data are monies that have passed through the state budgetary process. Hence, any portion of local efforts that was not passed through the state budget is excluded. Second, regulatory economies of scale are ignored. If scales exist, larger budget states could be misclassified as environmentally negligent and estimated parameters may send erroneous signals. Nevertheless, when estimating Eq. (2) we expect that both expenditure figures will be inversely related to the probability of attracting a new firm, since higher regulatory expenditures may lead to a tighter constraint on production activity.

The third measure of regulatory stringency is firm-level pollution abatement operating expenditures to abate the media air, water, and solid/contained waste (Abate) from the Current Industrial Report's *Pollution Abatement Costs and Expenditures*, commonly termed the PACE data set. These data, which include depreciation, labor, materials, supplies, services, and leasing, have been collected by the Bureau of Census annually since 1973, excluding 1987.[10] We collect these data for all manufacturers for 1986 and deflate them per $1000 of value added to account for geographic and temporal variation in industry size. Notice that private sector pollution abatement efforts also could be measured by expenditures for capital equipment; however, these data are not used, in view of significant measurement problems. For example, these figures are hypothetical, not actual, and modeling the timing of investments is beyond the scope of this paper.

PACE data might seem to be an ideal variable for measuring a state's effort to regulate polluters. Two possible shortcomings, however, are that (1) PACE data do not control for the mix of new versus existing plants in a state, and (2) PACE data are not disaggregated to the industry level for each state. Because new plants face stiffer environmental regulations than existing plants, states with relatively newer plants may have higher compliance costs. Furthermore, since PACE mixes data from pollution-intensive and non-pollution-intensive industries, states with a disproportionate number of polluting firms may have higher compliance expenditures. These two nuances of the PACE data set may induce erroneous empirical signals about the importance of firm-level pollution abatement expenditures. With these shortcomings in mind, we expect states with higher pollution abatement expenditures to attract fewer new firms.

Our fourth measure of state-level environmental stringency is List and d'Arge's [17] Environmental Protection Index (Index). The index, similar to other indices of green, such as Duerksen's [7] and Ridley's [22], uses a complex weighting scheme to combine local, state, and federal government pollution abatement efforts with firm-level abatement expenditures to assign a dollar ranking to each state. The

[10] Unfortunately, these data have been discontinued as of 1994.

TABLE I
Correlation of Environmental Measures

	CSG/Capita	CSG/Man.	Abate Exp.	Index
CSG/Capita	1.00	0.91	−0.03	−0.13
CSG/Man.		1.00	0.08	−0.13
Abate			1.00	0.34
Index				1.00

dollar ranking accounts for the substitution effect that may occur between inter-government regulatory efforts and provides a notion of how direct and indirect regulatory activities vary across states. In this 1986 index, a higher value implies more stringent environmental regulations. Therefore, the probability of attracting a new foreign firm is expected to be a decreasing function of the index.

Table I presents a correlation matrix for our four environmental variables. The correlation coefficients in Table I suggest that some of the four regulatory variables are highly correlated. This is not surprising, as one would expect CSG/Cap. and CSG/Man. to be highly correlated since population and the number of manufacturers are correlated; and given that pollution abatement expenditures are an input to the Index variable, the finding that their correlation coefficient is 0.34 is straightforward as well. Alternatively, the correlation coefficient between the Index variable and the two CSG variables is a scant −0.13, while Abatement expenditures and the CSG variables have correlation coefficients close to zero. These small correlation coefficients lend some support to Levinson's [15] argument that the regulatory process is multidimensional and provides an impetus for researchers to use multiple measures of environmental stringency when modeling the location patterns of new firms.

Other Independent Variables

With regard to other state attribute variables that may be important in the location decision, we include population density (Pop. den) in X_{j2} to control for market size and accessibility. Population density appears to be a catch-all variable, as it potentially captures important area attributes such as infrastructure and local market size. We therefore expect densely populated states to attract more new plants than sparsely populated states. A key tenet of most regional growth theories is the agglomeration economies that can accrue to firms locating in close proximity to one another. Availability of market information, technology transfers, access to a skilled labor pool, and networking with immediate suppliers of essential materials are all potential positive externalities associated with dense areas of manufacturers. To capture agglomeration economies (Agglo.), we include the number of existing plants in the two-digit industry of the locating FMNC. Including the number of plants in the equation may also help to control for unobservable state-level characteristics that are left uncontrolled in our regression framework. Consistent with previous studies, we expect that foreign firms will be drawn to states with a large number of existing plants in their industry.

We use average manufacturing wages (Wage) and percentage of unionized workers (%Union) as control variables for labor market characteristics. We expect higher wage states to attract fewer new firms; but the effect of a more unionized work force remains unresolved in the literature. Intuition suggests that unions deter new firms, as wages may be inflated and worker contracts potentially difficult to secure. Yet, to date FDI studies have not presented compelling evidence to support this conjecture. For example, Friedman et al. [8] find that the percentage of unionized workers is directly related to new firm start-ups, while Woodward's [26] results suggest that more unionized states attract relatively fewer new FDI plants. Upon controlling for wages in the estimated equation, however, it may be the case that the percentage of unionized workers is an indicator of the available pool of workers in a prospective state. Additionally, unionization could be an indication of labor force certainty with regard to labor issues; hence, FMNCs may choose to locate in a highly unionized state initially and have perfect information on current labor market rules. Thus, *a priori* the sign on the union variable is indeterminate.

To account for energy costs, we use KWH of electric energy purchased divided by manufacturer's shipments (Energy), the number of heating degree days per year (Hdays), and the number of cooling degree days per year (Cdays). As these three variables all represent factors that affect production costs, we expect that lower values will attract FDI.[11] We include a tax effort variable (Tax) to measure how much tax capacity a state chooses to exploit relative to the national average, 100. Values of the tax variable less than 100 indicate that a state taxes its manufacturers less than the national average, while values greater than 100 suggest the opposite. We expect a higher tax figure will deter new firm entry. Finally, given that a state's industrial recruiting program may influence the location decision (see, e.g., Woodward [26]), we include state-level promotional expenditures (Promo.) in X_{j2}. We anticipate that higher promotional expenditures will positively affect the probability of attracting new firms. A further description of all variables and their sources is presented in Table II, and arithmetic means and standard deviations are given in Table III.

3. EMPIRICAL RESULTS

Tables AII, AIII, and AIV, in the Appendix contain conditional logit parameter estimates for all manufacturing industries, pollution-intensive industries, and non-pollution-intensive industries. Also contained in Tables AII–AIV are pseudo-R^2 values for each model. Although the pseudo-R^2 values are relatively low—typically between 14% and 17%—they are similar to recent firm location studies that use the conditional logit model. Table AII also presents χ^2 values from likelihood ratio tests of whether data from pollution-intensive and non-pollution-intensive industries should be pooled. In each regression model the computed χ^2 value exceeds the χ^2 critical value at the $p < 0.01$ confidence level, suggesting that the exogenous vector of variables affects pollution-intensive and non-pollution-intensive industries differently.

Coefficient estimates in Tables AII–AIV imply that environmental regulations matter. The estimated coefficient of each environmental variable is negative and significantly different from zero at the $p < 0.06$ confidence level (columns 1–4 in Tables AII–AIV). Columns 5 and 6 in Tables AII–AIV contain results for the

[11] Note our use of quantity measures to control for energy expenditures. An alternative approach would be to include energy prices in the regression equation. Because the correlation coefficient between an energy price index (from the Census) and our quantity variable is nearly -0.30, we opt to use quantity data since they show more cross-sectional variation than the energy price index.

TABLE II
Description of Variables

Variable	Definition	Source
FDI	New plant investment.	*Foreign Direct Investment in the U.S.: Transactions*, compiled by the International Trade Administration (ITA), 1986–93
Environmental variables		
CSG	Real monies spent by local and state agencies to regulate polluters weighted by pop. (CSG/Cap.) and no. of mfg. (CSG/Man)	*Resource Guide to State Environmental Management*, Council of State Government, 1986
ABATE	Real pollution abatement operating expenditures per $1000 value added	U.S. Census Bureau Current Industrial Reports. Pollution Abatement Costs and Expenditures Annual, 1986.
INDEX	Environmental index that ranks a state's total effort to regulate polluters.	List and d'Arge (1996) EPI.
Other variables		
POP. DEN.	Population/land area.	*Current Population Reports*, U.S. Census Bureau, 1986.
AGGLO.	Total number of establishments in the two-digit SIC industry, by state	County Business Patterns, 1986
WAGES	Total annual payroll divided by the number of employees, by state and two-digit SIC	County Business Patterns, 1986
%UNION	U.S. union membership in manufacturing as a % of the total by state	*Directory of National Unions and Employee Associations*, 1986, U.S. Bureau of Labor Statistics
ENERGY	KWH of electric energy purchased weighted by mfg. shipments within state	*Manufacturing Climate Study*, Grant/Thorton, Chicago, IL, 1986; *Annual Survey of Manufacturers, Fuels and Electric Energy Consumed*, U.S. Census Bureau, 1986
HDAYS	Heating Degree Days: (accumulated days) × (temperature below 65°), by state	*Weekly Weather and Crop Bulletin*, U.S. Department of Commerce, U.S. Department of Agriculture, 1987
CDAYS	Cooling Degree Days: (accumulated days) × (temperature above 65°), by state	*U.S. Statistical Abstract*, U.S. Department of Commerce, 1990

regression models that include two of the four environmental variables in the regression equation. Coefficients on the environmental regulatory variables in the multidimensional models maintain expected sign and significance. Furthermore, jointly the environmental variables are significant at the $p < 0.01$ level in each regression model. Although coefficient estimates in Tables AII–AIV indicate

TABLE II—(Continued)

Variable	Definition	Source
TAX	Tax Effort Index. A state's tax effort indicates the extent to which a state utilizes its tax base available relative to the national average (100)	U.S. Advisory Commission on Intergovernmental Relations, 1987
PROMO	State's effort to attract FDI, measured (in millions) using the total budget multiplied by the percentage designated as "foreign investment attraction"	National Association of State Development Agencies' State Export Program Database

which variables are important in the FMNC's location decision, they fail to provide much information beyond their statistical significance since they are not marginal effects. The size of the coefficients can more readily be interpreted by noting that

$$\partial \log P_j / \partial \log x_{jm} = x_{jm} \beta_m (1 - P_j), \tag{3}$$

where x_{jm} is the mth element of the attribute vector X_j, β_m is the mth element of the vector β, and P_j represents the probability of choosing state j. Adjusting our coefficients according to Eq. (3) provides elasticity estimates.

In Table IV we present elasticity estimates that show how a one percentage point increase or decrease in the independent variable changes the predicted probability of a foreign firm choosing the most affected, median affected, and least affected state.[12] For example, a value of 0.262 for the median affected state in the

TABLE III
Descriptive Statistics

Variables	Mean	Standard deviation
CSG/Cap.	12.08	10.71
CSG/Man.	7,906.11	7,922.86
Abate	12.64	9.92
Index	6.07	3.11
Agglo.	349.21	694.96
Pop. Den.	4,976.12	5,132.60
Wages	23,742.57	12,842.50
%Union	0.19	0.12
Energy	545.73	750.84
Hdays	1,799.35	712.35
Cdays	1,164.60	821.31
Tax	96.14	15.06
Promo.	0.42	0.48

[12] We should note that these elasticities are not necessarily comparable. Per Table III, a one percentage point change in, for example, the Index is very different from a one percentage point change in CSG/Man, since the Index has a standard deviation one-half its mean while CSG/Man has a standard deviation larger than its mean.

TABLE IV
Estimated Elasticities of Environmental Variables for the Most, Median, and Least Effected States

Variables	Total sample	Pollution-intensive industries	Non-pollution-intensive industries
CSG/Cap.			
S. Dakota	−2.148[a]	−1.841[a]	−2.385[a]
Arizona	−0.306[a]	−0.262[a]	−0.339[a]
Georgia	−0.112[a]	−0.097[a]	−0.124[a]
CSG/Man.			
S. Dakota	−3.571[a]	−2.986[a]	−4.298[a]
W. Virginia	−0.390[a]	−0.323[a]	−0.472[a]
Georgia	−0.122[a]	−0.103[a]	−0.146[a]
Abate			
Louisiana	−1.219[b]	−1.260[c]	−1.931[b]
Michigan	−0.207[b]	−0.209[c]	−0.335[b]
Rhode Island	−0.013[b]	−0.013[c]	−0.020[b]
Index			
Arkansas	−2.104[a]	−2.226[a]	−1.951[a]
Illinois	−0.569[a]	−0.606[a]	−0.525[a]
Arizona	−0.227[a]	−0.240[a]	−0.210[a]

Note: Elasticities are calculated for states that have the maximum, median, and minimum values for each of the environmental measures. Regression models 1–4 in Tables AII–AIV in the Appendix provide coefficient estimates for the calculations.
[a] Denotes underlying coefficient is statistically significant at the 1% level.
[b] Denotes underlying coefficient is statistically significant at the 5% level.
[c] Denotes underlying coefficient is statistically significant at the 10% level.

CSG/Cap. pollution-intensive regression model suggests that a 1% increase in CSG/Cap. decreases the median state's (Arizona) probability of attracting a foreign firm by 0.262%.

A closer look at the estimated elasticities for the first set of environmental measures in Table IV (CSG/Man. and CSG/Cap.) indicates that individually they both have the correct sign and are significantly different from zero at the 1% level for each of the three sample types. For example, coefficient estimates in the pollution-intensive industry subsample imply that a 10% increase in the median state's (West Virginia) regulatory expenditures per manufacturer (CSG/Man.) decreases the probability of attracting a new FDI pollution-intensive plant by approximately 3.2%.[13] Findings are similar in the total sample and non-pollution-intensive subsample, as a 10% increase in (CSG/Man.) decreases the probability of attracting a new firm by 3.9% and 4.72% for the median state.

In the regression models that use firm-level pollution abatement expenditures as the environmental proxy (Abate), coefficient estimates suggest that a 10% increase in pollution abatement expenditures per $1000 value added induces a 2.07–3.35%

[13] A 10% increase in the average state's CSG/Man. increases regulatory expenditures by approximately $791 (10% $*$ 7906) per manufacturer, or a total dollar increase of $6,047,195 (7645 $*$ 791), where 7906 represents the mean of CSG/Man. (see Table II) and 7645 represents the total number of manufacturers in the average state.

decrease in the median state's probability of attracting a new foreign firm, depending on the subsample. Concerning the most affected state (Louisiana), we find that a 10% increase in abatement expenditures leads to a 12–19% probability reduction. Results from the specifications that use List and d'Arge's Environmental Protection Index (Index) also imply that regulatory stringency significantly affects plant location decisions. Since the index is constructed by combining effort variables, such as local, state, and federal expenditures to monitor polluters, with perception variables, such as firm-level abatement expenditures, marginal effects are difficult to interpret. Nevertheless, parameter estimates suggest that firms in all industries are deterred by an increase in the index, with elasticities in the area of 0.6% for the median state.

Interestingly, estimated elasticities in Table IV suggest that firms in pollution-intensive and non-pollution-intensive sectors are similarly influenced by a change in state-level environmental stringency. We test for behavioral differences across pollution-intensive and non-pollution-intensive sectors by pooling our data and using pollution intensity as an interaction variable. Accordingly, our null hypothesis is given by

$$H_0\colon\ \beta_{i\mathrm{np}} = \beta_{i\mathrm{p}}, \tag{4}$$

where $\beta_{i\mathrm{np}}$ ($\beta_{i\mathrm{p}}$) represents coefficient estimate i in the non-pollution (pollution)-intensive sector, where $i = 1, \dots, 4$ are the four regulatory variables. Using a χ^2 test distributed with one degree of freedom, we find that for each model type the null hypothesis in Eq. (4) cannot be rejected at conventional significance levels. χ^2 values of 2.0 (CSG/Cap. model), 0.9 (CSG/Man. model), 0.4 (Abate model), and 0.5 (Index model) indicate that foreign firms in pollution-intensive and non-pollution-intensive sectors are reacting to spatial environmental regulations in a similar fashion. Although this result is counterintuitive, it does provide further evidence for Levinson's [15] finding that pollution regulations do not systematically affect dirtier industries more than cleaner industries. One hypothesis that potentially explains this finding is that pollution-intensive sectors tend to be geographically less footloose than non-pollution-intensive sectors. For example, in the paper and allied industries (SIC 26), firms may be tied to resource-based locations such as Maine, Wisconsin, or the Pacific Northwest since transportation costs of raw materials may be unduly high, effectively prohibiting paper and allied firms from having the flexibility to make interstate comparisons to arbitrage away any discrepancies that exist in state regulatory policies.

As previously mentioned, it is quite possible that environmental regulations are multidimensional and that the four individual variables may separately measure different dimensions in the state regulatory process. To analyze this possibility, we have estimated elasticities of the environmental variables when both dimensions are included in the same regression model (models 5 and 6 in Tables AII–AIV in the Appendix). A summary of these results, as well as elasticity estimates for the other variables, is presented in Tables AII–AIV and Table V. Coefficient estimates in Table V are for the median state and reinforce the findings in Table IV; namely that new foreign manufacturing plants avoid states with more stringent pollution regulations.

Our coefficient estimates of the environmental variables in Table V can be put into perspective by examining the approximate loss in jobs due to more stringent

TABLE V
Estimated Elasticities of the Independent Variables for the Median State, from Multidimensional Environmental Factors

Variables	Total sample	Pollution-intensive industries	Non-pollution-intensive industries
Model 5			
CSG/Man.	−0.329[a]	−0.273[a]	−0.409[a]
Index	−0.471[a]	−0.534[a]	−0.405[a]
Pop. den.	0.043	0.003	0.086[c]
Wages	−0.103	0.520	−0.110
%Union	0.350[a]	0.436[a]	0.188
Energy	0.018	0.046	−0.004
Hdays	−1.154[a]	−1.275[a]	−1.119[a]
Cdays	−0.758[a]	−0.857[a]	−0.700[a]
Tax	−0.479	−0.715	−0.160
Promo.	−0.011	−0.060	0.064
Agglo.	0.77[a]	0.70[a]	0.75[a]
Model 6			
CSG/Cap.	−0.294[a]	−0.244[a]	−0.324[a]
Abate	−0.163[b]	−0.166	−0.291[b]
Pop. den.	0.030	−0.011	0.078
Wages	−0.104	0.581	−0.112
%Union	0.219[b]	0.310[b]	0.114
Energy	0.047[b]	0.076[b]	0.041
Hdays	−1.310[a]	−1.502[a]	−1.213[a]
Cdays	−0.945[a]	−1.052[a]	−0.808[a]
Tax	−0.152	−0.552	0.298
Promo.	−0.020	−0.063	0.330
Agglo.	0.77[a]	0.66[a]	0.73[a]

Notes: (1) The top panel estimates are calculated from multi-dimensional model 5 in Tables AII–AIV in the Appendix. (2) Estimates in the bottom panel are calculated from multidimensional model 6 in Tables AII–AIV in the Appendix.

[a] Denotes underlying coefficient is statistically significant at the 1% level.

[b] Denotes underlying coefficient is statistically significant at the 5% level.

[c] Denotes underlying coefficient is statistically significant at the 10% level.

environmental regulations. Given that the average FMNC employed approximately 160 workers between 1986 and 1993, and that the average state attracted 13.56 (651/48) new FDI occurrences between 1986 and 1993, one can calculate the expected loss in jobs induced by more stringent pollution protection. For example, using total sample estimates from model 5 in Table V, if we allow each of the environmental variables to increase by 10% and hold everything else constant, we find that the median state's probability of attracting a new firm decreases by 8% (3.29% + 4.71%). This decrease in attractiveness results in an estimated loss of 174 jobs ($8\% * 13.56 * 160$) between 1986 and 1993. Although this loss in jobs does not appear to be economically significant, given that we are analyzing only one form of FDI, we are underestimating the total job loss figure.[14]

For the most part, other significant coefficient estimates in Tables AII–AIV and Table V are in accordance with previous findings. For example, across pollution-intensive and non-pollution-intensive industries, a greater number of heating

[14] Many other benefits also accrue from attracting a new plant, including construction expenditures, tax revenues, agglomeration economies, and an influx of technology to the state.

(Hdays) and cooling (Cdays) degree days negatively affects the probability of attracting new firms—in model 5 the Hdays estimated coefficient of -1.154 in the total sample suggests that a 1% increase in the number of heating degree days decreases the probability of attracting a new firm by 1.154%. Another fairly robust result across specifications is that agglomeration economies (Agglo.) are important to foreign entrants. Consistent with previous studies, we find that for each 1% increase in existing firms in the locating firm's industry, the probability of attracting a new foreign firm increases by approximately 0.8%. This effect is significantly different from zero at the $p < 0.01$ level in each model and displays the importance of positive externalities such as technology transfers, access to a skilled labor pool, and networking with immediate suppliers of essential materials.

We find some interesting results related to the labor market and market size variables. The percentage of workers unionized (%union) is found to have a significant and positive effect in a majority of our specifications. As previously mentioned, while unions tend to raise wage and fringe benefit levels and tend to have tenuous relationships with managers, it is probable that heightened global competition during the period of analysis has induced unions to develop more cooperative relationships with managers. Given these possible contrasting effects and the mixed empirical findings to date, our findings should be viewed with caution. Concerning wage contracts, we find that although wages enter the majority of equations with a negative coefficient, they are not significant at conventional levels. This result is somewhat surprising but is not uncommon in the literature, as Woodward [26, p. 696] notes: "the wage rate has generally not been found to be a statistically significant factor (for foreign new plants)." With regard to market size, estimated elasticities in Table V indicate that more densely populated states tend to attract new firms; but this effect is only significant for non-pollution-intensive firms. One possible explanation for this finding is that pollution-intensive firms avoid locations that are heavily populated to elude the watchful eye of environmental regulators or community groups, which may be effective regulators of polluters (Arora and Cason [1]).

A somewhat contradictory finding in specification 6 is that energy costs are directly related to FMNCs location decisions in some model types. Yet this finding is consistent with some previous studies that include a control for energy expenditures (Woodward [26]). Also fairly surprising is that higher tax rates are only negative and significant in a few model types. This result adds to the controversy surrounding the effects of higher tax rates on foreign firms—despite a substantial amount of research, the effects of state corporate tax rates remain largely unresolved.

Although the empirical results herein are not directly comparable to empirical estimates in the domestic firm location literature, a comparison of findings can potentially provide interesting insights. As an example, consider Levinson's [15] recent empirical estimates, which suggest that the average state's probability of attracting a new firm decreases by 0.89% when aggregate abatement cost (a version of our Abate variable) increases by one standard deviation, or approximately a 95% increase.[15] Using data for all manufacturers, we see from Table IV that the median state's probability of attracting a new foreign firm decreases by 2.07% when real

[15] Also, note that Levinson's [15] elasticity estimates translate to a loss of about 65 production jobs over a 5-year period for the average state.

pollution abatement operating expenditures per $1000 value added (Abate) increase by 10%. While this comparison is purely anecdotal, it does provide an indication that foreign entrants may be more sensitive to pollution regulations than domestic entrants.

4. CONCLUDING REMARKS

Given that our economic system is rapidly evolving from many relatively small markets into a more integrated global market, firms are more readily using foreign countries to source production, add product markets, and diversify. As a result, many states have expended considerable effort to attract multinational corporations. Whereas many state attributes, such as factor prices, climate, and available market, have proved to be key determinants in the site decision, there is a lack of consensus on the effects that environmental regulations have on new FMNC location decisions.

Expanding on earlier studies of inbound FDI, we use state-level data from 1986–1993 to focus on the relationship between site choice and state environmental regulations, using four measures of regulatory stringency. Certain empirical results support the anecdotal evidence that environmental stringency and attractiveness of a location are inversely related. Moreover, the effects are found to be quite large, as comparable estimates from the domestic firm location literature are many times smaller than elasticity estimates presented in this paper.

Many extensions of our results are readily apparent. Although our empirical estimates suggest that foreign firms are more sensitive to pollution regulations than their domestic counterparts, comparisons are made across studies that include different types of control variables. As such, a study that analyzes the effects of environmental regulations across domestic and foreign new firms would be valuable. If our anecdotal evidence is supported, it would be interesting to investigate the country-level welfare implications of allowing heterogeneous environmental regulations across domestic and foreign firms.

Finally, we are inclined to mention an important caveat. Our empirical results could be open to scrutiny because of our modeling approach—like many previous studies our parameter estimates are based purely on between-state variation in the model. If one were to consider an alternative formulation, such as estimating a conditional logit panel data regression model including state fixed effects, the parameters would be exploiting the variability over time in state attributes—the *difference* between new firm births in state i at time t and new firm births in state i at time $t + \phi$ would be made a function of the *difference* in state i's regressors over this same time period. The advantage of this approach is that omitted variable bias will be mitigated, as any time-invariant factors will be controlled in the regression equation. We hope that our agglomeration variable, which picks up many factors, including the historical trend of past manufacturers entering and exiting the state, helps to alleviate this potential omitted variable bias. Nevertheless, it may be the case that a specification problem remains, which is leading to our curious result that environmental regulation affects non-pollution-intensive and pollution-intensive firms similarly. We anticipate that our paper will induce further investigation into this issue.

APPENDIX

TABLE AI
Total FDI Occurrences, 1986–1993, by State[a]

	Total	Pollution-intensive	Non-pollution-intensive
Alabama	11	6	5
Arizona	2	0	2
Arkansas	2	0	2
California	68	13	55
Colorado	6	1	5
Connecticut	3	2	1
Delaware	5	4	1
Florida	8	2	6
Georgia	39	14	25
Idaho	0	0	0
Illinois	30	11	19
Indiana	46	26	20
Iowa	11	3	8
Kansas	6	3	3
Kentucky	34	25	9
Louisiana	6	5	1
Maine	1	1	0
Maryland	11	2	9
Massachusetts	6	2	4
Michigan	34	20	14
Minnesota	2	0	2
Mississippi	2	2	0
Missouri	9	5	4
Montana	0	0	0
Nebraska	1	0	1
Nevada	2	1	1
New Hampshire	1	0	1
New Jersey	14	6	8
New Mexico	2	0	2
New York	25	9	16
North Carolina	48	21	27
North Dakota	0	0	0
Ohio	45	32	13
Oklahoma	3	3	0
Oregon	15	7	8
Pennsylvania	13	10	3
Rhode Island	4	0	4
South Carolina	19	10	9
South Dakota	0	0	0
Tennessee	33	14	19
Texas	36	23	13
Utah	1	0	1
Vermont	0	0	0
Virginia	31	8	23
Washington	11	1	10
West Virginia	0	0	0
Wisconsin	5	4	1
Wyoming	0	0	0
Total 1986–1993	651	296	355

[a] SIC industry codes 26, 28, 29, 32, 33, 34, and 37 are in the pollution-intensive group, and firms in the remaining two-digit SIC codes are labeled non-pollution-intensive.

TABLE AII

Conditional Logit Estimates for all Manufacturers

	Model					
Variables	1	2	3	4	5	6
CSG/Cap.	−38.02[a]	—	—	—	—	−36.56[a]
	(76.89)					(7.791)
CSG/Man.	—	−0.070[a]	—	—	−0.059[a]	—
		(0.014)			(0.133)	
Abate	—	—	−24.71[b]	—	—	−19.33[b]
			(9.938)			(10.13)
Index	—	—	—	−111.8[a]	−92.43[a]	—
				(22.12)	(21.63)	
Pop. den.	283.69	423.68	41.23	109.9	571.0	392.4
	(438.5)	(440.6)	(419.4)	(415.8)	(439.7)	(443.5)
Wages	−0.004	−0.004	−0.003	−0.003	−0.004	−0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
%Union	755.02	1220.2[b]	1913.3[a]	2291.6[a]	2090.6[a]	1304.4[b]
	(519.3)	(521.9)	(574.0)	(543.4)	(553.5)	(590.1)
Energy	0.061	0.058	0.122[b]	0.024	0.049	0.127[b]
	(0.056)	(0.056)	(0.064)	(0.056)	(0.057)	(0.065)
Hdays	−0.704[a]	−0.624[a]	−0.452[a]	−0.477[a]	−0.620[a]	−0.704[a]
	(0.136)	(0.131)	(0.133)	(0.131)	(0.130)	(0.137)
Cdays	−1.077[a]	−1.028[a]	−0.814[a]	−0.655[a]	−0.856[a]	−1.002[a]
	(0.133)	(0.131)	(0.130)	(0.133)	(0.137)	(0.136)
Tax	−2.731	−4.988	−7.771[b]	−8.793[b]	−5.635	−1.791
	(5.122)	(5.060)	(4.637)	(4.488)	(4.907)	(5.163)
Promo.	5.884	60.09	−90.21	−104.7	−42.97	−81.26
	(131.4)	(132.1)	(137.4)	(129.3)	(133.0)	(139.9)
Agglo.	833.33[a]	782.3[a]	743.2[a]	809.7[a]	769.2[a]	772.1[a]
	(65.89)	(66.31)	(72.75)	(66.83)	(67.06)	(72.33)
Loglike.	−2147.6	−2146.0	−2158.2	−2147.7	−2134.9	−2145.6
χ^2(df)	39.4(10)	41.4(10)	43.8(10)	39.0(10)	39.0(11)	42.4(11)
Pseudo-R^2	0.1478	0.1485	0.1436	0.1478	0.1525	0.1486
Nobs	651	651	651	651	651	651

Note. (1) Standard errors in parentheses are beneath coefficient estimates; coefficients and standard errors are multiplied by 1000. (2) Regional dummies are included in each regression; estimates are available upon request. (3) χ^2(df) values test the null of pooling data across pollution-intensive and non-pollution-intensive sectors.

[a] Denotes underlying coefficient is statistically significant at the 1% level.

[b] Denotes underlying coefficient is statistically significant at the 5% level.

[c] Denotes underlying coefficient is statistically significant at the 10% level.

TABLE AIII

Conditional Logit Estimates for Pollution-Intensive Firms

Variables	Model 1	2	3	4	5	6
CSG/Cap.	−32.59[a]	—	—	—	—	−30.26[a]
	(11.16)					(11.37)
CSG/Man.	—	−0.058[a]	—	—	−0.049[a]	—
		(0.019)			(0.019)	
Abate	—	—	−25.70[c]	—	—	−20.28
			(13.24)			(13.46)
Index	—	—	—	−118.2[a]	−104.17[a]	—
				(32.97)	(32.24)	
Pop. den.	−258.9	−134.8	−341.6	−309.7	41.86	−149.42
	(634.0)	(635.8)	(619.8)	(616.6)	(641.3)	(640.6)
Wages	0.016	0.018	0.024	0.018	0.020	0.022
	(0.020)	(0.020)	(0.022)	(0.021)	(0.021)	(0.021)
%Union	1177.0	1601.5[c]	2423.3[a]	2754.3[a]	2611.4[a]	1847.0[b]
	(820.6)	(821.4)	(916.8)	(864.1)	(867.1)	(932.8)
Energy	0.132	0.134	0.217[b]	0.102	0.124[b]	0.208
	(0.089)	(0.089)	(0.100)	(0.090)	(0.091)	(100.6)
Hdays	−0.772[b]	−0.710[a]	−0.670[a]	−0.625[a]	−0.690[a]	−0.814[a]
	(0.224)	(0.220)	(0.233)	(0.224)	(0.218)	(226.7)
Cdays	−1.246[a]	−1.199[a]	−1.013[a]	−0.843[a]	−0.952[a]	−1.146[a]
	(0.217)	(0.214)	(0.219)	(0.224)	(0.226)	(1.146)
Tax	−7.580	−9.491	−10.96	−10.54	−7.910	−6.122
	(7.580)	(7.452)	(7.062)	(6.758)	(7.206)	(7.648)
Promo.	−173.4	−128.0	−276.9	−293.9	−242.9	−257.2
	(200.4)	(201.3)	(206.6)	(196.2)	(201.9)	(209.7)
Agglo.	775.4[a]	715.4[a]	631.1[a]	765.7[a]	702.3[a]	666.5[a]
	(122.5)	(124.4)	(141.4)	(123.9)	(126.2)	(140.4)
Loglike.	−978.2	−977.7	−981.0	−976.0	−971.9	−977.0
Pseudo-R^2	0.1463	0.1468	0.1439	0.1483	0.1518	0.1474
Nobs	296	296	296	296	296	296

Note. (1) Standard errors in parentheses are beneath coefficient estimates; coefficients and standard errors are multiplied by 1000. (2) Regional dummies are included in each regression; estimates are available upon request.

[a] Denotes underlying coefficient is statistically significant at the 1% level.

[b] Denotes underlying coefficient is statistically significant at the 5% level.

[c] Denotes underlying coefficient is statistically significant at the 10% level.

TABLE AIV

Conditional Logit Estimates for Non-Pollution-Intensive Firms

	Model					
Variables	1	2	3	4	5	6
CSG/Cap.	−42.216[a]	—	—	—	—	−40.394[a]
	(10.86)					(11.03)
CSG/Man.	—	−0.084[a]	—	—	−0.073[a]	—
		(0.020)			(0.020)	
Abate	—	—	−38.986[b]	—	—	−33.784[b]
			(16.96)			(17.46)
Index	—	—	—	−103.64[a]	−80.068[a]	—
				(30.21)	(2.952)	
Pop. den.	829.74	1050.9[c]	482.01	434.96	1132.0[c]	1028.4
	(619.4)	(629.3)	(582.4)	(567.4)	(619.6)	(631.4)
Wages	−0.005	−0.005	−0.004	−0.004	−0.005	−0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
%Union	−110.80	378.36	1207.6	1272.8[c]	1121.5	679.17
	(733.7)	(742.5)	(815.5)	(767.2)	(782.3)	(832.2)
Energy	−0.001	−0.005	0.098	−0.039	−0.011	0.112
	(0.082)	(0.082)	(0.096)	(0.082)	(0.083)	(0.098)
Hdays	−0.682[a]	−0.603[a]	−0.328[b]	−0.399[b]	−0.599[a]	−0.648[a]
	(0.175)	(0.166)	(0.165)	(0.163)	(0.166)	(0.179)
Cdays	−0.952[a]	−0.905[a]	−0.636[a]	−0.546[a]	−0.736[a]	−0.841[a]
	(0.167)	(0.165)	(0.166)	(0.163)	(0.170)	(0.173)
Tax	2.485	0.203	−2.916	−5.858	−1.986	3.717
	(7.043)	(7.020)	(6.268)	(6.111)	(6.863)	(7.113)
Promo.	269.03	342.94[c]	156.44	193.36	258.55	134.92
	(179.7)	(180.9)	(190.1)	(178.2)	(182.3)	(193.4)
Agglo.	808.23[a]	756.48[a]	696.04[a]	773.72[a]	745.12[a]	730.49[a]
	(80.24)	(80.16)	(87.25)	(81.03)	(80.96)	(87.52)
Loglike.	−1149.7	−1147.6	−1155.3	−1152.2	−1143.5	−1147.4
Pseudo-R^2	0.1634	0.1650	0.1593	0.1616	0.1679	0.1650
Nobs	355	355	355	355	355	355

Note. (1) Standard errors in parentheses are beneath coefficient estimates; coefficients and standard errors are multiplied by 1000. (2) Regional dummies are included in each regression; estimates are available upon request.

[a] Denotes underlying coefficient is statistically significant at the 1% level.

[b] Denotes underlying coefficient is statistically significant at the 5% level.

[c] Denotes underlying coefficient is statistically significant at the 10% level.

REFERENCES

1. S. Arora and T. Cason, Do community characteristics determine environmental outcomes? Evidence from the toxics release inventory, *Southern Econom. J.* **65**, 691–716 (1999).
2. T. J. Bartik, Business location decisions in the United States: Estimates of the effects of unionization, taxes and other characteristics of states, *J. Business Econom. Statist.* **3**, 14–22 (1985).
3. B. Blonigen, Firm-specific assets and the link between exchange rates and foreign direct investment, *Amer. Econom. Rev.* **87**, 447–465 (1997).
4. B. Blonigen and R. Feenstra, "Protectionist Threats and Foreign Direct Investment," NBER Working Paper 5475, NBER, Cambridge, MA (1996).
5. D. Carlton, The location and employment choices of new firms: An econometric model with discrete and endogenous variables, *Rev. Econom. Statist.* **54**, 440–449 (1983).
6. C. Coughlin, J. Terza, and V. Arromdee, State characteristics and the location of foreign direct investment within the United States, *Rev. Econom. Statist.* **73**, 675–683 (1991).

7. C. Duerksen, "Environmental Regulation of Industrial Plant Siting," The Conservation Foundation, Washington, DC (1983).
8. J. Friedman, D. Gerlowski, and J. Silberman, What attracts foreign multinational corporations? Evidence from branch plant location in the United States, *J. Regional Sci.* **32**, 403–418 (1992).
9. W. Gray, Discussion of "State regulatory policy and economic development," *New England Econom. Rev.*, *in* "Proceedings of a Symposium on the Effects of State and Local Public Policies on Economic Development," March/April (1997).
10. W. Gray, "Plant Location: Do Different Industries Respond Differently to Environmental Regulation?" Working Paper, Clark University, Worcester, MA (1997).
11. V. Henderson, Effects of air quality regulation, *Am. Econom. Rev.* **86**, 789–814 (1996).
12. A. Jaffe, S. Peterson, P. Portney, and R. Stavins, Environmental regulation and the competitiveness of U.S. manufacturing: What does the evidence tell us? *J. Econom. Literature* **33**, 132–163 (1995).
13. B. Kogut and S. J. Chang, Technological capabilities and Japanese FDI in the U.S., *Rev. Econom. Statist.* **73**, 401–413 (1991).
14. J. Lester, A new Federalism? Environmental policy in the states, *in* "Environmental Policy in the 1990s" (N. Vig and M. Kraft, Eds.), Congressional Quarterly, Washington, DC (1994).
15. A. Levinson, Environmental regulations and manufacturers' location choices: Evidence from the Census of Manufacturers, *J. Public Econom.* **62**, 5–29 (1996).
16. A. Levinson, "Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufacturers," Dissertation, Columbia University, New York (1994).
17. J. List and R. d'Arge, "Pollution: Whose Citizens Are Being Protected?" Working Paper, University of Wyoming, Laramie, Wyoming (1996).
18. V. D. McConnell and R. Schwab, The impact of environmental regulation on industry location decisions: The motor vehicle industry, *Land Econom.* **66,** 67–81 (1990).
19. D. McFadden, Conditional logit analysis of qualitative choice behavior, *in* "Frontiers in Economics" (P. Zarembka, Ed.), Academic Press, New York (1974).
20. R. Nathan and F. Doolittle, "The Consequences of Cuts: The Effects of the Reagan Domestic Program on State and Local Governments," Princeton Univ. Press, Princeton, NJ (1983).
21. J. Ondrich and M. Wasylenko, "Foreign Direct Investment in the United States: Issues, Magnitudes, and Location Choice of New Manufacturing Plants," Upjohn Institute, Kalamazoo, MI (1993).
22. S. Ridley, "The State of the States, Fund for Renewable Energy and the Environment," Fund for Renewable Energy and the Environment, Washington, DC (1987).
23. Tannenwald, R. State Regulatory Policy and Economic Development, *N Engl Econom. Rev.*, *in* "Proceedings of a Symposium on the Effects of State and Local Public Policies on Economic Development," March/April (1997), pp. 83–97.
24. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Pollutant Emission Trends, 1929–1994, U.S. EPA, Washington, DC (1995).
25. N. Vig and M. Kraft, "Environmental Policy in the 1990s," Congressional Quarterly, Washington, DC (1994).
26. D. Woodward, Locational determinants of Japanese manufacturing start-ups in the United States, *Southern Econom. J.* **58**, 690–708 (1992).