Human Capital, Income, and Environmental Quality: A State-Level Analysis

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An empirical analysis reveals that states with more highly educated populations have better environmental conditions, after controlling for income, population density, and industrial composition. The strategy of raising human capital stocks to maintain or improve environmental quality is proposed as a complement, if not an alternative, to direct government intervention, which consists of command and control, market incentives, and moral suasion. Under this approach, general education becomes the control variable that guides economic behavior in a manner consistent with long-term environmental sustainability.

Three strategies are available for changing economic behavior when markets fail to allocate resources optimally: market-based incentives, consumer education, and regulations. Taxes, subsidies, and marketable pollution permits are market-based incentives or tools for improving environmental quality.[1] Regulations involve command and control (CAC) of firm production processes, while consumer educational efforts inform the public about harmful effects of specific chemicals such as agricultural and garden fertilizers, pesticides, herbicides, insecticides, and, more recently, refrigerants. Educational strategies rely in part on moral suasion to achieve environmental objectives. An example is the admonition ''Give a hoot—don't pollute.''

We propose that individuals or households with larger stocks of human capital derive greater utility from better environmental conditions. Furthermore, when facing multiple options, these households more often choose an option consistent with improving or maintaining environmental quality. This is based on Becker's argument ''that individuals maximize welfare *as they conceive it*'' (1993, p. 386; see also Becker 1996, ch. 1). Households with more highly educated members are more aware of and evaluate environmental issues differently than do those with less formal education (see also Fischel 1979; Nelson and Phelps 1966). Following Stigler and Becker (1977, p. 89), we incorporate what would otherwise represent ''unstable tastes'' into the household production function. The proposition is conceptually developed and empirically tested using state-level data. We find that states in which a larger share of adults completed high school have better environmental conditions, *ceteris paribus.*

While the importance of human capital is widely recognized in the literatures of economic development (T.W. Schultz 1964; Romer 1990; Lucas 1993), crime (Becker 1968), wage-earnings (Mincer 1974), fertility (Becker, Murphy, and Tamura 1990) and health (Kenkel 1991), its impact on environmental conditions has largely been ignored. Recent work by Grossman and Krueger (1995) reveals a significant, positive relationship between per capita income and environmental quality in more highly developed nations. We argue that changes in human capital modify individuals' appreciation of the environment independently of income, thereby causing changes in behavior that are measurable at the state level in the United States. In addition, educated consumers are more likely to pressure local firms into reducing pollution levels.

Human Capital and Environment: A Theoretical Model

We assume the following utility function for individuals, which is maximized subject to income and time constraints:

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$$(1)\quad Max\ U(x) + V(E,H,t_e),\ \text{with } V_E > 0,\ V_{EH} > 0,\ V_{Ht_e} \geq 0$$
$$s.t.\quad \pi x + \omega(t_l + t_e) \leq wt_w + y_o = y + y_o$$
$$T = t_w + t_e + t_l.$$

Here x denotes non-environmental goods, π denotes prices of these goods (which are assumed not to vary across states), E is local environmental quality, H is environmental human capital, t_w is time allocated to work at wage ω, t_e is time devoted by the individual to improving the environment, t_l is time devoted to leisure, T is total time available, y ($= \omega t_w$) and y_o are earned and unearned income, respectively, and Y ($= y + y_o$) is total income.

An individual's personal and social capital comprise a portion of the individual's overall human capital stock.[2] Investments in the form of personal choices made and experiences gained today determine future personal capital, so that these investments in turn have a direct effect on utility in the future. Thus, choices made today are a function not only of their effect on today's utility, but also of their effect on utility in the future.

Environmental human capital (H) comprises relevant past consumption choices, education, and other personal experiences associated with environmental services. Formal educational attainment is frequently used as a measure of the stock of human capital. Within an environmental context, formal education might promote awareness and a better understanding of cause-and-effect relationships involving pollution of the environment. This hypothesis is tested in the present study.

Current choices (location of residence and appreciation of local environmental quality) and experiences affect environmental capital in the future. Investments in H in the form of additional money spent locating in a particular area, or money spent for environmental improvement (such as lobbying public decision-makers), increase the accumulation of environmental human capital. In turn, greater environmental human capital generates additional demand for environmental investments if these investments are complements to environmental human capital in the utility function.[3] We assume here that environmental human capital depends on formal educational attainment (h), and we approximate H by h empirically.

The purpose of this paper is to test empirically whether $V_H > 0$, in which case individuals with higher levels of H experience greater utility when exposed to a given environmental quality level. We also indirectly test whether $V_{Ht_e} \geq 0$. In other words, rising levels of H affect the amount of time (and other resources) individuals willingly spend on environmental improvements.

Another issue involves collective action and the magnitude of V_{Ht_e}. Unless higher levels of H are associated with higher levels of t_e, i.e., $V_{Ht_e} \gg 0$ (individuals with more H allocate more time (t_e) to the environment), dE/dH could be zero if collective action problems become overwhelmingly large. That is, H will not affect E if any one individual acting alone is unable to influence environmental quality and if $V_{Ht_e} \approx 0$, such that increases in H do not lead to increases in t_e.

A related issue is the public goods–nature of environmental quality.[4] The fact that Y and h vary across states allows us to observe empirical differences in E. Individuals with more Y and greater stocks of h would be expected to allocate more resources to improving E, but the benefits of this investment would also accrue to other members of the community. Individuals can migrate in order to obtain a desirable level of public goods and services (Tiebout 1956).[5] This leads to a question of potential simultaneity among Y, h, and E, in that the interaction of these variables enhances utility, as suggested in the compensating wage literature.[6] To address the concern of reverse causation—people with higher incomes and educational attainment migrate to states with better environmental quality—we use instrumental variable estimators, as discussed in more detail below.

A decision-maker's willingness and ability to engage in defensive activities to protect the environment may increase with higher average incomes associated with additional formal education. We contend, however, that human capital—by increasing environmental appreciation and awareness—has a positive effect on environmental conditions that is independent of income. Greater environmental awareness, in turn, affects perceived benefits from and costs of achieving environmental quality (including learning about alternatives), for the following reasons.

More highly educated individuals are more likely to attach greater utility to future environmental payoffs since they tend to have longer time horizons and lower discount rates. Educated individuals are more knowledgeable about the effects of lifestyles on health (Kenkel 1991). They are also more likely to be aware of detrimental effects of environmental degradation on their health. For these reasons, educated decision-makers more likely engage in community activities that improve the environment, encourage state legislators to commit proportionally more funds to environmental programs, and persuade manufacturers to reduce pollution by purchasing goods safe for the environment. The empirical results reported below suggest that environmental conditions within states indeed improve as the share of adults having graduated from high school increases, *ceteris paribus*.

Data and Empirical Model

The hypothesis that larger stocks of human capital are associated with better environmental conditions is tested at the level of $i = 50$ states. We consider three different measures of environmental quality ($\boldsymbol{q}_i$): general environmental or "green" conditions (gc_i), air pollution (a_i), and toxic indicators (t_i). Environmental conditions are regressed on the percentage of adults in 1990 with a high school degree (h_i, as a measure of human capital), on 1987 personal income per capita (y_i), on 1987 population density (d_i), and, to control for major polluting activity as reflected in the industrial composition of each state, on manufacturing earnings as a percentage of total earnings (m_i) as well as the percentage of gross state product produced by the energy sector (e_i) in the same base year (1987).

Three otherwise identical equations are estimated for the different dependent variables:

(2)
$$\boldsymbol{q}_i = \alpha_0 + \beta_1 h_i + \beta_2 y_i + \beta_3 d_i + \beta_4 m_i + \beta_5 e_i + \varepsilon_i,$$

where $\boldsymbol{q}_i = (gc_i, a_i, t_i)$.

As discussed earlier, the error term in equation (2) is likely correlated with h_i and y_i. To avoid simultaneous equation bias, predicted values for h_i and y_i are obtained from two auxiliary regressions for use in equation (2).

Variable $gc_i \in \boldsymbol{q}_i$ measures general green conditions in a state as defined by Hall and Kerr (1991). The measure consists of state rankings based on 179 environmental indicators, and a higher value indicates better environmental conditions.[7] In addition to *bona fide* measures of environmental quality, including toxic emissions into landfills, the atmosphere, and water streams, gc_i contains variables such as the number of farms per 1,000 population, changes in the number of farms between 1974 and 1987, and deaths per 100,000 jobs in the workplace, among others, so that this variable must be interpreted with caution. Variables a_i and t_i more narrowly and precisely reflect environmental conditions in a state. Air pollution is measured as the percentage of population in each state living in counties that violate federal ozone and carbon monoxide standards. This variable is censored at 0, with six states having no counties in violation of standards, so that a Tobit estimator is used. The toxic indicator incorporates chemical releases to the land and the environment in general, as well as off-site transfers.[8]

We hypothesize that h_i is associated with better environmental conditions ($\partial gc_i / \partial h_i > 0$), *ceteris paribus*. The sign on gc_i with respect to income is indeterminate, a priori. The income elasticity of demand for environmental quality is likely to be positive; however, higher-income consumers may also consume goods associated with more pollution, such as larger and less fuel efficient cars. In addition, the effect is complicated by the possible existence of an inverse-U-shaped relationship between environmental quality and income. Selden and Song (1994) empirically tested for the existence of an inverse-U relationship between air pollution and income, extending Kuznets's analysis (1955, 1979) of the relationship between inequality and income growth. They found such a relationship to hold between pollution and GDP, using panel data from two low-, six middle-, and twenty-two high-income countries. Grossman and Krueger (1995), in contrast, found the opposite relationship, with environmental quality first falling and then improving with economic growth. We also expect higher population density to be associated with degraded environmental conditions. Thus, our interpretation of d_i is opposite to that suggested by Selden and Song. We expect m_i and e_i to be associated with lower environmental quality.

Estimation Results and Discussion

Coefficient estimates for equation (2) are presented in table 1.[9] As hypothesized, $\hat{h}_i$ has a statistically significant, positive effect on gc_i. Thus, after controlling for income, population density, and industrial activity, environmental quality is higher in states in which a higher proportion of individuals has graduated from high school. Coefficients for both m_i and e_i have the expected signs and are statistically significant at below the 10% level. Neither $\hat{y}_i$ nor d_i is significant in this first equation.

In the equation for a_i, only $\hat{y}_i$ has a statistically significant effect, suggesting that higher average income is a key factor associated with a higher level of air pollution in the United States. At the same time, the sign on $\hat{h}_i$ is negative, as expected. In the equation for t_i, coefficient estimates for $\hat{h}_i$, m_i, and e_i are statistically significant and have the expected signs; also, $\partial t_i / \partial \hat{y}_i > 0$ at the 5% level of significance. Thus, states with more highly educated populations have significantly lower toxic indicator scores, *ceteris paribus*.

These empirical findings therefore support our conceptual argument for a positive, independent relationship between environmental conditions and human capital that is separate from income. Obvi-

Table 1. Regression Results for Environmental Variables

Variable	Environmental Conditions (gc_i)	Air Pollution (a_i)	Toxic Indicators (t_i)
Constant	1389.2	−82.4*	706.7***
	(1.21)	(1.94)	(3.30)
Human capital ($\hat{h}_i$)	69.0***	−0.392	−12.9***
	(3.51)	(0.53)	(3.52)
Income/capita ($\hat{y}_i$)	−0.023	0.0086***	0.025**
	(0.36)	(3.60)	(2.17)
Density (d_i)	0.457	0.0135	−0.071
	(0.78)	(0.62)	(0.66)
Manufacturing (m_i)	−35.7***	0.37	4.46**
	(3.44)	(0.94)	(2.31)
Energy GSP (e_i)	−38.2***	−0.44	3.59*
	(3.47)	(1.04)	(1.76)
Sigma		17.2***	
		(9.00)	
Adjusted R^2	0.484		0.352

NOTE: Sample size = 50 states. Significance levels: * = 10%; ** = 5%; *** = 1% or lower in a two-sided test. Variables with a "^" are predicted values from an auxiliary equation (see appendix table 2).

ously, increasing human capital levels has other important tangible and intangible economic benefits, so that this strategy may be even more cost-effective when compared with the alternative policies.

The results in table 1 can be considered reduced-form estimates from a system in which environmental policies are endogenous, reflecting alternative levels of environmental quality. In table 2, environmental policies and spending are included in the equation, using instrumental variables estimation, to test whether h_i remains significant when these variables are added as controls. In addition, we test whether Selden and Song's hypothesis (1994) of an inverse-U relationship among environmental conditions, policies, and per capita income is confirmed at the state level by including a squared-income term in the equations. To conserve

Table 2. Extensions of the Empirical Results

Variable	Air Pollution (a_i)		Toxic Indicators (t_i)
Constant	−50.70	306.5***	−91.12
	(0.44)	(3.60)	(0.14)
Human capital ($\hat{h}_i$)	−15.63***	−7.71***	−17.40***
	(3.49)	(3.60)	(3.45)
Income/capita ($\hat{y}_i$)	−0.479***	0.019*	−0.00245
	(3.54)	(5.23)	(0.10)
Income/capita^2 ($\hat{y}_i^2$)	1.25e-05***		
	(3.63)		
Density (d_i)	−0.543***	−0.104***	−0.121
	(3.46)	(2.73)	(1.07)
Manufacturing (m_i)	−12.87***	−0.33	0.804
	(3.39)	(0.93)	(0.24)
Energy GSP (e_i)	15.77***	−6.98***	8.43**
	(3.35)	(3.80)	(2.02)
Policies ($\hat{p}_i$)	0.760***		0.211
	(3.48)		(1.33)
Spending ($\hat{s}_i$)		1.41***	
		(3.62)	
Sigma	15.16***	15.23***	
	(9.07)	(9.07)	
Adjusted R^2			0.363

NOTE: Sample size = 50 states. Significance levels: * = 10%; ** = 5%; *** = 1% or lower in a two-sided test. Variables with a "^" are predicted values from an auxiliary equation (see appendix tables 2 and 3).

space, we report results only for those equations in which h_i remained statistically significant.

Statistically significant coefficient estimates for both $\hat{y}_i$ and $\hat{y}_i^2$ were obtained only for a_i (table 2). The relationship is U-shaped—and thus generally consistent with Grossman and Krueger's work (1995)—with a turning point (minimum) at an income level of $18,601 per capita. The turning point compares with a sample average income of $15,678 per capita, and minimum and maximum values of $11,310 and $22,940. Only eight states (16%) have average per capita incomes above $18,600. Thus, most states have yet to reach the income level at which air pollution increases.

To explore in more detail the effect of $\hat{h}_i$ on $\boldsymbol{q}_i$ independent of environmental policies and programs in a state, additional regressions were estimated using predicted values for environmental policies (p_i) and program spending (s_i) in each state.[10] The program spending variable is contained in the environmental policies index (p_i), and also included in a separate regression model to determine whether it has an independent measurable effect.

Although environmental regulations are established primarily in federal legislation, significant differences arise across states not only in terms of state-specific policies, but also in terms of the voting records of each state's congressional representatives; these voting records in turn reflect preferences of the constituents residing in each state. For example, Hall and Kerr (1991) discuss how the conflict between Representatives John D. Dingell (Detroit, Michigan) and Henry A. Waxman (Los Angeles, California) prevented renewal of the Clean Air Act during the 1980s. To the extent that elected representatives reflect the preferences of their electorate, differences in voting records will be correlated with preferences of voters in different states, and these differences will be empirically measurable.

Likewise, state-level environmental policies vary with respect to recycling programs, landfill standards, toxic wastes, agriculture, energy and transit policies, and air, water, and ground pollution. Residents' preferences with respect to environmental programs are articulated through state legislatures. In this paper, we measure these preferences using, alternatively, the overall environmental programs index (p_i) and state spending per capita on environmental programs (s_i). As reported in appendix table 1, environmental program spending varies from $6.80 to $271.90 per capita, indicating considerable variation in this measure.

Results for two equations in which $\hat{h}_i$ retained a statistically significant coefficient estimate are presented in table 2, along with the equation testing for the Kuznets (1955) effect (quadratic term for income). Perhaps the most remarkable result is the robustness of the significance of the coefficient for $\hat{h}_i$ to the specification changes in the equations for a_i and t_i. In addition, $\hat{h}_i$ is statistically significant and has the hypothesized sign in both of the equations reported for a_i; thus, the hypothesis that higher stocks of human capital are associated with less air pollution is supported unequivocally, controlling for either environmental policies or program spending, and with or without the Kuznets effect.

Summary and Conclusion

Policymakers and natural resource economists traditionally have relied on three alternative sets of instruments to modify the behavior of economic agents when markets yield environmental outcomes considered less than desirable from a societal perspective. The instruments consist of market-based incentives, product-specific information or knowledge, and explicit regulations.

The theoretical model presented here suggests that general formal education, provided through public and private schools, changes the behavior of economic agents in a direction that has positive consequences for the environment. With respect to the environment, awareness or appreciation, not unlike the appreciation for music developed by its *aficionados*, is the mechanism through which greater educational attainment (human capital) is translated into behaviors that protect the environment.

Results of a state-level empirical analysis, using instrumental variables estimation, confirm that higher educational attainment has an independent, positive effect on environmental quality. This is true after controlling for income and three key variables associated with deteriorating environmental conditions (or the generation of pollutants) in a state: population density, manufacturing, and energy-related production. These findings suggest that a strategy of raising the educational attainment of the population—aside from all of the other well-known associated benefits in terms of higher labor productivity and economic well-being—entails the additional economic benefit of improved environmental conditions. Such a strategy could be considered as a complement or alternative to existing approaches for dealing with environmental conflicts.

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Notes

1. Trading of pollution rights between electric power-generating stations illustrates the use of market incentives, which originated with Pigou (1920). Hahn (1989) contains a review of related research.
2. Becker defines personal capital as "the relevant past consumption and other personal experiences that affect current and future utilities" and social capital as the "influence of past actions by peers and others in an individual's social network and control system" (1996, p. 4). Furthermore, according to Becker, "current behavior may raise future personal capital, or this capital may fall over time because of psychological and physiological 'depreciation' of the effects of past behavior. The capital stock next period equals the formation of personal capital this period plus the undepreciated portion of the capital from this period" (1996, p. 7).
3. For a complete analysis of analogous personal capital, see Becker 1996, p. 5 and Ch. 3.

4. See, for example, Cornes and Sandler 1980, ch. 3–8, for a discussion of externalities and public goods.
5. See also Knapp and Graves 1989; Clark and Cosgrove 1991; Rosenzweig and Wolpin 1988; T.P. Schultz 1988.
6. For example, Polachek and Siebert 1993, ch. 7.
7. The environmental data are discussed in more detail in the appendix. Rankings in Hall and Kerr (1991) are such that a lower rank reflects better conditions or policies that are more protective of the environment. We subtracted each state's rank from 10,000 to obtain a scale whereby a higher value for gc_i or p_i (environmental policies, which are discussed below) denotes better conditions or more pro-environmental policies.
8. Summary statistics for the variables used in the regressions are presented in appendix table 1.
9. Results for the instrumental variables estimation for h_i and y_i are reported in appendix table 2. The specification of these equations is based on earlier studies, including Cameron and Heckman (1993), Cohn and Hughes (1994), Goetz and Hu (1996), Katz (1992), and Nerlove et al. (1993).
10. Equations estimated to obtain instruments for these variables are reported in appendix table 3.

Appendix: Environmental Data Sources and Description

Measures of Environmental Conditions

All environment-related indicators are from Hall and Kerr (1991). The environmental conditions (gc_i) variable reflects state rankings on indicators reflecting air, ground, and water pollution. This variable includes factors such as density of motor vehicle traffic and pollution (1989); toxic chemicals released into the air (in pounds per capita and per square mile, 1988); toxic air emissions without end-of-stack controls (1990); number of facilities per capita posing a high risk of cancer (1990); pounds per capita of ozone-depleting emissions (1987); number of ozone-depleting factories per capita (1987); acid rain based on pH-scale (1990); sulfur dioxide emissions from electric power plants in pounds per capita (1988); nitrogen oxides from electric power plants in pounds per capita (1988); carbon dioxide emissions from electric power plants in pounds per capita (1988); and pounds per capita emissions of carbon dioxide released through fossil-fuel combustion (1988). Water pollution is based on fresh water withdrawals (1985), toxic chemicals released into surface water and public sewage systems (1988), toxic chemicals injected underground (1988), sewage systems in noncompliance (1988), sewage system investment needs (1988), impaired rivers, streams, lakes, and reservoirs (1988), funds for water quality and development (1988), population served by groundwater (1985), households with wells (1980), households with septic tanks only (1980), groundwater potentially contaminated by pesticides (1987), surface and groundwater potentially contaminated (1987), water systems with SDWA (Safe Drinking Water Act) violations (1987), water systems in significant noncompliance (1987), population with SDWA violations (1987), and water use for drinking purposes (1988).

Air pollution includes the percentage of population living in counties with air that failed the Clean Air Act's ground-level ozone (during 1987, 1988, and 1989) and carbon monoxide standards (1988

Appendix Table 1. Summary Statistics for Regressors

Variable	Unit	Mean	Std. Dev.	Min.	Max.
Endogenous variables					
Environmental quality (q_i):					
Environmental conditions (gc_i)	index†	5,520	656	4,261	6,717
Air pollution (a_i)	percent†	32.0	27.4	0.0	98.5
Toxic indicators (t_i)	index†	216.0	108.7	17.0	394.0
Environmental policies and programs (gp_i):					
Environmental policies (p_i)	index†	7,799	670	6,770	9,236
Environmental program spending (s_i)	\$/capita†	40.2	49.1	6.8	271.9
Exogenous variables					
Human capital (h_i)	percent	76.3	5.6	64.3	86.6
Income/capita (y_i)	\$/capita	15,678	2,654	11,310	22,950
Population density (d_i)	persons/mile^2	165.6	233.9	1.0	1,035
Manufacturing earnings (m_i)	percent of total earnings	19.8	7.8	4.6	35.1
GSP in energy (e_i)	percent of total GSP	3.8	7.2	0.0	30.3

†See text and appendix for further details.

Appendix Table 2. Equations for Predicting Educational Attainment and Income

Variables	Human Capital (h_i)	Income/ Capita (y_i)
Constant	39.9***	1878.2
	(2.88)	(0.42)
Density (d_i)	−0.0065**	2.74**
	(2.48)	(2.08)
Professional occupations (%)	85.9***	
	(3.29)	
State & local taxes (% of income)	0.0369	
	(0.13)	
Income ($/capita)	0.00085*	
	(1.73)	
Household size (persons)	−0.912	
	(0.26)	
Owner-occupied housing (% of total)	0.214**	
	(2.12)	
Corporate tax rate (%)		143.5***
		(3.70)
Unionization rate (%)		1.22
		(1.12)
Right-to-work law (YES = 1, NO = 0)		−694.2
		(1.44)
Human capital		208.1***
		(3.44)
Rural population (% of total)		−63.38***
		(3.78)
Northeast	−0.0528	1592.1***
	(0.03)	(3.21)
South	−7.20***	1697.1*
	(6.41)	(1.81)
West	0.659	−1492.0***
	(0.50)	(3.06)
Adjusted R^2	0.783	0.752
R^2	0.823	0.798

NOTE: Sample size = 50 states. Significance levels: * = 10%; ** = 5%; *** = 1% or lower in a two-sided test. Years for the instruments are chosen with a five- to ten-year lead, as a function of data availability from the Census and the objective of ensuring exogenity of the instruments. For example, the human capital measure when used as an instrument is for 1980.

and 1989); this measure is included in gc_i, and also used separately as a dependent variable (a_i). The toxic indicator variable (t_i) is similarly included in gc_i and is also used separately as a dependent variable. This measure reflects state rankings in terms of nine toxic waste indicators.

In the case of air and water pollution, the original discharge may lie in another (upwind or upstream) state. The conceptual model allows (and controls statistically) for the fact that individuals with higher incomes and educational attainment avoid states with polluted environments, regardless of the origin of the pollution. In addition, individuals living in states that are polluted by activities in other states work through the policy process to ameliorate such problems. Hall and Kerr (1991) provide two examples illustrating this point:

Appendix Table 3. Equations for Predicting Environmental Policies and Spending

Variables	Environmental Policies (p_i)	Environmental Program Spending (s_i)
Constant	−140.3***	−208.2
	(0.04)	(1.10)
Human capital ($\hat{h}_i$)	22.23	5.56**
	(0.58)	(2.39)
Income/capita ($\hat{y}_i$)	0.631***	−0.0216
	(2.71)	(1.19)
Income/capita^2 ($\hat{y}_i^2$)	−1.62e-05**	−4.66e-07
	(2.08)	(0.93)
Density (d_i)	0.732	0.072**
	(1.14)	(2.43)
Manufacturing (m_i)	17.98*	0.361
	(1.88)	(0.91)
Energy GSP (e_i)	−21.65**	4.51***
	(2.55)	(3.48)
Northeast	27.86	6.82
	(0.09)	(0.92)
South	39.30	−12.9
	(0.13)	(0.61)
West	26.11	15.9*
	(0.10)	(1.71)
Adjusted R^2	0.511	0.589
R^2	0.601	0.665

NOTE: Sample size = 50 states. Significance levels: * = 10%; ** = 5%; *** = 1% or lower in a two-sided test. Variables with a "^" are predicted values from an auxiliary equation (see appendix table 2).

> Connecticut, Massachussetts, and Rhode Island score just as poorly as New Jersey on air pollution indicators, partly due to prevailing winds, but also because of their own cars and industry. In fact, on a per capita basis, the five states with the most factories spewing out ozone-depleting chemicals are all in New England. . . . Several New England states have taken steps to curb air pollution by toughening tailpipe emissions standards, requiring pollution control devices on gas pumps, promoting use of cleaner fuels, and requiring industries to reduce their toxic chemical emissions. (p. 16)

And

> Maine and Connecticut, the two states with the worst acid rain measurements, catch the fallout from the Midwest. Like Vermont and Rhode Island, the two states don't rely much on coal-fired turbines, but they suffer from the emissions of Midwestern plants. Frustrated by federal inaction, Massachusetts and New Hampshire started their own programs to promote acid rain reduction. The University of Massachusetts coordinated a project to document acid levels in that state's waters. The results led to increased public awareness and the passage of state legislation requiring a cap on sulfur dioxide emissions from utilities and industry. (p. 20)

When we control for predicted environmental policies, the coefficient estimate for h_i remains statistically significant, and the effect is in the expected direction (text table 2).

Measures of Environmental Policy

Variable p_i reflects states' rankings on seventy-seven environmental policies and programs, including "Renew America" scores, environmental program spending and legislation, recycling efforts, air pollution control efforts, water quality and agricultural regulations, and various energy and transit laws. A higher index value reflects policies that are more protective of the environment. The other policy-related variable, s_i, is included in p_i and measures total spending for environmental programs per capita. As the federal government has reduced spending on environmental programs, state governments are increasingly responsible for addressing environmental concerns and funding environmental programs.