ENVIRONMENTALISM

and ECONOMIC PROSPERITY:

Testing the Environmental Impact Hypothesis

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The *MIT Project on Environmental Politics and Policy* focuses on the politics of natural resource and environmental policy-making at federal, state and local levels. Its basic research program explores the behavior of, and interaction among, government authorities, interest groups, academia, the media and the public in the process of formulating, implementing and evaluating natural resource and environmental policies. The Project's studies and analyses are especially concerned with the interplay of politics, science, economics and social values in environmental policy making.

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1. INTRODUCTION

As the 1988 presidential election drew near candidate George Bush declared his intent to be "the environmental president." With Boston Harbor as his backdrop he assailed his democratic opponent, Michael Dukakis, for dragging his feet on cleaning up water pollution. "No net loss of wetlands" was to be a hallmark Bush administration policy. Clean air and pure drinking water would be a right of all Americans. Indeed after eight years of the Reagan administration's New Federalism, in which federal leadership in managing environmental quality was all but abandoned to the states, many observers were cautiously optimistic that the new Bush administration would reassert federal executive leadership in environmental policy.[1]

The budding environmental president, however, failed to bloom. As the American economy began its slide into a long and deep recession the Bush administration set its sights on what it saw as a major roadblock to America's economic recovery: environmentalism. The complex web of environmental regulations and controls on industry and public resources, it asserted, was strangling business, throwing people out of work, stifling innovation, and reducing American industrial competitiveness. Where tradeoffs were perceived between fostering environmental quality on the one hand, and rekindling economic growth and development on the other, the administration would tilt in favor of the latter. The White House Council on Competitiveness became the administration's anti-environmental watchdog.

The notion that there is a fundamental conflict between the simultaneous pursuit of environmental quality and economic growth and development is not a recent invention of the Bush administration. From the beginning of the first environmental era -- the 1960s and 1970s -- industry has been quick to forecast the potential negative effects of environmental controls and standards.[2] Congressional hearings have been the fora for heated debates over each new piece of legislation and the regulations that followed.

The often bombastic nature of the "environment versus economy" rhetoric is well illustrated by the U.S. auto industry's assessment of the implications of the 1970 Clean Air Act. Lee Iococca, then vice president of the Ford Motor Company,

predicted the complete collapse of the U.S. auto industry within five years. At minimum, he argued, the air quality regulations would drive automobile prices through the roof and permanently cripple the U.S. economy.[3]

Nevertheless the first environmental era was a period of widespread good feelings about environmental policy. Environmentalism had strong bipartisan support. The presumed negative economic effects of environmental programs were discussed and acknowledged. Legislation frequently was modified and regulations postponed to accommodate industry concerns. But the basic idea that environmentalism was incompatible with a vibrant economy was not a powerful or persuasive icon in the policy-making process.

The 1980s marked the beginning of the second environmental era and entrance of the "environmentalism hurts economic prosperity" thesis into federal policy-making. Most significantly, it became a centerpiece of Reagan administration domestic policy, tightly incorporated into that administration's "New Federalism". Administrative actions were used to take the bite out of environmental legislation.[4] Regulations and standards considered burdensome on industry were watered down or suspended completely. Enforcement was intentionally neglected so that industry could get on with its business of doing business.

The Office of Management and Budget (OMB) was particularly effective in ensuring that economic and business concerns took precedence over what were portrayed as conflicting environmental measures. For example, OMB redrafted the congressional testimony of a top NASA scientist who was

prepared to declare that global warming was a proven phenomenon. OMB, in an effort to block any movement towards regulating the emission of so-called greenhouse gases from U.S. industries and products, rewrote the testimony so that global warming would be portrayed as a highly speculative hypothesis.

The Bush administration, through its Council on Competitiveness, merely centralized and refined the process of administrative regulatory relief begun by its predecessor, with a special focus on environmental regulations . In 1991 the Council attempted to redefine wetlands so that some 50% of what experts inside and outside the government considered wetlands would be opened for development. After signing the 1990 Clean Air Act and touting its environmental significance, President Bush issued an executive order suspending its key provisions. The Clean Air Act of 1990 may now be law, but for all intents and purposes it is not in force.

It is clear that over the past twelve years *the environmental impact hypothesis* — the general proposition that strong environmental policies, rigorously enforced, inhibit economic growth and development, stifle employment, and reduce competitiveness -- has substantially and pervasively influenced federal policy-making. Yet there has been surprisingly little rigorous research to substantiate it. A slew of anecdotes is usually tossed out by proponents of the thesis to support their case. Other anecdotes are hurled back by environmentalists to "prove" the opposite point. But such a fundamental policy issue should not be left to impressions and speculation. The question remains: Can the environmental impact hypothesis stand up to rigorous examination? Does the pursuit of environmental quality through government

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regulation systematically and extensively
harm economic performance and prosperity
to a measurable degree? This paper offers an
analysis with which to address that question.

2. THE ENVIRONMENTAL IMPACT HYPOTHESIS IN THEORY

The environmental impact hypothesis is almost intuitive in its simplicity, and perhaps that is why it is so appealing -- especially during periods of economic downturn. Sifting through the literature and the popular press one finds four interlocking assertions (or expectations) that form the core of the hypothesis:

- Environmentalism directly inhibits overall economic performance;

- Environmentalism stifles employment growth;

- Environmentalism depresses labor productivity and undermines industrial competitiveness.

- Environmentalism forces industry to flee to regions where environmental policies are less restrictive and burdensome.

The first point sums up the presumed impact of layers of environmental regulations, mandated pollution control activities, environmental impact requirements, land-use and siting restrictions, and tax-supported programs and projects that have mounted up since the beginning of the environmental era. **Figure 2-1** depicts the accumulation of major federal environmental legislation from 1960 through 1990. The virtual explosion of environmental legislation in the 1970s, which in turn spawned tens of thousands of administrative regulations, is readily apparent. The basic argument, then, is that the heavy burden of environmentalism -- the added costs of doing business, restrictive regulation, and increased taxes -- must weigh down economic performance.

This argument leads directly to the empirical proposition: *as environmental regulations and controls increase, overall economic performance should decrease -- all else being equal.* Conversely, as environmental regulations are removed economic performance should improve. This is the core proposition underpinning the anti-regulatory activities of the Council on Competitiveness

The second argument is equally straightforward. Environmentalism reduces employment because it directly constrains the conduct of business while simultaneously increasing the costs of doing business. In extractive industries such as logging, oil and gas production, and mining environmentalism may prohibit access to resource rich areas. Environmental controls may also limit the extent of extractive activities while simultaneously burdening industry with clean up and restoration costs. If extractive industries cannot expand their domain and if they must contend with the imposed costs of environmental protection and restoration, then less capital will be available for wages. Over time jobs may actually be lost as entire regions are either closed to extractive activities or the costs of doing business become prohibitive. This argument was at the center of the recent federal decision to deny endangered species protection for the Northern Spotted Owl in old growth forests of the Pacific Northwest.

Similarly, as environmental regulations impose ever higher costs on the manufacturing sector there is less capital available for plant expansion. Funds that pay for extensive pollution control systems and waste management are not available for plant

FIGURE 2-1: FEDERAL ENVIRONMENTAL LEGISLATION 1960-1990
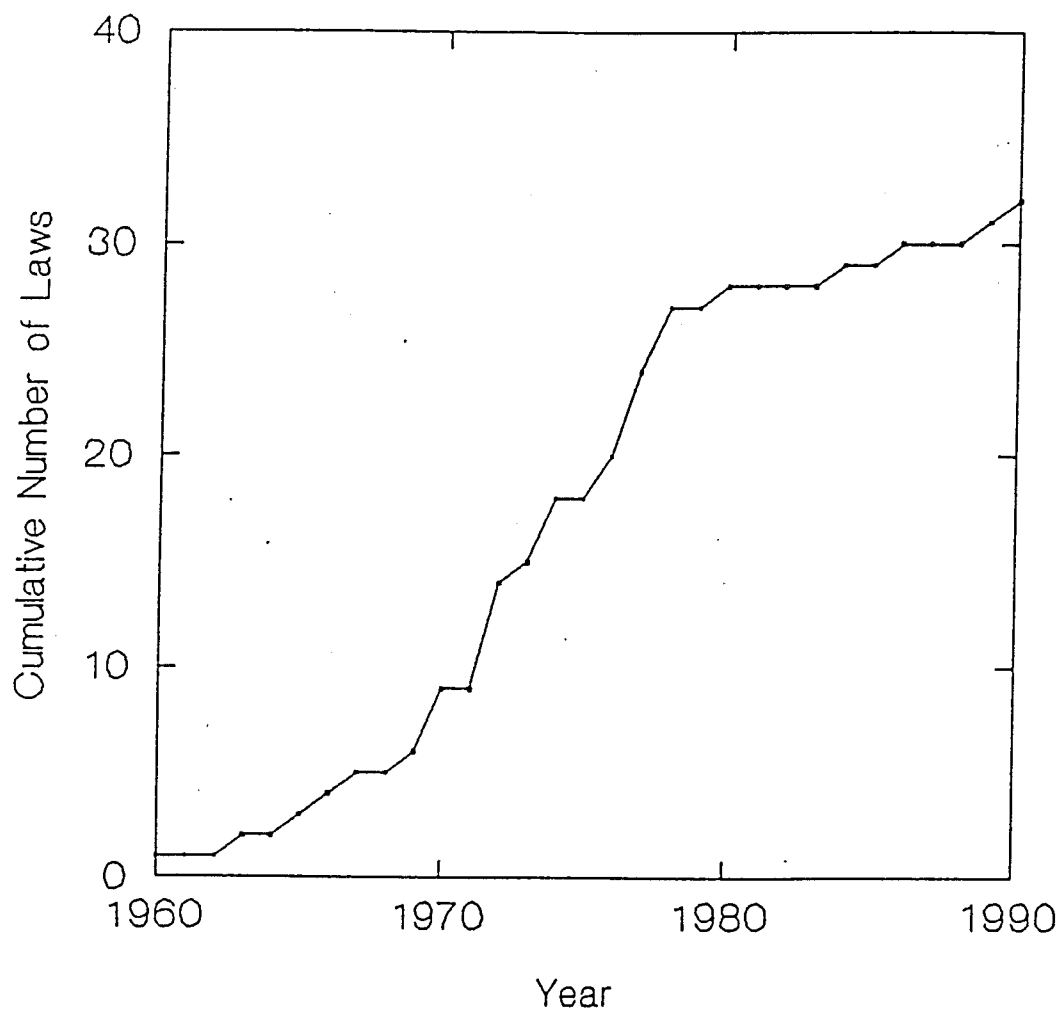
modernization and expansion, or wage increases.[5] Product prices jump to cover increased costs, and sales decline as a result. Should profits drop significantly industry layoffs inevitably follow. Certainly there is no new hiring. Indeed when politicians assert that jobs will be lost if more restrictive emissions standards are imposed on American manufactured automobiles, this is the underlying logic of their position.

Meanwhile, workers grow nervous about their job security and wages and put off major purchases -- and especially house purchases. Construction employment may be an early casualty of environmental controls as firms postpone or cancel plans for facilities expansion and employees withdraw from the real estate market. Of course construction employment may also suffer as a direct result of land-use restrictions, such as wetlands laws and habitat protection regulations for endangered species.

Thus *as environmental regulations and controls increase overall employment growth should slow, if not actually decline.* Correspondingly, *construction employment should fall,* reflecting the inability of industry to expand and fears about job security among the labor force. In the latter sense, the changing pace of growth in construction employment may be a leading indicator of negative environmental impact on the economy.

The third argument holds that environmentalism hurts labor productivity and industrial competitiveness by inhibiting plant modernization, stifling R&D and innovation, and replacing high skills jobs with low skills jobs. The contention that the costs of environmental compliance force businesses to divert scarce capital away from

investment has already been noted. The retention of outmoded production facilities means that the productivity-enhancing benefits of new technology are lost.

In theory environmental measures can also inhibit R&D and product innovation by adversely affecting the psychology of industry decision making.[6] Complex environmental regulations and the specter of future regulations create a general aversion to risks associated with the unpredictable environmental effects of new products and processes. In response to increased costs of doing business and fear of additional environmental regulations, industry gravitates to safe products that represent minor risks and incremental improvements over existing products. Ultimately, this behavior impairs both competitiveness and productivity.

Proponents of the environmental impact hypothesis acknowledge that environmentalism may create some new jobs. Increased activities in recycling, toxic waste cleanup, forest restoration, and treatment plant management may add jobs. However, they argue that to a great extent these will be low skills jobs. So while unemployed machinists, loggers, and construction crews may find new work, the economic value of that new work will be minimal. Thus, in terms of observable effects: *as environmental regulations and controls increase overall labor productivity and manufacturing productivity should decline.*

The fourth assertion, that industries will flee to regions with less restrictive environmental regulation in order to avoid the burdens of environmentalism, is a fear shared by both environmentalists and supporters of the environmental impact hypothesis. The former use this point to

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bolster their call for strong national environmental regulations. If environmental controls are geographically uniform, they argue, then industries will not have an incentive to flee. Supporters of the environmental impact hypothesis also predict the migration of environmentally burdened industries to regions with fewer environmental restrictions. But they point out that a uniformly strict national environmental policy will merely replace domestic industrial migration with international industrial migration. U.S. national economic prosperity, employment, and competitiveness will suffer as industries choose to move overseas rather than invest at home.

In this context a leading indicator of environmentally induced industrial migration is construction employment growth. While industries might wish to leave states with heavy environmental burdens, it is impossible to pick up and leave instantaneously. Similarly, labor -- while quite mobile in the United States -- requires time to move. Thus, it is conceivable that measures of economic production (such as gross state product) and employment growth might not be strong indicators of environmental impact on the economy because of the long lead times involved. However, construction employment growth should be a good leading indicator because it reflects future business plans. Industries planning to migrate three or five years in the future need facilities to move to. These are contracted for ahead of time. Therefore, *as environmental regulations and controls increase one should see a slowdown in construction employment growth*. Correspondingly, *there should be an increase in construction employment growth where environmental regulations are minimal or are in the process of being relaxed.*

The environmental impact hypothesis both substantively and from a policy perspective is concerned with the consequential effects of environmental policies on medium and long-term economic growth, employment, and competitiveness. It is not concerned with transient economic dislocations. Indeed every prospective government action -- e.g., changing interest rates, cancelling a weapons program, shifting the NASA budget -- results in some short-term loss of jobs and some loss of business to one or more industries. The scaling back of U.S. weapons purchases, for example, is expected to force the loss of hundreds of thousands of defense industry jobs, in the decade ahead. Thus, the analyses below focus on the enduring economic impacts of environmental policy.

3. TESTING THE ENVIRONMENTAL IMPACT HYPOTHESIS - I

Despite a multitude of national environmental laws, the U.S. federal system of power sharing ensures that there will be some degree of diversity among the environmental policies and programs of the states. How the states choose to implement and enforce federal laws, whether they augment federal laws with their own environmental legislation and regulations, and the amount of state taxpayer dollars available for pursuing environmental quality are just some of the variables that produce variation in environmental management among the states.

The scope and degree of this variation in environmental policies among the states depends to a great extent upon the tone and tenor of federal leadership. When federal leadership is strongly asserted and substantial federal funding is available the divergences among the states tend to lessen. But when federal leadership is weak and federal funding is not forthcoming states have both the opportunity and incentive to assert their individual preferences. Divergences in environmental policies widen.

The research design of this study explicitly takes advantage of the dynamics of this diversity among the states in examining the extent to which differences in their environmental records are reflected in their relative economic performance over the past two decades.

In its most forceful form the environmental impact hypothesis asserts that *states with weak environmental policies should exhibit more economic vitality than those with stronger environmental policies, all else being equal.* Of course, all else is rarely equal and we shall examine a more measured interpretation of the environmental impact hypothesis later in the paper. Nevertheless this forceful version of the environmental impact hypothesis serves as a good starting point from which to examinine the data. Based on the previous discussion five empirical predictions follow:

(1) States with stronger environmental records should experience poorer overall economic growth compared to those with weaker environmental records.

(2) States with stronger environmental records should experience slower employment growth compared to those with weaker environmental records.

(3) States with stronger environmental records should experience slower construction employment growth compared to those with weaker environmental records.

(4) States with stronger environmental records should experience slower manufacturing labor productivity growth compared to those with weaker environmental records.

(5) States with stronger environmental records should experience slower overall labor productivity growth compared to those with weaker environmental records.

In order to test these propositions data on gross state product, total (non-farm) employment, construction employment, and labor productivity (overall and manufacturing) were collected for each of the fifty states for the period 1982-1989. Intra-period growth rates were then calculated and

compared.

The period 1982-1989 is an especially good choice for analysis because the largest divergences in environmental policies among the fifty states occur at this time. Most notably this period represents the height of the New Federalism policies of the Reagan administration.[7] Federal funding to the states was cut significantly; enforcement of federal regulations was scaled back; and the states were given broad new discretionary powers for implementing and enforcing policy.[8]

Environmental policy was one of the main "targets" of the New Federalism. Some states continued to pursue environmental control with purpose and vigor. Other states responded to the shift in federal policy by scaling back their own efforts. To the extent that environmental policies have always varied among the states those differences were certainly magnified during the Reagan era. Thus, if environmentalism does hurt economic growth and development its differential effects should be particularly pronounced among the states during this time.

Second, 1982-1989 was a period of substantial national economic growth -- at least from a statistical standpoint. If environmentalism hindered employment and development in states with strong environmental policies and programs, then the effects will not be masked by the macroeconomic effects of the recessions of the early 1980s and early 1990s.

Third, the period was spanned by a single presidential administration with a well defined political-economic ideology that was basically anti-regulatory, anti-environment,

and pro-states rights. This constancy in executive branch philosophy and policy helps to minimize confounding influences on the economy while magnifying environmental policy differences among the states.

Thus, if the forceful version of the environmental impact hypothesis is correct, this period offers the best opportunity to observe the superior economic performance of the environmentally weak states relative to the environmentally strong states.

3.1 Data and Methods

3.1.1 Economic Indicators: As mentioned above, five economic indicators were chosen for analysis: gross state product growth, non-farm employment growth, construction employment growth, manufacturing labor productivity, and overall labor productivity.

Gross state product data, deflated for the base year 1982, were provided by the U.S. Commerce Department. These data (in current dollars) are published regularly in the Commerce Department's Survey of Current Business.

Employment data were obtained from the U.S. Labor Department's Employment and Earnings publication.

The manufacturing labor productivity indicator is the dollar value of output per worker per year in the manufacturing sector. The overall labor productivity indictor is the dollar value of non-farm output per non-farm worker per year. All dollar values are constant 1982 dollars.

The growth index used for each indicator

follows the general form:

$$\%GROWTH = \left[\frac{VALUE_{1989}}{VALUE_{1982}} - 1\right] \times 100$$

3.1.2 Environmental Indicators: The environmental impact hypothesis links environmental efforts -- policies, programs, and regulations -- with economic burdens. It is not concerned with the impact of environmental quality on the economy. Thus, the indicator(s) of a given state's environmental record should be related to the breadth, scope, and rigor of its environmental policies and programs and not its level of success. Of interest are states where public expenditures on environmental programs are high, where industry expenditures for environmental compliance are substantial, and where there are tight controls on plant siting, waste disposal, emissions, and land use.

New Jersey, for instance, ranks very high on environmental effort but fairly low on environmental quality. It is the former characteristic that is of interest to us here. Thus, references in this paper to "strong" or "weak" environmental states pertain only to their levels of effort, not their relative environmental cleanliness.

The indicator for the relative environmental record used in this study was taken from the work of Duerksen (1983). Based on data from the late 1970s and early 1980s he evaluated each state across a roster of 23 environmental indicators. For example, he looked at the comprehensiveness of state environmental impact statement regulations, the extent of state regulations protecting critical habitats and wildlife, state

per capita expenditures for environmental quality, and the scope of state power plant siting regulations and associated environmental impact assessments.

Each indicator was built on an ordinal scale and a final score for each state was computed by summing the ranks across all indicators. This study has adopted Duerksen's summary scores and simply re-ranked them so that the values would run from 1 to 50. A rank of 1 indicates the strongest environmental record and 50 reflects the weakest environmental record. Appendix 1 lists each state and its corresponding environmental rank..

Based on natural break points in this ranking the states were also grouped into three mutually exclusive categories: environmentally strong, environmentally moderate, and environmentally weak. This grouping by relative environmental commitment assumes that there are greater similarities in environmental regulation and management within the categories than between them. As shown in Appendix 1 the first seventeen states make up the strong category, the next fifteen are classified moderate, and the last eighteen fall into the weak category.

Since the environmental indicators are based on pre-1982 data and the economic measures are based on data from the period 1982-1989, the analyses in this section of the paper are looking for enduring medium term effects of environmental policies. In other words, state environmental policies set in motion in the late 1970s and early 1980s and enforced differentially throughout the 1980s should have exhibited persistent -- not one-shot -- effects on economic growth and development within the states.

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3.2 Results

3.2.1 Gross State Product and Economic Growth:

Do states with stronger environmental policies experience slower economic growth compared to states with weaker environmental policies? If so, then we would expect that, on average, states in the strong environmental category should have lower gross state product growth rates than states in the moderate category, and even lower growth rates than states in the weak environmental category. Correspondingly, states in the moderate environmental category should have lower gross state product growth rates than those of environmentally weak states.

In order to test the statistical likelihood of this relationship one actually sets up the converse relationship (a null hypothesis) and asks the question: Given these gross state product (GSP) data, what is the probability that the growth rates among the strong environmental states equal or exceed those of the moderate environmental states, which in turn equal or exceed the growth rates of the weak environmental states? The alternative to this null hypothesis is the environmental impact hypothesis. Symbolically, these two mutually exclusive hypotheses can be presented as:

$$H_{null}: GSP_{strong} \geq GSP_{moderate} \geq GSP_{weak}$$

$$H_{EI}: GSP_{strong} < GSP_{moderate} < GSP_{weak}$$

If the statistical test finds that the probability of the relationships specified by the null hypothesis, H_{null} , is small, then we can accept the alternative as being true -- that is, we can assume that the environmental impact hypothesis, H_{EI}, is true.[9] For the purposes of this study we will give the environmental impact hypothesis the benefit of the doubt and will reject the null hypothesis if the probability of it being true turns out to be 10% or less ($p \leq .10$).[10]

The results for the statistical tests on all five indicator are summarized in **Table I.** As can be seen, the likelihood that the growth in gross state product of the strong environmental states equals or exceeds those of the moderate environmental states, which in turn equal or exceed those of the weak states is greater than 99.9%. The data categorically refute the environmental impact hypothesis. There is either no difference in economic performance among the various environmental categories of states, or perhaps the relationship is the converse: economic performance actually improves with environmental effort.

We can explore this relationship further with the box plot shown in **Figure 3-1a.** For each environmental category the basic box represents the distribution of the core 50% of the cases scattered about that category's median (average) gross state product growth rate. The central line inside each box is the median value for the category. The line bisecting the entire graph reflects the pooled median of all the states -- that is, the national average.[11]

As can be seen, the strong environmental states sit above the national average and slightly above the moderate environmental states. Both of these groups sit substantially above the weak environmental states, which show growth rates below the national average. Growth in gross state product among the strong environmental states was more than twice that of environmentally

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Table I   During the 1980s Did States with Stronger Environmental Policies Experience Poorer Economic Growth than States with Weaker Environmental Policies?

| ECONOMIC GROWTH INDICATOR	SIGNFICANCE TEST Z-Score*	Prob.	ACCEPT ENVIRONMENTAL IMPACT HYPOTHESIS?
Gross State Product	-3.30	>0.999	no
Total (Non-Farm) Employment	-2.20	>0.987	no
Construction Employment	-4.36	>0.999	no
Manuf. Labor Product Productivity	-0.24	>0.594	no
Overal Labor Productivity	-2.81	>0.997	no

* Jonckheere's test of ordered alternatives is used to test for ordered differences among the three environmental categories in accordance with $H_{u,u}$. A Z-score of +1.28 or greater, corresponding to a signficance level of 0.10 or less, is required to accept the environmental impact hypothesis as true. See: Hollander and Wolfe (1973) and Lehamann (1975) for a description of Jonckheere's test.

Table II   During the 1980s Did States With Stronger Environmental Policies Out-Perform States With Weaker Environmental Policies?

ECONOMIC GROWTH INDICATOR	CORRELATION r-value*	Prob. r = 0	IS THERE A POSITIVE CORRELATION?
Gross State Product	+0.35*	< 0.007	yes
Total (Non-Farm) Employment	+0.23*	< 0.05	yes
Construction Employment	+0.54*	< 0.0001	yes
Manuf. Labor Product Productivity	+0.007	< 0.49	no
Overal Labor Productivity	+0.33*	< 0.011	yes

*An r-value of +0.23 or greater, corresponding to a significance level at or below 0.05, is required to accept the hypothesis that environmentalism is positively associated with a particular indicator of economic growth . This the converse of the environmental impact hypothesis.

Figure 3-1: GROWTH in GROSS STATE PRODUCT
1982-1989

(a)

13

(b)
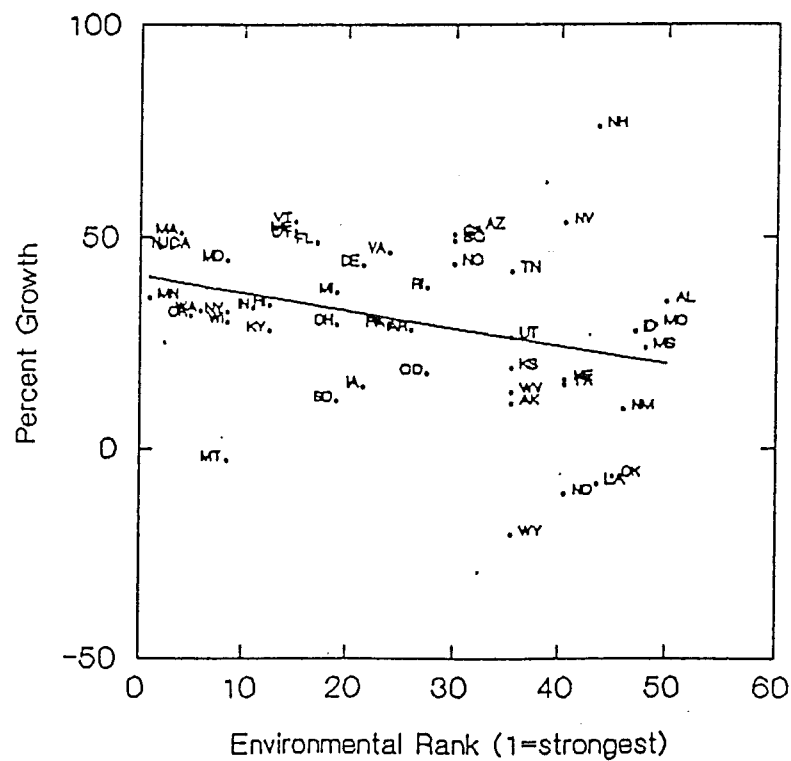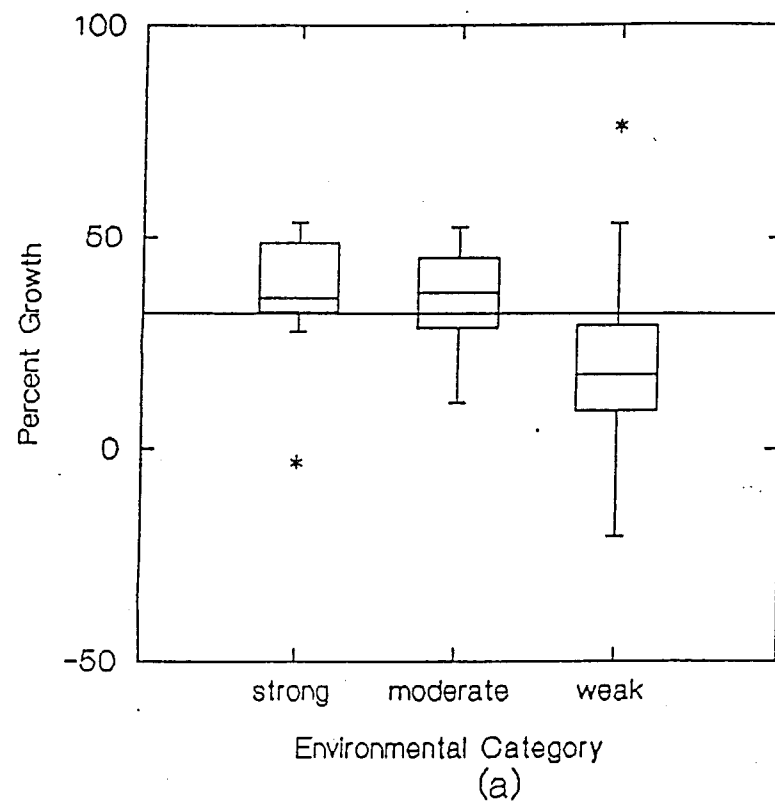
weak states. It *appears*, therefore, that there is a moderate positive correlation between gross state product growth and environmentalism -- just the opposite of what the environmental impact hypothesis asserts.

But graphical appearances can deceive. To test this possibility that a true positive correlation actually exists we turn to the individual environmental rank of each state and compare it to the state's rank in gross state product growth. If a positive correlation exists then a higher environmental rank should correspond to a higher rank on gross state product growth. A moderate positive correlation, above +0.23, is sufficient for us to accept the hypothesis that environmentalism is positively associated with economic growth.[12] (Again, the environmental impact hypothesis asserts that they should be negatively associated.)

Table II summarizes the correlation results for the data. The correlation between environmental rank and rank in growth in gross state product is +0.35, well above the acceptance threshold. The data clearly and strongly support the argument that stronger economic growth is associated with stronger environmental policies.

This positive relationship is obvious in **Figure 3-1b**, which is a scatterplot of the data: gross state product growth versus environmental rank. The plot depicts the growth in each state's gross state product for the period 1982-1989 along the vertical axis against its corresponding environmental rank along the horizontal axis. "1" represents the strongest environmental rank; "50" reflects the weakest. The line running through the cloud of points is the best linear (regression) fit to the data. This regression line is provided for descriptive purposes only. The

analysis does not posit a linear fit among the data.

If the environmental impact hypothesis were correct then the plot should spread from the lower left towards the upper right. It is readily apparent from **Figure 3-1** that this is not the case.

Two states with low environmental rankings showed some of the highest gross state product growth rates (e.g., Nevada and New Hampshire). But it is also true that the poorest gross state product growth rates -- indeed, negative growth rates -- were held almost exclusively by states with low environmental rankings. Thus, in terms of the states at the lower end of the environmental scale Nevada and New Hampshire are the exceptions, not the rule, on this measure of economic performance.

3.2.2 Total (non-farm) Employment Growth: In the political arena the environmental impact hypothesis focuses on jobs as an indicator of effect. Does environmentalism hinder employment growth? Is the effect strong enough to be observable at the state level? Here we run the same statistical tests on the total employment (EMPT) data:

$$H_{null}: EMPT_{strong} \geq EMPT_{moderate} \geq EMPT_{weak}$$

$$H_{LT}: EMPT_{strong} < EMPT_{moderate} < EMPT_{weak}$$

From **Table I** we see that the probability that the null hypothesis is true -- that there is either no difference or a real difference that is opposite that predicted by the environmental impact hypothesis -- is over 98.7%. Again we find the data unambiguously contradict the environmental impact hypothesis.

Figure 3-2: GROWTH in TOTAL (NON-FARM) EMPLOYMENT 1982-1989

(a)

Environmental Rank (1=strongest)

15   (b)
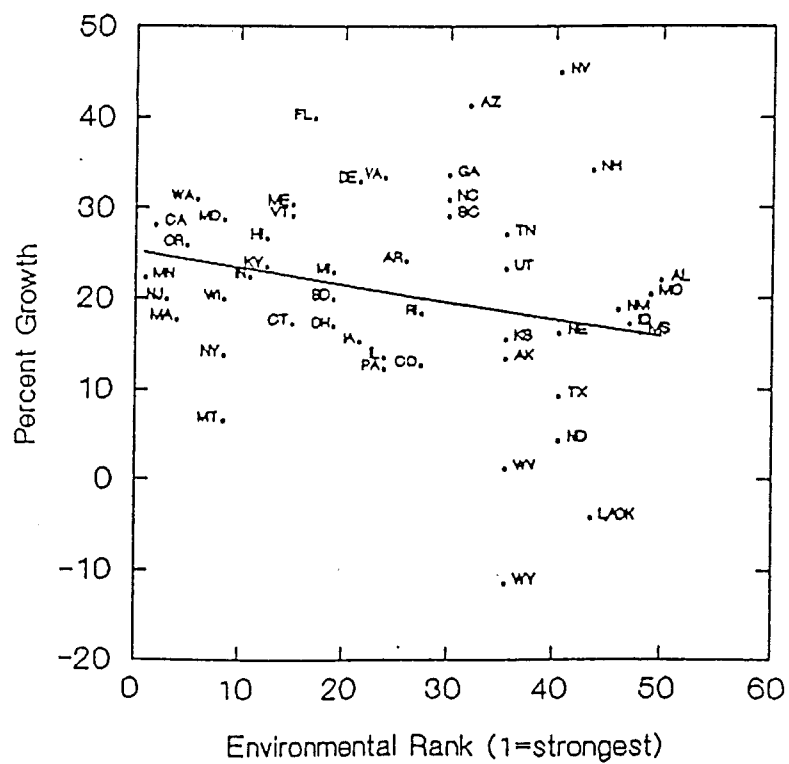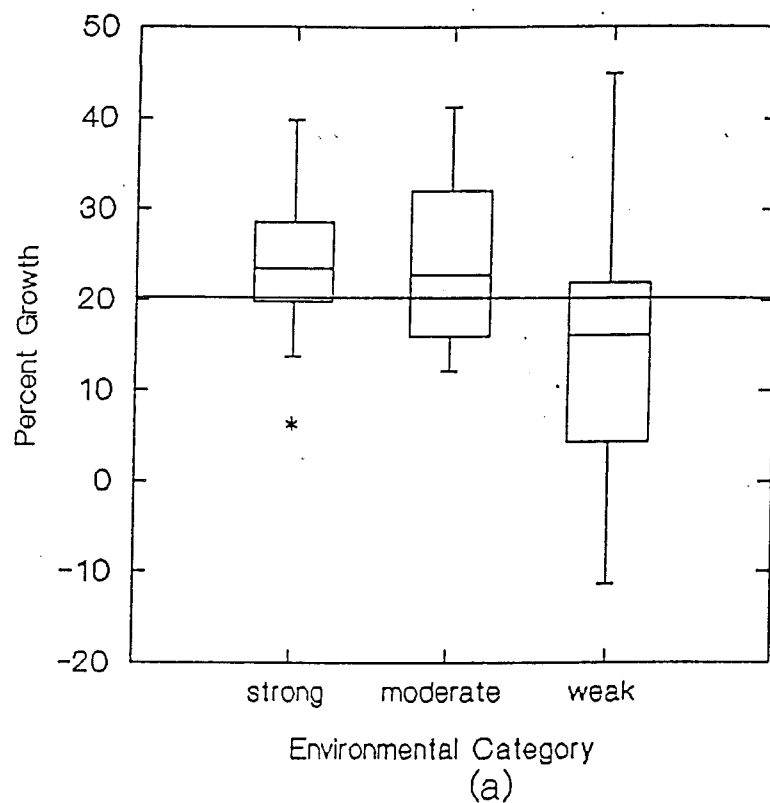
The box plot in **Figure 3-2a** tells us a little bit more. Here we see that the difference between the environmentally strong and moderate states seems insignificant; their median and the box placements are roughly equivalent. However, where the majority of the environmentally strong states sit above the national average in employment growth, the greatest portion of the environmentally weak states sits below the national median. In fact average employment growth among the environmentally strong states was about 45% better than that of the environmentally weak states.

Does this apparent positive correlation stand up to statistical testing? The rank correlation between employment growth and environmental rank shown in **Table II** is +0.23. This modest positive correlation, while weaker than that for gross state product growth, is still sufficiently strong for us to accept the likelihood that a true positive correlation exists: states with higher environmental ranks also tend to have higher employment growth.

Figure 3-2b is the corresponding scatterplot. New Hampshire and Nevada repeat their performance as anomalies among the environmentally weaker states.

3.2.3 Construction Employment Growth: As noted earlier examining construction employment growth tells us something about the longer-term effects of environmental policy on economic performance. If businesses flee environmentally strong states, as the environmental impact hypothesis posits, then employment growth in the construction trades in environmentally strong states should shrink. Meanwhile construction employment growth should pick up in the environmentally weak states as disaffected industries and workers make plans to relocate.

To test whether construction employment growth (EMPC) declines in environmentally strong states and increases in environmentally weak states, we examine the pair of hypotheses:

$$H_{null}: EMPC_{strong} \ge EMPC_{moderate} \ge EMPC_{weak}$$

$$H_{A}: EMPC_{strong} < EMPC_{moderate} < EMPC_{weak}$$

As shown in **Table I** the data suggest that the probability that either environmentalism is unrelated to construction employment growth, or that environmentalism is associated with higher construction employment growth is over 99.9%. We can say with considerable certainty that the environmental impact hypothesis is wrong.

As the box plot in **Figure 3-3a** shows the relationship between environmentalism and construction employment growth is the strongest we have seen yet. Where the strong environmental states float high above the national average the practically the entire box representing the weak environmental states lies below. Environmentally moderate states sit somewhere in between. Average construction employment growth among the environmentally strong states was about 53% for the period, while the environmentally weak states showed an average decline of approximately -1.4%.

It is also interesting to contrast the fairly low variance in construction employment growth among the strong and moderate environmental states (characterized by their short boxes) with the large variance of the environmentally weak states. This suggests

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Figure 3-3: GROWTH in CONSTRUCTION EMPLOYMENT 1982-1989

Environmental Category

(a)

Environmental Rank (1=strongest)

17

(b)
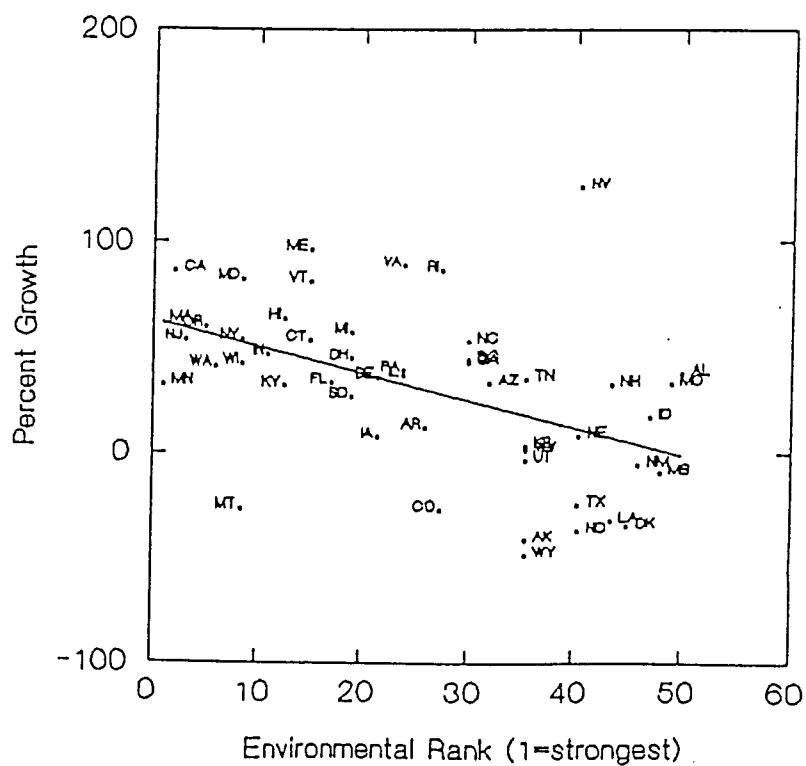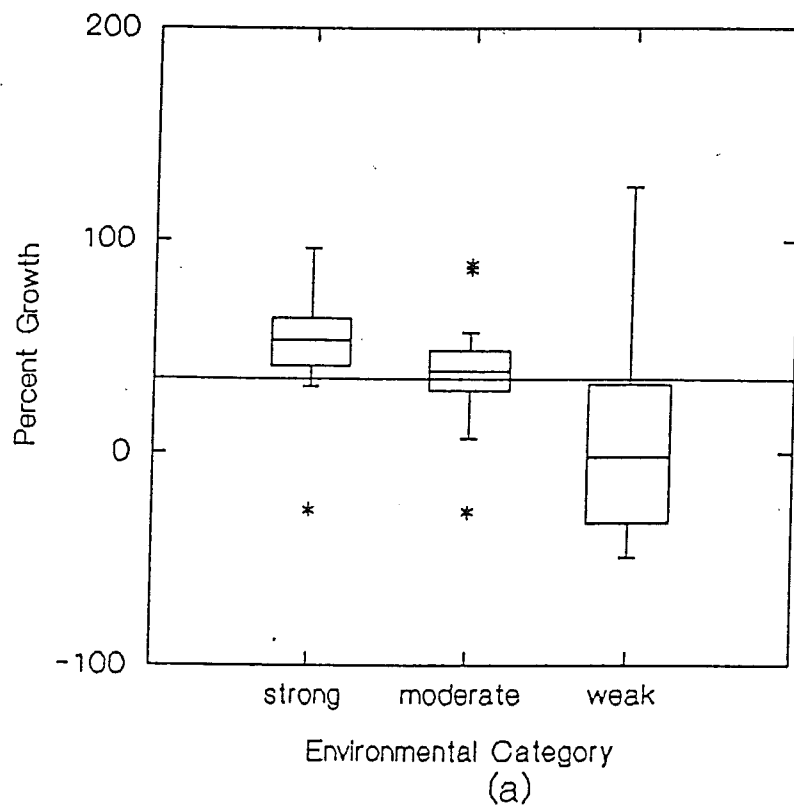
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that there may be some systematic differences among the states in this latter category that affect how environmental policies and programs are associated with construction employment.

The rank correlation (Table II) between construction employment growth and environmental rank is a hefty +0.54, the strongest correlation among the economic growth indicators. This says that the most intense construction employment growth took place in those states that had the stronger environmental policies and programs. Industry and labor did not flee in the face of environmental regulation.

The plot in **Figure 3-3b** offers visual confirmation. Notice the very tight scatter of the states about the estimated regression line. Nevada stands out as an outlier among the environmentally weak states, while Montana represents an anomaly among the environmentally strong states.

However onerous compliance with environmental measures in states with strong environmental records may have been, the growth in construction employment suggests that industry was investing for the future. There is no indication of business flight to states with lax environmental regulation as predicted by the environmental impact hypothesis.

3.2.4 Manufacturing Labor Productivity: Has environmental regulation in environmentally strong states sufficiently burdened industry to the point that it is reflected in weakened growth in manufacturing labor productivity (MPROD)? Failure to invest in plant modernization (due to capital diversion for pollution abatement) combined with the flight of industries to

environmentally weak states should be evident here. The pair of relevant hypotheses to test is:

$$H_{null}: MPROD_{strong} \geq MPROD_{moderate} \geq MPROD_{weak}$$

$$H_{a}: MPROD_{strong} < MPROD_{moderate} < MPROD_{weak}$$

From **Table I** we can see that the likelihood that there is no difference among the three environmental categories in terms of manufacturing labor productivity, or that the relationship runs opposite to that postulated by the environmental impact hypothesis, is over 59%. Though it is the lowest probability value in the table, it is still very much greater than would be needed to reject the H_{null}. The environmental impact hypothesis is supported by the data.

Examining **Figure 3-4a** one sees virtually no difference in either the box placements or the medians of the three environmental categories.

Testing the proposition that there is no true correlation between environmentalism and manufacturing labor productivity **Table II** shows the rank correlation coefficient shown for manufacturing labor productivity is effectively zero.

The scatterplot in **Figure 3-4b** shows just a cloud of points scattered randomly around a horizontal (null fit) regression line. New Hampshire's high growth in manufacturing labor productivity stands out as a curiosity among the lower ranking states on the environmental scale. The fact that Massachusetts also sits high above the other environmentally higher ranked states suggests the possibility of a link. A considerable amount of high-technology industry was spawned in lower New Hampshire during the

Figure 3-4: GROWTH In MANUFACTURING LABOR PRODUCTIVITY
1982-1989

(a)

(b)
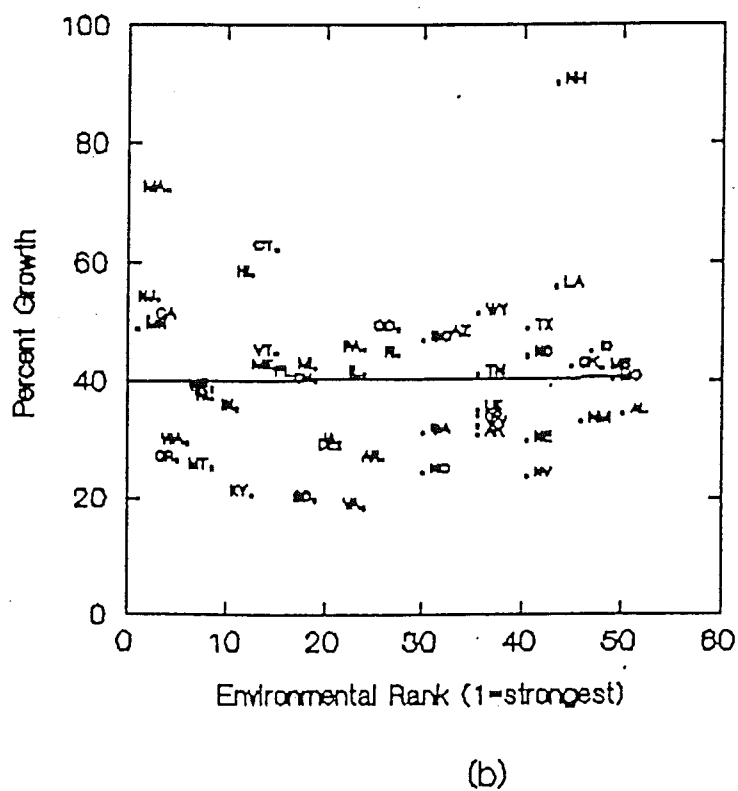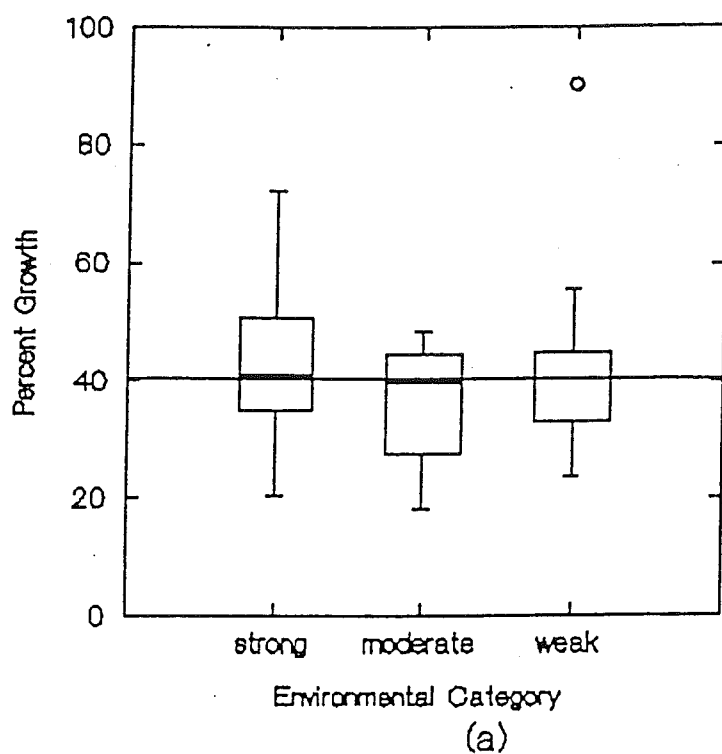
era of the "Massachusetts miracle." This bears further looking into.

3.2.5 Overall Labor Productivity: Overall labor productivity should reflect the effects posited above plus the "dumbing down" of job skills as predicted by adherents to the environmental impact hypothesis. That is, as more manufacturing jobs are replaced by labor intensive environmental jobs -- such as recycling, trash sorting, insulating, and even tourism -- overall labor productivity in strong environmental states should decrease.

We examine the pair of hypotheses for overall labor productivity (PROD):

$$H_{null}: PROD_{strong} \geq PROD_{moderate} \geq PROD_{weak}$$

$$H_a : PROD_{strong} < PROD_{moderate} < PROD_{weak}$$

And from Table I it is readily apparent that the data refute the environmental impact hypothesis. There is a 99.7% likelihood that either no difference in overall labor productivity among the three environmental categories exists, or that overall labor productivity in environmentally stronger states grew faster than in environmentally weaker states.

Figure 3-5a clarifies the situation. There does not seem to be a significant difference between the environmentally strong and moderate states, though the latter appear to have a median just slightly below the former. The environmentally weak states, however, clearly sit below the other two and the national average. In fact overall labor productivity growth among the strong and moderate environmental states was roughly double that of the weak environmental states.

From Table II the correlation of 0.33

supports the impression that there is indeed a positive correlation here that flies in the face of the environmental impact hypothesis. Overall labor productivity grew faster in states with higher environmental ranks. **Figure 3-5b** shows that once again New Hampshire is an oddity among the lower ranking environmental states.

3.3 Summary

The data failed by a wide margin to support the environmental impact hypothesis across all five indicators. In fact environmentalism was found to be positively associated with four of the five economic growth variables (manufacturing labor productivity being the exception).

The environmentally strong states outperformed the environmentally weak states by substantial amounts. The most dramatic difference was in construction employment growth. The moderate environmental states fell somewhere in between the other two categories in terms of economic performance.

Figure 3-5: GROWTH in OVERALL LABOR PRODUCTIVITY
1982-1989

Percent Growth

strong   moderate   weak

Environmental Category

(a)

Percent Growth

Environmental Rank (1=strongest)

(b)
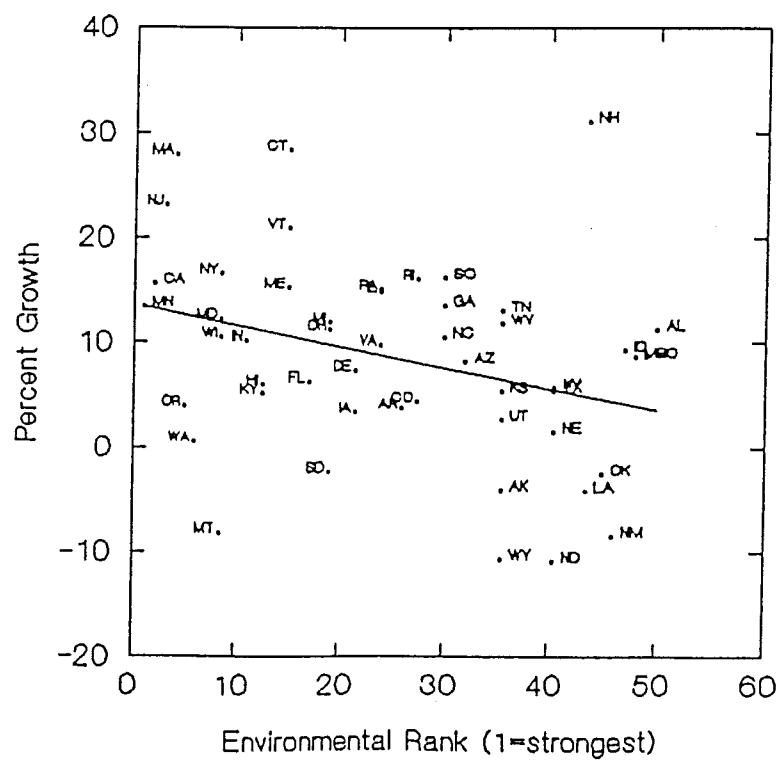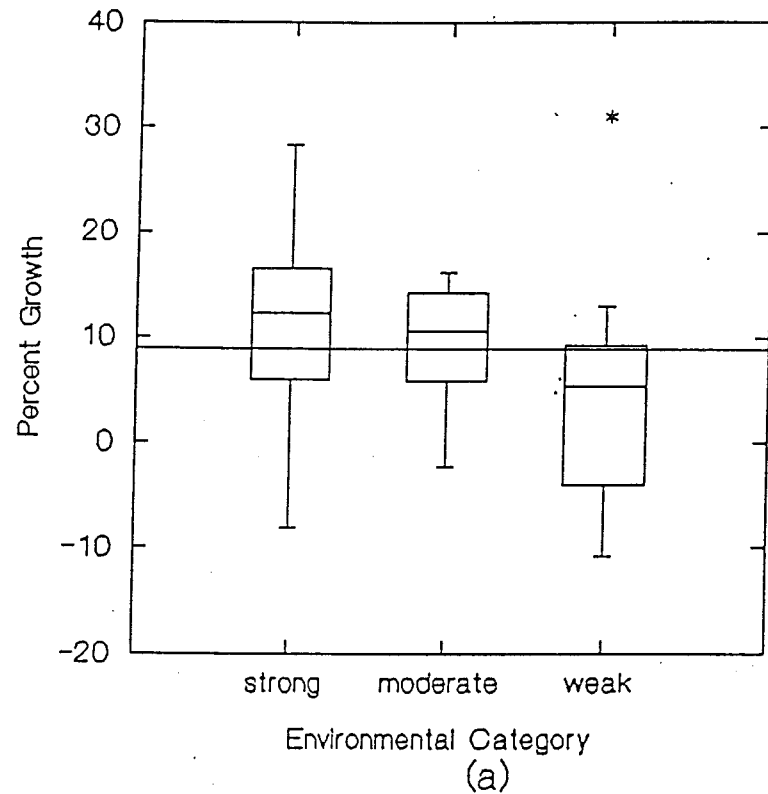
4. TESTING THE ENVIRONMENTAL IMPACT HYPOTHESIS - II

The notion that robust economic growth and development are more likely to be found among states with relatively lax environmental policies can be dismissed. This forceful interpretation of the environmental impact hypothesis, while theoretically interesting, is simply not true. Indeed, while a "null finding" -- the lack of any relationship between environmentalism and economic performance -- would have been sufficient to undermine the validity of the environmental impact hypothesis, the preceding analyses points to a consistent and systematic positive relationship between environmentalism and economic growth.

But it would be premature to dismiss the environmental impact hypothesis in its entirety. Consider the following argument. Environmentalism hinders economic growth - and development; it stifles employment. As environmental regulations and controls are lifted economic performance should improve and employment should increase *relative to times when environmental regulations were in place*. Thus, states that throw off the yoke of environmentalism should show improved economic performance, while those that retain or enhance environmental controls will not experience accelerated growth.

The subtlety of this argument is in its focus on relative changes in economic growth, rather than the absolute level of economic growth itself.[13] The boost to economic performance from lax environmental regulation may not be enough to change the relative economic ranking based on growth, but it would still represent an improvement in economic performance due to the relaxing of environmental controls.

Consider four states: A, B, C, and D. In the 1970s their hypothetical gross state products grew by 60%, 50%, 20%, and 10% respectively. Now imagine that in the 1980s C and D were able to relax significantly their environmental policies, while A and B maintained strong environmental efforts. Suppose that their respective gross state product growth rates in the 1980s turned out to be 40%, 35%, 25%, and 10%. While their relative ranking in the 1980s remains unchanged from the 1970s, it is clear that A and B's performance relative to the prior period slipped. Conversely the performance of C improved while D remained unchanged.

Even though both C and D still rank behind A and B in gross state product growth in the 1980s there relative improvement in economic performance would be consistent with the environmental impact hypothesis. The analysis in the preceding section of the forceful version of the environmental impact hypothesis would not detect this particular effect.

4.1 Data and Methods

In order to test this more subtle version of the environmental impact hypothesis data for the period 1973-1980 were compared with the data from 1982-1989. The data sources and indicator construction procedures for the 1973-1980 data set were identical to those used for the 1982-1989 data set.

As noted earlier the 1970s saw tremendous growth in federal environmental legislation and regulations. The nascent state of environmental policy, the availability of federal funds, and the assertive leadership the

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federal government fostered a modicum of similarity if no homogeneity among the state environmental policies. The period certainly stands in contrast to the 1982-1989.

If the environmental impact hypothesis is correct then we should see a systematic difference in the changing economic performance among environmentally strong, moderate, and weak states when they are compared across the two periods. Specifically, states that took advantage of Reagan administration policies to relax their environmental controls in the 1980s, or were forced to so because of federal budget cuts, (i.e., environmentally weak states) should exhibit improved economic performance. Conversely, states that chose to maintain and augment their environmental policies (environmentally strong states) should show either lesser improvement, no change, or a decline in performance.

To test this argument a growth difference index was constructed for each economic indicator. For each state the growth in a given economic indicator for the period 1973-1980 was subtracted from the growth in the period 1982-1989:

$$dGROWTH = GROWTH_{1982-1989} - GROWTH_{1973-1980}$$

Returning to the illustration used above the corresponding indices for A,B,C, and D would be -20, -15, +5, and 0 respectively. The difference ranking would be C,D,B, and then A, consistent with the expectations of the environmental impact hypothesis.

4.2 Results

4.2.1 Shifts in Gross State Product Growth:

Do environmentally stronger states experience poorer improvement in gross state product growth between the two periods than environmentally weak states? Here we examine the pair of hypotheses relating inter-decade differences in gross state product growth (dGSP):

$$H_{null}: dGSP_{strong} \geq dGSP_{moderate} \geq dGSP_{weak}$$

$$H_{\Pi}: dGSP_{strong} < dGSP_{moderate} < dGSP_{weak}$$

Table III presents the statistical tests of the subtle variant of the environmental impact hypothesis for all five indicators. Once again the results strongly and unambiguously contradict the environmental impact hypothesis. In terms of inter-decade shifts in the growth in gross state products the probability that there is either no difference among the states in the three environmental categories or that there is a difference favoring environmentally strong states is over 99.9%.

The box plot in **Figure 4-1a** reveals that while environmentally strong and moderate states demonstrate fairly similar performance improvements, the environmentally weak states do substantially worse. They hover for the most part below that national average. Where the average (median) improvement in gross state product growth among the environmentally strong states was about 23%, the environmentally weak states actually declined about -5%.

In **Table IV** the rank information is used to test the possibility of a positive

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Table III   Did States with Stronger Environmental Policies Show Poorer Inter-Decade Economic Gains than States with Weaker Environmental Policies?

| ECONOMIC GROWTH INDICATOR	SIGNFICANCE TEST Z-Score*	Prob.	ACCEPT ENVIRONMENTAL IMPACT HYPOTHESIS?
Gross State Product	-3.48	>0.999	no
Total (Non-Farm) Employment	-2.86	>0.998	no
Construction Employment	-4.12	>0.999	no
Manuf. Labor Product Productivity	-0.29	>0.614	no
Overal Labor Productivity	-2.81	>0.997	no

* Jonckheere's test of ordered alternatives is used to test for ordered differences among the three environmental categories in accordance with $H_{\equiv\text{-}\text{e}}$. A Z-score of +1.28 or greater, corresponding to a signficance level of 0.10 or less, is required to accept the environmental impact hypothesis as true. See: Hollander and Wolfe (1973) and Lehamann (1975) for a description of Jonckheere's test..

Table IV   Did States with Stronger Environmental Policies Show Better Inter-Decade Economic Gains than States with Weaker Environmental Policies?

ECONOMIC GROWTH INDICATOR	CORRELATION r-value	Prob. r = 0	IS THERE A TRUE POSITIVE CORRLATION?*
Gross State Product	+0.43*	< 0.002	yes
Total (Non-Farm) Employment	+0.35*	< 0.007	yes
Construction Employment	+0.51*	< 0.0002	yes
Manuf. Labor Product Productivity	+0.009	< 0.48	no
Overal Labor Productivity	+0.36*	< 0.006	yes

*An r-value of +0.23 or greater, corresponding to a significance level at or below 0.05, is required to accept the hypothesis that environmentalism is positively associated with a particular indicator of economic growth . This is the converse of the environmental impact hypothesis.

Figure 4-1: DIFFERENCES in GROWTH RATES
GROSS STATE PRODUCT: 1970s and 1980s
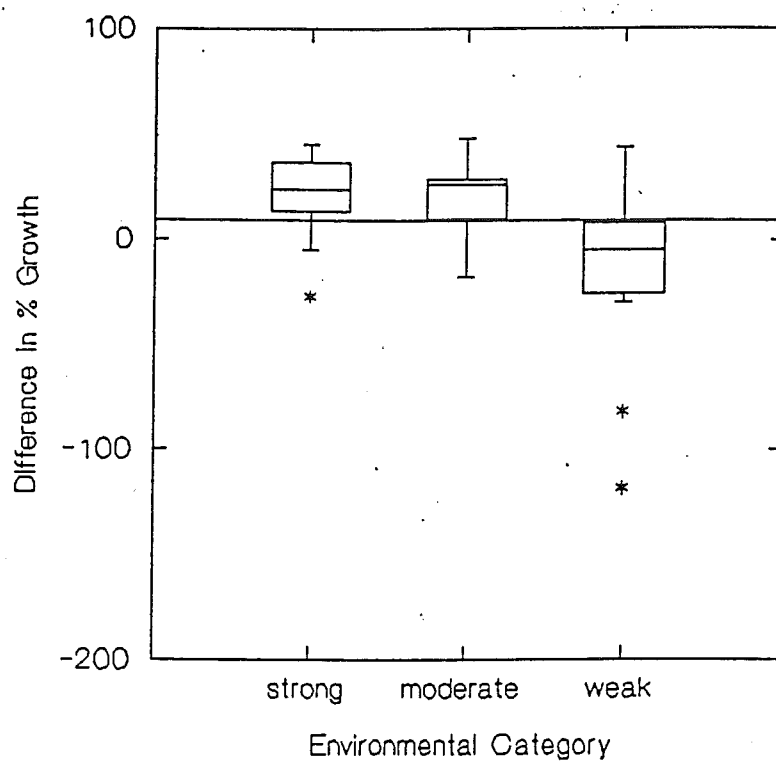
(a)
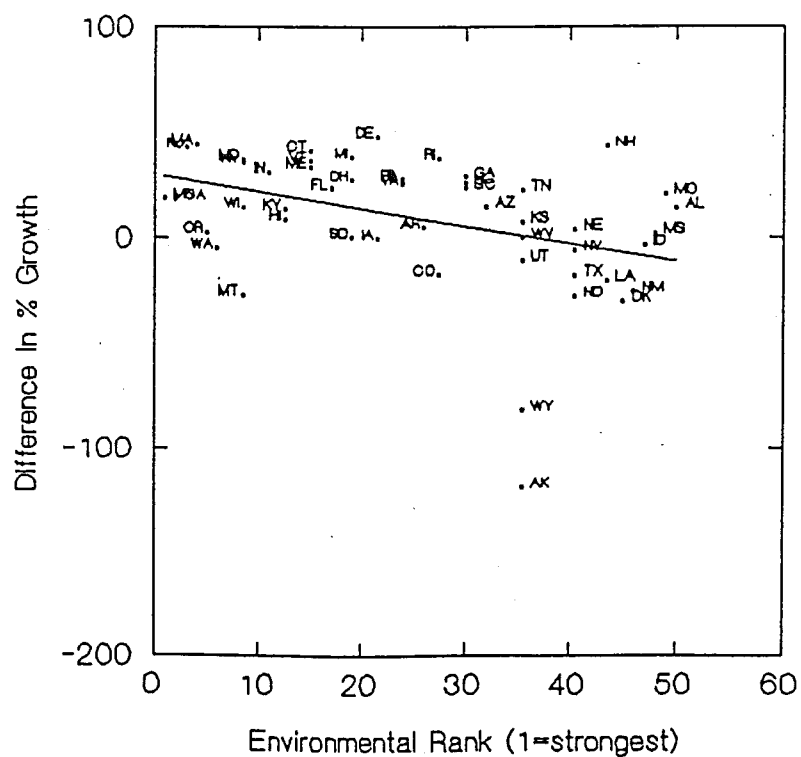
(b)

relationship between environmentalism and improvement in gross state product growth. The solid positive correlation coefficient of +0.43 confirms that the higher the environmental rank of a state the greater the inter-decade improvement in gross state product growth.

In FIGURE 4-1b we can see what this looks like visually. Clearly the data contradict the expectations of the environmental impact hypothesis. Compared to the 1970s environmentally strong states actually improved their economic performance in the 1980s . Environmentally weak states lost ground.

Alaska and Wyoming fair especially poorly in this comparison and stand as outliers among the environmentally weak states. When they are excluded from the analysis the correlation drops from +.43 to +.40. They do not affect the overall pattern in the data.

4.2.2 Shifts in Total Employment Growth: Even if weak environmental states fail to keep pace with strong environmental states in dollars generated, perhaps they nonetheless are better at retaining and adding jobs.' To test the environment versus jobs argument we examine the pair of hypotheses that relate inter-decade differences in total employment growth (dEMPT):

H_{null}: $dEMPT_{strong} \geq dEMPT_{moderate} \geq dEMPT_{weak}$

H_{a} : $dEMPT_{strong} < dEMPT_{moderate} < dEMPT_{weak}$

As given in Table III the probability that there are either no differences in inter-decade gains in employment growth among the

environmental categories, or that the gain favors environmentally stronger states is over 99.8%. There is no "environmental versus jobs" tradeoff at the state level.

The box plot in **Figure 4-2a** shows that while there is little systematic difference between environmentally strong and moderate states, environmentally weak states fall significantly below them, and the national average (median). While the rate of total employment growth among environmentally strong states increased by about 5% over the earlier period, the environmentally weak states saw a decline of almost -15%.

The box plot also shows that the variance among the weak states (indicated by the boxes size) insignificantly greater than the variance of either of the other two categories.This may provide some important clues for further study into the nature of the relationship between environmental policies and economic performance.

Is there a true positive association between environmentalism and inter-decade improvement employment growth? From **Table IV** it seems clear that there is. The correlation of +0.35 highlights the fact that as a state's environmental rank increases so does the degree to which its employment growth increased between the 1970s and 1980s.

Figure 4-2b is the associated scatterplot. Notice the tighter pattern of the scatter among the states with higher environmental ranks compared to the lower ranking states. The energy states, Texas, Alaska, Oklahoma, and Louisiana, cluster at the bottom. Wyoming is a significant outlier among the weak environmental states. But when that case is excluded and the data are reanalyzed the correlation barely changes. It drops from

Figure 4-2: DIFFERENCES in GROWTH RATES
TOTAL (NON-FARM) EMPLOYMENT: 1970s and 1980s

(a)

(b)
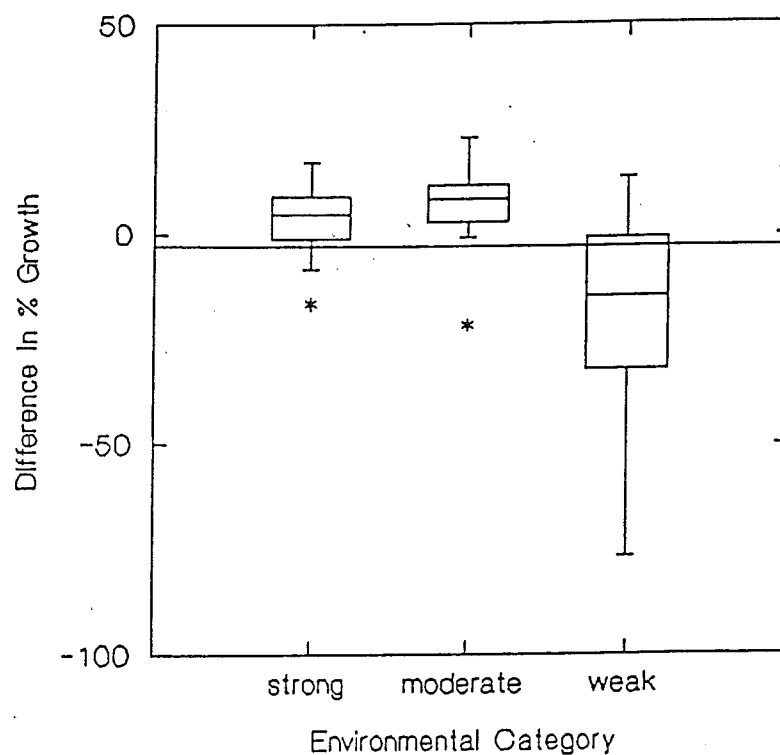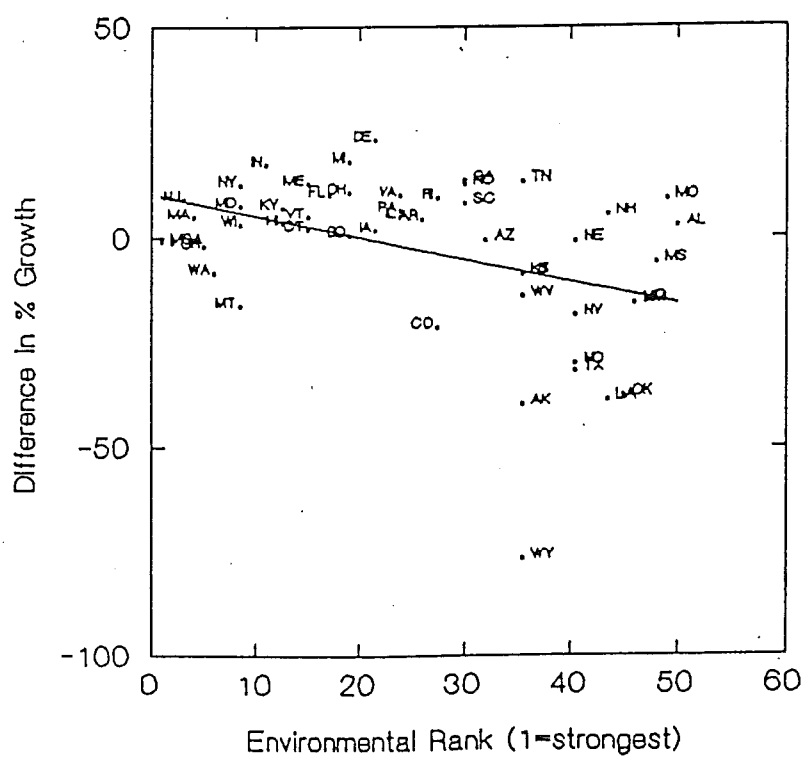
+.35 to +.33.

4.2.3 Construction Employment Growth:
Here again we look at the leading indicator for the environmental impact hypothesis. Is there some indication that industry and labor are migrating to environmentally weaker states? Does construction employment growth decrease systematically as one moved from environmentally strong to environmentally weak states? We test the contending hypotheses for differences in construction employment growth (dEMPC):

$$H_{null}: dEMPC_{strong} \geq dEMPC_{moderate} \geq dEMPC_{weak}$$

$$H_a: dEMPC_{strong} < dEMPC_{moderate} < dEMPC_{weak}$$

The answer from Table III is a resounding: no. The data clearly show that either there is no systematic difference among the environmental categories, or there is a positive relationship between environmentalism and economic growth.

Figure 4-3a depicts very starkly what seems to be a strong positive relationship between state environmentalism and inter-decade increases in construction employment growth. Median construction employment growth in environmentally strong states during the 1980s jumped 50% over the earlier period. In contrast it declined by more than -19% among the environmentally weak states.

The strong correlation of +0.51 in Table IV statistically confirms the visual impression of the box plot. It seems safe to conclude that there is a true positive association between environmental rank and improvement in construction employment growth.

The scatterplot in Figure 4-3b helps to clarify how individual states contribute to the overall pattern. The greater variance among the weak environmental states (seen in the box plot) seems to be the consequence of the very poor showing of the energy and sage brush states. Nevada stands out among the environmentally weak states for its peculiarly good showing

These data most strongly refute the argument that businesses will migrate to states with more relaxed environmental policies.

4.2.4 Manufacturing Labor Productivity Growth:
Did environmentally strong states experience less substantial inter-decade improvements in their manufacturing labor productivity? We test the pair of mutually exclusive hypotheses for differences in the growth of manufacturing labor productivity (dMPROD):

$$H_{null}: dMPROD_{strong} \geq dMPROD_{moderate} \geq dMPROD_{weak}$$

$$H_a: dMPROD_{strong} < dMPROD_{moderate} < dMPROD_{weak}$$

The statistical test of the manufacturing labor productivity data shown in Table III, while not as overwhelming as those for the other indicators, nonetheless strongly refutes the environmental impact hypothesis. It suggests that no systematic differences exist among the environmental categories when they are compared in terms of self-improvement on this indicator.

The box plot in Figure 4-4a reveals basically no difference in box placements or medians among the three groups of states. Inter-decade median increases in manufacturing labor productivity were 31%,

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Figure 4-3: DIFFERENCES in GROWTH RATES
CONSTRUCTION EMPLOYMENT: 1970s and 1980s
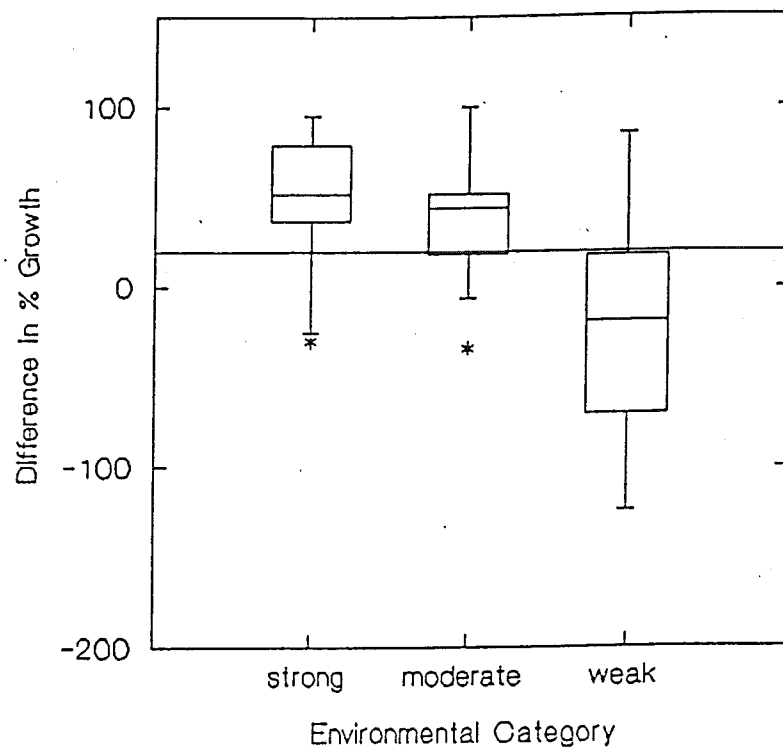
(a)
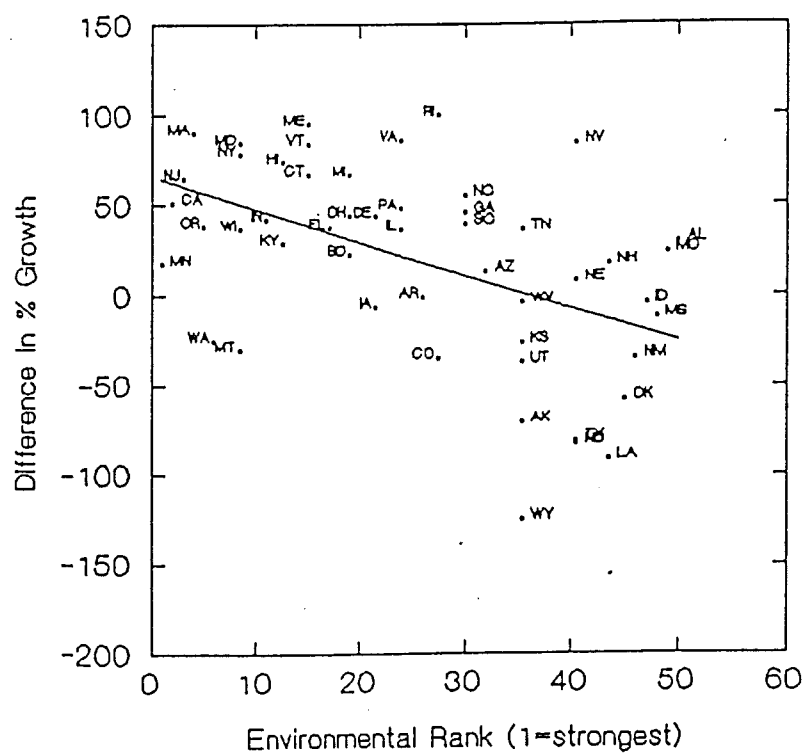
(b)

Figure 4-4: DIFFERENCES in GROWTH RATES
MANUFACTURING LABOR PRODUCTIVITY: 1970s and 1980s
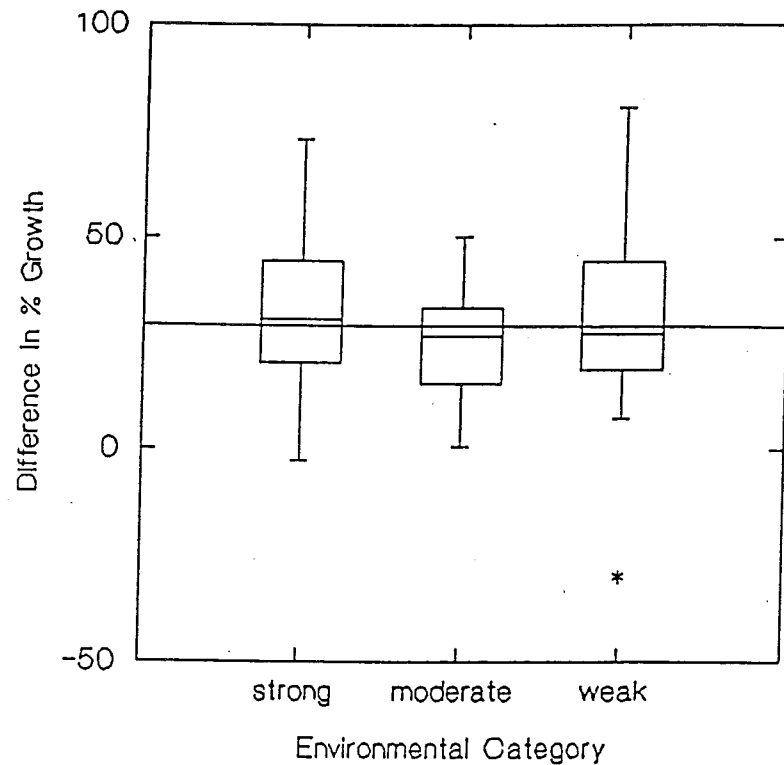
(a)
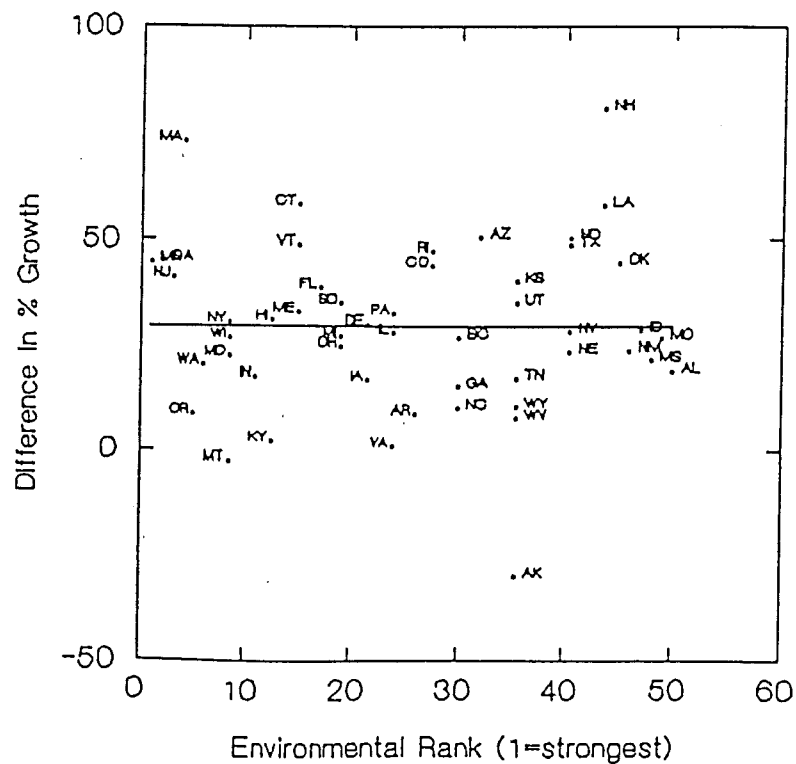
(b)

28%, and 27% for environmentally strong, moderate, and weak states, respectively.

It is not surprising therefore that the correlation shown in **Table IV** is, for all intents and purposes, zero. Correspondingly, the scatterplot in **Figure 4-4b** shows a random cloud distributed about a horizontal (zero-fit) regression line. Once again New Hampshire stands out as an anomaly among the environmentally weak states. Its atypically high increase in manufacturing labor productivity is parallelled by the performance of its neighbor Massachusetts. But New Hampshire's effect in the analysis is cancelled out by the other extreme case among the environmentally weak states, Alaska.

This null result forces us to reject the environmental impact hypothesis, which expects that weak environmental states should show improving manufacturing labor productivity as industry migrates. Environmentalism appears to have no observable systematic effect on manufacturing productivity growth among the states.

4.2.5 Overall Productivity Growth: Does environmentalism produce a general dumbing-down of the work force to the point that its effect can be observed in declining overall labor productivity growth among the environmentally strong states? The pair of hypotheses examined for differences in overall labor productivity (dPROD) is:

H_{null} : $dPROD_{strong} \geq dPROD_{moderate} \geq dPROD_{weak}$

H_{a} : $dPROD_{strong} < dPROD_{moderate} < dPROD_{weak}$

Based on the statistical test reported in **Table III** the answer is no. This assertion of

the environmental impact hypothesis is not supported by the data. The likelihood that there is either no systematic difference among the environmental categories, or that the difference runs contrary to the environmental impact hypothesis is over 99.7%.

Figure 4-5a suggests that environmentally strong states did experience higher increases in overall labor productivity growth compared to environmentally weak states. The difference between the environmentally strong and moderate states seems to be insignificant. Environmentally strong states showed inter-decade improvements averaging 14%. Environmentally moderate states showed inter-decade increases in overall labor productivity of around 12%. The environmentally weak states averaged an 8% increase, a little more than half that of the environmentally strong states.

Is the apparent positive relationship between environmentalism and this indicator real? The correlation of +0.36 in **Table IV** implies that the relationship is indeed real.

Examining **Figure 4-5b** the energy and sagebrush states do not cluster in a poor showing among the environmentally weak states, as they did for the other indicators. Alaska is an outlier, which when excluded from the analysis barely affects the correlation (it drops for +.36 to +.35)

4.3 Summary

This subtle version of the environmental impact hypothesis is not supported by the data. When economic performance was measured in terms of inter-decade gains in growth in gross state product, total

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Figure 4-5: DIFFERENCES in GROWTH RATES
OVERALL LABOR PRODUCTIVITY: 1970s and 1980s
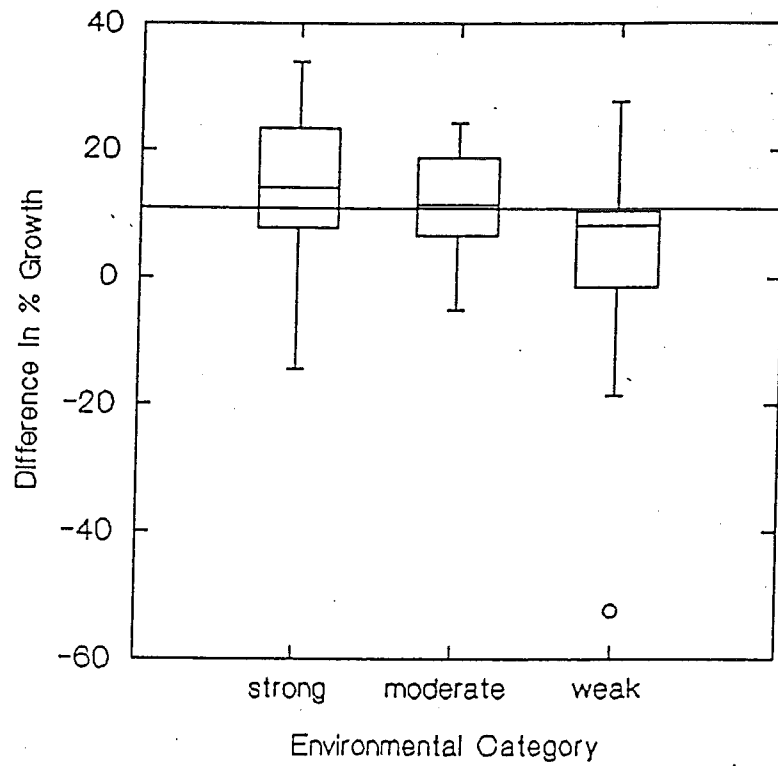
(a)
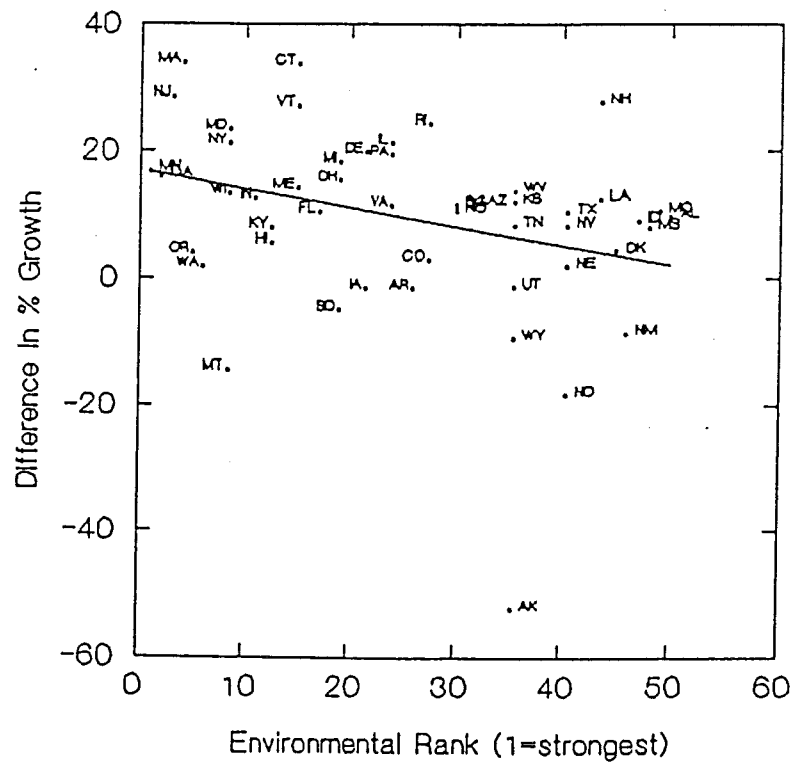
(b)

employment, construction employment, and overall labor productivity the states with higher environmental ranks systematically outperformed those with lower environmental ranks. No systematic differences were found when the states were compared in growth in manufacturing labor productivity. This null result likewise forces rejection of the environmental impact hypothesis.

Among all the economic indicators construction employment growth exhibited the strongest positive association with environmental rank. What should have been a powerful leading indicator that confirmed the environmental impact hypothesis ended up as offering the strongest contrary evidence.

5. DISCUSSION

When this study was first conceived it seemed reasonable to assume that it would either confirm a modest negative relationship consistent with the environmental impact hypothesis, or it would find a null relationship. After all the environmental impact hypothesis is at first glance quite plausible. Finding a positive correlation between environmentalism and economic growth was, therefore, a surprise.

There is always the danger in any analysis that extraneous factors will either create or mask patterns in the data that can be attributed mistakenly to the variables being examined. Such threats to the validity of the analysis are often ignored when the findings seem unambiguous, as they appear here. But irrespective of whether the results confirm one's suspicions or run contrary to what one expects it is necessary to ask: What other factors outside those posited in this study may account for the results?

5.1 Alternative Explanations for the Positive Correlation Between Environmentalism and Economic Growth

Three possibilities come immediately to mind. First is the possible overshadowing effects of the big state economies, such as California, New York, and Texas. Second is the changing economic context of the 1970s and 1980s. Third is the possibility that there are group characteristics among the states that skew the results.

5.1.1 Big State Economies: One obvious alternative explanation is that the results are driven by "big state" economies. On the one hand, the large industrial states tend to have the most severe environmental problems they

and so they should also tend to have the most burdensome environmental policies and programs. At the same time, by virtue of the sheer size and diversity of their economies they may also tend to show the strongest economic growth.

On the other hand, the small economy states are likely to have fewer environmental problems and thus less burdensome environmental controls. At the same time their relatively small size also provides less of a foundation for vigorous and robust economies.

The variation in state economics, measured in terms of 1982 gross state product, is shown **Figure 5-1**. The largest economy (California) is some 64 times that of the smallest (Vermont). There is a natural break in the distribution at around $80 billion below which there are forty-one states. This is followed by a cluster of six states between $100 billion and $160 billion, and then New York and California. What happens to the analysis when big state economies are excluded from the data set?

In a most extreme test **Table V** reproduces the analysis for the comparison of the 1970s and 1980s limiting the data set to the twenty-five states with gross state products under $40 billion. The hypothesis tested corresponds to the subtle version of the environmental impact hypothesis: Do states with stronger environmental records suffer poorer gains in economic growth compared to weaker environmental states?

The results in **Table V** are entirely consistent with those presented in **Table III**. Tests on every indicator suggest that either

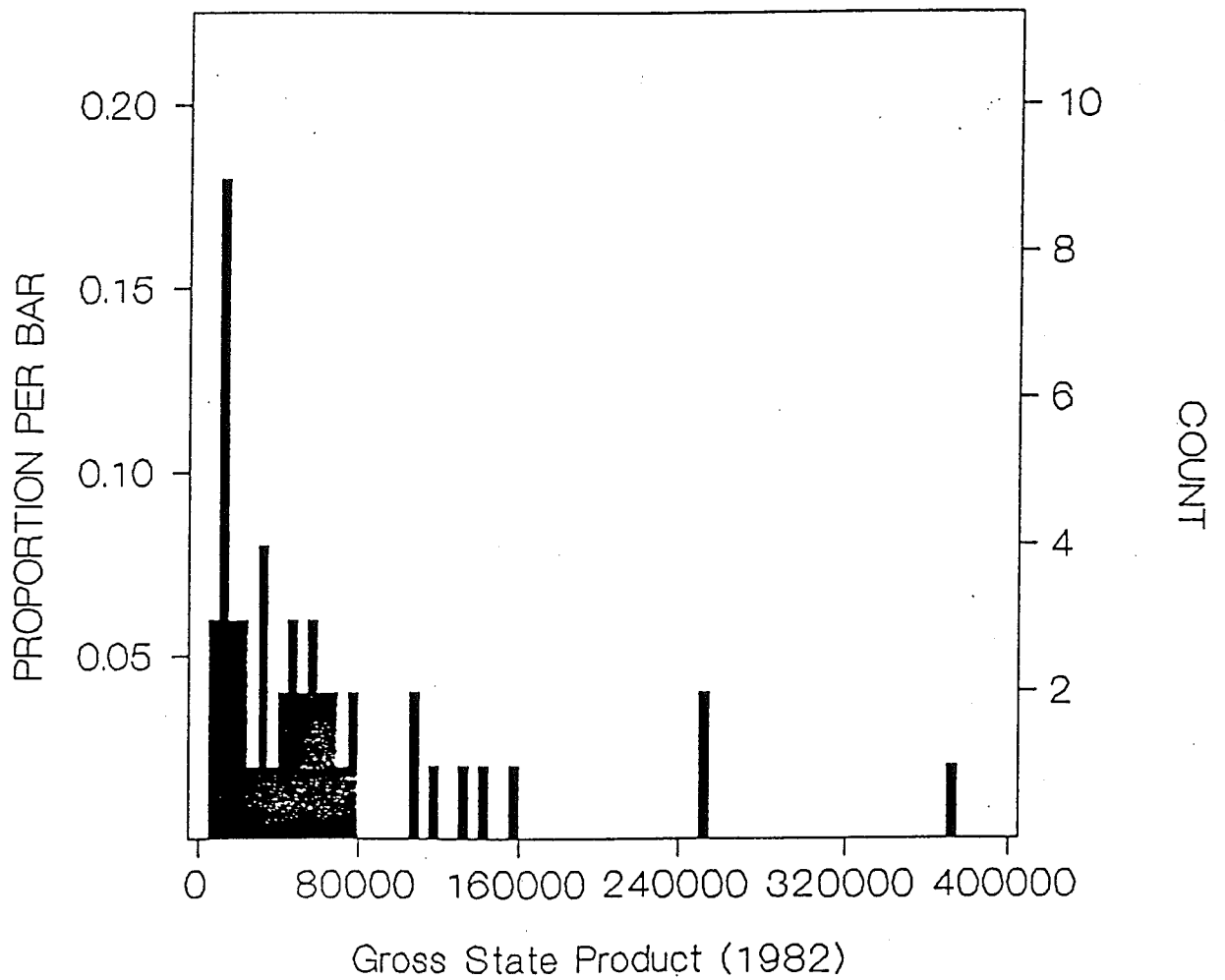# FIGURE 5-1: THE DISTRIBUTION OF STATE ECONOMIES (1982)

Table V   Among the 25 States with Gross State Products Under $40 billion (1982), Did Those with Stronger Environmental Policies Show Poorer Inter-Decade Economic Gains than Those with Weaker Environmental Policies?

25 States With Gross State Products Under $40 billion (1982)

ECONOMIC GROWTH INDICATOR	SIGNFICANCE TEST Z-Score*	Prob.	ACCEPT ENVIRONMENTAL IMPACT HYPOTHESIS?
Gross State Product	-2.15	>0.984	no
Total (Non-Farm) Employment	-2.80	>0.997	no
Construction Employment	-2.91	>0.998	no
Manuf. Labor Product Productivity	-0.14	>0.556	no
Overal Labor Productivity	-0.90	>0.816	no

* Jonckheere's test of ordered alternatives is used to test for ordered differences among the three environmental categories in accordance with H_{-1}. A Z-score of +1.28 or greater, corresponding to a signficance level of 0.10 or less, is required to accept the environmental impact hypothesis as true. See: Hollander and Wolfe (1973) and Lehamann (1975) for a description of Jonckheere's test..

Table VI   Among the 25 States with Gross State Products Under $40 billion (1982), Did Those with Stronger Environmental Policies Show Better Inter-Decade Economic Gains than Those with Weaker Environmental Policies?

ECONOMIC GROWTH INDICATOR	CORRELATION r-value	Prob. r = 0	IS THERE A TRUE POSITIVE CORRELATION?*
Gross State Product	+0.23	< 0.13	no
Total (Non-Farm) Employment	+0.38*	< 0.03	yes
Construction Employment	+0.38*	< 0.03	yes
Manuf. Labor Product Productivity	-0.05	< 0.60	no
Overal Labor Productivity	+0.02	< 0.46	no

*An r-value of +0.33 or greater, corresponding to a significance level at or below 0.05, is required to accept the hypothesis that environmentalism is positively associated with a particular indicator of economic growth . This is this converse of the environmental impact hypothesis.

there is no systematic relationship between environmentalism and economic growth, or there is a positive relationship. **Table VI** provides the associated correlation analysis, testing for the significance of a positive relationship. Here environmentalism is still positively associated in a statistically significant way with total employment and construction employment. With this restricted dataset the other indicators fail to support the existence of a positive association between environmentalism and economic growth. Nonetheless they do allow us to reject the environmental impact hypothesis' prediction of true underlying negative correlations.

Perhaps more reasonably, when the data set is restricted to the 41 states with gross state products under $80 billion (1982), thus excluding only the really uncharacteristic economies, all the positive correlations between environmental rank and the economic growth indicators are statistically significant.

The stability of the results despite this radical pruning of the data set means that we can dismiss the alternative explanation that "big economies" are masking the true negative effects of environmental policy on economic prosperity. The environmental impact hypothesis is firmly repudiated. The existence of a positive relationship between environmentalism and economic growth is consistently supported.

5.1.2 Changing Economic Context:
Another possible explanation for the results reported might be the changing economic context. That is, changing fiscal, energy, regulatory, and tax policy may simply swamp the negative effects of environmentalism on the economy. And if these shifts were correlated in time, they might account for the positive association found in the analyses. The election of Ronald Reagan in 1980 was certainly this type of economic watershed..

The irony in this alternative explanation is, of course, the big shift in economic and regulatory policies that took place as part of the Reagan revolution was specifically targeted to help these states that ultimately turn out to be the poorest performers in this study. Energy deregulation and the relaxing of restrictions governing natural resource exploration and extraction from public lands were hallmarks of the Reagan revolution policies.

In fact this study's research design, through its choice of time frame and significance levels, was "biased" in favor of those states that should have benefited disproportionately from Reagan administration policies. Therefore, if the changing economic context has affect the results of this study it is most likely masking an even stronger true positive association between environmentalism and economic growth.

More to the point, if practically every other conceivable economic factor such as the dynamics of the international currency market, the size of federal deficit, Japanese investment policy, the price of oil, or changing technology so readily overwhelms, masks, or inverts the putative negative effects of environmentalism then we should really turn our attention elsewhere. The argument that one cannot observe the harmful economic effects of environmentalism because they are lost in the noise of contemporary economic trends and events is an argument that concedes the triviality of the environmental impact hypothesis from both a substantive and a policy perspective.

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5.1.3 Group Characteristics Among the States: A third possible alternative explanation for the results argues that peculiarities inherent in the characteristics among one or more groups of the states may account for the findings. We have already considered on such group: the big economy states.

Reexamining the box plots and scatter plots in **Figure 4-1** through **Figure 4-5** it would appear that from the perspective of relative economic performance the differences between strong and moderate environmental states are slight. The useful analytic distinction, therefore, is between the weak environmental states and all the rest. This is an important conclusion because the states that make up the moderate environmental category are similar to the weak environmental states in terms of their general socioeconomic-economic profiles.

Why then do the weak environmental states do so poorly? As we look over the states that comprise the weak category we find that a number are energy producing states such as Texas, Louisiana, Oklahoma, and Alaska. It is possible that the boom/bust cycle that rolled through the energy sector in the 1970s and 1980s may account for their poor showing -- regardless of their relative environmental status.

Yet even when these cases are removed the basic results stand. The more restricted data set still shows that the economic performance among the weak environmental states is neither better than, nor worse than that of strong and moderate environmental states.[14]

Another threat to the validity of the analysis that is linked to group characteristics is a statistical phenomenon known as *regression to the mean.* Basically, it raises the possibility that the states that comprise the environmentally strong category may have experienced unusually weak economic growth in the 1970s while those in the environmentally weak category experienced unusually strong growth. In the 1980s as economic patterns returned to more normal forms both groups would regress towards more average performance. In this statistical adjustment strong environmental states would show improved growth while the weak environmental states would show decline. In this way an inflated, if not false, positive correlation might be obtained.

Theoretically this hypothetical effect might call into question the strength of positive correlation between environmentalism and economic growth. It cannot, however, affect the bottom line conclusion that the negative relationship predicted by the environmental impact hypothesis fails to materialize. Given the findings for the test of the forceful version of the environmental impact hypothesis presented in Section 3 at most regression effects would imply that the correlation uncovered in Section 4 should be zero, rather than positive.

When the time range for the two periods examined are varied by several years, the results in Sections 3 and 4 change marginally, but the positive correlations remain. This suggests that if a regression effect is present in the data it only reduces slightly the magnitude of the positive correlations. The positive association between environmental record and economic performance remains intact.

5.2 Consistency With Other Studies

As noted at the beginning of this study, there have not been many systematic efforts to examine the relationship between environmental policy and economic performance. Those few studies that do exist support the basic finding of this paper.

Several macroeconomic and microeconomic studies published in the late 1970s tried to simulate the effects of increasing environmental regulations on economic performance. These modelling exercises report marginally conflicting results. Some suggested that environmentalism may produce small positive economic effects in GNP and employment. Others report potentially small negative effects.[15] The differing assumptions and mathematical relationships used to structure these models are the most likely the causes of the variation in outcomes.

What is interesting, however, is that the estimated magnitude of the impact of environmental regulation on economic performance found in all of these macro-economic simulations was marginal -- regardless of whether the direction of the effect was positive or negative. Environmental policy was not a major influence on economic performance, development, and growth when placed in the context of larger forces such as fiscal, monetary, and tax policy.

A recent survey of U.S. firms by the Bureau of Labor Statistics found that only one-tenth of one percent of layoffs in 1988 were attributed to "environmentally related" causes.[16] This is an ambiguous category and since this was based on company responses, one might expect that even this number is inflated. Nevertheless, if 99.9% of the jobs lost in the U.S. are attributable to something other than environmentalism, then the environmental impact hypothesis is not only fundamentally wrong it is irrelevant.

5.3 Transient and Local Effects

Does this mean that strict environmental policies and regulations have absolutely no negative economic impacts? The answer is clearly no. Specific environmental regulations can and do have transient affects on specific industries, local communities, and certain occupations. The case study literature, while of mixed quality, documents this well.

But these effects are limited in scope and duration, and few in number.[17] While they are certainly important to those affected, and they can be unsettling at the community level, they are often barely noticeable at the state level. They are entirely undetectable at the national level.

Moreover, when such cases are examined closely environmental policies and controls do not turn out to be the root cause of the economic dislocations. Rather environmental intervention merely spotlights the underlying problems, and may accelerate their effects.[18] The Spotted Owl/Old Growth Forest controversy is a good example where a regional industry experiencing serious decline for more than a decade is suddenly placed in the national limelight.[19]

There are also transient and local economic effects from environmental policies and programs that have positive impacts. Countervailing forces are often set in motion by environmental efforts that result in job creation, technological innovation, and the

rise of new industries.[20] Over time these act to offset transient and local negative effects, though there are almost certainly delays that are felt at the local level.

6. SUMMARY

The analyses presented in this study clearly refute the environmental impact hypothesis in either its forceful or subtle variant. States with stronger environmental policies and programs did not exhibit hobbled economic growth or development compared to those with weaker environmental records. Moreover, rather than detect the absence of a systematic relationship between pursuit of environmental quality and economic growth and development -- which would have been sufficient to dismiss the environmental impact hypothesis -- the data revealed a clear and consistent *positive* relationship between the states' environmental effort and their economic performance. States with higher environmental rankings outperformed states with lower environmental rankings on four of the five economic growth indicators. This surprising yet solid finding allows us to dismiss the environmental impact hypothesis with even greater confidence.

While these results may tempt the reader to infer that environmentalism stimulates economic prosperity, any such conclusion at this point would be speculation. It is absolutely clear that the environmental impact hypothesis is repudiated by the data. However, the positive association between state-level environmentalism and economic prosperity may be the consequence of some third factor that is positively correlated with both environmentalism and economic growth. For example, states that tend to favor strong environmental policies may also be more likely to invest in education, health, transportation and communications infrastructure, and other elements that stimulate and support economic growth. In this case, the positive correlation between environmentalism and economic growth

would be spurious.

There are, of course, some plausible arguments for accepting the positive association between environmentalism and economic growth as an indicator of a partial cause and effect relationship. Highly skilled and well educated workers tend to be attracted to regions that offer a better quality of life. Thus, new industries, high-technology firms, and R&D laboratories may well migrate to environmentally strong states.

Strict environmental controls may also have a "Darwinian" effect on industry. The desire to avoid the expected high costs of waste disposal and pollution abatement can fuel process and product innovation that result in improved productivity, higher input-output efficiencies, and substantial cost savings. This has been the experience of such prominent firms as the 3M Corporation, Dupont, and Raytheon.

While the results presented in this study are certainly consistent with such speculation, they are not proof of cause and effect.

At minimum we can conclude that shifts in environmental policy, whether intended to extend environmental control or reduce it, have no discernable effect on state economic performance. If environmentalism does have negative economic effects they are so marginal and transient that they are completely lost in the noise of much more powerful domestic and international economic influences. The environmental impact hypothesis, while theoretically intriguing, has no empirical foundation and focuses attention on what is certainly one of the least influential factors affecting the pace

of economic growth and development.

The benefits of environmental protection are obvious and demonstrable. It is clear from the data and analyses presented in this report that the states can pursue environmental quality without fear of impeding economic prosperity. For those who continue to argue that environmentalism hurts economic growth and prosperity the burden of proof now clearly falls on their shoulders.

ENDNOTES

1. See, for example, the excellent collection of essays in Vig and Kraft (1990).

2. See Rosenbaum (1991).

3. Mr. Iococca is quoted in Smith (1992;74-75).

4. Rosenbaum (1991), Vig and Kraft (1990), Vig and Kraft (1984).

5. Ling (1985).

6. Ling (1985).

7. See: Davis and Lester (1989), Vig and Kraft (1984), Rosenbaum (1991;124-127).

8. Between 1973 and 1980 federal expenditures for regulation and monitoring for pollution abatement and control grew by 77% in constant dollars, while state and local expenditures grew by roughly 36%. But his pattern was reversed between 1982 to 1989. Federal expenditures actually shrunk by about 20% over the period while state spending rose 21%. See: U.S. Department of Commerce (1992; Table 9).

9. This may seem like a bizarre way to go about testing a hypothesis, but it is standard statistical procedure. One does not test the actual hypothesis one is interested in, but rather its converse. If the converse hypothesis -- called the "null" hypothesis in statistical jargon -- proves unlikely, then one accepts the alternative as true. The methodological and analytical underpinnings of this approach of falsifying the converse hypothesis are discussed in any standard text on research methods.

10. It is convention the that this probability is set to 5% (.05)or 1% (.01), which are much more stringent criteria than the 10% (.10) used here.

11. For the remainder of this report the **median** is used to represent the average value, rather than the mean. This lessens the impact of extreme outlying cases on the analysis. Since the most prominent outliers work against the environmental impact hypothesis, this tends to bias the analysis in its favor.

12. What we are actually doing here, once again, is testing the converse (null) hypothesis: that in reality there is either no correlation or there is a negative correlation between environmentalism and economic growth. For this data set consisting of 50 cases, a correlation greater than +0.23 would cause us to reject this null hypothesis that the true correlation is zero with a probability of 5% ($p \leq .05$) level . The .05 significance level is more stringent than that used to test the environmental impact hypothesis against the data.

13. In modelling terms, the forceful version focuses on the impact of environmentalism on the first derivative of economic performance with respect to time (i.e., growth) while the subtle version focuses on the second derivative of economic performance with respect to time (change in growth).

14. Once again, a null finding -- that is, a finding that suggests *no systematic* relationship between environmentalism and economic prosperity -- is sufficient to refute the environmental impact hypothesis.

15. OECD (1984), Data Resources, Inc. (1979), Muller (1980), Hollenbeck (1979), Haveman and Christianson (1977).

16. Cited in Lee (1990).

17. From the spotty data that are available, the number of jobs lost, plants closed, and local economies devastated due to the leveraged buy-out craze of the 1980s and the savings and loan failures -- which were both a direct result of government policies -- is probably more than one hundred times that due to "environment related" causes.

18. This issue is beyond the scope of this study, but will be addressed in a follow-on report.

19. See Anderson and Olson (1991).

20. See, for example Fischetti (1992), Cooper (1992).

APPENDIX I: Environmental Rankings of States -- 1982[*]

State	Environmental Rank	Category	State	Environmental Rank	Category
MN	1	strong	AR	26	moderate
CA	2	strong	RI	27.5	moderate
NJ	3	strong	CO	27.5	moderate
MA	4	strong	SC	30	moderate
OR	5	strong	GA	30	moderate
WA	6	strong	NC	30	moderate
MT	8.5	strong	AZ	32	moderate
WI	8.5	strong	AK	35.5	weak
MD	8.5	strong	KS	35.5	weak
NY	8.5	strong	WV	35.5	weak
IN	11	strong	WY	35.5	weak
KY	12.5	strong	UT	35.5	weak
HI	12.5	strong	TN	35.5	weak
ME	15	strong	ND	40.5	weak
VT	15	strong	NE	40.5	weak
CT	15	strong	NV	40.5	weak
FL	17	strong	TX	40.5	weak
SD	19	moderate	NH	43.5	weak
MI	19	moderate	LA	43.5	weak
OH	19	moderate	OK	45	weak
DE	21.5	moderate	NM	46	weak
IA	21.5	moderate	ID	47	weak
PA	24	moderate	MS	48	weak
IL	24	moderate	MO	49	weak
VA	24	moderate	AL	50	weak

[*] Based on Duerken (1983).

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