The Economic Impact of Environmental Regulation

by

Stephen M. Meyer[1]

The political debate over environmental policy has never been as contentious or rancorous as it is today. In Washington the new Congress is moving swiftly to roll back twenty-five years of environmental legislation and regulation. Less noticed by the national media, but perhaps of even greater significance, are moves toward environmental deregulation underway in state-houses across the country.

Driving these efforts is the widely held belief that three decades of creeping environmental controls has strangled the economy and undermined economic competitiveness. Still reeling from the recession of the early 1990s many state governments hope that untying the environmental regulatory knot will unleash a new burst of economic growth.

Of course environmental deregulation will not be cost-free. Steady progress toward cleaner air, water, and land will be slowed significantly, if not reversed. While this may be of small concern in still pristine states such as Wyoming, the implications for public health, ecology, and the quality of life in states such as New Jersey are more dire. Protection and preservation of rapidly vanishing wildlife, plants, habitats, and ecosystems will be weakened nation-wide. Undoubtedly we will lose parts of America's natural heritage that might otherwise have endured. Nevertheless the economic gains forthcoming from environmental deregulation might well be worth the price.

All which begs the question: What magnitude of economic gains should we expect from environmental deregulation? Are we talking about fractions of a percent growth in jobs? A doubling of growth rates? Amazingly, no one seems to know.

Given the high stakes involved the reader might find it unsettling to learn that credible evidence *supporting* this policy shift is virtually non-existent. To be sure, anecdotes about companies ruined by environmental regulation abound. Yet they provide no clues regarding the likely economic benefits from deregulation. Moreover there are an equal number of anecdotes about companies pulled back from the brink of bankruptcy by environmental efficiency. And stories about the growth of green companies continue to proliferate giving rise to the argument that "environmentalism" – vigorous policies of environmental protection – actually spurs economic growth.

When we turn away from anecdotes and special interest (i.e., industry and environmental lobbies') "studies" the results from rigorous, independent, economic analyses strongly suggest that no lasting macro-economic gains will

be forthcoming.[2] Focusing on a number of different industries, using a variety of economic indicators, and covering different time periods these studies find that neither national nor state economic performance have been significantly or systematically affected by environmental regulation.

For the most part this research has been industry specific and designed around a single economic performance indicator, such as industry productivity growth. What is missing is a broader examination of the macro-economic effect of environmental regulation. Nation level studies raise a number of sticky methodological problems because of a basic inability to control for the effects of conincident political, economic, technological, and social changes on basic economic performance. One cannot satisfactorily isolate the impact of environmental regulation.

In contrast state level studies offer the opportunity to investigate the relationship between environmentalism and economic performance while controlling for many "nuisance" effects. Fifty states sharing a common political, economic, technological and social space, but with differing environmental policies, allow for quasi-experiment statistical control. Moreover, as is described below there are solid substantive reasons to be interested in environment-economy tradeoffs at the state level. And with current motions toward returning regulatory discretion to the states this tradeoff – if it exists – becomes even more important.

And so we can ask: Do states with stronger environmental policies pay a price in job growth, and if so how much? Do they suffer higher rates of business failures? To what degree?

Although the questions posed are simple, obtaining valid and useful answers are not. Investigating the relationship between environmental regulation and economic performance requires four steps:

- sorting out the states according to the relative strength of their environmental policies;
- measuring the performance of state economies;
- cataloguing the many distinguishing state characteristics that might confound the relationship between environmental regulation and economic performance; and
- combining all the data in a statistical analysis.

Following this strategy this article summarizes the results of my most recent investigation into the relationship between state environmentalism and economic growth for the period 1982-1992.[3]

State Environmentalism

Among other things the Clean Air Act, the Clean Water Act, and related national environmental legislation were born out of the concern that the patchwork of diverse state environmental standards evolving in the early 1970s would wreak havoc on interstate commerce and create competitive disadvantages for states striving to improve environmental quality. National environmental legislation was expected to level the playing field.

Although national environmental policies have certainly raised the minimum level of environmental standards, three decades later very important differences in state environmental policies remain, as anyone who works in business or industry can attest. Federal laws notwithstanding, state regulations governing hazardous waste disposal, wetlands filling, air and water pollution, and wildlife protection vary considerably between Louisiana and Massachusetts, Mississippi and New Jersey, and Idaho and California.

Some of these differences can be explained in terms of “need.” The more heavily industrialized and urbanized states have more serious environmental problems and hence require more stringent controls. Other differences can be attributed to variations in state political cultures. Sagebrush states, for example, tend to reflect the “leave people be” attitude of their residents.

Regardless of what may explain these differences tabulating and comparing the characteristics of environmental policies among the states produces an interesting snapshot of the relative degree of “environmentalism” among the states.[4] TABLE 1 lists the states in order, starting with those with the weakest environmental policies and moving down to the strongest, for 1982 and 1990. A detailed description of the precise method for deriving the scores underlying these listings is not important for our purposes.[5] In essence each state was scored on a set of roughly twenty environmental policy indicators, for example: wetlands policy, hazardous waste disposal policy, and non-point source pollution policy. The scores across each of the policy areas were then summed. Since the 1982 and 1990 lists were scaled differently by their respective creators the scores for each period I standardized them (subtracting the mean for each respective series and dividing by the standard deviation) in order to allow meaningful comparisons. Consequently, a unit change in environmental score represents an approximate jump from the state ranked tenth (going weak to strong environmental policies) to the "average" state (i.e, the state ranked twenty-five). Another unit jump in environmental score would land on the state ranked about fortieth. Therefore a two unit difference on the

environmental scale separates the ten states with the weakest environmental policies from the ten states with the strongest policies.

What is important is that the listings are intuitive: the states that most of us would guess as having the most stringent environmental regulations appear near the bottom of the list. Those that we would imagine to have less rigorous standards are found near the top. This is essential for the analysis to be credible. Environmentalists, politicians, business and industry must "feel" comfortable that the correct comparisons are being made. If, for example, New Jersey were scored as have weak environmental policies it would simple (and proper) to dismiss the analysis.

State Economic Performance

There are many conceivable measures of state economic performance. Three most commonly used are gross state product, non-farm employment, and per-capita income. Other measures, such as manufacturing employment, construction employment, manufacturing productivity, and business failure rates tap into special aspects of state economic health.

Here I report the results for four key indicators: annual gross state product growth, annual non-farm employment growth, annual manufacturing employment growth, and annual business failure rates.[6] These four are representative of a wide array of measures and directly address the concerns regarding the environmental protection-economic performance tradeoff facing the policy community today.

Distinguishing State Characteristics

When medical researchers conduct studies on, say, the effects of coffee drinking on heart disease, they must take into account other factors that might influence their results. For example, they may “control for” differences among the study subjects in diet, exercise, smoking, family history, occupation, age, and sex.

The same holds true in economic analysis. The inability to randomly sort states and experimentally impose environmental policies forces us to compensate via statistical manipulation for confounding influences that lurk in the background. States with high per-capita incomes, for instance, may tend to have strong environmental laws (because wealthy people want them) and strong economic performance (because a strong capital base provides investment dollars). Conversely, states with high tax rates (supporting a variety of social programs) might also tend to have strong environmental policies but weak economic growth (due to tax burdens).

TABLE 2 lists the thirteen state characteristics taken into account here for statistical control. These are standard confounding variables found in most economic analyses.

State Environmentalism & Economic Growth: 1982-1989

Did states with strong environmental policies pay an economic price during the banner economic growth years of 1980s? The results shown in TABLE 3 from the multiple regression (cross-sectional time-series) analysis on the data for 1982-1989 answer: no.

The column labeled “Coefficient” reports the estimated change in the economic indictor for each unit change in environmental score. Glancing at the row for "Gross State Product" we see that gross state product growth *increased* on average about 0.2% for every unit *increase* in environmental regulatory. The relationship appears to be positive. If stronger environmental regulations harmed economic performance this value should be negative, indicating a decline in economic performance with increasing environmental regulatory stringency.

Perhaps a more meaningful reading of this coefficient is to tie it directly to differences in economic performance between the ten states with the strongest environmental policies and the ten states with the weakest policies. Are there clear winners and losers? As noted above the measure used to score relative state environmental standing separates these two groups of states by roughly two units. Therefore this translates into an average 0.4% advantage in annual growth in gross state product favoring the ten states with the strongest environmental policies (multiplying the coefficient – 0.2 – by 2 units produces a difference of 0.4 between the two groups).

The next column presents the classical statistical significance test of the coefficient. It asks: given the variation in the data what is the probability that we might observe an estimated coefficient as large as that shown in the previous column when no real relationship exists at all? That is, what is the likelihood that the true underlying coefficient is really “0” and that the 0.2 value is just a fluke. Traditionally, if this probability is 5% or greater then researchers tend to discard the estimated coefficient and instead assume it is zero. Conversely a significance test yielding a probability under 5% is taken as an indication that a systematic relationship exists.

As you can see the probability for gross state product is about 30% so we would be on solid ground dismissing the 0.2 coefficient and presuming that there is no systematic relationship between gross state product growth and environmental standing. Nevertheless this “0” finding still contradicts the assertion that environmentalism is trashing state economies.

The last column provides what may be more interesting and useful information about the data. The column labeled “Odds of a Negative Relationship” reports just that: the odds that the true underlying relationship is indeed negative – that strong environmental policies do impose economic burdens – despite what the estimated coefficient or the significance test for a “0” value may say. This is just a classical one-tailed significance test of the coefficient for the possiblity that it could have a real value of -0.1 which is then simply reported as odds rather than probabilty (for example a 50% probability would represent 1:1 odds; a 10% probability would represent 1:9 odds).

Unlike the classical signficance test, however, there is no conventional rule of thumb for deciding what represents "acceptable " versus "unacceptable odds". It is policy twin to the legal question: "what is a reasonable doubt?" Odds here merely quantify doubt. But what is reasonable? This is entirely subjective and intimately associated with perceptions of the relative costs and benefits resulting from a policy decision.[7]

In fact, the advantage of this “odds” test over the conventional statistical significance test is that it allows policymakers to make choices in terms of risk. Where the conventional statistical significance test offers a simple “accept the estimated coefficient as reported” or “reject it in favor of assuming it is really zero” the odds test gauges the degree of risk in assuming that the true coefficient falls within some meaningful range of values, which in our case is negative values. In TABLE 3 we see that the odds of meaningful negative relationship between gross state product growth and state environmentalism are about one to fourteen – not good by gambler’s standards[8]. There is no evidence that gross state product growth was depressed by strong environmental policies.

Jumping down to the next row we look at non-farm employment growth. There we find indications of a similar association between state environmentalism and economic performance. Each unit increase in state environmentalism is associated with an approximately 0.3% increase in non-farm employment. Job growth – not job loss – is associated with stronger environmental policies. The ten states with the strongest environmental policies appear to have experienced annual employment growth rates almost 0.6% above those of the ten states with the weakest environmental policies. However, once again the significance test (with a probability of 18%) suggests that we should consider the positive association to be spurious.

The odds that environmentalism could be negatively associated with job losses at the state level are extremely poor: slightly more than one to thirty one. We can safely reject the notion that state environmentalism resulted in economically meaningful job losses.

The results for annual growth in manufacturing employment follow the established pattern: a positive coefficient that is not statistically significant (p=28%), while the odds of it masking a true negative are small enough relationship (one to twelve) to suggest dismissing the idea. Many factors may account for the general trend in manufacturing job losses among the states, but strong environmental policies does not appear to be one of the more important ones.

Lastly we look at the annual business failure rate. Since the indicator is a *failure* rate, rather than a growth rate, evidence that stronger environmental policies harm business activity would be indicated by a *positive* coefficient (stronger policies should be associated with higher failure rates). But as the table shows the coefficient in this instance is negative. States with stronger environmental policies tended to have marginally *lower* business failure rates. Here again the coefficient fails to achieve the nominal 5% significance level, so we are advised to dismiss the negative coefficient and presume it should be zero. The odds that the underlying relationship might be positive – thus, supporting the advocates of environmental deregulation – are about one to six, failing to support the assumption that states with stronger environmental policies would experience a higher rate of business failures.

Summarizing, the findings for 1982-1989 consistently and unambiguously fail to support the argument that states with stronger environmental policies suffer an economic penalty. All the coefficients hinted at a very weak *positive* relationship – albeit one that is statistically insignificant – between state environmentalism and economic performance. More importantly the over all odds are better than 15:1 against the proposition that environmental regulation hurt state economic growth during this period.

State Environmentalism & Economic Growth: 1990-1992

Next we examine the period 1990-1992. Where 1982-1989 was a period of general economic growth 1990-1992 saw national economic recession. It can be argued that the failure to find a negative economic effect from environmental regulation in the 1980s may have been due to the fact that robust national economic growth overpowers, or at least masks, the stifling effects of environmental regulation. When recession hits, however, business and industry are far more vulnerable at the margin. Perhaps the true burden of environmental regulation is only measurable and observable during bad economic times.

TABLE 4 presents the results for 1990-1992. They are indeed different from what we saw above. The coefficients for annual growth in gross state product, non-farm employment, and manufacturing employment are all negative as the one would expect if stronger environmental policies placed a drag on business and industry. The latter two coefficients are about half the magnitude of

the coefficients estimated for the previous period, indicating a weaker effect. The ten states with the strongest environmental policies may have suffered about a 0.25% higher annual rate of job losses during the recession (compared to a 0.6% annual job growth advantage during 1982-1989). None of these coefficients, however, is statistically significant – or even close. The classical approach to analysis would have us dismiss these coefficients and presume that no systematic relationship exists.

However, when we look at the "Odds" column we find that the odds of a meaningful negative relationship tend to favor the argument that environmentalism does hobble economic performance during recessions. The odds that environmentalism is negatively associated with annual growth in gross state product during the recession are about 3 to 1. Non-farm and manufacturing employment growth show roughly even odds. Although these odds are not compelling they are, nonetheless, suggestive.

Surprisingly annual business failure rates during the recession among states with stronger environmental policies were less than those for states with weaker environmental policies. Interestingly the relationship is stronger here than during the earlier period – in terms of both the size of the effect and its statistical significance, which is below the 5% threshold. Thus, if states with stronger environmental policies suffered greater losses in terms of growth in the value of goods and services produced and jobs they also lost fewer businesses outright.

The results for the 1990-1992 recession provide modest though mixed support for proponents of environmental deregulation. On the one hand three of the four estimated coefficients are negative. And the odds slightly favor a true underlying negative effect. The size of the negative effect, if it exists, is small – and (except for gross state product growth) is about half the positive effect size estimated for the previous period. On the other hand the three negative coefficients are not statistically significant by classical standards and the one that is statistically significant indicates a positive relationship.

More Subtle Drag Effects from Environmental Regulation

Given the mixed results it is worth pursuing the argument that environmental regulation hinders state economic performance a bit further via a more subtle line of analysis. Suppose that states with very robust economies in the 1970s also were to more likely to adopt more stringent environmental regulations. (Stronger growth produced more pollution, congestion, land use conflicts, etc.. and therefore stronger demand for environmental controls.) Moving into the 1980s these same states might feel the drag of their environmental policies accumulating to a degree sufficient to slow their growth *relative to their own prior performance in the 1970s*, but not sufficient to slow

them to the point where they under-perform states with weaker environmental laws. This decelerating effect would not be detected in the analyses discussed above. This suggests searching for the deceleration pattern in the difference in economic growth rates between the 1970s and the 1980s.

As the results in TABLE 5 show the data contradict this formulation as well. All the coefficients suggest a marginal positive association between stronger environmental policies and economic performance as measured by changes in inter-decade growth rates. In general moving from the 1970s to the 1980s the ten states with the strongest environmental policies saw an average annual increase of 0.4% in gross state product growth, non-farm employment growth, and manufacturing growth over and above what the ten states with the weakest environmental laws experienced. The drop in the business failure rate for states with stronger environmental policies is further evidence against a negative effect.

However, since all the coefficients except for the business failure rate are statistically insignificant classical rules of analysis tell us that we are best off concluding that there is no systematic relationship at all. However these results strongly undermine the belief that a drag effect is present.

Furthermore on average the odds that an underlying negative association is hidden by noise in the data are roughly 1 to 10. Therefore we find no evidence that the accumulating environmental regulatory setting entering the 1980s translated into an increasing economic burden for states that imposed environmental controls above and beyond minimum federal standards.

Discussion

If we place our faith in classical statistical significance tests then the data argue that there is no systematic relationship – positive or negative – between state environmental policies and state economic performance in either good or bad economic times. Consequently, environmental deregulation cannot be expected produce measurable economic benefits at the state level. While individual firms, businesses, and industries might accrue specific benefits, the overall impact on the state economy will not be noticeable. (And, of course, this ignores the imposed costs – short term and long term – from scaling back environmental programs.) This conclusion is consistent with prior research by other investigators.

If we lean more heavily on considerations of risk (odds) then the message is mixed but still not supportive of policies of environmental deregulation. On the one hand strong environmental policies seem to be associated with better economic performance during periods of national economic growth. On the other hand strong environmental policies seem to be associated with weaker

economic performance during recessions. Taking into account that (1) the positive coefficients for 1982-1989 are approximately twice the absolute magnitude of the negative coefficients for 1990-1991 and (2) there are three to four years of good economic times for each year of recession the results imply that over the course of a decade states with stronger environmental policies enjoy a small net economic gain.

This does not mean that strong environmental policies *cause* strong economic growth. It merely means that whatever the underlying association environmentalism does not impede economic performance.

Clearly these findings are at odds with current political wisdom. How can we explain this? Five observations come into play:

- the relative magnitude and scope of environmental regulatory costs are comparatively small when examined in the context of other business cost factors;

- state governments are sensitive to business concerns and do compromise in setting environmental standards and enforcing them;

- business and industry do adjust to environmental restrictions and requirements, resulting in both compliance and profit making;

- a very large fraction – upward of 90% – of the expense of environmental compliance is eventually plowed back into the private economy to pay for goods and services; and

- there may well be a small – but growing – correlation between environmental efficiency and productive efficiency resulting in stronger economic performance.

Business perceptions and lobbyists' protests notwithstanding, the relative magnitude and scope of the economic costs of environmental regulation turn out to be far from towering – well under 2% in most instances – when compared to other business cost factors such as taxes, wages, benefits, and interest rates. And indeed, while business surveys usually find respondents claiming that environmental costs would be one reason they *might* relocate to a new state (or, overseas), business migration and location studies consistently show that other factors ultimately determine the decision. Why? Because when the calculus is done the true weight of environmental costs just does not measure up to the amplified perception.

Since manufacturing and manufacturing competitiveness command special status in discussions of economic performance let's consider how annual

pollution control operating costs stack up against the value of goods shipped. As shown in TABLE 6 the overall ratio for manufacturing industry averages about 0.6%. Although there is considerable variability among industries, all ratios are under 2%. Not surprisingly the highest ratios correspond to the most-polluting industries.

In contrast when we compare employee payrolls against the value of goods shipped the ratio is thirty times greater. In the most-polluting industries the burden of employee payroll is about ten times greater than environmental costs. (Petroleum and coal industry is the exception, and the discrepancy is entirely accounted for by petroleum refining, which is not labor intensive). In the least-polluting industries the payroll burden is about 100 times greater.

Consider that none of the forecasts of economic doom by business or industry regarding the impact of prospective environmental laws and regulations have ever materialized. The U.S. auto industry did not collapse as a result of the Clean Air Act. Recycling has not thrown hundreds of thousands of people working in the plastic, paper, glass, and bottling industries. Nor has logging in the Pacific Northwest ceased to exist despite the listing of the Spotted Owl as an endangered species. Accepting that there is a substantial amount of built in political hyperbole in such predictions, they nevertheless reveal perceptions grossly out of sync with reality.

So why do business leaders and lobbyists single out environmental costs as so noteworthy, when they are comparatively insignificant? To a large extent business still does not perceive environment-related costs as ordinary and proper business costs, recent advertising campaigns to the contrary. Environmental costs are seen as a form of externally imposed social tax, an illegitimate tax place on business.

In this respect the concepts of “extranalities” and “social costs” have not crossed from business management schools to board rooms. Manufacturing plant owners do not consider taking clean water from and returning chemical-laden dirty water to the same river as either a public subsidy or imposing a public cost. As one CEO explained “...Look, the public benefits from our products. They use them and they get jobs. Part of the price of this benefit is the impact we have on the environment. That should be born by the public, not the company.” And so for business and industry these costs, however small, stand out in bold face – despite the fact that they do not tabulate them systematically or reliably.

The same holds true for non-manufacturing business sectors, even fairly green industries. In New England, for example the ski industry perceives itself under enormous pressure to extend the skiing season and availability of runs through artificial snow making. This means drawing tremendous quantities of

water from local streams and rivers. The economics of artificial snow making favor the ski resorts only as long as the down stream impacts on water quality, wildlife, residents and businesses (such as tourism, canoe and raft rentals, fishing) of these withdrawals are ignored or are paid for by someone else. If forced to pay the true price for extended snow making, the industry would reconsider its plans.

In a sense, business is psychologically dependent on environmental subsidies: the ability to pollute or use common resources without charge. When more stringent environmental policies effectively reduce these subsides business feels betrayed. Strong environmental policies are perhaps more of a psychological burden than an economic concern. If the results described here are correct, state governments that succumb to the lure of environmental deregulation may make local business leaders happier, but the effect will not translate into more robust state economies or even more conducive business climate.

Turning to capital spending we see that the ratios for pollution-related capital spending to overall capital spending are substantial. In 1991 manufacturing averaged about 7.5% of new capital expenditures for pollution abatement and control. This is roughly four times the ratio for private business in general, which amounted to less than 2% in 1990.

Looking at individual industries petroleum & coal top the list with a ratio of almost 25%. This is quite a hefty chunk of capital spending. (However, folding in the non-manufacturing side of the petroleum refining industry reduces the ratio to 10%.) The next highest ratio is about 14% for the paper industry. Ratios decline after that. Electric utilities allot about 5% of capital expenditures to pollution abatement and control.

Although capital spending ratios are frequently used for gauging environmental regulatory burdens on industry there are good reasons to be cautious about interpreting these numbers. First and foremost with few exceptions business still has not implemented accounting mechanisms for accurately tracking environment-related expenditures. Consequently the capital spending data are influenced by the fact that most firms do not know what portion of their capital spending went exclusively, or almost exclusively, for pollution control – as opposed to modernization.

Second, single year estimates of capital spending ratios are misleading because capital spending runs in cycles. Time series data of business capital spending show that the fraction allotted to pollution abatement and control dropped steadily between 1975 and 1989, and then began to rise in 1990. The long-term downward trend, despite increasing environmental regulation, suggests industry learning behavior: business successfully anticipates

environmental protection requirements and incorporates them into planning. The trend also suggest that although requirements may increase the expanding availability of environmental technology, products, and services has helped to moderate the unit costs of compliance.

Another reason why the environmental regulatory burden may not show up at the state level is because state governments are sensitive to business concerns. State-houses in particular feel the political weight of industry and regulated interests and are responsive. Consequently, state environmental regulations are rarely imposed without considerable compromise. Rightly or wrongly, state politicians fear "anti-business" labels and the possibility of business flight to other states. Therefore, performance standards, implementation requirements, and enforcement are adjusted to take into account economic impact.

And federal environmental regulations – such as those under the Clean Air Act and the Clean Water Act – have been adjusted numerous times to reduce economic impact. Standards have been lowered and deadlines extended. Even determinations under the Endangered Species Act have been tailored to reduce conflict with economic concerns. To be sure such accommodations rarely satisfy (or are even acknowledged by) industry lobbyists, who prefer no restrictions of any kind. Nevertheless they do make environmental laws more business-friendly.

In a consistent regulatory setting business does learn. Business learns from trends to anticipate future directions in policy and adjusts accordingly. Adjusting to environmental standards can take many forms. But ultimately healthy firms do find a comfortable market path. This means that the initial impact of new environmental regulations may generate short-term economic perturbations such as job shifting – displaced workers will move to other firms within an industry or to firms in other industries. Over the longer run there is no net loss of economic performance.

Consider that when the first wave of environmental laws was passed in the 1970s industry was forced to make large, unplanned, capital expenditures for retrofitted "tail pipe" pollution control systems. Tail pipe controls merely capture pollutants in one form or another for disposal. Catalytic converters on cars, scrubbers on the stacks of power plants, and carbon filters in waste treatment plants are examples of tail pipe controls. These are inherently uneconomic responses in the sense that they increase costs by adding another element to production or the product but do not contribute to product or productivity improvement. Undoubtedly these "tail pipe" controls had many of the negative economic consequences commonly noted by advocates of the green burden argument.

By the early 1980s, however, environmental standards began to be folded into plant management and plant design. Business learned. New facilities incorporated pollution control technologies into their production and management processes; more forward looking firms attempted to reduce pollution at the source. Production process change attempted to cut pollution by directly altering the input-output mix. Higher efficiency processing and recycling can cut overall wastage, or entirely new processes may eliminate particularly noxious pollutants. Production process change holds the potential for recouping the costs for environmental compliance, and in some special instances even allow for positive economic returns after a fixed payback period.

We see evidence consistent with such learning behavior in comparing the division of capital spending for pollution control between “tail pipe” and “production process change”. TABLE 7 shows the proportion of total capital spending for pollution control devoted to production process change for selected industries for 1979, 1985, and 1991. The data show wide variations among industries and across time. For 1991 (the last year for which data are available) the manufacturing average is 29% but the corresponding fraction for individual industries ranges from 10% to over 50%.

Two interesting patterns are suggested by the table. First, the percentage of capital spending for pollution abatement via process change is increasing over time for pollution intensive industries. These industries can taking advantage of opportunities to recoup environment-related costs via efficiency enhancement. Thus, over all expenditures may not reflect true net costs when returns from productivity improvement are considered.

Second, the industries with the largest proportion of capital spending going to pollution abatement and control (TABLE 6) also tend to put more relative effort into production process change. This may partially explain why industries that spend a relatively large percentage of their capital on pollution control – such as petroleum refining – may not suffer competitively as much as the raw statistics imply. They get more back in return.

Entering the 1990s once again new standards are being imposed and the immediate compliance response of business is capital spending to address requirements. Thus we see an increase in the percent of capital spending by the most pollution intensive industries. But this is a short-term immediate response to a long term condition. As learning and innovation set in, these numbers should fall.

Expenditures for environmental compliance are not a tax – even though they are often portrayed as such by lobbyists – that disappear into the pockets of a government bureaucracy. Today a very large portion of the expense of environmental compliance is plowed back into the private economy to pay for

goods and services. The money spent by complying firms represents sales and income to environmental product/service providers, who are private businesses. New demand spurs new products and new services. And as time passes these products and services grow increasingly sophisticated, belying the notion that green jobs are fundamentally unskilled.

Some estimate that about 90% of environmental spending goes to private business.[9] In 1991 slightly less than 10% of manufacturing operating costs for pollution abatement and control went to government units for services. Paper work, filing, and other "soft" compliance costs do not add that much more to the over all tab, although the relative burden on individual firms most certainly increases with decreasing scale of operation.

Although wetlands, endangered species, and similar land use protection may prevent a specific project from being built in a specific location within a state, such outright prohibitions are rare exceptions. Far more often projects require modification to meet environmental standards. This generates additional work, especially for consultants and workers with specialized construction techniques and skills.

Lastly, environmental "efficiency" and productive efficiency are almost certainly correlated to some degree, though there is considerable disagreement about the present size of that correlation as well as its long term potential. The relationship is most easily demonstrated in energy conservation and recycling of process materials. Similarly pollution prevention programs – attempting to reduce the overall waste stream from production – can and do yield economic benefits.

In short the findings reported here (and throughout the economics literature for specific industries and earlier periods) are not all that surprising when the complex interaction between environmental regulatory demands and the economy are considered in context. Environmental policymaking provides numerous opportunities for substitution, tradeoff, accommodation, learning, and adjustment that effectively mitigate what in theory should be a measurable economic burden.

IMPLICATIONS

Undoubtedly those readers with adverse personal and professional experiences in the environmental regulatory process are shaking their heads in disbelief. Of course specific environmental regulations can and do have real effects on individual businesses and firms, specific industries, and even local communities. However, these economic effects are limited in scope and duration and are fewer in number than popular political mythology allows. They do not rise above the background noise of state economies either singly or

cumulatively. Even if we accept the possibility that state environmentalism may increase the relative severity of recessions that impact is wiped out within a year or two of economic recovery.

Consequently, those who hope to improve their state's business climate, economic competitiveness, and employment picture by rolling back environmental statutes are misinformed and are in for great disappointment. The evidence is compelling that this strategy will not produce any meaningful economic gains, while imposing real environmental losses. Instead efforts should shift to factors that have been shown to really affect the bottom line: state tax and labor policies and transportation and communication infrastructure.

In this respect the large sums of money spent lobbying and litigating to block or otherwise water down environmental regulations under the belief of presumptive economic harm might be more productively spent reengineering business accounting systems to accurately track environment-related costs (and returns) and determine where substantial cost-savings can truly be found.

None of this means that we can proceed mindlessly heaping environmental regulation upon regulation. Nor does it imply that we should not work to design, implement, and enforce environmental policies in more procedurally benign ways. But it does mean that to the extent that we do identify transient economic (and social) effects of environmental policy they should be addressed in both context and proportion.

For example rather than trying to relax goals, standards, requirements, and prohibitions, regulatory reform should focus on process: especially reducing time delays. When you get down to specifics, the number one complaint by business owners is the time delays inherent in getting a decision out of the system. Often a timely denial is less costly than a drawn out approval. Unfortunately, outrage over procedural delays and their very real costs is often transformed into a misguided political campaign against the costs of protecting the environment.

Regardless of political happenings today, over the longer term both public demand and economic competitiveness will push business and industry to internalize environmental costs. Environmental regulations simply force environmental impacts into the competitiveness equation, thereby producing a form of environmental-economic Darwinism. Regulatory incentives to avoid the expected high costs of waste disposal and pollution abatement can fuel process and product innovation that improve productivity, increase input-output efficiencies, and provide substantial cost savings. This has been the experience of such prominent firms as the 3M Corporation, Dupont, and Raytheon. New businesses are created to satisfy new demands for environmental services and products.

Of course not all firms and industries learn, and even among those that try some will undoubtedly lack the resources to adapt or reengineer – especially small businesses. Indeed large corporations such as Dow, 3M, and Chevron dominate the anecdotal evidence on the positive economic effects of environmental regulation. In contrast, small businesses with low capitalization, and firms already teetering at the margin of profitability may fold, unable to maintain production and comply with envrionmental restrictions. Firms that cannot compete without dumping some of their costs on the environment (and thereby compel the public to subsidize their operation) never were really competitive in the true sense of the term. But the loss of such companies is ultimately compensated for by new start up companies that use more innovate technologies.

The all out assault on federal and state environmental statutes now underway is unwarranted and unwise. There is no environment-economy crisis – real environmental gains will be lost without accruing any enduring economic benefits. The valid concerns of business and industry will not be addressed in a meat-ax approach to reforming environmental policies. Gutting environmental statutes merely prolongs pubic subsidization of inefficient uncompetitive businesses.

Table 1 State Environmental Standings

1982-1989	1990-1992
Alabama	Wyoming
Missouri	Mississippi
Mississippi	Arkansas
Idaho	Louisiana
New Mexico	Alabama
Oklahoma	Alaska
New Hampshire	West Virginia
Louisiana	Nevada
Nebraska	Utah
North Dakota	Tennessee
Texas	North Dakota
Nevada	New Mexico
Utah	South Dakota
West Virginia	Oklahoma
Tennessee	Kentucky
Alaska	Texas
Wyoming	Idaho
Kansas	Montana
Arizona	Arizona
North Carolina	Kansas
Georgia	Colorado
South Carolina	Delaware
Rhode Island	Missouri
Colorado	Indiana
Arkansas	South Carolina
Illinois	Hawaii
Pennsylvania	Georgia
Virginia	Nebraska
Iowa	Ohio
Delaware	Pennsylvania
Michigan	Washington
South Dakota	Vermont
Ohio	New Hampshire
Florida	Rhode Island
Maine	Virginia
Connecticut	Illinois
Vermont	Maine
Kentucky	Maryland
Hawaii	Iowa
Indiana	Michigan
Maryland	North Carolina
Wisconsin	New York
Montana	Minnesota
New York	Florida
Washington	Oregon
Oregon	Connecticut
Massachusetts	Massachusetts
New Jersey	New Jersey
California	Wisconsin
Minnesota	California

Table 2: State Characteristics with Potential Confounding Effects
Size of Land Area
Economic Weight of Extractive Industry Sector
Population Crowding & Land Use
Energy Cost
Economic Weight of Manufacturing Industry Sector
Size of Consumer Market and Labor Pool
Size of Economy
Technological Capacity
State Wealth
Extent of Economic Development and Urbanization
Manufacturing Labor Cost-1
Manufacturing Labor Cost-2
Tax Rate

Table 3: Impact of State Environmental Policies on Average Annual Economic Growth: 1982-1989

Economic Indicator	*Coefficient*	*Probability of No Relationship*	*Odds of a Negative Relationship*
Gross State Product	0.20	0.31	1:14
Non-Farm Employment	0.28	0.18	1:28
Manufacturing Employment	0.29	0.28	1:12
Business Failure Rate	-6.30	0.35	1:6

Table 4: Impact of State Environmental Policies on Average Annual Economic Growth: 1990-1992

Economic Indicator	*Coefficient*	*Probability of No Relationship*	*Odds of a Negative Relationship*
Gross State Product	-0.36	0.32	3.2:1
Non-Farm Employment	-0.13	0.58	1.2:1
Manufacturing Employment	-0.14	0.66	1.2:1
Business Failure Rate	-13.59	0.02	1:142

Table 5: Impact of State Environmental Policies on Changes in State Economic Growth between the 1970s and the 1980s

Economic Indicator	*Coefficient*	*Probability of No Relationship*	*Odds of a Negative Relationship*
Gross State Product	0.20	0.30	1:13
Non-Farm Employment	0.21	0.41	1:7.6
Manufacturing Employment	0.16	0.62	1:3.8
Business Failure Rate	-14.37	0.03	1:94

Table 6: Business Expenditures for Pollution Control as a Percentage of Total Business Capital Expenditures and Annual Value of Goods Shipped – 1991

INDUSTRY SECTOR	***Pollution Abatement Capital Expenditures vs. Total Capital Expenditures***	***Pollution Abatement Operating Expenditures vs. Value of Shipments***	***Employee Payroll vs. Value of Shipments***
All Manufacturing	7.5%	0.6%	18.7%
Petroleum & Coal Products	24.8%	1.8%	3.0%
Paper & Allied Products	13.7%	1.3%	15.0%
Chemicals & Allied Products	12.5%	1.4%	10.6%
Primary Metals	11.4%	1.5%	16.3%
Electrical Machinery	2.9%	0.4%	21.0%
Transportation Equipment	2.8%	0.3%	16.5%
Instruments and Rel. Products	2.3%	0.2%	25.0%
Machinery (exc. electrical)	1.8%	0.2%	22.6%
Electric Utilities	5.0%	–	–

Source: U.S. Department of Commerce (1993; 12-13), *U.S. Statistical Abstract, 1993* (table 1256).

Table-7 Fraction of Industry Pollution Abatement Capital Expenditures Invested in Process Change*

INDUSTRY SECTOR	YEAR 1979	1985	1991
All Manufacturing	14%		29%
Petroleum & Coal Products	27%	35%	39%
Paper & Allied Products	17%	25%	46%
Chemicals & Allied Products	11%	18%	26%
Primary Metals	5%	8%	16%
Electrical Machinery	22%	11%	16%
Transportation Equipment	15%	34%	14%
Instruments and Rel. Products	23%	16%	10%
Machinery (exc. electrical)	5%	10%	52%

Data Source: U.S. Department of Commerce

* Air and Water Pollution Abatement Only

ENDNOTES

1. The author is Professor in Political Science at MIT where he directs the Project on Environmental Politics & Policy. He also serves as a Conservation Commissioner in Massachusetts.
2. For an excellent review of rigorous economic studies see: Adam Jaffe, Steven Peterson, Paul Portney, and Robert Stavings (1995) "Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?" *Journal of Economic Competitiveness* ....
3. See: Stephen M. Meyer (forthcoming) *Environmentalism and Economic Prosperity* (Cambridge: MIT Press).
4. A number of such studies have been produced over the years. See: Duerksen, Christopher J. (1983) *Environmental Regulation of Industrial Plant Siting: How to Make It Work Better* (Washington, D.C.: The Conservation Foundation), Hall, Bob and Mary Lee Kerr (1991) 1991-1992 *Green Index* (Washington D.C.: Island Press), Renew America (1987-1989) *The State of the States* (Washington, D.C.)
5. The 1982 ranking is based on Duerksen and the 1990 ranking is from Renew America as cited in endnote 4..
6. See: Meyer, op cit.
7. Data on gross state product and employment were obtained from the Department of Commerce. Business failure rates are reported as business failures per 10,000 establishments. These data were provided by Dun & Bradstreet.
8. [7] Although most students of statistics do not realize it, the classical 5% threshold for judging statiscal significance is also arbitrary. Unfortunely, it is now enshrined in practice.
9. This calculation defines a meaningful negative relationship as one in which the true coefficient is -0.1 – each unit increase in environmental score (regulatory stringency) cuts annual growth in gross state product by 0.1%. This is a very conservative threshold that captures declines that are probably less than the ability to measure real changes in the economic indicator. In general a 0.1% change is about 5% of the difference in observed growth rates between the ten states with the weakest envrionmental standards and the ten states with the strongest standards.
10. Goodstein, E.B. (1994) "*Jobs and the Environment: The Myth of a National Trade-Off*," (Economic Policy Institute).