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Title

DOES NATIONAL PURSUIT OF A HEALTHIER ENVIROMENT LEAD TO REDUCED ECONOMIC GROWTH? SOME CROSS COUNTRY EVIDENCE

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ABSTRACT:

Using a recently developed overall measure of environmental performance that considers a whole host of environmental dimensions, this paper employs cross country regression analysis on a large number of countries around the world in order to investigate whether improved national environmental performance adversely effects national economic growth. The results are consistent with the hypothesis that actions taken by countries to upgrade the environment come at a price of reduced economic growth.

The essence of economics is that mankind lives in a cost world, a world of trade-offs. If humans want more of one good, then, unfortunately, they must sacrifice, make due with less of another good. The same holds true for the good known as environmental quality. While those who are emotionally charged with environmental concerns might sincerely wish, might want to convince themselves and others, that we can improve the environment without any negative consequences, this, as in all endeavors in this scarcity ridden milieu we inhabit, is not apt to be case. In the real world as opposed to the world we dream to have, we can never have our cake and eat it too. Improved environmental performance, improved environmental quality, imposes an added cost on industry for producing other goods. For example, if we want less pollution in the air, then, among many other changes, coal generating electric plants must install expensive pollution abatement equipment, cars must be built with pollution control devices, and cars must be designed to use less fuel.

The major hypothesis of the paper is that improved national environmental performance, by increasing the cost of producing goods and services, reduces economic growth. That is to say, national policies and regulations targeted at bettering the quality of the environment come at the expense of lower economic growth. The purpose of the paper is to use cross country regression analysis to test the hypothesis, and given that the hypothesis is true, to get some notion of the magnitude of the effect of incremental improvement of the environment on economic growth.

The paper is comprised of five sections. The first section reviews some of the recent literature on the cost of environmental improvement. The second section discusses a simple model relating economic growth and environmental performance. The third section discusses the variables and identifies the sources of the variables that will be used in the empirical analysis. The fourth section shows the results of cross country regressions of average annual real economic growth

for both a ten year period and a five year period on a measure of overall environmental performance in isolation, and when adjusting for various control variables. The fifth and final section concludes.

I. QUICK OVERVIEW OF SOME RELATED LITERATURE:

Findings from earlier studies undertaken in the late nineteen seventies for the U.S. indicate that environmental regulations may account for anywhere between an eight and a sixteen percent reduction in productivity growth (Denison 1979, Norsworthy et al. 1979).

More recently, Nicole Crain, for twenty-four OECD countries, finds a negative relationship between GDP per capita and all regulations (environmental, as well as other kinds of regulations), as measured by the OECD index of economic regulation (Crain 2005). He estimates that for the U.S. in 2004, the total cost of federal government environmental regulations alone, excluding any local and state regulations, was around 221 billion for all Americans, and that these regulations resulted in a cost of 1249 dollars per employee for every firm in the economy.

For the Korean economy, Lee, evaluating fifteen Korean manufacturing industries for the period from 1982 through 1993, finds that environmental regulations are responsible for a twelve percent reduction in average annual productivity growth (Lee 2007).

Theoretically, Moser, Prskawetz, and Tragler, considering a competitive model that assumes firms employ identical technology, conclude that, although environmental regulation standards can lead to greener production, it can come only at the expense of dampened economic growth (Moser, Prskawetz and Tragler 2011).

Contrary to the position held by most main stream economists, Porter and Van Der Linde maintain that environmental regulation, by stimulating innovation, may actually be beneficial to the economy (Porter and Van Der Linde 1995). However, Amber and Barla, reviewing the evidence for this point of view (known as the Porter hypothesis), find that, while under certain special circumstances and conditions environmental regulations may be beneficial, overall it does not seem to be the case (Ambec and Barla 2007).

There is also a lot of work done with regard to changes in the demand for environmental quality that accompany changes in the level of economic development as theorized by the

environmental Kuznets hypothesis. An example of the genre is Mohapatra and Giri's article (Mohapatra and Giri 2009). Mohapatra and Giri use panel data on fifteen major Indian states from 1991 through 2003 in the Indian economy to test for the environmental Kuznets hypothesis at the state level in India with regard to air quality. While their estimated signs on Gross State Product and Gross State Product Squared (negative and positive respectively), are right in line with the environmental Kuznets hypothesis, the variables are not significant when they are run as independent variables to explain overall air quality. However, their findings do suggest that, at least for India, in explaining air quality, population density, urbanization and state expenditure are statistically relevant variables.

Comprehensive reviews of the literature on the environmental Kuznets hypothesis can be found in Dinda (Dinda 2004) and in Stern (Stern 2004)

II. THE MODEL:

The model consists of an equation and a single partial derivative. The equation along with its associated partial derivative is as follows.

$$(1)\ G = f(E, \mathbf{C}) \quad \delta G/\delta E < 0$$

In the equation, G is the rate of economic growth, E is environmental performance, and **C** is a set of control variables. The single partial derivative, the partial derivative of the rate of economic growth on environmental performance, is shown to be negative. This indicates that, theoretically, it is predicted that better environmental performance comes at the expense of reduced economic growth. The basic reasoning is that any improvement in the environment imposes an additional cost of production on business, making it more expensive to produce goods, thereby reducing economic growth.

The paper looks at four control variables. They are the level of economic development, the extent of savings and investment, the degree of wage flexibility, and the size of the private sector.

It is expected, in line with convergence theory, that mature advanced economies have lower rates of economic growth than the less advanced countries, so that, the relationship between

economic growth and the first control variable, economic development, is predicted to be negative.

The second control variable, the amount of savings and investment in the economy, is anticipated to be positively related to economic growth. Ever since the Classical economists, capital has been seen as a major factor of production. Savings and investment is the key process for augmenting the capital stock. Capital formation is crucial for economic growth as higher levels of capital per worker increase worker productivity.

As growth often entails the reallocation of resources such as the movement of labor resources from old occupations to newly created ones, anything that can ease or facilitate the movement of resources between alternative uses such as greater resource adaptability or increased wage and price flexibility, is apt to be positive for economic growth. Thus, it is assumed that the third control variable, wage flexibility, is positively associated with economic growth.

Finally, the fourth control variable, the size of the private sector, is expected to be positively related to economic growth. Capitalism, through private property and the profit motive, provides an incentive and a favorable institutional setting to increase output, to invent, and to innovate.

III. THE VARIABLES:

The average annual rate of real economic growth in constant 2000 U.S. dollars for the ten year period from 2000 through 2009 and for the five year period from 2005 to 2009 is used as the dependent variable in the regression analysis. The yearly data by country on the annual percentage growth of GDP in constant 2000 U.S. dollars comes from the World Bank (World Bank 2011). From these, the author computed the average annual real growth rates for the five and ten year periods.

The multidimensional measure of environmental performance used in the study is the Environmental Performance Index for 2010. The index comes from the Yale Center for Environmental Law & Policy and the Center for International Earth Science Information Network of Columbia University (Emerson and Levy et. al 2011). The index takes into consideration a variety of environmental categories in its construction including such items as

climate change, air pollution, and water pollution. The index ranges between zero and one hundred with higher values indicating better environmental performance.

The data source for the measure of economic development, real GDP per capita in constant 2000 U.S. dollars for the year 2005, is the World Bank (World Bank 2011).

The extent of savings and investment in the economy is proxied by the three year average of the percentage of savings to GDP for the years 2005, 2006, and 2007. The percentage of savings to GDP for each of the three years comes from the World Bank.

The gauge of wage flexibility is the weighted average from 2008 through 2009 of the flexibility of wage determination of the Competitiveness Report of the World Economic Forum (World Economic Forum 2009). Their wage flexibility index has a potential range between one and seven with higher values signifying greater wage flexibility. It is based on answers to the question, "How are wages generally set in your country?, with an answer of one indicating that it is by a centralized bargaining process, and an answer of seven indicating that it is up to each individual company.

The measure of the size of the private sector is obtained by taking one hundred minus the percentage of government consumption to GDP for the year 2008. The source data for the percentage of government consumption to GDP for the year 2008 comes from the World Development Indicators of the World Bank (World Bank 2011).

IV. THE EMPIRICAL FINDINGS:

Table I presents the results of ordinary least squares regressions of economic growth on environmental performance alone, and of economic growth on environmental performance adjusting for the various control variables. The equations are numbered in the very first row. The potential independent variables are listed in the first column, and the last two rows, for each regression, provide the r-squared value (RSQ), and the number of countries that makes up the sample (N). For any given variable entering an equation, the table shows the estimated coefficient (top most value), and its individual t-statistic (underneath the estimated coefficient in parenthesis). A variable that is significant at the one percent level or better in an equation is marked by a single asterisk under the individual t-statistic. If there are two asterisks, then it

indicates that the variable is significant at the five per cent level of significance or better, and, lastly, if it is given three asterisks, then it means that the variable is significant at the ten percent level of significance or better.

TABLE I

TEN YEAR AVERAGE ANNNUAL GROWTH FROM 2000 THROUGH 2009 ON ENVIROMENTAL PERFORMANCE AND ON ENVIROMENTAL PERFORMANCE AND OTHER VARIABLES

	(1)	(2)	(3)	(4)	(5)
CONSTANT	8.162 (7.72) *	7.469 (6.63) *	6.632 (6.29) *	3.603 (2.46) **	-3.635 (-1.07)
ENVIROMENTAL PERFORMANCE INDEX	-.0654 (-3.71) *	-.0469 (-2.35) **	-.0512 (-2.93) *	-.0476 (3.08) *	-.0355 (-2.26) **
GDPPC		-.000056 (-2.29) **	-.000096 (-4.49) *	-.000076 (-4.29) *	-000061 (3.26) *
PERCENTAGE OF SAVINGS TO GDP			.0742 (6.22) *	.0493 (4.32) *	.0418 (3.54) *
WAGE FLEXIBILITY				.6544 (3.17) *	.6333 (3.14) *
SIZE OF PRIVATE SECTOR					.0780 (2.28) **
RSQ	.084	.124	.368	.412	.424
N	153	151	140	121	118

The results lend support to the contention that improved environmental performance brings about a reduction in national economic growth. The environmental performance index is

negative and significant at the five percent level or better in each of the five equations in table I, and is significant at the one percent level or better in three of the five equations. Whether the environmental index is used alone (equation (1)), adjusting for the level of economic development (equation (2)), or adjusting for both the level of economic development and for other variables (equations (3) through (5)), the regression findings show that improved national economic performance leads to reduced national economic growth. Looking at the estimated coefficient for the environmental performance in the third equation, which falls roughly in the middle of the range of estimates for the environmental performance index for the entire set of regressions in the table, indicates that a one point increase in the environmental performance index, that has potential values ranging between zero and a hundred, results in around a one twentieth point reduction in the rate of economic growth.

The control variables in the regressions in table I also behave as expected. Gross domestic product per capita (GDPPC), the measure of economic development, is, consistent with convergence theory, negative in every one of the four equations that it enters. This development variable is significant at the one percent level of significance or better in three of the four equations (equations (3) through (5)), and significant at the five percent level or better in the remaining equation (equation (2)).

The variable attempting to capture the amount of savings and investment in the economy, the percentage of savings to GDP, is, just as anticipated, positive in the three equations it appears. What's further, the variable is significant at the one percent level of significance or better in each of these equations.

Greater adaptability of the economy, in terms of wage flexibility, is also favorable for economic growth. The wage flexibility variable is positive and significant at the one percent level of significance in the two equations that it enters (equations (4) and (5).

Lastly, the results indicate that greater market orientation is positive for economic growth. The size of the private sector is positive and significant at the five percent level of significance or better in the fifth equation, the lone equation in which the variable enters as one of the independent variables.

Table II repeats the regression runs for table I using, instead of ten years, the shorter five year period from 2005 through 2009 to compute the dependent variable, the average annual growth

rate. The results are similar to table I. Once again, the environmental performance index is negative and significant at the five percent level of significance or better in each of the equations. Once again, all of the control variables behave well.

TABLE II

FIVE YEAR AVERAGE ANNNUAL GROWTH FROM 2005 THROUGH 2009 ON ENVIROMENTAL PERFORMANCE AND ON ENVIROMENTAL PERFORMANCE AND OTHER VARIABLES

	(1)	(2)	(3)	(4)	(5)
CONSTANT	9.330 (8.16) *	8.512 (6.95) *	7.469 (5.95) *	4.250 (1.97) ***	-5.902 (-1.18)
ENVIROMENTAL PERFORMANCE INDEX	-.0842 (-4.41) *	-.0638 (-2.95) *	-.0634 (-3.06) *	-.0709 (-3.14) *	-.0512 (-2.24) **
GDPPC		-.000057 (-2.16) **	-.000098 (-3.89) *	-.000083 (-3.23) *	-.000061 (-2.27) **
PERCENTAGE OF SAVINGS TO GDP			.0686 (4.85) *	.0693 (4.20) *	.0559 (3.26) *
WAGE FLEXIBILITY				.7463 (2.50) **	.7347 (2.52) **
SIZE OF PRIVATE SECTOR					.1068 (2.12) **
RSQ	.113	.141	.304	.339	.341
N	155	152	141	122	119

V. CONCLUSION:

Justified concern for the consequences of environmental degradation such as global warming should not cloud researchers' objective assessment of the real costs of environmental improvement. Good decisions are made with good information, and, generally speaking, the better the quality of the available information, the better the quality of the decisions that rely on the information. This is just as true for environmental decisions as it is true for other decisions. Sugar coating the sacrifice required for environmental upgrading is not apt to be helpful, and politicians and leaders pursuing such approach are not likely to retain their esteem in the long run.

The empirical cross country analysis of the paper suggests that better environmental quality comes at the expense of reduced economic growth. Whether environmental quality is used as a sole regressor in a growth equation, or is accompanied by control variables, such as the level of economic development, the extent of savings and investment, or the degree of economic flexibility, the regressions indicate that improved environmental performance lowers economic growth.

Economic growth is the means for improvement in the standard of living of mankind. The cross country regression analysis of the paper suggests that improvement in environmental performance requires sacrifice in economic growth.

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