ENVIRONMENTAL AID AND ECONOMIC DEVELOPMENT IN THE THIRD WORLD

ARVIN, B. Mak *
KAYANI, Zafar
SCIGLIANO. Marisa A.

Abstract

Climate change has a profound impact on the planet, especially on developing countries – as highlighted by the *Stern Report* to the British government in 2006. One solution to mitigating environmental degradation and achieving better outcomes appears to be through the provision of aid to poor countries. Using newly available data from the PLAID (Project-Level Aid) database project, we ask what determines the level of environmental aid to developing countries – and in particular whether such aid is affected by the level of economic development of the recipient country. At the same time, we investigate whether economic development is affected by the receipt of environmental aid. Implicit in the second question, of course, is the notion that, besides addressing the ecological outcomes, environmental aid may have the potential to enhance the economic prosperity of poor countries.

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1. Introduction

Since the Industrial Revolution, human activities have had a substantial impact on climate change. Most significantly, the burning of fossil fuels and ensuing increase in greenhouse gases have played a part in global warming and ozone depletion. During the 20th century average global surface temperature increased by 0.6˚C,

B. Mak Arvin, Ph.D., Professor, Department of Economics, Trent University, Peterborough, Ontario, Canada K9J 7B8, marvin@trentu.ca, Zafar KAYANI, Ph.D., Assistant Professor, Department of Economics, Trent University, zafarkayani@trentu.ca, Marisa A. SCIGLIANO, M.A., M.L.S.' Technical Services Librarian, Bata Library, Trent University, mscigliano@trentu.ca

snow cover and ice extent fell by 10 percent, sea level rose by 10 to 20 centimeters, and El Niño episodes became more profound (Conceiaco, 2003).[1] The global average temperature is expected to continue to rise throughout the 21st century by an additional 1.0°–3.5°C.

Recognizing the importance of taking corrective measures to reduce global warming industrialized countries agreed to meet the target set under the 1995 Kyoto Protocol, namely to reduce greenhouse gas emissions by an average of five percent below the 1990 levels through 2008-12. At the same time, countries in both North and South have begun to acknowledge that environmental degradation has not been limited to air pollution. Anthropogenic activities have also had profound effects on land and water surface change through deforestation, desertification, and urbanization, all of which compromise the environment, and which have already had irreversible effects on biodiversity.

Climate change has an adverse impact in developing countries in particular, and especially for those that are dependent on subsistence agriculture (see, for example, Stern 2007). Lack of adequate health care also means that poorer countries are more vulnerable to the wrath of droughts, floods, and other natural disasters which often plague regions of the world and which have become more intense and more frequent as the result of changing environmental conditions.

Developing countries suffer a double injustice when it comes to climate change. Not only do they suffer the most severe consequences, for example facing rising sea levels and diminishing crop yields – but they are now expected to be 'part of the solution' by reducing their emissions at the expense of their own economic growth (Roberts and Parks, 2007).

Recognizing the depth of environmental challenges, industrialized countries have provided billions of dollars of

[1] El Niño is an abnormal warming of the surface water in the eastern Pacific that causes the normally wet weather in the western Pacific to shift further to the east. This causes a host of problems including droughts (for example, in parts of India and Southeast Asia) and flooding (in countries such as Chile and Peru).

environmental aid to governments in developing countries and to private organizations for a range of projects – from sewage treatment to nuclear safety – in an attempt to mitigate environmental problems. The cynics would argue that donors are merely currying political favor at home or providing aid for geopolitical or commercial imperatives – hoping for a significant positive return on their aid investments. Others might argue that environmental aid would bring better local and regional outcomes. Regardless of opinion, the problems associated with the current environmental malaise are enormous. For example, 1.6 million people die prematurely every year from indoor air pollution, largely as a result of toxins from domestic cooking fuel. Another 1.7 million, mostly children, die prematurely every year due to poor sanitation and unsafe water as a result of untreated sewage or industrial effluents (United Nations, 2006). Food production is also compromised as land degradation through widespread deforestation and ensuing soil erosion has led to numerous problems including declines in agricultural output and more frequent flooding and droughts.

It is evident that environmental aid has the potential not only to bring about better environmental outcomes but also to improve the economic well-being of the citizens of the Third World. For example, an individual whose health is not compromised by unsanitary water is better able to work, providing economic security; farms not devastated by drought can provide sustenance for families; rivers not polluted by effluents can serve as a source of income for commercial fishermen.

In this realm, one important question is how is such aid determined? For example, other than its link to the environmental condition of a poor country, does the disbursement of such aid reflect the country's economic development or its size? In addition, turning the question on its head, one could ask, is the economic development of a country affected by the level of environmental aid it receives? The intent of the latter question is to investigate whether environmental aid has the potential to improve the economic prosperity of a country. This paper answers both of these questions. The balance of the paper is organized as follows. Section II provides additional background for the study and explains the nature of our data on environmental aid. Section III describes the model, the

variables, and our other data sources. Section IV presents the results. The final section draws some conclusions.

2. Background

There is a significant body of literature examining the impact of aid on the conditions in developing countries. However, relatively few studies of aid allocation concentrate on the possible link between foreign assistance and the state of the environment. For example, on the theoretical side, Chao and Yu (1999) explore the welfare effects of tying aid to environmental clean-ups. In the same vein, Hatzipanayotou et al. (2002) develop a two-country model of aid and cross-border pollution resulting from production activities in the recipient country. They characterize a Nash equilibrium for the donor and recipient country with respect to aid and pollution abatement. Their paper reveals that the medium and longer-term impact of cross-border pollution can lead to reductions in the total amount of emissions by encouraging greater levels of international transfers such as aid.

There has also been dearth of research on the empirical front. However, some empirical studies have emerged in recent years. Arvin et al. (2006) explore the link between foreign aid and ecological conditions in developing countries using a Granger causality test, while Arvin and Lew (2007) examine the same nexus in a broader model which takes into account a host of factors that affect environmental conditions.

All of these papers consider foreign aid in aggregate – that is, overall assistance given to a developing country – not the flows for the stated purpose of addressing their environmental woes. Collecting data on aid that is 'environmentally friendly' is no easy task since projects have to be classified according to how kind they are to the environment. Significant progress in this regard has been made through Hicks et al.'s PLAID (Project-Level Aid) database project – which is the collection, standardization, and coding of development projects from over 50 bilateral and multilateral donors to more than 170 countries over two decades. A summary of Hicks et al.'s work appears in their 2008 book: *Greening Aid? Understanding the Environmental Impact of Development Assistance.*

Hicks et al. utilize data from the Organisation for Economic Co-operation and Development's Creditor Reporting System as well as data from various multilateral organizations to classify individual development assistance projects during the 1980s and 1990s into five categories – from most to least environmentally beneficial. Our study uses Hicks et al.'s aggregate figures over the 1980s and 1990s. Hence, the aid data used in our study is the allocation of environmental aid to individual recipients, as categorized by the PLAID research project, during the two distinct periods 1980-89 and 1990-99. The recipients range from larger countries like China to smaller countries such as Fiji.

3. Empirical framework

Our investigation is different from earlier studies in several important ways: First and foremost, we use the newly available data on environmental aid. Second, we consider additional motives for granting of such aid – besides those associated with achieving better environmental outcomes. The most important motive in this regard is the level of economic development of the recipient country – as measured by its GDP per capita. Third, our econometric approach allows consideration of a scenario where the amount of environmental aid and the level of economic development are *jointly* determined. The approach involves estimating two simultaneous equations to allow for the possibility that environmental aid flows affect the level of economic development as well as being influenced by the level of development.[2]

Thus, we proceed with the following econometric specification, which consists of a pair of equations:

[2] Hicks et al. (2008) try to explain the overall pattern of environmental aid allocations by suggesting that variables such as a recipient country's level of economic development, population size, colonial history, transparency of environmental policies, and geographical proximity to donors are all positive determinants of environmental aid. However, unlike our study, they do *not* allow factors such as economic development to be influenced by such aid in the process of simultaneous causation. That is, their inferred relationship is unidirectional rather than bidirectional.

$$LN(EAID_{jp}) = a_0 + a_1 LN(GDPPC_{jp}) + a_2 LN(MANUV_{jp}) + a_3 LN(ORGW_{jp}) + a_4 LN(POP_{jp}) + \lambda_{jp} \quad (1)$$

$$LN(GDPPC_{jp}) = b_0 + b_1 LN(EAID_{jp}) + b_2 LN(FREE_{jp}) + b_3 LN(KOFG_{jp}) + b_4 LN(POPGR_{jp}) + \mu_{jp} \quad (2)$$

where the subscript *jp* on a variable denotes developing country *j* and *p* denotes the period ($p = 1,2$); and λ_{jp} and μ_{jp} are random error terms. The *a*'s and the *b*'s are the parameters to be estimated; *LN* denotes the natural logarithm of a variable. The decision to use aggregate data in the two periods 1980-89 and 1990-99 is not spurious: it reflects the existing data as reported by Hicks et al. (2008).

The variables are defined as follows.[3] All financial flows are measured in constant 2000 U.S. dollars and unless otherwise stated are obtained from World Bank (2008). The values are annual averages for each decade in question. $EAID_{jp}$ is environmental aid given to a recipient country and is expressed in millions of dollars – from Hicks et al. (2008). $GDPPC_{jp}$ is GDP per capita and is our measure of economic development of the recipient country. $MANUV_{jp}$ is manufacturing value added (manufacturing output after subtracting intermediate inputs – expressed in millions of dollars) and is our measure of the degree of industralization of the poor country. $ORGW_{jp}$ is organic water pollutant emissions (kg per day per worker) and is our measure of the environmental need of the

[3] It should be emphasized that our model could have included many better or additional variables such as various measures of poverty. However, these were not readily available for the number of recipient countries and the years we wished to examine.

country.[4] POP_{jp} and $POPGR_{jp}$ denote population and population growth respectively. Population is measured in millions of inhabitants. $FREE_{jp}$ is the Freedom House Index of Democratic Freedom.[5] The index is the average of the political rights and civil liberties indicies. Each of these indicies runs from one to seven, with one as the highest and seven the lowest value. (Source: Freedom House, 2008.) Inclusion of this control variable in equation (2) was prompted by our belief that more free societies generally enjoy a higher level of economic development – as argued by Persson and Tabellini (2006). The last variable in our system of equations is $KOFG_{jp}$ – the KOF Index of Globalization – which measures the degree of globalization in an economy on the basis of 24 variables (see Dreher et al., 2008 for discussion and source). This dimension was added to the model to control for the often made assertion that globalization affects the economic prosperity of countries.

Thus, equation (1) hypothesizes that environmental aid is affected by the level of economic development of the recipient country, by its degree of industrialization, by its environmental need, and by its size (measured by population). Analogously, equation (2) hypothesizes that the level of economic development of a poor country is affected by its receipt of environmental aid – which may be fungible,[6] by the growth rate of its population, by its level of

[4] Many variables are possible as indicators of recipient environmental need, but data on most variables lacked quality for all recipients and years. One of the most complete indicators of a recipient country's environmental need is its water pollution level – explaining our choice of this variable. We also experimented with using air pollution in equation (1), but our attempts did not yield improved results.

[5] The Freedom House Index has been used in a number of recent studies as the standard measure of democracy. See for example, Barro (1996), and Arvin and Barillas (2002).

[6] Fungibility refers to the notion that the funds received may be used to achieve other objectives – besides the one for which the donor originally intended it for. For example, aid given primarily for drought control or solid waste management may be used to construct a dam – given that the

democracy, and by the economy's degree of globalization. Equations (1) and (2) form a system of simultaneous equations and are *jointly* estimated to allow for the endogeneity of the independent variables.

4. Results

Since the level of economic development may not only influence the receipts of environmental aid but may also be the result of such receipts, estimating equations (1) and (2) separately produces biased estimates since the independent variables in question are endogenous. If we are to have any hope of producing unbiased results, it is necessary to use an estimation procedure which is appropriate in the context of a process of simultaneous causation. We apply one such procedure to deal with this endogeneity, namely two-stage least squares. The results from our estimation (with standard errors shown in parentheses below the coefficients) are reported below:

$$LN(EAID_{jp}) = 13.47 \underset{(0.82)^{**}}{- 1.92\, LN(GDPPC_{jp})} \underset{(0.73)^{**}}{+ 1.87\, LN(MANUV_{jp})} +$$

$$\underset{(1.93)^{***}}{5.42\, LN(ORGW_{jp})} \underset{(0.73)}{- 0.73\, LN(POP_{jp})}$$

$$R^2 = 0.33\,, \; DW = 1.72$$

$$LN(GDPPC_{jp}) = \underset{(0.19)^{**}}{- 8.72 + 0.41\, LN(EAID_{jp})} \underset{(1.01)}{- 1.41\, LN(FREE_{jp})} +$$

$$\underset{(1.05)^{***}}{4.28\, LN(KOFG_{jp})} \underset{(0.54)}{- 0.19\, LN(POPGR_{jp})}$$

$$R^2 = 0.43\,, \; DW = 1.80$$

Significance levels: ** : 5 percent; *** : 1 percent.

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recipient government may have already set aside its own funds to battle drought or manage solid waste.

Results for equation (1) indicate that environmental aid is positively linked to the degree of industrialization of the country and its environmental need. Clearly, more industrialized developing countries and those with higher water pollution receive more environmental aid. Both of these results are statistically significant. At the same time, environmental aid is negatively correlated with the level of development of the recipient country as well as its population – although only the first relationship is statistically significant. As expected, more impoverished countries (those with a lower level of economic development) receive more environmental aid. However, the fact that population is not a positive and statistically significant determinant of environmental aid is surprising.

Turning to the results for equation (2), it is evident that only two variables are statistically significant: environmental aid and degree of globalization – both of which bear a positive relationship to the economic prosperity of a country – as measured by its per capita income. Higher economic development is associated with more environmental aid – which is sensible; and a developing country's increasing involvement in the global economy appears to contribute to its economic well-being. However, the fact that neither democracy nor the rate of population growth affect a poor country's economic development is somewhat puzzling.

Given our natural logarithm specification for equations (1) and (2), we can interpret the estimated coefficients as partial elasticities (i.e., percentage changes in the dependent variable due to a one percent change in an independent variable). It is clear from our results for equation (1) that environmental aid is elastic with respect to *all* the variables that bear a statistically significant coefficient. Particularly pronounced, but not surprising, is the elasticity of environmental aid with respect to environmental need (an elastic value of 5.42). By contrast, from our results for equation (2), it is evident that while the elasticity of economic development with respect to the degree globalization is high (an elastic value of 4.28), the elasticity of economic development with respect to environmental aid is remarkably low (an inelastic value of 0.41).

5. Conclusions

Given the steady deterioration in earth's climate, developed countries have taken the initiative to provide poorer countries with environmental aid. This paper investigated whether such aid increases the level of economic development of poorer countries and/or whether this aid is impacted by the level of development of these countries – through an empirical model where aid is determined simultaneously with development. Results suggest that there is a bidirectional nexus between the two variables. Needless to say, much more research in this area is required to unravel the complex relationship between environmental aid and economic development. Case studies probing deeper into the exact nature of this relationship may be a fruitful area for future research.

It goes without saying that in order to assist developing countries deal with the adverse effects of climate changes, much more is needed besides environmental aid. Poorer countries should be encouraged to design and nurture their own environmental plans, especially those that can facilitate generation of income and employment through environmental/natural resource management.

This promotion would be made easier if one or more international institutions were able to provide dedicated attention to the provision of this international public good. The kind of international body, such as the one being discussed here, does not exist at present. Any such organization would need to be charged with the kind of responsibility currently expected of the current crop of international financial institutions – such as the World Bank, Inter-American Development Bank, or the International Monetary Fund – but from an environmental auditing perspective which will probably overlap with other purely financial or economic considerations in many cases. This supranational body would need to work closely with the international financial institutions and inter-governmental organizations in terms of coordinating national and international policy in order to curb and manage environmental problems such as greenhouse gas emissions that have an impact on climate change.

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