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The Multinational Corporation and the  
Environment: Testing The Pollution  
Haven Hypothesis

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**THE MULTINATIONAL CORPORATION AND THE ENVIRONMENT:  
Testing the Pollution Haven Hypothesis\***

**By Ravi Ratnayake & Michael Wydeveld**

**Abstract**

In a world of increasing foreign direct investment flows some concerns have been raised that differences in environmental stringency between nations will prompt multinational corporations to relocate production in those countries where standard and enforcement of environmental regulations are relatively lax. This paper aims to test the validity of such a notion which has been dubbed the pollution haven hypothesis. We do so by developing a model based on trade and foreign direct investment theories and testing it using a cross-country data set. The econometric analysis in our study finds no evidence to suggest that environmental regulation is a significant determinant of inward FDI.

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### **1. Introduction.**

Environmental problems are being increasingly seen as emanating from production and consumption of environmentally sensitive goods and services. Environmental impacts are believed to extend beyond national boundaries damaging environment on a global scale causing great concerns about global warming, depletion of ozone layer and greenhouse gas effects. At the center the environmental concerns is the issue of foreign direct investment (FDI) in environmentally sensitive industries, which has come to permeate our consciousness, as the total amount of world FDI has risen dramatically.<sup>1</sup>

It has been suggested that stringent environmental regulations and standards may induce multinational corporations (MNCs) to relocate their investment and production in the countries with laxer environmental regulations (Low and Yeats, 1992). As the environmental control costs are part of total production costs, the relocation of production to lower cost countries can give distinct comparative advantage to those relocating firms over the firms located in environmentally rich countries. This argument has been closely associated with the capital/industrial flight hypothesis that increasing the stringency of domestic environmental regulations, which adversely affects the competitive position of domestic firms, will push investment out of the national boundaries. These policies are known as 'push factors' to FDI. An alternative view is that some governments allow foreign MNCs a moratorium from domestic environmental regulations which act as 'pull factors' for FDI [e.g., Pearson (1985), Leonard (1988)]. This view is known as the pollution haven hypothesis which suggests that when the relative stringency of environmental

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<sup>1</sup> In 1975 the total world wide stock of FDI was US\$282 billion, in 1985 \$713.5 billion, and by 1992 \$3880.4 billion, Root (1990), UNCTAD (1994).

regulations is different between countries, capital will relocate to those countries where regulations are relatively less stringent.

This paper tests the validity, or otherwise, of the pollution haven hypothesis using a cross-country data set. We examine the pollution haven hypothesis from MNCs' capital investment behaviour, while recognising that a great volume of capital flows actually occur through mediums other than the multinational corporation, e.g., multilateral lending agencies, official aid, portfolio investment. However, this need not be a major limitation to our study. Increasingly governments providing such flows as official development aid are evaluating the environmental impact of their assistance and are therefore unlikely to conform to this market driven hypothesis. Given that MNCs continue to increase their dominance of world trade and investment activity, an appraisal of the validity of pollution haven hypothesis based on the behaviour of these firms will become increasingly valuable.

The structure of the paper is as follows. Section 2 presents a brief review of both theoretical and empirical literature of the pollution-haven hypothesis. Section 3 presents the model of the determinants of FDI, while in section 4 we test our model and analyse the regression results. Section 5 provides a summary of the findings and some concluding remarks.

## **2. Previous Literature**

The literature on the pollution-haven hypothesis is sparse, particularly in theoretical treatment. Attempts thus far seem predisposed to extending existing trade models. The Heckscher-Ohlin (HO) theorem has provided a starting point for most of the early theoretical evaluations on how environmental regulations affect the pattern of international trade and investment.<sup>2</sup> In terms of this theory it is possible to view the environment as a productive resource, and its assimilative and regenerative

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<sup>2</sup> For details see Jaffe et al (1995). More recent models, such as Uptah (1995), Markusen et al (1993), are looking at imperfect market scenarios.

capacities as natural factor endowments<sup>3</sup> [e.g., Walter (1982), Pearson (1985), Siebert (1987)]. In this theoretical setting FDI may be seen as a partial substitute to exports.<sup>4</sup> If environmental regulations are tightened in countries well endowed with assimilative and regenerative capacities the production conditions of the pollution-intensive sector will be adversely affected.<sup>5</sup> At the same time, the relative cost advantage of the country poorly endowed with assimilative capacity increases. This implies that if capital is internationally mobile, in a two-country model, capital of the environmentally rich country will be transferred to the environmentally poor country despite the fact that this locational shift may be ecologically antagonistic to the country's natural resource endowments<sup>6</sup>.

Empirical studies of the linkages between investment and environment regulations are limited<sup>7</sup>. Most of studies investigate shifting plant locations<sup>8</sup> rather than the impact of environmental regulations on flows of FDI in a multi-country setting. For example, Walter (1982) examines the percentage of capital spending for pollution control by US MNCs in their domestic operations and in their overseas operations. He identifies 8 pollutive industries for examination.<sup>9</sup> He examines the years 1970-

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<sup>3</sup> If we recognise that countries differ in the relative abundance of these capacities, under circumstances in which all other factor endowments are identical across countries and pollution is assumed to occur solely within national borders, the HO theory predicts that those countries well endowed with assimilative and regenerative capacities will export those goods whose production process is relative intensive in the use of these capacities. These same countries will then import those goods whose production process is relatively less pollution-intensive.

<sup>4</sup> Conversely relocation may stimulate trade. Colgate & Featherstone (1992) suggest that there are two lines through which capital relocation may stimulate trade. First, the imports of the home country may rise as the country imports products produced by foreign subsidiaries. Second, exports of the home country may rise as foreign subsidiaries require capital goods and intermediate inputs and parts for production.

<sup>5</sup> Yet, this rise would be less than had they been poorly endowed with such capacities.

<sup>6</sup> It is frequently assumed that LDCs are well endowed with assimilative and regenerative capacities, because of their large stock of untapped resources. However, it should be recognised that some eco-systems are particularly fragile and that a quantification of the environmental capacities, not just the stock of resources, is required.

<sup>7</sup> See Dean (1992) for a review of this literature.

<sup>8</sup> These studies includes those comparing plant location across federated state systems (e.g. U.S) where control of environmental policy is delegated through the subsidiarity principle.

<sup>9</sup> They include; Iron and steel and nonferrous metals; Fabricated metals; Stone, clay and glass; Chemicals; Pulp and paper; Rubber; Petroleum and; Mining.

76 and discovers, with the sole exception of mining, that in all these pollutive sectors the percentage of capital investment required for pollution controls abroad were significantly lower than in the US indicating that if everything is equal, there is a clear advantage for overseas production over domestic production. Pearson (1987) and Leonard (1988) similar investigations using individual country data.

Despite each empirical study having a different focus, one methodological similarity can be discerned. Each study has begun by establishing the relative environmental stringency of the countries, states and/or industries being studied. This has been done either qualitatively, as in Tobey (1990), or by quantitative calculation of ECCs. The latter method being the most common (Jaffe et al, 1995). If one country has higher ECCs vis' a vis' another country then that country is said to have more stringent environmental regulations. To substantiate the pollution haven hypothesis would then require that these ECCs are significant in providing a motivation for relocation. As mentioned before, the empirical evidence, however, suggest that although in aggregate ECCs appear large, when compared against total costs or value added they are generally found to be insignificant.<sup>10</sup> A major limitation of these studies is that frequently only the direct costs, such as spending on "end of pipe" abatement equipment have been considered in the estimates of ECCs. The indirect costs such as costs on improved worker health), transitional costs, government administration costs and other social impacts have been ignored.<sup>11</sup>

However, even when we include these indirect costs most studies still find ECCs to be relatively insignificant. Dean (1992) summarising available evidence on ECCs suggests that these costs, on average, constitute a small proportion of total industry

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<sup>10</sup> For the US, studies have estimated total ECCs of between \$81 billion and \$125 billion in 1990, Rutledge & Leonard (1993), Environmental Protection Agency (1990). In 1991, 65.5% of total ECCs, estimated above, were incurred by business, 26.3% by Government and 8.3% by personal consumption, Rutledge & Leonard (1993).

<sup>11</sup> Leonard (1988) makes a similar observation but stops short of terming them indirect ECCs. He argues that other factors, such as social blockage of new plants and constraints on hazardous production, which result in MNCs incurring negotiation and legal costs, must also be considered.

costs and reduce output insignificantly, though in some particular industries ECCs may be significant. It is those industries in which ECCs have proved to be significant that have then been termed pollution intensive (e.g., Low & Yeats, 1992).

Our study contributes to the existing literature on the pollution haven hypothesis in a number of ways. First, we test the hypothesis using a cross-country data set and avoid the data limitations associated with the individual country case studies. Second, our model includes variables which have previously been untested, due largely to their qualitative nature. Thus we have used proxies and indexes to fill this gap in the existing empirical work. Finally, we treat less developed countries and developed countries separately to test the validity of the hypothesis within each group, an approach no other study (as far as these writers are aware) has attempted. All previous studies have accepted on faith the notion that less developed countries are less environmentally stringent than developed countries.

### **3. The Model Specifications**

On the observation that trade theory, capital theory and the theory of the firm are “converging on, and even overlapping, each other”. Dunning (1981, 1988) developed an ‘eclectic’ theory to explain international production by MNCs. According to this theory FDI take place due to three major reasons; (a) locational specific advantages such as low cost labour and availability of raw materials, (b) ownership-specific advantages such as exclusive possession of certain assets (technology, patents, trade marks, skills etc.) and © internalization advantage that the ability of firms to internalize the ownership advantages to protect them against market failures<sup>12</sup>. In terms of eclectic approach laxer environmental regulations can be treated as a locational specific advantage.

Based on the integrated approach to trade and FDI mentioned above, we specify the following model to analyse the determinants of FDI flows between countries.

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<sup>12</sup> There have been a number of comprehensive surveys on the literature of FDI theory [e.g., Argarwal (1980), Root (1990), Cantwell (1991)]. There have also been surveys in particular aspects

$$FDI_j = \alpha + \sum \beta X_j + \sum \gamma Y_j + \sum \chi Z_j + \sum \delta E_j + U_j$$

Where  $FDI_j$  is a variable calculated by dividing inward FDI for a particular country  $j$ , by the annual GDP for that same country.  $X_j$  is a vector of variables representing market size and potential,  $Y_j$  is a vector of variables to representing factor endowments,  $Z_j$  is a vector of variables representing incentive and disincentives to FDI, and  $E_j$  is a vector of variables representing the impact of environmental regulations.  $\beta$ ,  $\gamma$ ,  $\chi$ ,  $\delta$  are the vectors of coefficients associated with four vectors of variables mentioned above.  $U_j$  is a stochastic error term.

### **Market Size and Potential ( $X_j$ )**

FDI flows can be influenced by market size of the recipient country for two reasons (Argarwal, 1980). The first recognises that FDI servicing the host market only becomes profitable when the average costs of operating in the host country are lower than the cost of serving that market through exports from the home country. This requires a critical volume of sales to be achieved in the host country. If consumer adoption rates are identical in different markets then it is argued that this critical level will be quicker met in larger markets. Second, market size may act as a strategic motivation for FDI. Oligopolists react to competitive effects of competitors establishing in foreign markets so as to prevent a fall in sales and/or market share, and to prevent the possibility of first mover advantages accruing to their competitors. We use three proxies to represent various aspects of market size and potential. First, following Tsai (1994) and UNCTC (1992), we use GDP per capita (GDPPC) as a proxy for market size in our model. Second, following, Rugman (1980), Argarwal (1980) and Dunning (1988), we also included a variable measuring a country's manufactured exports as a percentage of their GDP (EXG) as an indicator of the desirability of a particular country as an export platform. Third,

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of FDI and attempts to formulate a general theory on FDI [e.g., Rugman (1980), Dunning (1988), Hennart (1991)].



import growth (MGR) included in our model as a proxy for potential market demand in the host country.

### **Factor Endowments ( $Y_j$ )**

The endowments of countries can affect FDI flows for industries which rely on the intensive use of such factors. The factors most frequently highlighted in theory and practice are land, capital and labour. In our model, we include measures for each of these factors, land per capita (LANDPC), gross domestic investment as a percentage of GDP (GDIG), and labour force participation rates (LFP) and labour productivity (LP). Further, due to ground breaking work by Leontief in the 1950s, the distinction between skilled labour and unskilled labour is often raised. Many other researchers have followed this distinction in their studies of trade patterns. We believe that the availability of skilled labour is a major factor attracting FDI and include a variable measuring the availability of skilled labour (SKL) in the model.

Research and development intensity is used in our study as a proxy for country's technological capacity. Clegg (1987) found that research and development intensity to be positively and significantly correlated to FDI in the UK, Japan and West Germany, insignificantly in the US and significantly and negatively in Sweden. The measure he used was research and development expenditures divided by domestic industrial production to act as a proxy for degree of innovation and creation of technological ownership advantages. Following Papanastassiou & Pearce (1990), we use a measure of scientist and engineers in total employment (RND) as an indicator of a country's technological capacity. Our choice is entirely guided by the availability of data.

Following Tsai (1994), we include gross domestic savings as a proportion of GDP (GDSG) in the model to represent the availability of investment capital. A high value for such a variable may indicate that overseas investment is promoted as a vent for surplus capital, while a very low value could indicate poorly formed capital markets which may discourage investment which uses domestic capital markets. Since

MNCs can often raise capital from other sources, it seems the first effect is likely to be the most important.

### **Incentives and Disincentives to FDI ( $Z_j$ ).**

The incentives and disincentives offered by the host and home governments add a dimension of risk and uncertainty to the flows of FDI [Walter (1982), Dunning (1988)]. A country may offer incentives such as tax holidays, tax concessions or exemptions and concessionary credit etc. which can affect investment location decisions. Disincentives include internal and external taxes. We include a measure of indirect taxes as a percentage of GDP (ITAXG) as an indicator for disincentives to inward FDI.

Closely related to the idea of incentives and disincentives is the consideration of favourable economic environment for FDI. Firstly, in order to represent the openness of a country, an index of protectionism (PR) was included in the model. Secondly, the incentives for FDI are likely to be greater if the country concerned has a substantial amount of external debt (EDEBT). Finally, the political stability of the country must also be considered. The political stability of a nation can undoubtedly effect investment decisions (Walter, 1982). This is despite the fact that countries like the US have established guarantees for its firms from losses incurred because of nationalisation of their assets overseas. It is highly unlikely that such guarantees would meet all costs associated costs such as the lose of market power, lose of exclusive control over technology and brand name, etc. The political stability in our model is represented by an index of a stable and well-adapted political system (PS).

### **Impact of Environmental Regulations ( $E_j$ )**

In terms of the integrated approach mentioned above, laxer environmental regulations and standards may be considered as a locational-specific advantage in relocating FDI in environmentally poor countries. In our model five environmental variables have been used to examine the impact of environmental stringency on the location of FDI . First, the variable ENV51 measures the amount of CO<sub>2</sub> emissions

per \$1 of output. It is assumed that the higher the ENVS1 value the less is the degree of stringency of environmental regulations. The major limitation of ENVS1 is that it reflects not only environmental stringency but also the energy intensity of production. Second, the variable ENVS2 represents the number of international environmental agreements ratified by a country. More ratifications implies greater environmental concerns of the country under investigation, which is taken as a proxy for the stringency of environmental regulations. However, this is a less perfect measure of environmental stringency due to the influence of scale effects and the distinction between ratification and enforcement of the terms of the agreement. It could be argued, for example, that Brazil has ratified a great number of international environmental agreements (12 in all) due to its large country status in world politics, but that Brazil's enforcement of such agreements is still weak. Third, we include the variable ENVS3 which indicates whether the environmental regulatory system is sufficiently adaptive for a company to maintain its competitiveness under current environmental commitments. This may be a crude measure of compliance costs associated with environmental standards in different countries. However, it should be noted that this says little of the stringency of environmental regulations and if these regulations achieve their environmental objectives. Two final measures are ENVS4 (emissions of greenhouse gasses divided by GDP) and ENVS5 (emissions of CFC gases divided by GDP).

#### **4. Estimation and Results**

The pollution haven hypothesis is tested using two samples of countries. This is because we had to obtain data from two different sources. One source is the World Bank data base from which the data for the large sample is obtained. The second source is the World Competitiveness Report which provides data for only for a small number of countries. For the large sample of countries certain variables, for which complete data is not available, have been omitted while the regression for

the small sample include these additional variables. The hypothesis is also tested in two sub-samples for developing countries and industrialised countries.

In terms of the theoretical hypotheses described in the preceding section, we adopted the following specifications for examining the role of environmental stringency in determining the flows of FDI. The equation estimated on the large sample is:

#### Equation 1

$$FDI = f (GDPPC, EXG, MGR, LANDPC, GDIG, LFP, RND, EDEBT, GDSG, ITAXG, ENVS)$$

$$+ \quad + \quad + \quad + \quad ? \quad ? \quad + \quad + \quad - \quad - \quad ?$$

The expected signs derived from the theory are given below each explanatory variable. For our small sample we adopted the following specification.

#### Equation 2

$$FDI = f (GDPGR, EXG, GDIG, SKL, RND, GDSG, PR, PS, LP, ENVS)$$

$$+ \quad + \quad ? \quad + \quad + \quad - \quad ? \quad + \quad ? \quad ?$$

where,

FDI = inward foreign direct investment

GDPPC = GDP per capita

EXG = export growth

MGR = import growth

LANDPC = per capita land

GDIG = gross domestic investment

LFP = labour force participation

RND = research and development

EDEBT = external debt

GDSG = gross domestic savings

ITAXG = indirect domestic taxes

ENVS = proxies of environmental stringency

SKL = skilled labour

PR = index protectionism  
PS = index political stability  
LP = labour productivity

To substantiate the validity or otherwise of the pollution haven hypothesis various cross country regressions were run for the year 1994. The number of countries in the sample varied depending on the availability of data, with the largest sample of 89 countries. The measurement and the sources of data are given in appendix A. Each regression began with a null hypothesis which included all the vectors except for the environmental vector ( $E_j$ ). From here we tested the significance of each variable in each vector. If variables proved consistently insignificant they were dropped from subsequent regressions. Having established the major determinants of FDI flows, we added the environmental variables.

The results of the regressions on inward FDI for the large sample are presented in table 1. The standard tests were conducted to test for functional form (Ramsey's RESET test), heteroskedasticity (White test) and multi-collinearity and our results were found to be free from such problems. With regard to functional form, we have tested linear, log linear and semi-log linear and we found that the linear form gave the best results. RESET test produced F ratios less than 1 in all reported equations indicating that the results are free from functional form mis-specifications.

The results of particular interest are those for regression 2 and 3 where alternative measures of environmental stringency are used. The statistically significant and negative coefficient of ENV51 in regression 2 tend to refute the pollution haven hypothesis. The coefficient of the alternative environmental stringency variable ENV52 is insignificant in regression 3. These results are further supported by the variable addition tests (F and chi-square) conducted using various environmental proxies which show that environmental standards have no statistically significant effect on inward FDI.

Using the same data from which we estimated the regression results of table 1, we re-ran the regressions distinguishing between developed countries (20

observations) and less developed countries (69 observations). Table 2 presents the results of these regressions. We can immediately observe that each set have some common but also some dissimilar significant variables. In some instances variables which proved insignificant in combined regressions are now proving significant, e.g., EDEBTG in the regressions for developed countries. The results of alternative environmental measures indicate that the pollution haven hypothesis has no substance for countries at a similar level of economic development. In both groups of countries, the other factors such as export growth and technological capacity are much more important than environmental factors in investment decisions.

To further test this speculation we ran a regression on a smaller sample of countries including a number of additional variables for which we did not have complete data for across a large sample. The results are given in Table 3. Again the statistically insignificant coefficients of ENV3, ENV4 and ENV5 indicate that environmental regulations are unimportant in explaining inward FDI.

**Table 1: Inward FDI, 89 Countries, 1994 (Large sample)**

Variables/ Regressions	(1)	(2)	(3)
C	0.0100 (1.7371) <sup>b</sup>	0.0300 (3.4422) <sup>a</sup>	0.0300 (3.0229) <sup>a</sup>
GDPPC	0.0500 (1.8442) <sup>b</sup>	0.0400 (1.9636) <sup>b</sup>	0.0400 (1.8831) <sup>b</sup>
LFP	—	0.0700 (3.6504) <sup>a</sup>	0.0700 (3.7762) <sup>a</sup>
GDSG	0.0100 (1.3992) <sup>c</sup>	0.0200 (1.7645) <sup>b</sup>	0.0200 (1.5654) <sup>c</sup>
LANDPC	0.0007 (3.1266) <sup>a</sup>	0.0006 (2.9431) <sup>a</sup>	0.0006 (3.0227) <sup>a</sup>
EXG	0.0700 (6.6419) <sup>a</sup>	0.0800 (7.5541) <sup>a</sup>	0.0800 (7.0682) <sup>a</sup>
EDEBTG	-0.0004 (-0.1573)	—	—
MGR	-0.0100 (-0.8312)	—	—
ITAXG	-0.0050 (-0.1107)	—	—
GDIG	0.0020 (1.0783)	0.0006 (0.6208)	0.0006 (0.6658)
RND	0.1000 (1.7582) <sup>b</sup>	0.0600 (1.4187) <sup>b</sup>	0.0600 (1.2581)
ENVS1	—	-3.0000 (-1.3101) <sup>c</sup>	—
ENVS2	—	—	00000 (0.0285)
R <sup>2</sup>	0.4912	0.5395	0.5296

Notes: t-ratios are given in parentheses, the significance levels are: a=1%, b=5%, and c=10%.

**Table 2: Inward FDI, developed and less developed countries, 1994**

Variables/ Regressions	Developed Countries		Less Developed Countries	
	(4)	(5)	(6)	(7)
C	0.0300 (1.4852) <sup>c</sup>	0.0500 (1.6021) <sup>c</sup>	0.0400 (5.6567) <sup>a</sup>	0.0400 (4.5757) <sup>a</sup>
GDPPC	—	—	0.0400 (1.7970) <sup>b</sup>	0.0400 (1.8345) <sup>b</sup>
LFP	0.0700 (1.6515) <sup>c</sup>	0.0800 (1.8460) <sup>b</sup>	0.0700 (3.7725) <sup>a</sup>	0.0700 (3.8748) <sup>a</sup>
LANDPC	—	—	0.0010 (4.7452) <sup>a</sup>	0.0010 (4.8589) <sup>a</sup>
EXG	0.0500 (3.3246) <sup>a</sup>	0.0500 (3.0987) <sup>a</sup>	0.0900 (7.6183) <sup>a</sup>	0.0900 (7.3756) <sup>a</sup>
RND	0.1000 (-3.0909) <sup>a</sup>	0.1000 (-2.9033) <sup>a</sup>	0.1000 (-1.3436) <sup>c</sup>	0.1000 (-1.4364) <sup>c</sup>
EDEBT	0.0020 (1.4658) <sup>c</sup>	0.0020 (1.1975)	—	—
ENVS1	0.00001 (0.8928)	—	-0.4 (-0.1604)	—
ENVS2	—	0.0000 (0.0283)	—	-0.0002 (-0.3477)
R <sup>2</sup>	0.6345	0.6138	0.6325	0.6330

Notes: t-ratios are given in parentheses, the significance levels are: a=1%, b=5%, and c=10%.



**Table 3: Inward FDI, 36 Countries, 1994 (small sample)**

Variables/ Regressions	(8)	(9)	(10)
C	0.0100 (0.4422)	0.0100 (0.6414)	-0.0080 (-0.4222)
GDPPC	0.0500 (1.5853) <sup>c</sup>	0.0600 (1.8018) <sup>b</sup>	0.0700 (1.9932) <sup>b</sup>
GDSG	-0.2000 (-2.8440) <sup>a</sup>	-0.2000 (-3.0160) <sup>a</sup>	-0.2000 (-3.1525) <sup>a</sup>
EXG	0.1000 (9.6683) <sup>a</sup>	0.1000 (9.9162) <sup>a</sup>	0.1000 (10.1624) <sup>a</sup>
GDIG	0.1000 (1.9683) <sup>b</sup>	0.1000 (2.2120) <sup>b</sup>	0.1000 (2.2515) <sup>b</sup>
RND	0.0020 (0.4176)	0.0020 (0.3816)	0.0030 (0.5749)
PR	-0.0003 (-0.0842)	-0.0006 (-0.2345)	0.0008 (0.3159)
PS	0.0040 (1.6824) <sup>c</sup>	0.0040 (1.6780) <sup>c</sup>	0.0030 (1.4998) <sup>c</sup>
SKL	0.0040 (1.3411) <sup>c</sup>	0.0030 (1.1718)	0.0030 (1.3810) <sup>c</sup>
LP	-0.0002 (-0.4942)	-0.0002 (-0.6086)	0.0000 (0.1922)
ENVS3	-0.002 (-0.4457)	—	—
ENVS4	—	-0.0002 (-1.0526)	—
ENVS5	—	—	8.0000 (1.2095)
R <sup>2</sup>	0.8642	0.8689	0.8719

Notes: t-ratios are given in parentheses, the significance levels are: a=1%, b=5%, and c=10%.

## 5. Conclusions

In this study we tested the pollution haven hypothesis which is based on the notion that differing environmental standards significantly influence the location of FDI. The investigation has been carried out using an integrated theoretical approach on a sample of 89 countries. We have looked at the determinants of inward flows of FDI. We created the distinction between less developed countries and industrialized countries to test the validity of the hypothesis within each group.

Our results run against the hypothesis being tested. A variety of proxies used to represent environmental stringency failed to obtain any significant results. The other factors such as labour force participation, availability of land, export growth and political stability appear to be much more important than environmental factors in decisions of locations.

Indeed, the implications of substantiating the pollution haven hypothesis, or failing to thoroughly disprove it, are profound. The pollution haven hypothesis taken on faith, as it currently is in some quarters, provides a rationale for harmonisation of world environmental standards, unilateral actions against trade, and/or the restriction of capital movements. Such actions have grave implications for the world's ecological environment, multilateral trading system and any particular country's prosperity.

## Appendix A: Measurements and Sources of Data

All financial figures converted to \$US. Source: World Tables 1994, World Bank, unless otherwise stated.

### ***Dependent variables:***

FDI A ratio of Inward FDI/GDP at market prices, Source: Balance of Payments Statistics Yearbook 1994, IMF.

### ***Independent variables:***

GDPPC GDP per capita at market prices, lagged by one period.

LFP Labour force participation as a percentage of the total population, lagged one period.

GDIG Gross domestic investment as a ratio of GDP, lagged one period.

LANDPC Land area (in hectares) per capita, lagged one period. Source; World Resources 1992-93, World Resources Institute.

EDEBT Total external debt as a ratio of GDP, lagged one period.

EXG Total exports as a ratio of GDP, lagged one period.

MGR Imports growth (annual), lagged one period.

ITAXG Indirect taxes as a ratio of GDP, lagged one period.

GDSG Gross domestic savings as a ratio of GDP, lagged one period.

RND Research and development potential (number of individuals) divided by the population, lagged on period. Source; ISCS.

ENVS1 CO<sub>2</sub> emissions divided by GDP, lagged one period. Source: World Resources 1994-95.

ENVS2 Number of multilateral environmental agreements ratified by each country (0-25). Source; UN Environmental Data Report 1993-94.

Data for the following variables which were used in the estimation of equations on the small sample were obtained from the World Competitiveness Report 1994, IMD, World Economic Forum. Refer to the World Competitiveness Report 1994 for further details.

PR An index of protectionism, sample countries are placed on a scale of 0 to 10, where zero implies foreign products and services are prevented from being imported.

PS Political stability measured in terms of an index of a stable and well adapted political system, scale used is 0 to 10, where zero implies the political system is not adapted to today's economic challenges.

SKL Index of availability of skilled labour, scale used is 0 to 10, where zero implies skilled labour is hard to get in the country.

LP Labour productivity (average) per hour in US dollars.

ENVS3 An index of how environmental regulations affects competitiveness, scale used is 0 to 10, where zero implies existing laws to protect the environment adversely affect corporate competitiveness.

ENVS4 Emissions of green house gases divided by GDP.

ENVS5 Emissions of CFC gases divided by GDP.

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