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ENVIRONMENTAL STRINGENCY, CORRUPTION AND FOREIGN DIRECT INVESTMENT (FDI): LESSONS FROM GLOBAL EVIDENCE

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ABSTRACT

Developing countries face a dilemma: to have either a stringent environmental policy that may lead to less foreign direct investment (FDI) or a less stringent environmental policy but more FDI through which economic growth may occur. Motivated by this paradox, it is necessary to examine the dynamic relationship between FDI, pollution control and corruption to suggest a mechanism that may be effective in combating the pollution haven effect. Using dynamic panel Generalised Method of Moments (GMM) estimation for 110 countries from 2005 to 2012, the findings suggest that the stringency in environmental control alone has had a negative effect on FDI, and at the same time, high levels of corruption have attracted FDI inflows. Interestingly, in contrast to previous findings, our results show that high stringency in environmental control coupled with low levels of corruption has attracted significantly more FDI inflows. In other words, ethical institutions could nullify the negative effect of stringency in pollution control to FDIs. This finding, besides its robustness to various environmental stringency measures, is a potential answer to the pollution haven effect for developing countries.

Keywords: FDI, pollution haven, corruption, economic growth, environmental stringency

INTRODUCTION

The pollution haven hypothesis or pollution haven effect is a phenomenon in which countries with less stringent environmental controls in place become a relocation destination for FDI due to relatively stringent environmental policy in other countries (Copeland & Taylor, 2004; Dean, Lovely, & Wang, 2009). Most previous research studies have failed to find strong evidence to support this hypothesis (Jaffe, Peterson, Portney, & Stavins, 1995), while recent research studies with better theoretical frameworks and estimation techniques confirmed the hypothesis (Becker & Henderson, 2000; Brunnermeier & Levinson, 2004; Levinson & Taylor, 2008; Mulatu, Gerlagh, Rigby, & Wossink, 2010)[1].

As awareness of environmental sustainability has gained stronger support from both policy makers and government agencies in developing countries in recent years, stringent environmental regulations and pollution controls have been enacted to better protect the environment as well as promote sustainable economic development (Kyoto Protocol and Cleaner Air Act 2011, among others). This noble move is not without a cost to host countries. It is because a stricter pollution control policy could mean a significant reduction in potential FDI inflows (Copeland & Taylor, 2004). Consequently, developing countries may resort to increasing their comparative advantage by adopting lower environmental standards to attract foreign investment (Zhu, He, & Liu, 2014). This is in fact a race to the bottom competition, which further degrades the environment at the expense of FDI inflows. Over the last decades, it has become evident that most developing countries have attracted huge amounts of FDI from pollution-intensive industries (Cole, Elliott, & Fredriksson, 2006).

The adverse effect will be more severe with high levels of corruption. Corrupt officials or entrusted authorities might abuse their power for their own interest in the enforcement of environmental regulations (Damania, 2002). The situation has worsened over the years to the extent that these countries have been regarded as pollution havens. Figure 1 clearly depicts the negative relationship between FDI and stringency level in developing countries. Unlike developing countries, developed countries experience a positive relationship between FDI and environmental stringency, (see Figure 2). In rectifying this unhealthy development, developing countries face a dilemma either to have a better control over the environment and less FDI or less control over the environment and more FDI, through which their economies may grow faster.

All theoretical foundations support the importance of honest (not corrupt) institutions or bureaucrats to attract FDI inflows for sustainable economic growth. Barassi and Zhou (2012) use parametric and non-parametric methods to reassess the findings on the relationship between FDI and corruption and they find robust evidence that host countries with lower corruption levels than the average of Corruption Perception Index would attract FDI stock higher than other host countries of the same percentile of the FDI stock. However, Barassi and Zhou (2012) and most existing studies of FDI-corruption seem to overlook the presence of environmental regulations. The effect of corruption might be substantive when explaining foreign investment in the presence of environmental regulations (Fredriksson, List, & Millimet, 2003; Kellenberg, 2009; Mudambi, Navarra, & Delios, 2013). Cole et al. (2006) recently examine the influence of environmental policy on the FDIs and find that high FDIs inflow to the stringent environmental policy countries only when they have significant levels of corruption.

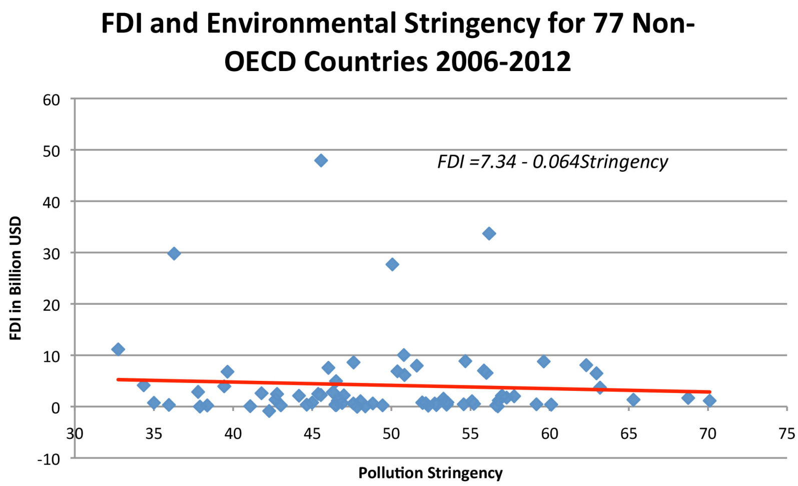

Figure 1. FDI and environmental stringency for 77 non-OECD countries

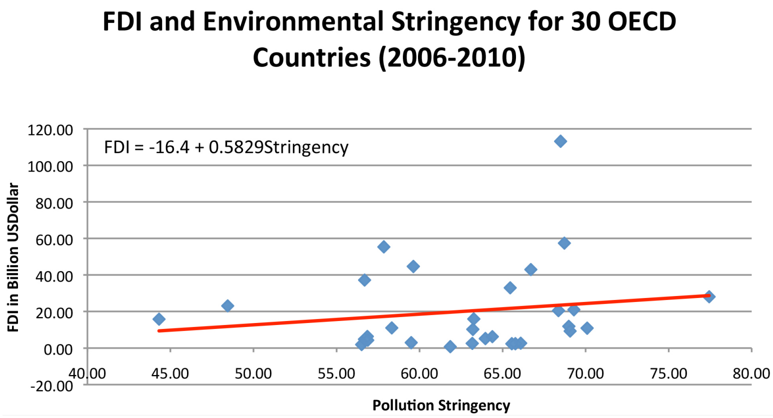

Figure 2. FDI and environmental stringency for 30 OECD countries

The purpose of this paper is to examine the existence of pollution haven effect in the presence of corruption across countries. Furthermore, this study attempts to provide an insight on how to attract more FDIs but at the same time maintain prudent control of their natural environment. This paper may help to reveal answers for mixed findings of the pollution haven and FDI-corruption nexus. In particular, we provide empirical evidence to demonstrate the positive effects of environmental regulations on FDI by having high quality institutions.

This paper contributes to the pollution haven literature in three ways. First, this study empirically supports the pollution haven hypothesis, but it is non-monotonic. The relationship between FDI and environmental stringency is non-linear and contingent to corruption level. Second, this study justifies the need for honest bureaucrats together with stringent environmental policies. A certain level of honesty must be achieved to avoid the pollution haven phenomenon. Third, this research relies upon dynamic panel method, which addresses the endogeneity problem of independent variables and country-specific effects on heterogeneous panels. Apart from being both efficient and non-bias, the estimated coefficient is statistically more reliable.

MODEL, METHODOLOGY AND DATA

Model Specification

Following Barassi and Zhou (2012), we estimate the following model by controlling for environmental stringency and corruption on FDI inflow. The model specification is as follows:

$$FDI_{i,t} = \alpha FDI_{i,t-1} + \beta_1 STR_{it} + \beta_2 COR_{it} + \beta_3 STR \times COR_{it} + \lambda X'_{it} + \eta_i + \varepsilon_{it} \tag{1}$$

where subscripts *i* and *t* denote country and year, respectively, *FDI* is FDI inflow of host country in billions of US dollars, *STR* is stringency of environmental regulations, *COR* is level of corruption that ranges from 1 to 10 with a higher value indicating less corruption. Here we can deduce that a low level of corruption also means a higher level of honesty or integrity, and *X* are controlled variables that influence FDI inflows, including openness, inflation, GDP growth, total population, financial development and infrastructure. The country-specific effect is represented by η, and β_1, β_2, β_3, λ, α will be estimated by the GMM estimator, and ε is the error term. The lagged dependent variable is taken into account as data on FDI inflows often exhibit persistent trends. We speculate that profit-maximising MNEs or investors respond homogeneously towards heterogeneity of environmental regulations. Therefore, the sign for β_1 should be negative, which means relatively stringent environmental regulations deter FDI whilst a lack of environmental regulations induces FDI. In other words, the pollution haven effect can be validated in this finding. Based on the findings of Egger and Winner (2005), we can confirm that the expected sign of β_2 is negative, which means corruption is a stimulus for FDI. The sign of the interaction term β_3 would contribute to the on-going debate particularly in the study of FDI and corruption. The parameter indicates how environmental stringency and corruption together behave toward FDI. The long run effects can be derived by dividing each of the β_i by $(1-\alpha)$, the coefficient of the lagged dependent variable.

Dynamic Panel GMM Estimation

Potential endogeneity of independent variables, inclusion of the lagged dependent variable and the presence of the country-specific effects have made it impossible for us to estimate using panel estimation models such as pooled OLS or fixed and random effect. Problems aforementioned would bring Nickell (1981) bias if we used the panel data estimation. The generalised method of moment (GMM) estimation proposed by Arellano and Bond (1991) has the capability to eliminate these problems. The GMM method can tackle the country-specific effects by taking the first differences of equation (1). However, the data set has missing values for some explanatory variables and will subsequently bring difficulties in the transformed data (Roodman, 2009). Therefore, the forward orthogonal deviation transformation procedure proposed by Arellano and Bover (1995) is used to wipe out the country-specific effects. However, new bias appears to have resulted from forward orthogonal deviation, which is correlation between a lagged dependent variable and the error terms. Arellano and Bond (1991) and Arellano and Bover (1995) suggest that the lagged levels, lagged two or more periods should be used as instruments for the difference, lagged dependent variables and other endogenous variables. This method can be referred to as either one-step or two-step difference GMM.

Alonso-Borrego and Arellano (1999) and Blundell and Bond (1998) show that if the lagged dependent variable and independent variables follow a random walk or are persistent over time, the lagged levels of these variables are poor instruments for the regression equation in differences. Arellano and Bover (1995) suggest a system GMM estimator to reduce the biases and imprecision produced by a different estimator by estimating the different equation and the level equation as a system. In the system estimation, the instruments for the regression in levels are the lagged first-differenced variables. We adopt the two-step system GMM in this study because the two-step GMM is more favoured than the one-step GMM in estimating the coefficient with lower bias and standard errors (Windmeijer, 2005).

The consistency, efficiency and lack of bias of the GMM estimator is contingent on three specification tests, namely the Hansen or Sargan test for over-identifying restrictions, the serial correlation test for disturbances, and the difference in Hansen test for extra moment's conditions (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998). The Hansen or Sargan test is based on the overall validity of the instruments and is conducted by analysing the sample analogue of the moment conditions used in the estimation process. Failure to reject the null hypothesis of the Hansen or Sargan test would indicate that the instruments employed are valid. The serial correlation test is conducted to diagnose the presence of second order autocorrelation in the different equation. Failure to reject the null hypotheses of the difference in Hansen test would give support to the validity of additional moment conditions. These three specification tests are considered in this paper. Failure to reject the null hypotheses of these three specification tests would confirm that all the instruments used are valid and the GMM results are well specified.

Table 1
Descriptive statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
FDI inflows (USbill)	10.46	22.66	–28.26	196.39
Environmental Performance Index (EPI)	53.47	9.58	32.54	77.99
WEF's stringency of environmental regulation	4.16	1.10	2.00	6.70
Corruption Perception Index (CPI)	4.44	2.23	1.40	9.60
Control of Corruption, Kaufmann et al. (2010)	2.62	1.05	1.02	5.05
GDP growth	3.89	4.99	–17.95	34.50
Inflation, consumer prices	6.11	5.16	–4.86	44.39
Private sector credit (% of GDP)	96.89	683.39	6.03	15788.26
Total population (per 1000 people)	50446.36	168726.40	214.65	1337705.00
Openness ((Export + Import)/GDP)	92.42	51.45	22.12	444.10
Telephone lines (per 100 people)	22.96	18.13	0.29	67.24

Note: List of countries used in the analysis; Angola, Finland, Luxembourg, Senegal, Argentina, France, Macedonia, Serbia, Armenia, Gabon, Malaysia, Singapore, Australia, Georgia, Malta, Slovak, Republic Austria, Germany, Mexico, Slovenia, Azerbaijan, Ghana, Moldova, South Africa, Belarus, Greece, Mongolia, Spain, Belgium, Guatemala, Morocco, Sri Lanka, Bolivia, Haiti, Mozambique, Sudan, Botswana, Honduras, Namibia, Sweden, Brazil, Hungary, Nepal, Switzerland, Bulgaria, Iceland, Netherlands, Syria, Cameroon, India, New Zealand, Tajikistan, Canada, Indonesia, Nicaragua, Tanzania, China, Iran, Nigeria, Thailand, Colombia, Ireland, Norway, Togo, Costa Rica, Italy, Oman, Trinidad and Tobago, Cote d'Ivoire, Jamaica, Pakistan, Tunisia, Croatia, Japan, Panama, Turkey, Cyprus, Jordan, Paraguay, Ukraine, Czech Republic, Kazakhstan, Peru, United Arab Emirates, Denmark, Kenya, Philippines, United Kingdom, Ecuador, Korea Rep., Poland, Uruguay, Egypt, Kuwait, Portugal, Vietnam, El Salvador, Kyrgyz Republic, Qatar, Yemen, Eritrea, Latvia, Romania, Zambia, Estonia, Libya, Russia, Ethiopia, Lithuania, and Saudi Arabia

Data

The model uses unbalanced panel data from 110 developed and developing countries for the period of 2005 to 2012, (see full list of countries in Table 1). FDI inflow data are expressed as FDI inflows billions of dollars and is available from the UNCTAD. The Environmental Performance Index (EPI) obtained from

Yale University is used as a proxy for stringency of environmental regulations. We verified the robustness of our results by substituting EPI data with data from the World Economic Forum's (WEF) Executive Opinion Survey. The WEF's stringency of environmental regulation index has been widely used to measure stringency of environmental regulations in recent studies (e.g., Kalamova & Johnstone, 2011). The corruption perception index (CPI) was obtained from Transparency International to measure the level of corruption in host countries. The index was scaled from 0 to 10, where a higher score indicated a higher level of honesty. An alternative to the index, Control of Corruption, was obtained from the World Governance Indicator (Kaufmann, Kraay, & Mastruzzi, 2010). The index was rescaled by adding 2.5 to the original data, which were scaled from 0 to 5, in which a higher value indicated a higher level of honesty. Hence, in this paper, a negative coefficient for COR means a high level of corruption induces FDI. The remaining controlled variables were obtained from the World Development Indicators (WDI). Table 1 reports the descriptive statistics of the data used in the study.

RESULTS

Table 2 shows the result of the GMM estimates of the baseline model (Model 1) and the subsequent models (Model 2 to Model 7) used in the analysis. Based on the three specification tests conducted, the GMM estimators are unbiased, consistent and efficient. The sign for environmental regulatory stringency supports the pollution haven effect in which the presence of stringent environmental regulations is found to have negative impact on the FDI. Model 1 to Model 4 from Table 2 show the full sample analysis, which suggests that a one-point increase in stringency measured by EPI is related to the decrease in FDI inflows by approximately 0.243 to 0.700 in short run and 0.402 to 1.118 in long run. The result is consistent for OECD and non-OECD countries that show a negative relationship between environmental stringency and FDI. The result supports the pollution haven hypothesis as in Kalamova and Johnstone (2011).

The study also reveals that corruption is negatively significant to FDI. The result implies that high levels of corruption attract more FDI. This result is not surprising because many investors try to cut the red tape or bureaucracy with corruption in developing countries. This result also implies that honesty (antonym of corruption) has a negative effect on FDI and is consistent with the results of Egger and Winner (2005), who showed that corruption can be a "helping hand" for FDI inflow.

Table 2
Dynamic panel estimate for FDI, stringency and corruption 2005–2012

	Full sample				Non-OECD		OECD
Model	1	2	3	4	5	6	7
Interaction	EPI*TI	WEF*TI	EPI*Kauf.	WEF*Kauf.	EPI*Kauf.	EPI*TI	EPI*TI
FDI(-1)	0.374*** (0.003)	0.211*** (0.031)	0.396*** (0.003)	0.116*** (0.030)	0.809*** (0.004)	0.723*** (0.008)	–0.037 (0.031)
FIN	0.055*** (0.003)	0.137** (0.053)	0.081*** (0.003)	0.098*** (0.032)	0.012*** (0.004)	0.028*** (0.002)	–0.620*** (0.115)
GDPGROWTH	0.407*** (0.013)	0.522*** (0.172)	0.406*** (0.008)	0.452*** (0.113)	0.282*** (0.014)	0.267*** (0.019)	0.138 (0.233)
INFLATION	–0.050*** (0.010)	0.000 (0.059)	-0.026** (0.016)	–0.035 (0.060)	–0.107*** (0.013)	–0.003*** (0.010)	–1.102*** (0.210)
LNOPEN	2.238*** (0.415)	–1.942 (5.667)	2.044*** (0.403)	0.303 (3.529)	9.673*** (0.573)	4.335 (0.595)	–6.755 (16.896)
LNPOP	4.063*** (0.144)	4.927*** (1.173)	3.850*** (1.313)	5.788*** (0.995)	3.818*** (0.095)	2.082*** (0.243)	–117.576 (160.376)
STRICT (EPI)	–0.700*** (0.049)		–0.243*** (0.056)		–0.211** (0.085)	–0.273 (0.065)	–24.191** (5.703)
STRICT (WEF)		–9.615*** (4.632)		–4.574 (4.472)			
COR (TI)	–4.267*** (0.537)	–11.837** (4.213)				–4.350** (0.690)	–69.037 (34.591)
COR (Kaufmann et al.)			1.077 (0.774)	–17.440** (7.693)	–4.707** (1.054)		
STRXCOR	0.119*** (0.009)	2.548*** (0.790)	0.039*** (0.014)	3.398** (1.555)	0.106*** (0.039)	0.096*** (0.014)	3.544* (1.978)
CONSTANT	–20.148 (4.251)	0.110** (30.659)	–41.510*** (4.607)	–29.738 (24.966)	–69.163*** (5.701)	–27.685 (6.795)	
No. of instruments	91	39	91	44	66	41	29
Obs per group (avr)	3.74	2.85	3.76	2.86	3.71	2.81	2.87
AR(2) (*p*-value)	0.148		0.147		0.836		0.547
Hansen (*p*-value)	0.45	0.14	0.29	0.13	0.18	0.55	0.62
Observations	400	285	402	286	286	284	86
Number of countries	107	100	107	100	77	77	30

Thus far, the results of this study are not in favour of stringent policy control. The situation is worsening with corrupt bureaucrats. Surprisingly, the effect of an interaction term between environmental stringency and corruption (STR × COR) is positive and significant. This implies that environmental stringency and honesty (inverse of corruption) cannot be analysed independently. Stringent environmental control policy should be combined with integrated law enforcement and honest bureaucrats; in other words, good policy needs to be enforced by honest bureaucrats to have a positive impact on FDI. Another interesting finding from the analysis is that the positive coefficient of β_3 from the partial derivative of Equation 1 $\left(\frac{dFDI_{it}}{dSTR_{it}} \text{ and } \frac{dFDI_{it}}{dCOR_{it}}\right)$ can be interpreted as the threshold level that could nullify the negative effects of environmental stringency and corruption on FDI. Setting $\left(\frac{dFDI_{it}}{dSTR_{it}}\right)$ to 0 will provide the honesty threshold level. For instance for model 2, the threshold level is $\left(\frac{\beta_1}{\beta_3}\right)$, which is $\left(\frac{9.615}{2.548}\right)$ or 3.7735 level of honesty. For Model 1 and 3, the threshold levels are 5.8 and 6.2, respectively. At any point above this threshold level, stringency in environmental policy will no longer have a negative impact on FDI. This interesting finding can be an answer to the on-going debate of the impact of FDI on both environmental regulation and corruption. This corruption's threshold value seemed to be somewhat complementary to the findings of Barassi and Zhou (2012), who found that a less corrupt country would encourage more FDI stock than a more corrupt country if they share the same percentile in the FDI stock cumulative distribution. The positive coefficients of the interaction term are consistent with the results of Kirkpatrick and Shimamoto (2008) and imply that transparency, consistency, and accountability in the regulatory environment can provide perception of a safer investment climate and subsequently gain investor confidence towards host countries, hence encouraging FDI. Our results contradict the findings of Kheder and Zugravu (2012) who declare that investors favour countries with relatively weak environmental regulations regardless of the corruption level of host countries. It is noteworthy that Kheder and Zugravu (2012) do not consider the interaction between environmental stringency and corruption.

The estimation result with respect to sign and magnitude of the estimated coefficient are consistent for OECD and non-OECD countries as shown in Table 2. The result is robust for different environmental stringency measures used, i.e., either EPI or WEF and for various corruption indicators such as corruption perception index or the worldwide governance indicators by Kaufmann et al. (2010). The findings strongly support the conjecture that pollution haven occurs in a strict environmental regulations economy but with corrupt institutions. The phenomenon of the "helping hand" is also supported by these results because high levels of corruption promote FDI as discussed in Egger and Winner (2005). Interestingly, the significant and positive coefficient of the interaction term between stringency and corruption for all models provides consistently robust evidence on the effect contingent upon FDI under different corruption threshold levels.

CONCLUSION

The purpose of this study is to empirically assess the role of corruption and stringency of environmental regulations on FDI inflows in 110 developed and developing countries within the period of 2005 to 2012. Dynamic panel GMM techniques are employed to control for potential endogeneity of independent variables and country-specific effects.

There are several major findings in this paper. First, using different proxies for environmental pollution stringency, the findings are consistent with the previous findings that support pollution haven hypothesis, i.e., the idea that pollution leniency policy attracts more FDI. Second, stringent environmental policy alone will discourage FDI inflows. Third, if an economy wants to continuously enjoy FDI inflows and at the same time protect the environment, institutional development that promotes honesty, ethics, and trustworthiness is a crucial prerequisite. Finally, the study suggests that a certain level of honesty must be established so that all countries are not necessarily engaging in the race to the bottom competition.

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NOTE

1. In contrast to the pollution haven hypothesis, the "Porter Hypothesis" argues that complying with environmental regulation is not a choice. It is because new and greener technology is always cost efficient in the long run and therefore the benefit will offset the extra cost incurred to comply with environmental regulation (Porter & van der Linde 1995; Hamamoto, 2006; Kumar & Managi, 2009, among others).

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