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Relationship between FDI and Environment: Evidence from Emerging Countries

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This paper uses generalized method of moments (GMM) panel estimator, proposed by Arellano-Bond and Blundell-Bond**,** to examine the relationship between FDI and environment for the period of 2000-2010 for a sample of 16 emerging countries. The effect of financial development, institutional quality and macroeconomic policy related variables are controlled for from the macroeconomic literature. The OLS based regression results reveal that environmental quality is not significant in explaining FDI inflows in emerging countries. However, based on dynamic panel data analysis, environmental quality is significant in explaining FDI. Using a number of controls it is found that stock market capitalisation to GDP, gross saving to GDP, gross capital stock to GDP, market size , and economic freedom (institutional quality) exercised by the host countries are important determinants in FDI inflows. However, the influence of such determinants is mixed in direction and magnitude at different significance levels. Thus, climate change and its mitigation strategy and overall environment policy have important implications for attracting FDI in the countries in question. In addition, the results highlight the role of institutional quality and financial development in attracting FDI.

Keywords: FDI, Environment, Dynamic Panel Data Model
JEL Classifications: G34, C01, F4, F62

I. INTRODUCTION

Since the global financial crisis of 2007-08, net capital flows experienced downward trends in emerging countries (Bems 2016). Several factors, for example, institutional quality, financial development and policy related variables, are considered to be the cause of this imbalance naively, and are widely studied in the literature. However, in the face of global climate change and rise in the natural calamities and disasters, studies on the role of environment and growth

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have gained popularity. Motivated by this, we hypothesize that environment affects *the* FDI flows to emerging countries. The study attempts to investigate the determinants of FDI inflows in emerging countries by focusing particularly on the environment.

In the literature, a wide range of variables are investigated as potential determinants of FDI. Attempts towards the investigation of FDI determinants include both theoretical and empirical papers. With most of the empirical papers involving time series or panel data analysis.[1] In a classical paper, Lucas (1988) tried to explain the underlying causes of capital not flowing from rich to poor countries,[2] which is also known as the "Lucas Paradox." In an empirical investigation of "Lucas Paradox," Alfaro *et al.* (2003) find that institutional quality is the most important variable explaining the "Lucas paradox" using cross-country data from 1971 to 1998. In a world of perfect capital mobility, there is little or no relation between domestic savings and investment (Feldstein-Horioka1980). This is so, because investors will invest where they get higher returns. The puzzle is that they find high correlations between domestic investment and savings in industrialised countries where markets are considered free and uncontrolled (also known as Feldstein-Horioka puzzle). Using data of 41 developing countries on 44 economic, social, political and policy related variables, Root and Ahmed (1978) find that only the corporate tax level is important to attract FDI in manufacturing industry. The literature on FDI determinants is largely inconclusive, both theoretically and empirically. The present study contributes to the literature by empirically investigating the FDI-environment relationship in emerging countries.

The determinants of FDI are usually examined both in microeconomic and macroeconomic settings. This paper uses macro-related panel data for a number of advantages. First, a large data set often provides more variability and less collinearity compared to cross-section or time series data. Panel data provides reliable estimates and less restrictive assumptions, and help in modeling complex dynamic macroeconomic behaviour. However, potential bias and inconsistency may arise due to endogeneity (which arises from measurement errors, simultaneity and omitted variables), and unobservable individual country specific

[1] Assuncao *et al.* (2011) surveyed a large list of theoretical and empirical papers on the determinants of FDI. See also Blonigen (2005) for survey on literature on empirical studies of FDI determinants.

[2] Neoclassical theory patronises such flows from rich to poor countries.

effects. Thus, a dynamic panel data regression is essential. Second, this paper uses generalized method of moments (GMM) panel estimator, proposed by Arellano and Bond 1991, Arellano and Bover 1995, Blundell and Bond 1998) to reassess the relationship between FDI and environment. The GMM panel estimator accounts for unobserved country-specific effects (solves its correlation with error terms), removes endogeneity and serial auto-correlation and uses lagged dependent variables as instruments. The original Arellano Bond estimator is called "difference GMM," whereas the augmented one is called "system GMM." As GMM estimators, the Arellano-Bond estimators have one and two-step variants. The one-step estimation assumes the error term to be independent and homoscedastic across countries and over time, whereas the two step estimators relax the assumptions of independence and homoscedasticity by using the residuals obtained from the first step estimation to construct a consistent estimate of the variance-covariance matrix. Thus, when the error term is heteroskedastic, the two-step estimator is more asymptotically efficient. Though more efficient, the two-step estimates of the standard errors tend to be downward biased. An acceptable investigation is built on a theoretical approach which finds the research issues to be solved economically or theoretically. This paper proposes an empirical model for FDI determinants that is more likely to be econometrically acceptable.

We choose 16 emerging countries, classified by FTSE[3] and MSCI,[4] excluding Pakistan, Greece, Korea and Qatar. The economic explanation behind exclusion of Pakistan and Greece is political and economic crisis they are facing, which may cause structural breaks in the data and bias the results. However, for Qatar, the assumption is that its economy is different from other emerging countries. Meanwhile, Korea is not a common country in these two lists. The emerging countries in our sample include Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Mexico, Peru, Philippines, Poland, Russia, Thailand and Turkey. We use data for 2000-2010 in order to meet dynamic panel data model requirement of small T and large N. In this case, T stands for time in years, and N stands for number of countries.

[3]The country list as per FTSE can be accessed here (date of authors recent access, June 29, 2017): http://www.ftse.com/products/downloads/ftse-country-classification-update_latest.pdf

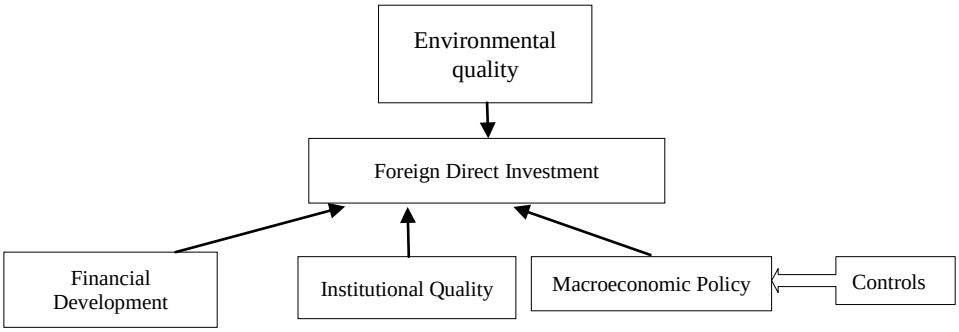
[4]The country list as per MSCI can be accessed here (date of authors recent access, June 29, 2017): https://www.msci.com/market-classification

The study is important for a number of reasons. First, subsequent to global financial crisis of 2007-08, FDI flows reduced to a great extent across developed and developing countries. The study aims to scrutinise the underlying cause of FDI inflows. It may also help to improve strategies to increase FDI and growth by exposing key factors that attract FDI (see Borensztein, Gregorio and Lee 1998, Li and Liu 2005), particularly in high growth-oriented emerging economies. However, Aluguacil, Cuaros and Orts (2011) suggest that improving overall investment climate, with better macroeconomic and institutional conditions, is more important to generate growth, rather than providing incentives only to foreign investors.

The study contributes to the literature in a number of ways. First, the study controls for (along with environment) macroeconomic variables that are vital to explain FDI into emerging economies. Second, the study uses a novel dataset of macroeconomic variables to explain FDI inflows into the emerging countries. Third, the econometric method used in this study is appropriate for studying dynamic relationships between FDI and environment. Furthermore, appropriate diagnostic tests are conducted to examine the efficiency of the Model and its parameters.

Busse and Hefeker (2005) find significant results for stability-oriented variables such as government stability, low internal conflict and ethnic tensions, basic democratic rights, and strong law and order for 83 developing countries over the period 1984-2003. Schnieder and Frey (1982) find political instability significantly reduces FDI for 80 less developed countries. In the present study, we have made a proposition that environment quality determines FDI in emerging countries. In addition, institutional quality, level of financial development and macroeconomic policy (such as tax policy, interest rate policy and associated uncertainty) are the control variables in the regression of FDI-environment. Figure 1 presents this proposition.

Figure 1: Macroeconomic Model of FDI



Note: The Model is simple and limited abstraction.
Source: Authors.

II. THE EMPIRICAL MODEL

The paper uses log of value of FDI inflow as the dependent variable. In order to ensure that the endogenous variable is stationary and to control for the size of the target country, log of FDI has been used. OLS regression will be conducted based on the following Eq.1 and Eq. 2

$$\text{LFDI}_{it} = \text{a} + \beta\text{LEPI}_{it} + \varepsilon \quad (1)$$

where a is intercept, LFDI is log of FDI, LEPI is log of environmental performance index, and ε is error term, for country i at time t.

There may be omitted variable bias in Eq. 1 . For this reason, controls related to institutional quality, financial development and policy related variables widely used in macroeconomic literature are used in Eq. 2 .

$$\text{LFDI}_{it} = \text{a} + \beta\text{LEPI}_{it} + \text{Controls} + \varepsilon \quad (2)$$

where a is intercept, LEPI is log of environmental performance index, and ε is error term. Controls include variables related to institutional quality, financial development and macroeconomic policy related variables.

No lagged dependent variable has been used in Eq. 1 and Eq. 2 . In this connection, to address and take care of endogeneity (from simultaneity, measurement errors), dynamic panel Model is specified and given as follows:

$$y_{it} = \gamma y_{i,t-1} + \beta x_{it} + \varepsilon_{it} \quad (3)$$

where it is assumed that ε_{it} are $\text{IID}(0, \sigma^2)$ identically and independently distributed error terms, dependent variable y_{it} is FDI inflow, $y_{i,t-1}$ is a lagged dependent variable, x'_{it} is KX1 matrix of explanatory variables (K total number of explanatory variables) and $\beta = \beta_1\beta_2\ldots\beta_k$ is vector of all coefficients of

independent variables. Thus, all the coefficients $\beta_1\beta_2 \ldots\beta_k$ represent short-run effects. The long-run effect can be derived by dividing each of betas by 1-γ.

The empirical specification of the Model is, thus, as follows:

$$\mathrm{LFDI}_{it} = \alpha + \gamma\,\mathrm{LFDIIN}_{i,t-1} + \beta_1\mathrm{LMNWAGE}_{it} + \beta_2\mathrm{LCORPTAX}_{it} + \beta_3\mathrm{LCPI}_{it} + \beta_4\mathrm{LEPI}_{it} + \beta_5\mathrm{L}\frac{\mathrm{STKMKTCAP}}{\mathrm{GDP}}_{it} + \beta_6\mathrm{LREALEX}_{it} + \beta_7\mathrm{LECOFREEDOM}_{it} + \beta_8\mathrm{LPOP}_{it} + \beta_9\mathrm{LREALINT}_{it} + \beta_{10}\mathrm{L}\frac{\mathrm{GS}}{\mathrm{GDP}}_{it} + \beta_{11}\mathrm{L}\frac{\mathrm{GCAPSTK}}{\mathrm{GDP}}_{it} + \varepsilon_{it} \quad (4)$$

where L denotes natural logarithm, GDP is gross domestic product, FDI denotes amount of foreign direct investment measured as FDI inflows, MNWAGE denotes cost of production or labour cost and measured as minimum wage expressed in USD, CORPTAX denotes tax level and is measured as corporate tax rate, CPI denotes corruption level and is measured by corruption performance index, EPI denotes environment condition, public health and ecosystem vitality and measured as Environmental Performance Index, STKMKTCAP/GDP denotes financial development level and is measured as stock market capitalisation as percentage of GDP, REALEX denotes the value of local currency relative to USD and derived as real exchange rate in USD adjusted with inflation, ECOFREEDOM denotes property rights, rule of law and economic stability and is measured as economic freedom index, POP denotes the size of the market, measured by population, REALINT denotes returns to savers and investors (measured as real interest rate adjusted for inflation), GS/ GDP denotes savings level and financial inclusion and is measured by savings rate as percentage of GDP, and GCAPSTK/GDP denotes the level of fixed capital in use and is measured by gross capital stock as percentage of GDP.

The hypotheses for the present study are as follows:

$Ho: \beta 1 = \cdots = \beta 11 = 0$

$Ha: \beta 1 \neq \cdots \neq \beta 11 \neq 0$

TABLE I

EXPECTED DIRECTION OF RELATIONSHIP BETWEEN FDI AND ITS DETERMINANTS

variables	Sign Expected	variables	Sign Expected
LEPI	Negative	LSTKMKTCAP/GDP	Positive
LREALINT	Negative	LGS/GDP	Positive
LREALEX	Positive	LECOFREEDOM	Positive
LPOP	Positive	LCPI	Negative
LMNWAGE	Negative	LGCAPSTK/GDP	Positive
LCORPTAX	Negative		

Note: The sign or direction of causality is assumed as a priori, considering causality from these determinants to FDI. Reverse causality is also possible; however, this is not included within the scope of the present paper.

III. DATA

The data for the present study are collected from the database of the World Bank, UCNTAD, Fraser Institute, Yale Centre of Environment and Policy, Transparency International, KPMG and ILO. The analysis is conducted on annual data for the period of 2000-2010 for 16 emerging countries. During this period, there was global financial crisis of 2007-08. As a result, there might be a structural shift in the data. The issue of structural break from panel data Model context is not addressed in the study[5] (considering all the countries in the sample not equally affected by the financial crisis and some emerging economies, for example, India and China, remain decouple (independent) of US business cycle and crisis (Kose, Otrok and Prasad 2012) and have been found to be resilient. There are 176 observations for the variables, except for corporate tax rate and real interest rate. Corporate tax rate has 169 observations, while real interest rate has 161 observations. Details of the data and sources are summarised in Table II.

TABLE II

LIST OF VARIABLES

Particulars	Definition	Source
LFDI	Natural logarithm of FDI inflows	*UNCTAD, FDI/TNC database.unctad.org/fdistatistics*
LREALINT	Natural logarithm of real interest	World Bank Database. *data.worldbank.org*
LREALEX	Natural logarithm of real exchange rate	World Bank Database. *data.worldbank.org*
LPOP	Natural logarithm of population	World Bank Database. *data.worldbank.org*
LMNWAGE	Natural logarithm of minimum wage rate	ILO www.ilo.org
LCORPTAX	Natural logarithm of corporate tax rate	KPMG www.kpmg.com
LSTKMKTCAP/ GDP	Natural logarithm of ratio of stock market capitalisation as perchantage of GDP	World Bank Database. *data.worldbank.org*
LGS/GDP	Natural logarithm of ratio of gross savings as perchantage of GDP	World Bank Database. *data.worldbank.org*
LEPI	Natural logarithm of environmental performance index	The Yale Center for Environmental Law & Policy epi.yale.edu
LECOFREEDOM	Natural logarithm of economic freedom index	www.fraserinstitute.org
LCPI	Natural logarithm of corruption Performance Index	www.transparency.org
LGCAPSTK/GDP	Natural logarithm of gross capital stock as perchantage of GDP	World Bank Databse. *data.worldbank.org*

[5]See wachter and Tzavalis (2012) for structural break issue in dynamic panel data Models.

Table III presents descriptive statistics of variables. FDI inflows have very high standard deviation, implying imbalanced distribution across emerging countries. FDI inflows range between $-4,550 million and $1,14,734 million. The negative balance of FDI inflows indicates divestment is higher than investment. The mean wage per month is $145.69, with standard deviation of 112.01, while the minimum wage is $1.82 and maximum wage is $506.37. The minimum wage reflects severe inequality from emerging countries' point of view. With respect to the corporate tax rate, the minimum is 15 per cent, which is more attractive to multinational corporations as opposed to maximum rate of 43 per cent. The real interest rate of 48 per cent represents highly unfavourable environment for local firms to go for investment. The maximum savings to GDP and gross capital to GDP are about 60 per cent and 48 per cent respectively, which reflect internal strength for local investment.

TABLE III

DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
FDIIN($mn)	176	14526.54	19937.94	-4550	114734
MNWAGE ($)	176	145.69	112.01	1.82	506.37
CORPTAX (%)	169	27.69	112.01	1.82	506.37
CPI	176	3.71	1.19	1.7	7.5
EPI	176	52.14	7.75	35.03	66.09
STKMKTCAP/GDP	176	40.50	27.36	4.75	178.19
REALEX	176	1004	3047.06	0.91	16975.05
ECOFREEDOM	176	6.55	0.76	3.20	8.25
POP(mn)	176	219	377	9.99	1330
REALINT	161	7.31	0.99	-9.84	48.71
GS/GDP	176	25.35	10.36	12.43	60.75
GCAPSTK/GDP	176	23.86	6.49	14.89	48.24

IV. RESULTS AND DISCUSSION

In order to avoid the risk of spurious regression, it is important to check whether the dependent variable and regressors are integrated to the same order, that is I(0) (stationary), or I(1), given variables are cointegated. Unit root test is widely used in the literature for determining the order of integration of data series. The type of Unit root test for panel data is different from that of Univariate unit root test. In the present study, since dataset is panel, we apply Fisher type Unit root test. The null hypothesis for unit root test is, all panel have unit root. Table IV presents the results of the Unit root test for the panel dataset used in the analyses.

TABLE IV

FISHER-TYPE UNIT-ROOT TEST

Based on augmented Dickey-Fuller tests			
Ho: All panels contain unit roots		Number of panels =	16
Ha: At least one panel is stationary		Avg. number of periods =	10.81
		Statistic	p-value
Inverse chi-squared	P	53.7880	0.009
Inverse normal	Z	-1.2257	0.110
Inverse logit	L*	-1.7390	0.042
Modified inv. chi-squared	Pm	2.7235	0.003

As it can be seen from Table IV, inverse chi-square, inverse logit and modified inverse Chi-square are identified by P, L* and Pm respectively, having significant result at 5% significance level, except inverse normal as identified by Z have p-value larger than 5% significance level. Overall, we can reject the null hypothesis of unit root. This means, there are no unit roots in panels, included panel mean and time trend. Thus, we can proceed to estimate regression with the dataset of I(0) variables.

Before estimating dynamic panel regression, which is the main econometric Model in the present paper, it is useful to examine OLS estimation (classical regression approach). Table V presents the OLS regression results of the paper. Model 1 is estimated Model with only environment variable. Model 2 is extended with other controls. Model 1 and M Model 2 correspond to equations 1 and 2 respectively.

TABLE V

OLS BASED REGRESSION RESULTS

	Model (I)	Model (II)
Intercept	12.11	-2.19
LEPI	-0.88	0.18
LMNWAGE		0.52*
LCORPTAX		1.29
LECOFREEDOM		-0.68
LPOP		0.64*
LGCAPSTK/GDP		-0.64
LGS/GDP		-0.82
LREALEX		-0.32*
LSTKMKTCAP/GDP		1.35*
LREALINT		-0.65*
LCPI		5.27*
R^2	0.003	.48
DW	.56	1.18
F stat		12.03*

Notes: DW is Durbin Watson statistics, which measures serial correlation in errors. R^2 is coefficient of etermination. The Null Hypothesis for F test is: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)= C(10)=C(11)= C(12)=0.

*5% significance level;** 10% significance level

Model I : $\mathrm{LFDI} = a + \beta \mathrm{LEPI} + \varepsilon$

Model II: $\mathrm{LFDI} = a + \beta \mathrm{LEPI} + \mathrm{Controls} + \varepsilon$

The OLS results show that the environment coefficient is not significant (-.88) in Model 1. This implies that environment is not an important variable in explaining FDI flows in emerging countries based on bi-variate relationships. The sign of relationship is negative, which is expected. However, inference based on bi-variate relationship is subject to controversy, as there may be endogeneity due to omitted variable bias, measurement errors and simultaneity. For this reason, we estimate extended Model (in Model 2) with a number of control variable. In Model 2, environment remains insignificant (0.18) as well, though the sign of relationship becomes positive. The significant coefficients in Model 2 are minimum wage (0.52), population (0.64), real exchange rate (0-.32), stock market as percentage of GDP (1.35), real interest rate (0-.65) and corruption (5.27). The results do not comply with a priori expected sign for minimum wage, real exchange rate, and corruption.

The purpose of this empirical paper is to determine FDI-environment relationship, by applying Arellano Bond (1991) and Blundell Bond (1998) panel data Model on the dataset ranging from 2000 to 2010 for 16 emerging countries.

Table VI presents the main results of the paper (corresponding to equation 3). While column 1 shows results of one-step Arellano Bond (AB) estimation (Model 1), column 2 shows two-step AB estimation (Model 2). Meanwhile, Columns 3 and 4 present one step (Model 3) and two step (Model 4) Blundell Bond estimation respectively.

TABLE VI
DYNAMIC PANEL DATA ESTIMATION RESULTS

	Arellano-Bond (Difference GMM)		Blundell-Bond (System GMM)	
	One Step Estimation coefficient Model (I)	Two Step estimation coefficient Model (II)	One Step Estimation coefficient Model (III)	Two Step Estimation coefficient Model (IV)
Lagged LFDIIN	.012	.743	.266*	1.66
	(.084)	(.701)	(.107)	
LEPI	5.91	-26.14	7.08**	-77.76
	(4.46)	(40.43)	(4.08)	
LMNWAGE	-.15	.12	.006	3.37
	(.147)	(.758)	(.096)	
LCORPTAX	-.36	-6.81	.173	12.07
	(.909)	(8.58)	(.768)	
LCPI	.37	-11.68	1.38	-32.49
	(1.34)	(15.95)	(.986)	
LSTKMKTCAP/GDP	.174	.982	.307**	1.068
	(.174)	(1.59)	(.165)	
LREALEX	.022	-7.00	-.049	-14.45
	(.822)	(18.93)	(.101)	
LECOFREEDOM	.472	2.829	.322	9.74
	(.251)	(3.055)	(.359)	
LPOP	5.63*	29.02	1.012**	1.015
	(2.52)	(65.60)	(.577)	
LREALINT	.048	-.044	-.0149	.267
	(.060)	(.670)	(.077)	
LGS/GDP	.098	-5.50	-1.33*	1.61
	(.461)	(7.97)	(.603)	
LGCAPSTK/GDP	2.00*	4.74	2.28*	7.37
	(.601)	(11.58)	(.337)	
Number of Observations	94	94	116	116
Number of Instrument	57	57	66	66
Prob (chi)	0.0093	0.0005	0.00	0.00

Note: *Presents the estimation results on*

$$LFDIIN_{it} = \alpha + \gamma\, LFDIIN_{i,t-a} + \beta_1 LMNWAGE + \beta_2 LCORPTAX + \beta_3 LCPI + \beta_4 LEPI + \beta_5 L\frac{STKMKTCAP}{GDP} + \beta_6 LREALEX + \beta_7 LECOFREEDOM + \beta_8 LPOP + \beta_9 LREALINT + \beta_{10} L\frac{GS}{GDP} + \beta_{11} L\frac{GCAPSTK}{GDP} + \varepsilon_{it}$$

*Two-step estimation for Blundell bond reported only coefficients. Standard errors are reported in parentheses. *5% significance level;** 10% significance level*

The effects of environmental performance, policy and sustainability are both negative and positive in even and odd Models respectively. This variable is

significant in Model, 3 with coefficient 7.08. Recently the global climate change and mitigation strategy have been emphasized at national level in different countries. Increased flows to developing countries has raised the concern for exploitation of lenient environmental policies and production of pollution intensive goods, though China has been exception where FDI has crowded out inefficient local firms and increased efficiency (Liang 2006), not confirming "Pollution Haven Hypotheses." Baek and Koo (2008) confirmed "Pollution Haven Hypotheses" for India and China (that FDI is harmful for environment quality, both in the short and long run). The FDI-environment relationship is controversial, and needs further examination (Gray 2002; see also Mabey and McNally 1999). Hassaballa (2013) provides suggestions for effective policies to reduce pollution emissions and to regulate FDI-environment relationship.

The coefficient of minimum wage variable has negative sign in Model 1 and positive sign in Models 2, 3 and 4. As suggested by Model 1, the coefficient is -.152, which implies that a 1% decrease in wage rate results in 0.152% increase in FDI. However, the results for minimum wage are statistically insignificant at 10% in all the Models. The findings here suggest that labour cost is not a vital factor in attracting FDI in sample emerging countries, but Zhang (2005) found negative effect. The effect of corporate tax rate is negative in Model 1 and Model 2, while positive in Models 3 and 4 respectively. However, the results for corporate tax are statistically insignificant in all the Models. The coefficient is highest for Model 4, which is 12.07. Bellak and Leibrecht (2011) find negative results for corporate tax ,while Cassou (1997) finds significant effects.

The effect of corruption is mixed in all the Models. However, the results are insignificant, which implies that corruption level does not exert any influence in FDI flows. The existing studies are inconclusive; for example, Barassi and Zhou (2012) find corruption effects vary with FDI quintiles; Egger and Winner (2005) find positive effect, while Habib and Zurawicki (2001) an Alemu (2012) find negative effect.

The level of financial development affects FDI positively in all the four Models. The result is significant in Model 3, where the coefficient is 0.307. It implies that a 1 percentage point increase in stock market capitalisation relative to GDP will increase FDI by 0.307 percentage point. Alfaro *et al.* (2004) find developed financial market affects FDI positively. Henry (2000) finds that stock

market liberalisation affects private investment positively. The effect of real exchange rate is negative in all the Models except Model 1. The results are insignificant. While Goldberg and Klein (1997 find significant result, Xing (2006) finds negative results.

The effect of institutional quality is positive in all the four Models; however, results are insignificant. Institution's quality is a robust factor in predicting FDI (Ali, Fiess and Maconald 2010). Benassy-Quere,Coupet and Mayer (2007) and Buchanan, Le and Rishi (2012) find positive results. Thus, emerging countries should make efforts to raise their institutional quality for attracting more FDI.

The market size, as measured by population in the country, is positive in all four Models, with significant coefficient of 5.63 in Model 1 and 1.012 in Model 3. Asiedu (2006) finds positive results. The effect of real interest rate is positive in Models 1 and 4, while negative in Models 3 and 4. The results are not significant. Interest rate has no significant impact on FDI inflows and hence cannot be used for policy making purposes (Anna 2011). The effect of level of savings is positive in Models 1 and 4, but negative in Models 2 and 3. The coefficient of -1.33 is significant for Model 3.[6]

The level of capital stock is positive in all four Models, with significant coefficient of 2.00 and 2.28 in Models 1 and 3 respectively. Desai, Foley and Hines (2005) find positive results, indicating foreign investment is not a substitute of domestic investment.

We also estimated fixed effect and random effect regression. Omitted variables can bias the results, because omitted variables are correlated with the errors (See Hausman and Taylor 1981). This creates endogeneity problem within the Model. The fixed effect Model is useful when omitted variables are time invariant (fixed or constant) and correlated with errors, while random effect Model provided unbiased estimates only when either there is no omitted variables or such variables are uncorrelated with errors. However, existence of some omitted variables in a random Model will produce some biasness.

[6] See Bosworth, Collins and Reinhart (1999) for the capital flows to developing countries and implications for savings and investment.

TABLE VII

FIXED EFFECT REGRESSION RESULTS

	Fixed Effect Regression Coefficient (Std. Error)	Random Effect Regression Coefficient (Std. Error)
LEPI	-4.05 **	1.926
	(2.40)	(1.083)
LMNWAGE	.085	.263
	(.205)	(.114)
LCORPTAX	-.4178	-.546
	(.565)	(.451)
LCPI	.750	1.29
	(.690)	(.513)
LSTKMKTCAP	.202	.3602
	(.155)	(.1451)
LREALEX	-1.18	-.148
	(.536)	(.049)
LECOFREEDOM	.640	.259
	(.555)	(.597)
LPOP	4.043	.671
	(2.757)	(.140)
LREALINT	.0182	-.058
	(.0812)	(.083)
LGS/GDP	1.306*	-.457
	(.590)	(.367)
LGCAPSTK/GDP	.833	1.49
	(.565)	(.512)
Number of observations	129	129

Notes: Standard errors are reported in parentheses.
*5% significance level;** 10% significance level

Result of fixed effect Model shows that environmental performance index and gross savings to GDP are significant at 10% and 5% significance levels respectively. The coefficient for environmental performance index is - 4.05 and for gross savings to GDP is 1.30. There is no significant result for the random effects Model.

For determining whether fixed effect and random effect are the same, or random effect is not better than the fixed effect, Hausman test is conducted. In statistical point of view, fixed effects are always a reasonable thing to do with the panel data (they always give consistent results). However, they may not be the most efficient Model to run. Random effects will give better p-values as they represent more efficient estimators. Therefore, we should only run random effects if it is statistically justifiable to do so.

TABLE VIII

HAUSMAN TEST

Test: Ho: difference in coefficients not systematic		
Chi2	=	28.67
Prob>chi2	=	0.0026

We find that fixed effect Model is better, as we reject the null hypothesis that the difference in coefficients is not systematic as p value turns out to be 0.0026 only.

In this paper, FDI is an endogenous variable and other macroeconomic variables are exogenous (see Table II for details). However, it is important to see if FDI affects any of the exogenous explanatory variables. For this, it is useful to see the exogeneity of the explanatory of variables, that is they are uncorrelated with errors. To avoid endogeneity, instruments are used. Whether such instruments are valid, are considered important (i.e. uncorrelated with errors and healthy instruments). For this purpose, Sargan test is used to see the over identifying restrictions of the instruments (as the test assumes Model parameters are identified with a priori restrictions). Table IX presents the result of Sargan test, which suggests that we cannot reject the null hypotheses at 10% significance level, implying that instruments are valid.

TABLE IX

SARGAN TEST OF OVER-IDENTIFYING RESTRICTIONS

H0: over-identifying restrictions are valid		
chi2(44)	=	57.6628
Prob > chi2	=	0.08

Table X shows the results of serial autocorrelation test, which shows that there is serial autocorrelation in first differenced errors in Order 1, however, such autocorrelations vanish in Order 2. Serial autocorrelation implies that errors in one period are directly related to errors in ensuing period. Due to this, estimates do not look more precise than actually they are (because of inaccurate standard errors). Thus, the efficiency of the estimates is questionable. In dynamic panel data Model, as there is no first order serial autocorrelation, lagged FDI works as a suitable instrument for the main dependent variable FDI.

TABLE X

TEST FOR AUTOCORRELATION IN PANEL DATA

Arellano-Bond test for zero autocorrelation in first-differenced errors H0: no autocorrelation		
Order	z	Prob > z
1	-4.1174	0.00
2	-.70547	0.48

V. CONCLUSIONS

The paper investigates whether environmental quality of the recipient country affects FDI inflows on a dataset of 2000-2010 for 16 emerging economies. The findings of dynamic panel data Model suggest some empirical evidence for the influence of environment and other control variables on FDI. Based on the study findings, a number of policy recommendations are made here. Multinational firms are required to follow policies of doing business with high priority on environmental safeguards. There are opportunities to bring more FDI if local governments and, even local firms, follow environmental guidelines. In addition, there is option to earn carbon credit (in foreign currency) for local firms if they consume carbon. To do so, the Model of carbon finance needs to be adopted by emerging countries. For this reason, emerging countries should establish a good environmental standard for attracting FDI.

Foreign portfolio investors invest in the market where there is a low chance to manipulate prices, and more options of instruments to take the benefit of diversification and minimize risk. Market capitalisation indicates depth and size of the market. A stock market with stocks having large market capitalisation is difficult to be manipulated. To attract more FDI, the emphasis should be given on building an efficient stock market with substantial market capitalisation, listing of large number of issues (stocks and bonds), and trading opportunities of derivative products. Meanwhile, population or size of the market is a key factor of interest for foreign investment, if the aim is to sell locally. For example, telecom industry enjoys large foreign investment in countries where subscriber base is large. To attract more FDI, regulatory support, investment incentives, allocation of land on easy terms, dividend repatriation facilitation, etc. are likely to be important, especially where the local market size is a key issue.

Foreign investors look for benefits from exchange rate variations. Developing countries face larger variation than developed countries in terms of exchange rates. The ratio of gross capital to GDP and that of gross savings to GDP also influence FDI. Hence, policy makers should formulate policies to increase savings and capital bases.

In the case of other variables in our Model, corruption, corporate tax rate and wage rate have not been found statistically significant. Though high domestic savings can lead to high domestic investments, FDI complements high domestic investments, especially in large infrastructure. High local corruption levels discourage FDI. Moreover, as foreign firms increase local wage rates, skilled workers tend to prefer foreign firms. Thus, benefitting from local low wages is not always important in FDI outcomes.

Macroeconomic stability (low and stable inflation, flexible exchange rate) is important for attracting FDI. Rule-based monetary policy, independent central banks and high standards of economic and political institutions can increase credibility among foreign investors. Policies aiming to change local environment, developing human capital, reducing corruption and providing tax incentives would attract more FDI.

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