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Pollution Heaven: Be Honest

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ABSTRACT

Most of the developing countries are facing a dilemma either to have a better control over the environmental policy that may lead to less foreign direct investment (FDI) or less control on the environmental policy but enjoys more FDI through which economic may grow faster. Motivated by this paradox, it is necessary to empirically examine the dynamic relationship between FDI, pollution control and corruption to suggest a mechanism that may be useful to get rid of pollution heaven malaise. Using dynamic panel GMM estimation for 110 countries from 2005 to 2012, the finding conforms that the stringency in environmental control alone has negative effect on FDI and at the same time, high level of corruption indeed has attracted FDI inflows. Interestingly, in contrast to previous finding, our result shows that high stringency in environmental control coupled with low level of corruption has significantly attracted more FDI inflows. In other words, not corrupt or honest institutions could nullify the negative effect of stringency in pollution control to FDIs. The finding, besides it's robustness to various environmental stringencies measures, is a potential answer to pollution heaven predicament for developing countries.

INTRODUCTION

Awareness of sustainable environment 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). However, this noble move is not without a cost to host countries. Stricter pollution control policy could mean significant reduction of potential foreign direct investment (FDI) inflows. At the end, developing countries may resort to increase their comparative advantage by adopting lower environmental standards to attract foreign investment. This move is in fact a race to the bottom competition which degrades further the environment at the expense of FDI inflows.It is evident over the last decades, most of the developing countries have attracted huge amount of FDI from pollution-intensive industries (Cole et al 2006).

The adverse effect will be more severe with high level of corruption. Corrupt officials or entrusted authority might abuse their power for their own interest in the enforcement of environmental regulations (Damania, 2002). The situation is worsening over the years to the extent that these countries are regarded as pollution heaven.Figure 1 clearly depicts the negative relationship between FDI and stringency level in developing countries. Unlike to developing countries, developed countries experience a positive relationship between FDI and environmental stringency, (see Figure 2). In rectifying this unhealthy development, the developing countries face a dilemma either to have a better control over the environment but less FDI or less control over the environment and have more FDI through which economic may grow faster. Initial investigation clearly shows the positive relationship between corruption and stringency level of environmental control (Figure 3).

All of the theoretical foundation supports the importance of honest (not corrupt) institutions or bureaucrats to attract FDI inflows for sustainable economic growth. Recently, Barassiand Zhou (2012) uses parametric and non-parametric method to reassess the findings of the relationship between FDI and corruption and they find robust evidence that host countries with lower corruption level 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 ignore the presence of environmental regulations. Corruption might be insignificant when explaining foreign investment in the presence of environmental regulations (Fredriksson et al., 2003; Kellenberg, 2009) and corruption does not affect FDI inflows independently (Mudambi et al, 2013).Cole et al. (2006) recently examines the influence of environmental policy on the FDIs. They find that high FDIs inflows in the stringent environmental policy countries only when they have significant level of corruption.

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

Section II presents the model, the methodology and the data used in the estimation. Section III discusses the empirical results. Section IV concludes.

MODEL, METHODOLOGY AND DATA

Model Specification

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

$$FDI_{i,t} = \alpha FDI_{i,t-1} + \beta_1 STR_{it} + \beta_2 COR_{it} + \beta_3 STRXCOR_{it} + \lambda X \quad (1)$$

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 higher index show less corrupt. Here we can deduce that low level of corruption also means higher level of honesty or integrity, and the and ***X***is controlled variables that influence FDI inflows including openness, inflation, GDP, GDP growth, total population, financial development and infrastructure. 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. Lagged dependent variable is taken into account as data on FDI inflows often exhibit persistent trend. We conjecture that profit maximizing MNEs or investors respond homogeneously towards heterogeneous of environmental regulations. Therefore, sign for β_1 is supposed to be negative which means relatively stringent environmental regulations deter FDI whilst lack of environmental regulations induces FDI. In other words, pollution haven effect can be validated in this finding. Based on the Egger and Winner (2005), we could confirm that the expected sign of β_2 is negative which means corruption is a stimulus for FDI. The sign of the interaction term $\beta_3$would contribute in the on-going debate particularly in the study of FDI and corruption. The parameter indicates that how environmental stringency and corruption together behave towards FDI.

Dynamic Panel GMMEstimation

Potential endogeneity of independent variables, inclusion of the lagged dependent variable and the presence of the country-specific effects have made impossible for us to estimate using panel estimation model such as pooled OLS, fixed and random effect respectively. Problems aforementioned would bring Nickel (1981) bias if we use the panel data estimation. Thus, generalized method of moment (GMM) proposed by Arellano and Bond (1991) have the capability to eliminate these problems. GMM method can tackle the country-specific effects by taking the first differences of equation (1) but however, we suffer missing values of some explanatory variables and will subsequently bring difficulties in the transformed data (Roodman, 2009). Therefore, we use forward orthogonal deviation transformation procedure proposed by Arellano and Bover (1995) to wipe out the country-specific effects. However, new bias appears resulted from forward orthogonal deviation, which is correlation between 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 to be used as instruments for the differenced lagged dependent variables and other endogenous variables. This method can be refers to 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 follows a random walk or persistent over time, the lagged levels of these variables are poor instruments for the regression equation in differences. Arellano and Bover (1995) suggest system GMM estimator in order to reduce biases and imprecision produced by difference estimator by estimating the difference 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 since two-step GMM is more favoured than the one-step GMM in estimating the coefficient with lower bias and standard errors (Windmeijer, 2005).

The unbiased, consistency and efficiency 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 and Bond, 1991; Arellano and Bover, 1995; and Blundell and Bond, 1998). The Hansen or Sargan test is based on the overall validity of the instruments by analysing the sample analogue of the moment conditions used in the estimation process. Failure to reject the hypothesis null of the Hansen or Sargan test would indicate that the instruments employed are valid and the system GMM estimation are well specified. Serial correlation test is conducted by do not reject the hypothesis null of the absence of the first order serial correlation, AR(1) and/or (just in case when the hypothesis null is rejected) do not reject the absence of the second order serial correlation, AR(2). Failure to reject the hypotheses null of difference in Hansen test would give support to the validity of additional moment conditions. These three specification tests are considered in this paper.

Data

We test the model using unbalanced panel data from a mix of 110 developed and developing countries for the period of 2006 to 2010, (see full list of countries in Table 2). FDI Inflow data is expressed as FDI inflows billions of dollars and are available from the UNCTAD. Environmental Performance Index (EPI) obtained from Yale University is used as a proxy for stringency of environmental regulations. We check robustness of our result 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 and Johnstone, 2011). Corruption perception index (CPI) was obtained from Transparency International to measure the level of corruption in host countries. The index scaled from 0 to 10 where the higher score indicates higher level of honesty. Hence, in this paper, negative coefficient for COR means high level of corruption induces FDI. The remaining controlled variables were obtained from the World Development Indicators (WDI). Table of descriptive statistics are included in the Table 3.

RESULTS

Initially we report the estimation results of the baseline model (Model 1) and we subsequently report results for robustness check after considering another alternative variable (Model 2 to Model 10) to measure the stringency of environmental regulations and corruption to FDI.

Based on the three specification tests conducted, the GMM estimators are unbiased, consistent and efficient. The sign for environmental regulatory stringency support pollution haven effect in which stringent environmental regulations is found to have negative relationship with the FDI. Table 1 for full sample analysis suggest that a point increase in stringency measured by EPI is related to the decrease in FDI inflows by approximately 0.572 to 1.215in short run and 0.899 to 1.911 in long run. The result is consistent for OECD and non-OECD countries that show negative relationship of environmental stringency and FDI. In line with Kalamova and Johnstone (2011), pollution haven occurred in developed and less developed countries.

The study also reveals that FDI is negatively related to corruption. Since the corruption index used in the study is ranging from 1 to 10 with higher the index lower the level of corruption, the result of negative coefficient implies that high level of corruption attract more FDI. The result is of no surprise as many investors try cut the red tape or bureaucracy with corruption. The result also can be deduced to imply honesty (antonym of corruption); Honesty has negative effect to FDI. The result is consistent with Egger and Winner (2005) in which corruption can be "helping hand" for FDI inflow.

The result so far is not in favour of stringent policy control. The situation is getting worst with corrupt bureaucrats. Surprisingly, the effect of interaction term between environmental stringency and corruption (STR*COR) is positive and significant. This implies that the environmental stringency and honesty (inverse of corruption) cannot be analysed separately. Stringent environmental control policy should come together with integrated law enforcement and honest bureaucrats or in other words good policy needs to be enforced by no corrupt bureaucrats to have positive impact on FDI. Another interesting finding from the analysis is that the positive coefficient of β_3 from partial derivative of Equation 1 ($\frac{dFDI_{it}}{dSTR_{it}}$ and $\frac{dFDI_{it}}{dCOR_{it}}$) can be interpreted as the threshold level that could nullify the negative effects of environmental stringency and corruption on FDI. Setting ($\frac{dFDI_{it}}{dSTR_{it}}$) to 0 will provide the honesty threshold level. For instance for model 2, the threshold level is $^{\beta_1}/_{\beta_3}$ or (8.958/1.563) or 5.7131 level of honesty. At any point above this threshold level, stringency in environmental policy will no longer have negative impact to FDI. This interesting finding can be an answer for on-going debate of the impact of FDI towards both environmental regulations and corruption. This corruption's threshold value seemed somewhat complements the findings of Barassi and Zhou (2012) in which less corrupt country would encourage more FDI stock than 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 Kirkpatrick and Shimamoto (2008) and implies that transparent, consistent, and accountable in regulatory environment can provide perception of a safer investment climate and subsequently gained investor's confidence towards host countries, hence encourage FDI. Our results contradict to the findings of Kheder and Zugravu (2012) who declared that investors favour countries with relatively weak environmental regulations regardless of the corruption level of host countries.

The estimation result with respect to sign and magnitude of the estimated coefficient are consistent for OECD and non-OECD countries (Column OECD and non-OECD). The result is robust for different environmental stringency measure (EPI) and (WEF) or corruption level (TI) and Kaufmann et al. (2008). The finding strongly support the conjecture of pollution heaven occurs in a strict environmental regulations economy through corrupt institutions to induced FDI. The phenomenon of "helping hand" is also supported by the result since high level of corruption promotes FDI. Interestingly, the significant and positive coefficient of the interaction term between stringency and corruption are consistently providing robust evidence on the contingent effect to FDI under different 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 period of 2005 to 2012. Dynamic panel GMM techniques are employed to control for potential endogeneity of independent variables and country specific effect.

There are several major findings in this paper. First, in separate analysis of environmental pollution stringency and corruption level, the finding is consistent to the previous finding that support of an evidence of pollution heaven that is 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, no corruption and trustworthiness is crucial prerequisite. Finally, the study suggeststhat certain level of honesty has to be worked out so that all countries are not necessarily to engage in the race to the bottom competition.

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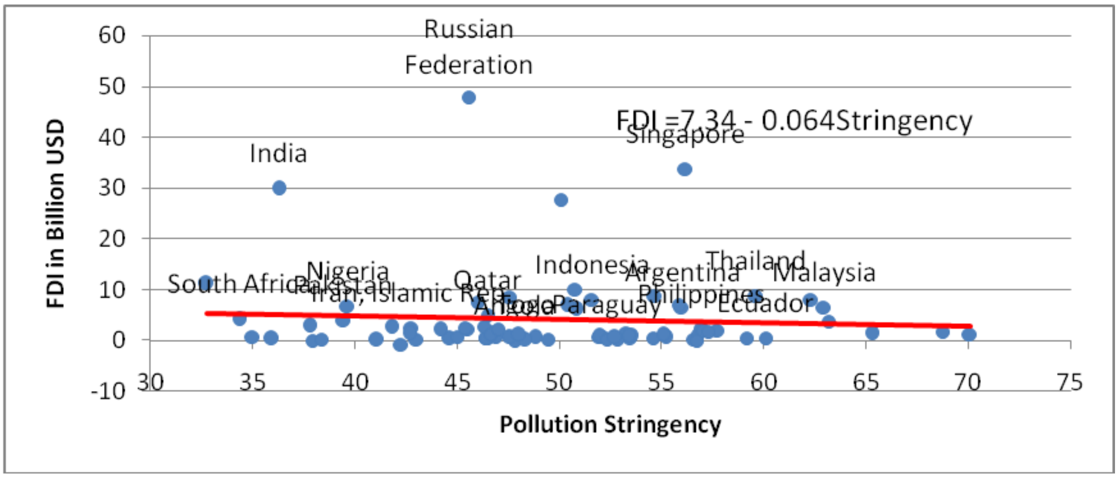

FIGURE 1: FDI and Environmental Stringency for 77 Non-OECD Countries

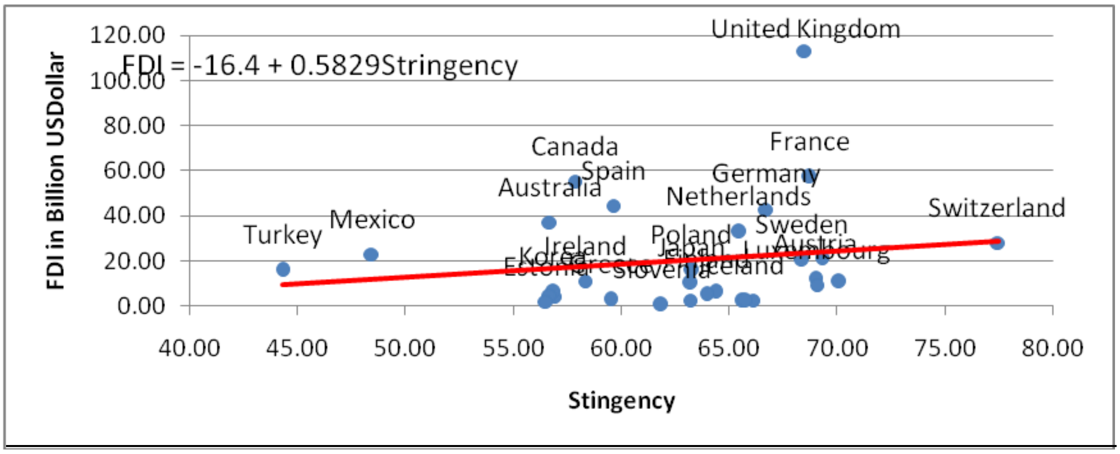

FIGURE 2:FDI and Environmental Stringency for 30 OECD Countries

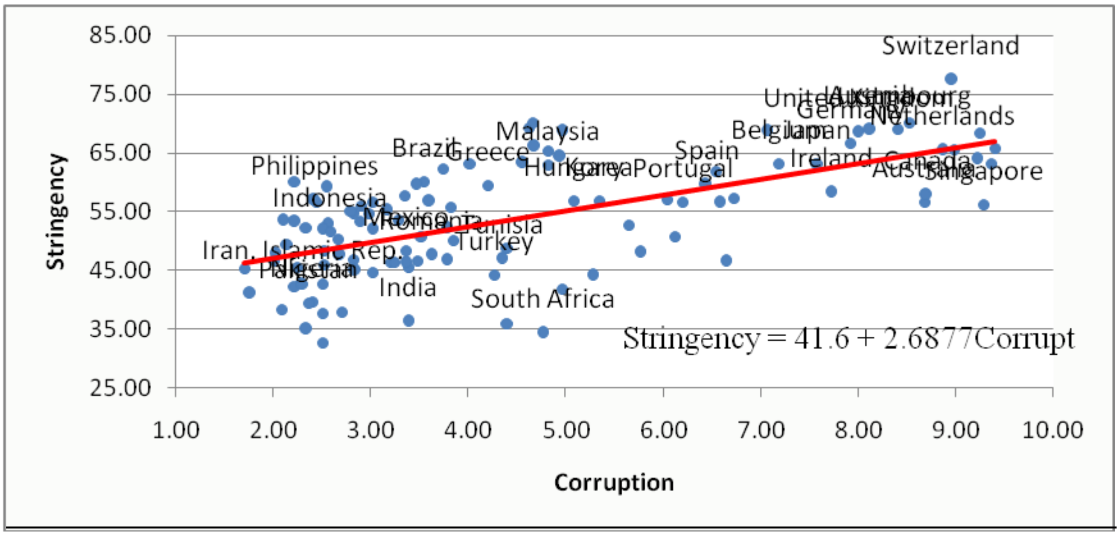

FIGURE 3**:** Stringency and Corruption

TABLE 1: Dynamic Panel Estimate for FDI, Stringency and Corruption 2006- 2012

	FULL SAMPLE					NON OECD			OECD	
MODEL	1	2	3	4	5	6	7	8	9	10
FDI(-1)	0.300***	0.205***	0.315***	0.364***	0.228***	0.953***	0.667***	0.721***	0.569***	0.019
	(0.006)	(0.018)	(0.005)	(0.004)	(0.017)	(0.006)	(0.011)	(0.007)	(0.081)	(0.028)
FIN	0.019**	0.057**	0.026***	0.040***	0.072***	0.021***	0.047***	0.013**	-1.489***	-0.627**
	(0.009)	(0.026)	(0.007)	(0.004)	(0.036)	(0.004)	(0.013)	(0.014)	(0.46)	(0.288)
GDPGROWTH	0.353***	0.296***	0.196***	0.405***	0.474***	0.575***	0.190***	0.249***	-0.537	0.310
	(0.018)	(0.071)	(0.031)	(0.012)	(0.053)	(0.016)	(0.042)	(0.021)	(0.35)	(0.435)
INFLATION	0.026	-0.012	-0.047***	-0.002	0.016	-0.183***	0.136***	-0.059***	-7.040***	-0.248
	(0.017)	(0.043)	(0.016)	(0.019)	(0.036)	(0.021)	(0.045)	(0.014)	(1.259)	(0.618)
LNGDP	5.673***	2.837***	5.768***	3.168***	4.093***	0.625***	0.688*	2.084***	14.39***	37.388*
	(0.426)	(1.071)	(0.382)	(0.223)	(0.875)	(0.115)	(0.411)	(0.198)	(3.08)	(19.159)
LNOPEN	3.636***	4.360***	6.446***	-1.619*	-1.521	-0.400	-1.056	1.729***	69.069**	-68.346
	(0.740)	(1.452)	(0.760)	(0.941)	(2.494)	(0.453)	(1.173)	(0.610)	(33.71)	(43.077)
LNPOP	0.676*	3.491***	1.313***	1.546***	1.114	-0.077	1.206***	1.163***	-12.118**	-2.459*
	(0.358)	(0.918)	(0.338)	(0.275)	(0.742)	(0.178)	(0.373)	(0.233)	(4.342)	(1.435)
STRICT (EPI)	-0.955***		-1.215***	-0.572***		-0.232***		-0.283**		-35.453***
	(0.141)		(-0.11)	(-.100)		(0.079)		(0.132)		(12.141)
STRICT (WEF)		-8.958***			-7.662***		-3.302***		-16.007***	
		(2.279)			(2.504)		(0.775)		(5.703)	
COR (TI)	-8.585***	-5.366**				-5.429***	-2.477**		-69.037*	-23.619**
	(1.540)	(2.462)				(1.054)	(1.120)		(34.591)	(9.605)

COR (Kaufmann et al.)				-8.393***	-17.878***			-6.603**		
				(1.884)	(4.393)			(2.794)		
STRXCOR	0.167***	1.563***	0.366***	0.189***	3.671***	0.095***	0.668***	0.138***	23.239***	4.198**
	(0.026)	(0.454)	(0.043)	(0.031)	(0.903)	(0.021)	(0.230)	(0.052)	(7.655)	(1.525)
CONSTANT	3.843	-32.873**	3.045	5.660	15.518	12.301**	0.325	-12.370		
	(9.190)	(13.051)	(7.573)	(7.743)	(14.819)	(5.986)	(6.319)	(8.314)		
No. of Instruments	79	50	79	90	56	68	41	65	28	29
Obs per group (avr)	3.74	2.85	3.8	3.76	2.86	3.69	2.81	3.71	1.93	2.87
AR(1) (p-value)	0.042	0.055	0.040	0.041	0.059	0.02	0.094	0.026	0.242	0.093
AR(2) (p-value)	0.147		0.151	0.149		0.86		0.879		0.47
Hansen (p-value)	0.186	0.195	0.713	0.341	0.248	0.339	0.515	0.626	0.468	0.315
Observations	400	285	388	402	286	284	197	286	58	86
Number of countries	107	100	102	107	100	77	70	77	30	30

*** significant at 1%; ** significant at 5%; * significant at 10%. Value in parenthesis is standard error. All p-value of the difference in Hansen tests of exogeneity of instruments subsets are not rejected at the 10% significance level.Some countries or cross sections are dropped in the estimations due to inadequacy in lagged instruments.

TABLE 2. List of Countries

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 Saudi Arabia

TABLE 3. Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
FDI inflows (bill)	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
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
GDP (current US$)	377.07	814.76	1.21	5930.53
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