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Abstract

This paper aims at determining the causal relationship between FDI and corruption in 42 developing countries using linear and non linear panel methods over the period 1998 to 2009. The findings show a causal association as corruption appears to Granger caused FDI and FDI seems to Granger lead corruption using linear methods, while for weaker results are obtain using non linear methods. The general value of these results is that adequate institutional facilities must be in place in developing economies to reduce losses from corruption especially in an attempt to attract foreign direct investment.

Keywords: Panel Linear and Non-Linear Causality, Corruption and Foreign Direct Investment

JEL Number: C33, D73, E22

Introduction

The growing literature on the relationship between corruption and foreign direct investment (FDI) inflows suggests that corruption can have either a negative or positive effect on FDI (see the survey of Campos *et al* (2010)). Treating corruption as a factor that affects the costs of investment operations Bardhan (1997) argued that foreign investors would have to pay extra costs in the form of bribes to get licenses or government permits to conduct business and such additional costs would decrease the expected profitability of investment. Moreover, corruption increases uncertainty because corruption agreements are not enforceable in the courts of law. Therefore, foreign investors would tend to avoid investing in countries with high levels of corruption. However, a positive impact of corruption on FDI inflows could exist. In the presence of a stiff regulation and an inefficient bureaucracy, corruption may augment bureaucratic efficiency by accelerating the process of decision making (Bardhan, 1997). Empirically, the evidence on the effects of corruption on FDI flows has been mixed but most studies have not found the commonly expected conclusion that a high level of corruption deters FDI. Some empirical papers provide support of a negative link between corruption and FDI, while others fail to find any significant relationship. However, what has been omitted from this literature is research that allows for the possibility that FDI inflows can cause corruption activities rather than the other way around so that corruption may not necessarily be an independent variable. In fact corruption is a consequence of economic and non-economic variables and so should be treated as an endogenous variable. For instance, FDI can create additional resources which permit a country to fight corruption effectively. On the other hand, if more FDI inflows represent a richer economy this can also raise the probability of individuals getting involve in corruptive activities.

It appears therefore that the causal pattern between corruption and FDI cannot be determined theoretically and one must undertake an empirical analysis to resolve this issue. It should be noted that the previous empirical investigations undertaken on this association regressed corruption on FDI, which implicitly assumes that corruption is exogenous to the model; no analysis allowed for corruption and economic growth to be endogenous and simultaneously determined. By undertaking formal causality tests this paper hopes to rectify this deficiency in the literature.

Employing a set of 42 countries covering the period 1998 to 2009 this study assesses the relationship between corruption and FDI using both linear and nonlinear panel causality tests. Linear panel causality methods are increasingly becoming quite popular in economic applications (see Hurlin and Venet, 2001; Hurlin, 2004; Craigwell and Moore, 2008; Greenidge *et al*., 2010). However, little examples exist in the economic literature that uses non-linear panel causality tests. In this regard the application here is a first for corruption and FDI studies. The complex nature of FDI and corruption which depend on several economic and non-economic indicators imply that the former two variables could follow a non-linear process and it therefore seems appropriate to conduct non linearity causal tests on such.

The plan for this paper is as follows: the literature review is presented in Section 2, then the causality methods are discussed in section 3, followed by an outline of the estimated results in section 4 and in the final section conclusions are made.

2. Review of the Empirical Literature on Corruption and FDI

The empirical studies on the impact of corruption on FDI have been done on different countries and over different time periods using time series and cross-national data, and to a lesser extent, panel data. A general conclusion from a review of this literature suggests that the expected relationship that a high level of corruption adversely affects FDI is not common. Starting with the work of Wheeler and Mody (1992) on United States (US) firms, an insignificant association was discovered between the size of FDI and the host country's risk factor, making these authors conclude that the importance of the risk factor should "be discounted, although it would not be impossible to assign it some small weight as a decision factor (p.70)." Wei (2000a), however, blamed this insignificant result on the way Wheeler and Mody (1992) incorporated the corruption index; rather than explicitly include a corruption index into their model, they combined it with 12 other indicators - some of which may be marginally important for FDI - to form one variable. Hines (1995) investigated the influence of the US anti-bribery legislation (Foreign Corrupt Practices Act of 1977) on the operation of US firms in countries where corruption is high. The dependent variable he employs is the growth rate of US FDI inflows and this is regressed on the Business International Index used as a measure of corruption for 35 host countries during the period 1977 to 1982. His finding supports the hypothesis that the Corrupt Practices Act significantly reduced US FDI flows into more corrupt host countries after 1977. In a slightly different approach, Smarzynska and Wei (2002) utilize a firm-level data set from transition economies to investigate the effects of corruption in terms of firms' decision not to enter a particular market, rather than under the situation of reduced bilateral investment flows. Conditional on FDI occurring, their results show that FDI entry strategy in a corrupt host country is to establish joint ventures with a domestic partner to save the transaction costs of dealing with local government officials rather than to create a wholly owned subsidiary.

Freckleton et al (2010) study of forty two developing countries uses panel data to estimate the relationship among FDI, corruption and economic growth. The results suggest that lower levels of corruption enhance the effect of FDI on economic growth. Abed and Davoodi (2002) also applied cross-section and panel data methods to assess the impact that corruption has on per capita FDI inflows in transition economies. The evidence reveals that countries with a low level of corruption draw more per capita FDI. However, once the authors control for the structural reform factor, corruption is no longer significant, implying that structural reform is more critical at reducing the level of corruption in attracting FDI. Using bilateral FDI flow data from 12 source countries to 45 host countries and three different measures of corruption, Wei (2000a) examines the effects of taxation and corruption on FDI and found that a rise in either the tax rate on multinational firms or the level of corruption in the host countries would contract inward FDI. In a follow up paper Wei (2000b) evaluated the impact of corruption on the composition of capital using bilateral capital flow data from 14 source countries to 53 host countries. The results lent support to the popular notion that there is a negative association between corruption and FDI and that the reduction in FDI caused by corruption is greater than the negative impact of corruption on other types of capital inflows. Habib and Zurawicki (2002) analyze the effects of corruption on bilateral FDI flows using a sample of 7 source countries and 89 host countries. They found that foreign firms tend to avoid situations where corruption is visibly present because corruption is considered immoral and might be an important cause of inefficiency. Using a single source country, Voyer and Beamish (2004) apply cross-sectional regressions to investigate the effects of the level of corruption on Japanese FDI in 59 (developed and emerging) host countries. The results indicate that Japanese FDI is negatively related to the level of corruption especially in those emerging economies where there is a nonexistent or underdeveloped comprehensive legal system to effectively reduce illegal activities. Utilizing only cross sectional data from 52 developing countries, Akçay (2001) estimates the effects of the level of corruption on FDI inflows with two different indices of corruption. He could not support the hypothesis that FDI and corruption are adversely associated.

The above studies on corruption have concentrated on its effect on FDI. Such analyses are usually undertaken with the Ordinary Least Squares method and implicitly assume that corruption is exogenous. If this assumption does not hold then estimates from such exercises could be biased and inconsistent. Indeed it is quite possible that FDI can cause corruption as discussed in the introduction where it was proposed that FDI creates additional resources which allow a country to fight corruption effectively, or on the other hand, can encourage involvement in corruptive activities. All of above research have ignored the fact that corruption is not necessarily an independent variable, and in fact, can be caused by FDI.

2. Methodology and Data

2.1 Methodology

This paper uses the concept of statistical causation developed by Granger (1969), where a variable X is said to Granger cause Y, if values of Y are better predicted from past values of X, than from its own values. Hurlin and Venet (2001) and Hurlin (2004) applied this notion of causality to panel data by allowing the autoregressive coefficients to be treated as constants which improve the number of observations and degrees of freedom leading to greater efficiency of the estimates. This procedure contrasts with the more popular approaches of Holtz-Eakin *et al.* (1988), Weinhold (1996) and Nair-Reichert and Weinhold (2001) where the autoregressive coefficients can vary and efficiency is only possible with a 'large time dimension'.

2.2.1 Hurlin Panel Causality Linear Tests

The Hurlin (2004) procedure is based on the following Equation (1):

$$CO_{it} = \eta_i + \sum_{k=1}^{p} \delta_k CO_{it-k} + \sum_{k=0}^{p} \beta_{ik} x_{it-k} + \varepsilon_{it} \qquad (1)$$

where CO represents corruption, the individual country specific coefficients are given by η, the autoregressive and regression coefficients on lagged values of corruption and the explanatory variables (x) that include foreign investment as a percentage of GDP (FDI) are denoted by δ and β, respectively, while ε is the error term with classical properties. The individual effects η are presumed fixed along with δ and β and the lag order, k, is identical (balanced) for all cross-section units of the panel (Hurlin, 2004).

Implementing the Hurlin (2004) panel causality methodology starts with checking for homogenous and instantaneous non-causality (*HINC*) which is based on a Wald coefficient test that all the βs are equal to zero for all individuals i and all lags k. If the regression coefficients are not significantly different from zero, then the hypothesis is accepted which implies that the variable x is not Granger causing CO in the sample. Once the result indicates non-causality then there is no need for further testing (Hurlin and Venet, 2001; Hurlin, 2004; Greenidge *et al.,* 2010). If the null hypothesis is rejected there exists the possibility that a causal relationship for the variables is identical across all countries in the series (Greenidge *et al.,* 2010). This is referred to as the homogeneous causality (*HC*) test which indicates that the regression coefficients are not statistically different across the countries for all lags. *HC* is rejected if the Wald statistic is significant. The rejection of the HC test requires that the regression coefficients must be examined for any statistically significant causal relationships across differing countries. This heterogeneous non-causality (*HENC*) test is one in which the coefficients of the lagged variables are checked to see if all of these terms are equal to zero or statistically different. A Wald statistic is also done for this calculation (Hurlin and Venet, 2001; Hurlin, 2004; Greenidge *et al.,* 2010).

3.3.2: Harvey and Leybourne Panel Causality Non Linear Tests

Non linearity causality tests were first introduced by Baek and Brock (1992) using nonparametric methods of spatial probabilities. However, the main problem with these tests is that they failed to provide appropriate statistics that have similar critical values even if the data being considered is a linear I(0) or I(1) process and is likewise consistent against non-linearity of either form (Harvey and Leybourne, 2007). This problem is rectified by Harvey and Leybourne (2007) and hence their methodology is adapted in this paper. I

Assuming that the hypothesis being tested is $FDI \rightarrow CO$, the regression model is written as follows:

$$CO = \beta_0 + \beta_1 FDI_{it-1} + \beta_2 FDI^2_{it-2} + \beta_3 FDI^3_{it-3} + \beta_4 \Delta FDI_{it-1} + \beta_5 (\Delta FDI_{it-1})^2 + \beta_6 (\Delta FDI_{it-1})^3$$

(2)

A similar expression can be derived for $CO \rightarrow FDI$ by interchanging CO and FDI in Equation (2). The same steps that were undertaken with the Hurlin (2004) linear panel causality approach can then be followed.

2.2 Data

Besides corruption (CO) and foreign direct investment as a percentage of GDP (FDI), the data set consists of several control variables which are augmented to the test equations to check the robustness of the relationship between CO and FDI. The control variables utilized are per capita GDP and domestic investment as a percentage of GDP (FDI_GDP) and (GR) respectively. These variables are self-explanatory as they are often employed as standard macroeconomic variables in explaining the impact of corruption on per capita growth (see Freckleton *et al,* 2010). The data utilised in this paper cover the period 1998 to 2009 for forty two markets and were obtained from the International Monetary Fund’s International Financial Statistics and the World Bank’s Statistics Database.

4. Estimated Results

The validity of the causality tests relies on having stationary series, appropriate lag lengths and incorporating control variables that rule out the possibility of an omitted variable being the driving force of the causal relationship of interest (Feige and Mcgee, 1977). So this section starts by exploring the temporal properties of the series. The results indicate that corruption (CO), per capita income (GR), and foreign and domestic investment as a percentage of GDP ((FDI_GDP) and (Invt_GDP)) are all stationary in levels. The series are also checked for cross sectional dependence, and nonlinearity using the method developed by Pesaran (2007) which combines the cross averages of lagged levels and first differences of the series, known as the cross sectional augmented DF regression (CADF). These results indicate that most of the countries in the sample displayed linear and independence behaviour. Note all of the above mentioned results were not reported due to space considerations but are available on request. Once the variables are stationary and independent, the panel Granger causality tests can be conducted on the statistical significance of the regression coefficients using the above mentioned Wald statistics.

4.1 Linear Panel Causality Results

Two types of panel regression methods are considered; the pooled ordinary least square (OLS) model and the fixed effects model. The pooled OLS model assumes no variation of the coefficients and intercept terms while the fixed effects model allows for variation within each country intercept (Hsiao, 2003; Craigwell and Moore, 2008). The test statistics, based on the two panel regression methods, are given for lags 1 to 3; an F test was used to test restrictions on the coefficients at the chosen lag lengths which were determined by the Schwartz Bayesian Criterion (SBC), given the relatively small sample utilized here.

The HC test results seen in Table 1 reveal a strong causal relationship from corruption to FDI, and a similar link from FDI to corruption. To ensure that the model in Table 1 is well specified, per capita GDP and domestic investments as a percentage of GDP are added as control variables. These results are displayed in Table 2 and revealed similar underlying results as those derived from Table 1.

With evidence that corruption causes FDI, country specific causal tests of the HINC form can be conducted (Hood *et al.,* 2008; Craigwell and Moore, 2008). Utilizing the HINC tests, the regression coefficients across countries are statistically different from zero and the null hypothesis is rejected (Table 1). The $HENC$ test is also used to determine if the β_{ik} coefficients are different across countries. Table 2 shows the majority of the markets indicate causality between corruption and FDI, 27 markets suggests a bidirectional causal link between FDI and corruption and all but one market indicate that FDI Granger caused corruption.

4.2: Non-linear Panel Causality Results

The non-linear panel causality results seen in Table 3 show that the hypothesis of corruption Granger causing economic growth is rejected contrasting with the acceptance findings that economic growth Granger leads corruption. Since there is evidence of causality, as in the linear panel investigations, country specific non-linear panel causal checks are made utilizing the HC and HINC tests (Table 4). In contrast to the linear tests, the results indicate that the majority of the markets (33) revealed that FDI Granger leads corruption, 16 markets has a significant non-linear causal relationship from corruption to FDI while there was bi directional links for 11 markets and 4 markets had no pattern.

Conclusion

This paper aims at determining the causal relationship between FDI and corruption in 42 developing countries using linear and non linear panel methods over the period 1998 to 2009. The findings show that the outcome of the causal association depends on the method used. The linear panel methods revealed that the majority of the markets indicate causality between corruption and FDI, 27 markets suggests a bidirectional causal link between FDI and corruption and all but one market indicate that FDI Granger caused corruption. In contrast, for the nonlinear tests, 9 markets show no discernable pattern, the majority of the markets (33) revealed that FDI Granger leads corruption, 16 markets have a significant non-linear causal relationship from corruption to FDI while there was bi directional links for 11 markets

The general value of the above results is that adequate institutional facilities must be in place in developing economies to reduce losses from corruption especially in a further attempt to attract FDI.

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Table 1: Homogenous and Instantaneous Non-Causality Tests (No Controls and Controls)

		HINC		HINC		HC	

		(No Controls)		**(With Controls)**			
	Lags	OLS – Levels	Fixed effects – Levels	OLS – Levels	Fixed effects – Levels	OLS – Levels	Fixed effects – Levels
$CO \rightarrow FDI$	1	34.85***	4.41***	23.76***	3.81***	8.41***	3.17***
	2	33.24***	4.36***	20.87***	3.52***	7.02***	2.89***
	3	30.71***	2.81***	17.43***	2.17**	5.99***	2.30**
$FDI \rightarrow CO$	1	34.94***	4.44***	22.28***	3.24***	7.12***	2.15**
	2	33.24***	2.62***	19.07***	2.91***	6.29***	2.08**
	3	31.61***	3.09***	17.66***	2.04**	5.27***	1.67*

Note: ***,** and * indicates significance at the 1,5 and 10 percent level, respectively.

Table 2: Heterogeneous Granger Causality Tests

Country	$CO \rightarrow FDI$	$FDI \rightarrow CO$

Argentina	3.63***	4.70***
Belarus	-0.44	8.93***
Belgium	7.99***	6.03***
Bolivia	9.59***	0.97
Botswana	-0.15	12.96***
Brazil	1.26	8.44***
Bulgaria	5.78***	4.10***
Cameroon	2.74***	4.22***
Chile	3.61***	11.75***
China	0.45	8.35***
Colombia	1.94*	7.77***
Costa Rica	0.76	9.95***
Ecuador	4.86***	3.31***
Egypt	3.07***	6.04***
Estonia	4.91***	7.79***
Ghana	2.19**	7.25***
Guatemala	1.70*	5.94***
Hungary	5.14***	6.69***
Indonesia	1.13	4.14***
India	-0.65	8.07***
Jamaica	7.73***	3.51***
Jordan	5.97***	5.62***
Kenya	-0.04	5.40***
Malaysia	3.34***	7.75***
Mexico	2.02**	7.51***
Namibia	3.43***	8.13***
Nicaragua	6.39***	2.94***
Pakistan	0.83	5.35***
Paraguay	2.56**	4.26***
Peru	0.93	8.93***
Philippines	1.66*	6.39***
Poland	2.09**	7.81***
Romania	2.66***	6.00***
South Africa	1.94*	9.99***
El Salvador	1.26	9.00***
Senegal	-0.76	8.42***
Tunisia	6.13***	6.08***
Turkey	0.09	8.47***
Uganda	2.84***	4.84***
Ukraine	2.11**	5.11***
Uruguay	-0.20	14.25***
Venezuela	5.00***	3.12***

Table 3a: Non-Linear Causality Results: Dependent Variable (CO)

Causal Variable	Lags	Coefficient	t-statistic
FDI	1	0.168	28.38***
FDI^2	2	-0.001	-12.42***
FDI^3	3	0.00026	3.70
ln(FDI)	1	-0.13	-5.86***
$\ln(FDI)^2$	1	0.0009	1.15
$\ln(FDI)^3$	1	-0.0004	-1.09*

Table 3b: Non-Linear Causality Results: Dependent Variable (FDI)

Causal Variable	Lags	Coefficient	t-statistic
CO	1	5.84	5.22***
CO^2	2	0.77	2.10**
CO^3	3	-0.03	-0.98
ln(CO)	1	3.95	0.86
$\ln(CO)^2$	1	-0.23	-0.04
$\ln(CO)^3$	1	-1.62	-0.38

Note: ***,** and * indicates signif icance at the 1,5 and 10 percent level of testing, respectively.

Table 4: Heterogeneous Granger Non-Linear Causality Tests

Country	$CO \rightarrow FDI$	$FDI \rightarrow CO$

Argentina	1.90*	0.04
Belarus	-1.92*	8.08***
Belgium	4.16***	4.79***
Bolivia	6.34***	-2.94***
Botswana	-2.73***	9.69***
Brazil	-0.43	4.81***
Bulgaria	3.64***	1.08
Cameroon	1.30	0.49
Chile	0.26	6.05***
China	-0.99	5.44***
Colombia	-0.04	4.19***
Costa Rica	-0.90	6.35***
Ecuador	2.38**	-2.00**
Egypt	1.27	1.43
Estonia	2.44**	3.86***
Ghana	0.51	3.05***
Guatemala	0.21	1.86*
Hungary	2.51**	2.02**
Indonesia	-0.09	3.22***
India	-1.51	8.45***
Jamaica	5.26***	-0.47
Jordan	3.64***	3.19***
Kenya	-0.79	4.43***
Malaysia	0.37	3.06***
Mexico	0.41	3.29***
Namibia	0.722	2.81***
Nicaragua	4.70***	-1.90
Pakistan	-0.18	3.92***
Paraguay	1.11	0.43
Peru	-0.49	4.87***
Philippines	-0.14	2.11***
Poland	0.51	3.49***
Romania	1.32	2.29***
South Africa	-0.13	5.17***
El Salvador	-0.36	5.46***
Senegal	-1.95*	9.02***
Tunisia	3.05***	1.45
Turkey	-1.07	7.63***
Uganda	1.60	1.05
Ukraine	0.90	2.15**
Uruguay	-2.15**	13.83***
Venezuela	2.85***	-1.95*