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A Dynamic Panel Analysis of the Determinants of FDI in Africa

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Abstract

Numerous studies have examined the determinants of FDI. However, due to sample selection and research methodology, there continues to be mixed and inconclusive evidence of both the significance and direction of impact of changes in the determinants on FDI. We apply the GMM technique to dynamic panel analysis and identify the determinants of FDI (in proportion to GDP) for 35 African countries for the period 1974-2009. Granger causality indicates short-run causal effects from domestic investment, external debt and government spending to FDI. Johansen cointegration test indicates significantly positive long-run effects of domestic investment and trade openness on FDI.

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1. Introduction

Many African economies over the last four decades have increasingly implemented an FDI policy framework in order to attract more investment for sustainable economic development. The period starting mid-1970s marked the formation of some major trading blocs by African economies and also accession of several African economies to WTO with a view to promote free trade through greater economic cooperation. While FDI in Africa have increased over the years, the increase in FDI has varied greatly across countries within Africa and across industrial sectors within each country. According to a report by the United Nations, FDI inflows declined from 2008 for three consecutive years. But with ongoing economic reforms and economic growth, FDI in Africa is now projected to double from US$42.7 billion in 2011 to an amount somewhere between US$75-100 billion in 2014. The report further confirms that in 2011, FDI in Africa from the developing economies exceeded investments from the developed economies. As documented in the trade literature, the impact of FDI on economic growth of developing economies has been largely positive; consequently, the implementation of an FDI-policy framework is now being viewed with increasing importance. This paper, using dynamic panel cointegration and causal analysis, examines the role of trade openness, domestic investment, market size, external debt and government spending as potential determinants of FDI for 35 African countries for the period 1974-2009 that witnessed increasing implementation of inward oriented FDI policies as a major economic reform by the African countries under study.

2. Literature Review

The literature on the determinants of FDI is vast and extensive, but most empirical studies, based either on cross-country or country-specific analyses, provide mixed and inconclusive evidence of both the significance and direction of impact of changes in each of the determinants of FDI discussed in this study. Kravis and Lipsey (1982), Culem (1988), Lucas (1993), Jensen (2003), Djokoto (2012) and Panagiotis and Skandalis (2012) observed a significantly positive relationship between trade openness and FDI. On the other hand, Schmitz and Bieri (1972), Globerman and Shapiro (2002) and Busse and Hefeker (2007) observed an insignificant relationship between the two. Ndikumana and Verick (2008) showed that domestic investment can have a positive impact on FDI, and although the relation runs both ways, the impact of domestic investment on FDI is stronger and more robust. While Harrison and Revenga (1995) found no impact of domestic investment on FDI, McMillan (1999) found a negative relationship between domestic investment and FDI. Lautier and Moreaub (2012) have also shown that lagged domestic investment can have a positive impact on inbound FDI. For market size, although Bandera and White (1968), Lunn (1980), Dunning (1980), Kravis and Lipsey (1982), Culam (1988), Wheeler and Mody (1992), Tsai (1994), Billington (1999) and Pistoresi (2000) have shown that market size plays a significant role in attracting FDI, Elbadawi and Mwega (1997) have shown that market size is not an important determinant of FDI in Africa. The results are also mixed for external debt and government spending. While Agisafe at al. (2006) showed that external debt contributes significantly to FDI, Benga and Sanchez-Robles (2003) showed that external debt has a negative impact on FDI. In a working paper, Anyanwu (2011) showed that government spending has a significantly positive effect on FDI. But Mkenda and Mkenda (2004) reported a significantly negative relationship between government spending and FDI.

Due to this mixed evidence this study aims to re-examine the long-run relationship between FDI and its potential determinants as an FDI policy measure for Africa.

3. Data and the Model

This study uses annual time series data from UNCTAD Statistics for 35 African countries for the period 1974-2009. The 35 countries are Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Cote d'Ivoire, Djibouti, Egypt, Gabon, Gambia, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritiana, Mauritius, Morocco, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Swaziland, Togo, Tunisia, Zambia and Zimbabwe. The variables included as potential determinants of FDI are trade openness, domestic investment, market size (measured by per-capita real GDP), long-term external debt and government spending. The variables in the model are indexed as FDI, OPN, DIV, GDP, EXD and GSP. Total net FDI inflow is the difference between credits and debits in capital transactions. Trade openness index is constructed by dividing total exports and imports of a nation by its nominal GDP. Domestic investment is the value of fixed assets (new less the disposed) owned by households, businesses and government. Per-capita real GDP is used as a measure of market size. Per-capita real GDP has been extensively used as a measure of market size in most empirical studies since per-capita real GDP, when compared with absolute real GDP, reflects income rather than population and is, therefore, considered a better indicator of market potential. External debt is the total long-term debt (outstanding) of a nation. Government spending is the total government expenditure on the purchases of goods and services for the people of a nation. Per-capita real GDP is measured in 2005 constant prices and exchange rates. All other variables are expressed as a percentage of nominal GDP and measured in current prices and current exchange rates.

We estimate a model of the form:

$$\mathrm{FDI}_{it} = \alpha_0 + \alpha_1 \mathrm{OPN}_{it} + \alpha_2 \mathrm{DIV}_{it} + \alpha_3 \mathrm{GDP}_{it} + \alpha_4 \mathrm{EXD}_{it} + \alpha_5 \mathrm{GSP}_{it} + \varepsilon_{it} \quad (1)$$

In equation (1) the coefficients α_1, α_2, α_3, α_4 and α_5 measure the long-run response of FDI inflows to changes in trade openness (OPN), domestic investment (DIV), market size (GDP), external debt (EXD) and government spending (GSP), respectively. The instrumental variables for the linear model in (1) are constant, FDI, GDP, OPN, DIV, EXD, GSP, GDP{1}, OPN{1}, DIV{1}, EXD{1} and GSP{1} where {1} denotes the lag-length of a variable. In panel data, regressors in other periods are considered valid instruments for period-t regressors if the latter are either endogenous or introduced in the model as lags of the dependent variable. These instruments permit consistent estimation even if the assumption of strict exogeneity fails. In IV estimation, we assume the existence of a matrix of instruments where the instruments satisfy the moment conditions.

The model in (1) is estimated in three steps: first, the stationarity of each variable is examined by performing four unit roots tests, namely, Levin, Lin and Chu (LLC, 2002), Im, Peasaran and Shin (IPS, 2003), Maddala and Wu (MW, 1999) and Choi (2006); second, if the variables are found to contain a unit root, then the cointegrating relationships between the variables are determined; finally, if a long-run relationship is found to exist, then an error correction model is estimated to investigate the dynamic causal relationships between the variables.

4. Model Estimation and Results

4.1 Unit Root Tests: The results of the four unit root tests performed at levels and first-differences are reported in Table I. The results indicate that the variables are integrated of order one.

Table I. Unit Root Tests

Constant and Trend [Level]								
	LLC Test	prob.	IPS Test	prob.	MW Test	prob.	Choi Test	prob.
FDI	2.39	0.9917	- 1.9**	0.0289	147.33*	0.0000	- 1.20	0.1148
OPN	0.49	0.6884	- 1.7**	0.0485	105.00*	0.0043	- 1.42	0.0785
DIV	2.06	0.9801	0.24	0.5932	77.29	0.2572	0.58	0.7174
GDP	5.43	1.0000	5.09	1.0000	37.90	0.9994	5.72	1.0000
EXD	3.01	0.9987	7.08	1.0000	20.56	1.0000	7.51	1.0000
GSP	- 0.73	0.2323	0.68	0.7501	61.36	0.7599	1.20	0.8853
Constant Only [First-Difference]								
	LLC Test	prob.	IPS Test	prob.	MW Test	prob.	Choi Test	prob.
∆FDI	- 12.5*	0.0000	- 30.4*	0.0000	728.8*	0.0000	- 19.2*	0.0000
∆OPN	- 11.1*	0.0000	- 21.3*	0.0000	571.8*	0.0000	- 17.3*	0.0000
∆DIV	- 18.0*	0.0000	- 19.7*	0.0000	520.5*	0.0000	- 17.0*	0.0000
∆GDP	- 10.2*	0.0000	- 10.1*	0.0000	281.8*	0.0000	- 9.2*	0.0000
∆EXD	- 6.28*	0.0000	- 6.04*	0.0000	201.9*	0.0000	- 5.3*	0.0000
∆GSP	- 15.7*	0.0000	- 21.5*	0.0000	568.0*	0.0000	- 17.4*	0.0000

4.2 Cointegration Tests: The Johansen Fisher panel cointegration test is performed in order to investigate cointegrating relationships. The test is performed at one lag. The results are reported in Table II. The results indicate cointegrating relationships between the six panel variables.

Table II. Johansen Fisher Panel Cointegration Test

Model 1: No intercept and trend in CE and VAR				
Cointegrating Equations	Fisher Statistic (Trace Test)	prob.	Fisher Statistic (Max.Eigenvalue)	prob.
none	582.9*	0.0000	370.6*	0.0000
maximum 1	280.9*	0.0000	183.9*	0.0000
maximum 2	145.2*	0.0000	101.0*	0.0090
maximum 3	85.3	0.1024	59.3	0.8165
Model 2: Intercept (no trend) in CE-no intercept in VAR				
Cointegrating Equations	Fisher Statistic (Trace Test)	prob.	Fisher Statistic (Max.Eigenvalue)	prob.
none	478.8*	0.0000	341.7	0.0000
maximum 1	216.9*	0.0000	151.3	0.0000
maximum 2	114.2*	0.0007	80.7	0.1787
maximum 3	73.2	0.3722	54.2	0.9180

[1] *, ** indicate significance at 1% and 5% levels, respectively.

4.3 Granger Causality Test: The Engle and Granger (1987) test is performed to determine short-run and long-run causalities. The ECM term in (2) captures the long-run causality between the variables.

$$\begin{bmatrix}\Delta FDI_{it}\\ \Delta OPN_{it}\\ \Delta DIV_{it}\\ \Delta GDP_{it}\\ \Delta EXD_{it}\\ \Delta GSP_{it}\end{bmatrix}=\begin{bmatrix}C_1\\ C_2\\ C_3\\ C_4\\ C_5\\ C_6\end{bmatrix}+\sum_{k=1}^{p}\begin{bmatrix}\beta_{11k} & \beta_{12k} & \beta_{13k} & \beta_{14k} & \beta_{15k} & \beta_{16k}\\ \beta_{21k} & \beta_{22k} & \beta_{23k} & \beta_{24k} & \beta_{25k} & \beta_{26k}\\ \beta_{31k} & \beta_{32k} & \beta_{33k} & \beta_{34k} & \beta_{35k} & \beta_{36k}\\ \beta_{41k} & \beta_{42k} & \beta_{43k} & \beta_{44k} & \beta_{45k} & \beta_{46k}\\ \beta_{51k} & \beta_{52k} & \beta_{53k} & \beta_{54k} & \beta_{55k} & \beta_{56k}\\ \beta_{61k} & \beta_{62k} & \beta_{63k} & \beta_{64k} & \beta_{65k} & \beta_{66k}\end{bmatrix}\begin{bmatrix}\Delta FDI_{it-k}\\ \Delta OPN_{it-k}\\ \Delta DIV_{it-k}\\ \Delta GDP_{it-k}\\ \Delta EXD_{it-k}\\ \Delta GSP_{it-k}\end{bmatrix}+\begin{bmatrix}\lambda_1\\ \lambda_2\\ \lambda_3\\ \lambda_4\\ \lambda_5\\ \lambda_6\end{bmatrix}ECM_{it-1}+\begin{bmatrix}\varepsilon_{1it}\\ \varepsilon_{2it}\\ \varepsilon_{3it}\\ \varepsilon_{4it}\\ \varepsilon_{5it}\\ \varepsilon_{6it}\end{bmatrix} \quad (2)$$

Causality between the variables is examined by the F test. The results of the Granger Causality test are reported in Table III.

Table III. Granger Causality

	ΔFDI	ΔOPN	ΔDIV	ΔGDP	ΔEXD	ΔGSP	ECM
ΔFDI		1.02 (0.3945)	5.99*** (0.0000)	0.15 (0.9637)	21.69*** (0.0000)	2.61** (0.0343)	44.25*** (0.0000)
ΔOPN	5.49*** (0.0002)		3.46*** (0.0081)	1.46 (0.2134)	1.88 (0.1125)	0.44 (0.7768)	2.19** (0.0284)
ΔDIV	0.32 (0.8671)	1.76 (0.1358)		2.74** (0.0274)	0.63 (0.6385)	3.44*** (0.0084)	1.43 (0.1521)
ΔGDP	0.54 (0.7063)	6.19*** (0.0000)	2.80** (0.0248)		0.16 (0.9602)	3.18** (0.0132)	- 0.11 (0.9099)
ΔEXD	9.81*** (0.0000)	5.04*** (0.0005)	1.97 (0.0968)	0.27 (0.8971)		1.40 (0.2311)	-1.47 (0.1431)
ΔGSP	3.37*** (0.0094)	0.76 (0.5524)	0.66 (0.6193)	1.11 (0.3482)	5.54*** (0.0002)		-1.81 (0.0708)

Results indicate that there is short-run bidirectional causality between FDI and external debt, between FDI and government spending, and between market size and domestic investment. Short-run unidirectional causalities are observed from FDI to trade openness, from trade openness to market size and external debt, from domestic investment to FDI, from external debt to government spending, and from government spending to domestic investment and market size. Long-run causality is found to exist from FDI to trade openness.

4.4 Short-Run and Long-Run Dynamics: The short-run coefficients are obtained by estimating the following error correction model:

$$\Delta FDI_{it} = \beta_1 \Delta OPN_{it} + \beta_2 \Delta DIV_{it} + \beta_3 \Delta GDP_{it} + \beta_4 \Delta EXD_{it} + \beta_5 \Delta GSP_{it} + \lambda ECM_{it} + \varepsilon_{it} \quad (3)$$

The parameters β_1, β_2, β_3, β_4 and β_5 in equation (3) are the short-run coefficients for trade openness, domestic investment, market size, external debt and government spending, respectively. Since the variables are integrated of order one as determined from the unit root tests, they are included in the model in first-difference form. The sign of the coefficient of the

[2] the figures in the paranthesis are the p-values;
[3] **, *** indicate significance at 5% and 10% levels, respectively.

ECM_{it} term indicates convergence toward long-run equilibrium. The long-run coefficients are obtained by estimating the following model:

$$FDI_{it} = \beta_0 + \beta_1 OPN_{it} + \beta_2 DIV_{it} + \beta_3 GDP_{it} + \beta_4 EXD_{it} + \beta_5 GSP_{it} + \sum_{j=1}^{p} \gamma_{ij} \Delta OPN_{it-j} + \sum_{j=1}^{p} \lambda_{ij} \Delta DIV_{it-j} + \sum_{j=1}^{p} \delta_{ij} \Delta GDP_{it-j} + \sum_{j=1}^{p} \varphi_{ij} \Delta EXD_{it-j} + \sum_{j=1}^{p} \psi_{ij} \Delta GSP_{it-j} + \mu_{it} \quad (4)$$

In equation (4) β_1, β_2, β_3, β_4 and β_5 are the long-run elasticity coefficients for trade openness, domestic investment, per-capita economic growth, external debt and government spending, respectively. The optimal lag length is chosen by Akaike Information Criterion and Schwartz Bayesian Information Criterion. The model is then estimated for short-run and long-run coefficients using the GMM technique. The results are summarized in Table IV and Table V.

Table IV. Short-Run Coefficients

	coefficient	prob.
ΔOPN	- 0.01	0.5571
ΔDIV	0.17***	0.0021
ΔGDP	- 0.0001	0.8332
ΔEXD	- 0.03	0.6048
ΔGSP	0.10	0.221
ECM	- 0.44***	0.001

Table V. Long-Run Coefficients

	coefficient	prob.
OPN	0.04***	0.0000
DIV	0.11***	0.0051
GDP	- 0.0001	0.4119
EXD	0.01	0.2481
GSP	0.02	0.6235

Although the short-run effect of trade openness on FDI is insignificant, the long-run effect is, however, significantly positive. Liberal trade policies that are attractive for foreign investment will, therefore, attract more FDI. Both the short-run and long-run effects of market size on FDI are insignificant. Our findings are consistent with those of Elbadawi and Mwega (1997) that market size is not an important factor in explaining FDI in Africa. The short-run and long-run effects of external debt on FDI are insignificant. This would possibly arise for countries with high external debt burden since those countries present higher possibilities of default risk and are less attractive to foreign investors. In fact, the average long-term external debt burden of the African countries under study during the period 1974-2009 was almost 62% of GDP. According to Agisafe et al. (2006), although current debt flows may stimulate private investment, over-reliance on external debt as a foreign capital may adversely affect inbound FDI since more resources will have to used for repaying the debt. The short-run and long-run effects of government spending on FDI are also insignificant. Although government

[4] ***indicates significant at 10% level.

expenditure on infrastructure is an important determinant of FDI, the impact on FDI may also be negative or insignificant if government spending erodes the market share of the foreign investors. The short-run and long-run effects of domestic investment on FDI are significantly positive. There are many factors that may give rise to a significantly positive relationship between domestic investment and FDI. According to Lautier and Moreau (2012), links between domestic and foreign investors often arise due to agglomeration effects and inter-firm externalities. As previous studies have shown, domestic investment attracts FDI from investments on infrastructure, increases in domestic factor productivity and reductions in transaction costs. According to McMillan (1998) and Ndikumana and Verick (2008), FDI may "follow" domestic investment since the domestic investors, when compared with the foreign investors, tend to possess more accurate information about the local economy. The foreign investors, in such a case, often use domestic investment as an indicator of local market conditions. The adjustment coefficient -0.438 reported in Table IV is negative and statistically significant, thereby indicating rapid adjustment toward long-run equilibrium.

5. Concluding Remarks

Using dynamic panel cointegration and causal analysis this paper has identified the determinants of FDI for a panel of 35 African countries for the period 1974-2009. The unit root tests indicate that the panel variables are integrated of order one. The GMM technique has been used to examine both the short-run and the long-run effects. The Johansen-Fisher panel cointegration test indicates cointegrating relationships between the variables. Granger causality indicates short-run causal effect from domestic investment to FDI. Significantly positive long-run relationship is also observed between domestic investment and FDI. Although no causal effect is found to exist from trade openness to FDI, the long-run relationship between trade openness and FDI is significantly positive. Based on the results of the panel cointegration and causal analysis, increased participation in international trade and more domestic investment will expectedly increase FDI (in proportion to GDP) in the 35 African countries under study.

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