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The Long-Run Effect of FDI Inflows on Total Factor Productivity: Evidence from African Countries

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Abstract
From 2001-2014, had foreign direct investment inflows had significant long-term effects on total factor productivity in African countries. Following the latest dynamic techniques of panel data analysis of pooled mean group and mean group estimator (the Pesaran and Smith 1995, Journal of Econometrics 68: 79-113), we find strong evidence of insignificant impact of FDI inflows on total factor productivity. Augmented mean group estimator(AMG) introduced by Eberhardt and Teal (2010, Discussion Paper 515, Department of Economics, University of Oxford) and the Pesaran (2006,Econometrica 74: 967-1012) common correlated effects mean group estimator results also strongly support insignificant impact FDI inflows on total factor productivity in the long run in African economies. Augmented mean group estimator, common correlated effects mean group estimator and pooled mean group estimator result findings show that covariates or control variables (Trade and Domestic investment) have significant effects on total factor productivity in the long run. The result findings show that covariates or control variables are important determinants (factors) in defining exact relationship between FDI inflows and total factor productivity.
Keywords: FDI inflows; Total Factor Productivity; Panel Data; Economic growth
JEL Classification numbers: C33; F21; F23

1. Introduction

Foreign Direct investment (FDI) outflows from developing countries have grown faster in last thirty years than those from developed countries. According to United Nations Conference on Trade and Development (UNCTAD) data, the share of developing countries in total world FDI outflows increased more than thirty-fold from 0.5% in the early 1970s to about 16% in 2008. FDI outflows from developing countries reached approximately 300 billion US dollars in 2008, which is more than three times the value of world FDI outflows in 1970[1](UNCTAD, 2013).FDI outflows have increased in last two decades in Africa but not so rapidly as compared to that of FDI inflows in Africa. FDI inflows have increased a lot in African economies in last two decades. Foreign direct investment has increased rapidly worldwide and is most important form of all private capital flows to developing economies. FDI has long been considered as main vehicle of technology transfer from developed to developing economies (WOO, 2009). The effects of FDI outflows and inflows may differ between developed and developing countries. Firstly, financial markets are under developed in many developing countries and many firms in developing economies have not access to foreign capital markets. Secondly, developing economies multinational companies face more financial constraints relative to developed countries multinational companies (UNCTAD, 2006).

Recent financial crises has directed policy makers to restructure appropriate policies for growth. It is generally thought that short term debt is most volatile form of foreign capital and may contribute to instability of financial markets at times of financial crises. On the contrary, foreign direct investment is considered more stable form of capital inflows. Foreign direct investment has long been viewed to be a main vehicle of technology transfer. FDI is considered as main tool for economic development and growth in the developing economies. FDI represents the largest share of external capital flows to developing economies(United Nations Conference on Trade and Development 2007).It is generally assumed that FDI brings healthy and positive effects to the economy, for instance, transfer of advance technology, latest and innovative management practices, new way of production processes etc. It is very interesting and important empirical question whether and how FDI inflows affect total factor productivity growth in African countries in last few decades. Economists have recently analyzed whether FDI, a factor largely overlooked in economic growth literature, has an independent direct effects on per capita income growth (Blonigen and Wang 2005; Melitz 2005; Kose et al.2006).

It is interesting to compare our result findings with existing empirical studies on FDI and international financial integration. As mentioned above that previous studies on FDI have focused on growth of income per capita rather than TFP growth. Despite the difference between TFP and income per capita, Direct effects of FDI on growth of income per capita and TFP are rather straight forward. Existing research studies on FDI and per capita income growth failed to find statistically significant positive effect of FDI on income growth. Some of

[1] The figures are based on data from the UNCTAD FDI database
(http://stats.unctad.org/FDI/ReportFolders/reportFolders.aspx)

studies reported that positive effect of FDI on income growth is only conditional on other factors such as human capital (Borensztein, de Gregorio, and Lee 1998) and financial development (Alfaro et al. 2004).

Technology change is an important determinant of FDI. This was Robert Solow's view as well as many economists view in the economic growth literature (Helpman; 2004).However, previous research studies on the role of FDI in economic growth is still in its early stages (growing rapidly) and has focused on growth of income per capita (Alfaro et al.2004; Blonigen and Wang 2005; Borensztein, de Gregorio, and Lee 1998) but Total Factor Productivity has been hardly researched in the economic growth literature that is our interest in this article. Given the evidence on significance of TFP in clarifying cross-country income differences and preeminence of technology development and dissemination as important determinant of TFP in endogenous growth theory. Best to our knowledge, It is quite surprising that there is no cross-country empirical study on the effect of FDI on TFP in the African economies.

In this paper, we are specifically measuring the long run impact of FDI inflows on total factor productivity in African countries. We have selected African countries because Africa continent comprises of developing economies, FDI inflows are growing very faster in recent decades in Africa and developing economies. It is quite surprising that no studies have been done finding long term impact of FDI inflows on TFP in African economies, though FDI inflows have almost increased by multiple times in Africa compared with early 1970s. We want to bridge this shortcoming in the existing literature by exploring how FDI inflows effect total factor productivity in African countries by introducing new and interesting result findings. A novel contribution in the econometrics of panel data model is about cross-section dependence. Recently Eberhardt and Teal (2010) developed two estimators that allow for unobserved correlation across panel members (cross-section dependence).It is very important and could be as a main contribution of our paper.

In this paper, we have used a different approach to examine the impact of FDI inflows on Total Factor Productivity (TFP) using pooled mean group estimate (PMG), Augmented mean group estimator (AMG), mean group estimator and common correlated effects mean group estimator (CCEMG) on the basis of macroeconomics panel data over time span 2001-2014 annually in Africa. The main idea behind this paper is to measure effects of FDI inflows on total factor productivity in the long run based on theoretical model using recently developed panel pooled mean group estimator (PMG), Augmented mean group estimator (AMG) and common correlated effects mean group estimator (CCEMG) over the time span of 2001-2014 annually in African economies. Our findings are as follows: (1) we find strong evidence of insignificant impact of FDI inflows on total factor productivity in the long run using pooled mean group and mean group estimator and (2) Augmented mean group estimator and common correlated effects mean group estimator results also strongly support insignificant impact FDI inflows on total factor productivity in the long run in African economies (3) The statistical results show that covariates or control variables are important determinants (factors) in defining accurate relationship between FDI inflows and total factor productivity in the econometric model. The paper is organized as follows: **Section 2** describes Total Factor Productivity **Section 3** presents Data and Panel Unit root tests; **Section 4** Heterogeneous panel estimators; **Section 5** Pooled Mean Group (PMG) Estimator and **Section 6** is the conclusion.

2. Total Factor Productivity

Consider standard aggregate production function where aggregate output(Y) depends on physical capital (K), labor (L), human capital (H), and TFP or stock of knowledge (A):

$$Y_t = A_t L_t^a k_t^b$$

Where t is the time index, Y_t denotes output, A_t is a technology parameter representing total factor productivity, L_t denotes labor input, K_t denotes the capital stock, and a and b are elasticities of production with respect to L_t and K_t, respectively. Total Factor Productivity is defined as $\ln A_t = \ln Y_t - a \ln L_t - b \ln K_t$ with a as the labor share of income and $b = (1 - a)$ as capital share of income. Since our main objective is to investigate how FDI inflows along with related covariate factors(Trade, domestic investment, economic freedom, human capital) affects total factor productivity in the long run in African economies.

We estimate the capital stock, K, using the perpetual inventory method:

$$K_t = I_t + (1-\delta)K_{t-1}$$

Where I_t is the investment and δ is the depreciation rate. Consistent with the literature, we set the initial value of the capital stock equal to $K_0 = I_0/(g+\delta)$, where I_0 is the value of the investment series the first year it is available(1971), and g is the average growth rate of the investment series between first year with the available data and the first year of the estimation period(see Caselli,2005).Depreciation rate is assumed to be 6% as it is considered standard rate in the literature. Data on Trade, human capital, gross capital formation are taken from World Development Indicators (WDI) database.

The calculation of total factor productivity, A_t, requires data on factor income shares. For African economies, these data are available for all variables for period 2001 to 2014 annually. Growth accounting is consistent with varied alternative production functional forms linking input and output factors. It is necessary to assume perfect competition so that earnings of the factors are according to their factor productivity. Thus, we can measure TFP growth rates according to income paid to the factors to measure their contribution in the production process (Bosworth and Collins 2003; Caselli 2005; Hulten 2000).Since exact measures of factor income shares are often difficult to obtain for individual countries. Most of the research studies assume that income shares are identical across time and space. Gollin (2002) provide strong evidence in support of constant income shares across time and space. Bernanke and Gurkaynak (2001) also find no evidence for labor shares to vary with real GDP per capita. Most estimated labor income shares lie between 0.6 and 0.8, the average being 0.65.In our article, we have assumed fixed labor share of 0.65 and actual income shares from Gollin (2002) and Bernanke and Gurkaynak (2001). We therefore calculate total factor productivity according to as $\ln A_t = \ln Y_t - 0.65 \ln L_t - 0.35 \ln K_t$, as common practice in literature.

3. Data and Panel Unit Root Tests:

3.1. Data Description

In this study, we have used net IFDI (% GDP) and GDP Deflator (base year varies by country). Data on FDI inflows, $IFDI_t$, are taken from UNCTAD FDI database. UNCTAD defines FDI as “an investment involving long term relationship and reflecting lasting interest and control of a resident entity in one economy in an enterprise resident in an economy other than that of the foreign direct investor”(UNCTAD, 2009). Given that UNCTAD and WDI data ends in 2014, the empirical analysis covers the period from 2001 to 2014 annually. $IFDI_{it}$ is *FDI inflows* of country *i* in year *t,* Y_{it} is total factor productivity of country *i* in year *t*; $TRADE_{it}$ of country *i* in year *t*; and μ_{it} is the error term. The starting period of this data set is determined by earliest availability of date of the data. We have used net FDI inflows rather than the gross FDI inflows because the gross FDI figures reflect the sum of the absolute outflow and inflow values in the balance of payment financial accounts, and thus do not take into account disinvestment. Because net FDI inflows have negative values in some years, it is not possible to use logarithms. Thus, it is common practice in research to use the net FDI as a percentage of the GDP to derive economically interpretable results. Data on the net FDI outflows as a percentage of the GDP is taken from the UNCTAD FDI database. GDP, TRADE, HC (Human Capital), Gross Capital formation and GDP Deflator are taken from World Bank, World Development indicators Database. The sample consists of twenty nine African countries over the time span of 2001-2014.These countries are chosen because these are having largest FDI inflows in Africa according to UNCTAD data. The countries included are Algeria, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo, Republic of the, Congo, Democratic Republic of, Egypt, Equatorial Guinea, Gabon, Kenya, Lesotho, Madagascar, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Tunisia and Uganda. Some of the African countries that are not included because of missing and non-availability of data.

3.2 Panel unit root tests

Levin et al. (2002) and Im et al. (2003) panel unit root tests suggest that our variables TFP, IFDI, TRADE and EF are stationary at levels but DI and HC are stationary at the first difference as reported in Table 1(a) and Table 1(b). TFP, IFDI, TRADE and EF are *I(0)* but DI and HC is *I(1).* Thus, Our variables are not integrated of same order. Some variables are I(1) or I(0). To avoid the problem associated with conflicting results provided by conventional unit root tests-such as Levin *et al.* (2002) and Im *et al.* (2003) - we use panel ARDL testing approach for co-integration in this study. We use Panel ARDL testing approach to co-integration developed by Pesaran (1997), Pesaran and Shin (1999) and Pesaran *et al*. (2001) to test for the existence of a long-run relationship. This test is based on autoregressive distributed lag (ARDL) framework. This approach can be used irrespective of whether the variables are *I*(1), *I*(0) or mutually co-integrated. Due to low power and other problems associated with other cointegration techniques, the ARDL approach to cointegration has become popular in recent years. Many unit root tests are available. In this study, I have used only two of them, Levin et al. (2002) and Im et al. (2003). The results of unit root tests are reported in Table 1.Due to the confirmatory data analysis, the Levin et al. (2002) and Im et al. (2003) are performed jointly. Both tests are performed with intercept and no trend. The number of lags are selected based on Schwarz Information Criterion (SIC).

Table1 (a). Panel unit root tests for dependent and independent variables (intercept without trend)

Unit root procedure	LLC	ADF-Fisher	IPS	LLC	IPS
	Levels			First differences	
TFP	-72.05***		-60.91***	-148.36***	-102.63***
	(0.00)		(0.00)	(0.00)	(0.00)
IFDI	-15.77***		-9.38***	-18.84***	-17.54***
	(0.00)		(0.00)	(0.00)	(0.00)
TRADE	-4.70***		-1.81**	-16.83***	-12.46***
	(0.00)		(0.035)	(0.00)	(0.00)
DI	-3.72***		-0.8442	-17.59***	-12.20***
	(0.00)		(0.1998)	(0.00)	(0.00)
EF	-6.50***		-4.32***	-18.84***	15.49***
	(0.00)		(0.00)	(0.00)	(0.00)
HC	-7.23***		-1.307	-5.96***	-3.65***
	(0.00)		(0.10)	(0.00)	(0.00)

Notes: LLC, Levin, Lin and Chu; IPS, Im, Pesaran and Shin; p-values are in parentheses;***, ***, * indicate that the null hypothesis is rejected at 1, 5 and 10 percent, respectively.

Table1 (b). Panel unit root tests for dependent and independent variables (intercept with trend)

Unit root procedure	LLC	ADF-Fisher	IPS	LLC	IPS
	Levels			First differences	
TFP	-109.825***		-92.036***	-127.480***	-85.7275***
	(0.00)		(0.00)	(0.00)	(0.00)
IFDI	-11.8043***		-6.966***	-16.645***	-12.866***
	(0.00)		(0.00)	(0.00)	(0.00)
TRADE	-8.1016***		-3.10204**	-15.428***	-9.0516***
	(0.00)		(0.001)	(0.00)	(0.00)
DI	-5.3998***		-0.94423	-14.991***	-8.90964***
	(0.00)		(0.1725)	(0.00)	(0.00)
EF	-7.8467***		-3.92656***	-19.0676***	-12.3601***
	(0.00)		(0.00)	(0.00)	(0.00)
HC	-5.87377***		-1.11720	-11.114***	-5.67880***
	(0.00)		(0.1320)	(0.00)	(0.00)

Notes: LLC, Levin, Lin and Chu; IPS, Im, Pesaran and Shin; p-values are in parentheses;***, ***, * indicate that the null hypothesis is rejected at 1, 5 and 10 percent, respectively.

4. Heterogeneous Panel Estimators

4.1. Empirical Model

Assume the following econometric model: for $i= 1,\ldots, N$ and $t= 1,\ldots,T$

$$\text{Let } Y_{it} = \beta_i X_{it} + \mu_{it} \quad (1)$$

$$\text{Where } \mu_{it} = \alpha_{1i} + \lambda_i f_t + \varepsilon_{it} \quad (2)$$

$$X_{it} = \alpha_{2i} + \lambda_i f_t + \gamma_i g_t + e_{it} \quad (3)$$

X_{it} and Y_{it} are observables, β_i is the country-specific slope on the observable regressor, and μ_{it} contains the unobservables and error terms ε_{it}. Where the number of groups $i= 1,2,\ldots N$; the number of periods $t= 1,2,\ldots, T$. X_{it} is a k x 1 vector of explanatory variables (IFDI, TRADE, DI, EF and HC); δ_{ij} are the k x 1 coefficient vectors; λ_{ij} are scalars; and μ_i is the group specific effect. Y_{it} is dependent variable representing Total factor productivity (TFP).

The unobservables in (2) are made up of group fixed effects α_{1i}, which capture time-invariant heterogeneous across groups, as well as an unobserved common factor f_t with heterogeneous factor loadings λ_i, which can capture time-variant heterogeneity and cross-section dependence. The factors f_t and g_t are not limited to linear evolution over time; they can be nonlinear and nonstationarity, with obvious implications for cointegration. There are also some other issue arises because regressors are driven by some of the same common factors as the observables: the presence of f_t in (2) and (3) induces endogeneity in the estimation equation (Coakley, Fuertes, and Smith 2006; Eberhardt and Teal 2011). ε_{it} and e_{it} are assumed white noise.

4.2 *Pesaran and Smith (1995)*

The Pesaran and Smith (1995) MG estimator does not concern itself with cross-section dependence and assumes away $\lambda_i f_t$ .Thus (1) above is estimated for each panel member *i*, including an intercept to capture fixed effects and a linear trend to capture time-variant unobservables. The estimated coefficients β_i are subsequently averaged across panel members, but in the standard implementation this is just unweighted average**.**

4.3 Pesaran (2006)

The Pesaran (2006) CCEMG estimator allows for the empirical analysis as arranged in (1), (2) and (3).The empirical setup prompts cross-section dependence, time-variant unobservables with heterogeneous impact across panel members, and problems of identification. The CCEMG estimator solves this problem with powerful augmentation of the group specific regression equation: apart from regressors X_{it} and an intercept, this equation includes cross-section averages of independent and dependent variables as additional regressors. The combination of averages of Y_{it} and X_{it} can account for the unobserved common factor f_t. Because the relationship is estimated for each panel member separately, the heterogeneous impact (λ_i) is also given by construction (Eberhardt, Helmer, and Strauss 2010).

4.4. Eberhardt and Teal (2010)

Eberhardt and Teal (2010) developed AMG estimator as alternative to the Pesaran (2006) CCEMG estimator with production function estimation in mind. In the Pesaran (2006) CCEMG estimator, the unobservable common factor f_t is treated as nuisance, something to be accounted for that is not of particular interest for the empirical analysis. Unobservables represent total factor productivity (TFP) in cross country production functions. Standard panel approaches to cross-country empirics are commonly based on a production function of Cobb-Douglas form (Eberhardt and Teal 2011; Eberhardt 2012).In Monte Carlo simulations (Eberhardt and Bond 2009), the AMG and CCEMG performed similarly well in terms of bias or root mean squared error (RMSE) in panels with nonstationary variables (cointegrated or not) and multifactor error terms (cross-section dependence).

4.5 Econometric analysis and results:

In this paper, we are specifically measuring the long run impact of FDI inflows on total factor productivity in African countries. Our findings are as follows: (1) we find strong evidence of insignificant impact of FDI inflows on total factor productivity in the long run using pooled mean group and mean group estimator and (2) Augmented mean group estimator and common correlated effects mean group estimator results also strongly support insignificant impact FDI inflows on total factor productivity in the long run in African economies (3) The statistical results show that covariates or control variables are important determinants (factors) in defining accurate relationship between FDI inflows and total factor productivity in the econometric model. The results of mean group estimator (MG), Augmented mean group estimator (AMG) and common correlated effects mean group estimator (CCEMG) strongly support insignificant impact of FDI inflows on total factor productivity in African economies. Our result findings are robust by using different econometric techniques.

As results reported in Table 4 and Table 5, Augmented mean group (AMG) estimator result findings show that domestic investment (*DI*) has negative and significant effects on total factor productivity in the long-run in African countries. The results show that increase in domestic investment results in decrease of total factor productivity in the long run by using different econometric techniques. AMG, CCEMG and MG result findings show that TRADE has only negative and significant effects on total factor productivity in the long run. It infers from result findings that that increase in TRADE results in decrease of total factor productivity (TFP) in the long run. The econometric results show that economic freedom (EC) and Human Capital (HC) has insignificant effects on total factor productivity in the long in African economies.

5. Pooled Mean Group (PMG) Estimator

After testing the variables for stationarity, we apply recently developed Panel ARDL methodology. Pesaran et al. (1999) suggest two different estimators which are consistent when both T and N are large. The difference between these two different estimators is that pooled mean group estimator is consistent under assumption of long-run slope homogeneity while mean group estimator is more consistent under the assumption that both slope and intercepts are allowed to vary across country. An alternative estimator being set up under the assumption of homogeneity slope is dynamic fixed effects (DFE), in which slopes are fixed and the intercepts allow to vary across country. According to the study of Pesaran and Shin (1997), the following basic ARDL (*p;q*) model will be considered as main equation;

$$Y_{it} = \alpha_0 + \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where the number of groups $i= 1,2,....N$; the number of periods $t= 1,2,......, T$. X_{it} is a k x 1 vector of explanatory variables*(IFDI, TRADE,DI,EF AND HC)*; δ_{ij} are the k x 1 coefficient vectors; λ_{ij} are scalars*; and* μ_i is the group specific effect.

$$\Delta y_{it} = \varphi_i(y_{i,t-1} - \varphi' X_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-1}) + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3)$$

Where $\phi_i = -(1-\sum_{j=1}^{p} \lambda_{ij})$, $\theta_i = \sum_{j=0}^{q} \delta_{ij} /(1-\sum_k \lambda_{ik})$, $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \delta_{im}$ $j=1,2,.......,p-1$.

and $\delta^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}$ $j=1,2........,q-1$.

The parameter ϕ_i is the error-correcting speed of adjustment. If $\phi_i=0$, then there will be no evidence for long-run relationship. This variable is expected to be significantly negative so that variables show a return to long-run equilibrium. φ' vector is of particular importance which contains the long run relationships between the variables. Pesaran, Shin, and Smith (1997, 1999) have proposed a PMG estimator that combines both pooling and averaging. This intermediate estimator allows the intercept, short-run coefficients, and error variances to differ across groups (as would the MG estimator) but constrains long-run coefficients to be equal across groups (as would the FE estimators).The MG estimates are unweighted mean of the *N individual* regression coefficients. The PMG model allows for heterogeneous short-run dynamics and common long-run elasticities. Often only the long-run parameters of interest. Since equation (2) is nonlinear in the parameters, Pesaran, Shin and Smith (1999) develop a maximum likelihood method to estimate the parameters. Expressing the likelihood as the product of each cross-section's likelihood and taking log yields (Blackburne III and Franke, 2007).

5. 1 *PMG and MG Estimation Results*

Pooled mean group (PMG) estimator is used instead of Three Stage Least Squares (3SLS) and General method of Moments (GMM) because PMG is an intermediate estimator which involves pooling and averaging. This estimator allows the intercepts, short run coefficients, and error variances to vary across country, but constrains the long-run coefficients to be same (Pesaran et al., 1999) Furthermore, it has advantages over OLS and especially DOLS since it allows for differences in the countries for the short run dynamics. Long-run coefficients are constrained to be same. The economy policies show their effects on application of macro and micro variables after a delay of specific time period. For instance, increase in interest rate or inflation will show its effect in economy after some time period. Thus in this study, ARDL method, which is a cointegration technique and introduced by Pesaran and Shin (1997) and Pesaran, Shin and Smith (2001), was used to analyze lagged values. We follow ARDL (1,1,1) model specified by Pesaran et al. (1999). We consider common ARDL (1,1,1) specification for all countries based on Schwarz Information Criterion (SIC). That specification is reliable with strong balanced panel and large T. Data we use meet these assumptions.

The results of pooled mean group (PMG) estimator show that FDI inflows have negative and insignificant effects on total factor productivity in the long-run in African economies. The pooled mean group result findings show that covariates or control variables (TRADE, DI, EF and HC) have also significant effects on total factor productivity (TFP) in the long run. The result show that domestic investment (*DI*) has negative and significant effects on total factor productivity in the long-run .i.e. (increase in domestic investment result in decrease of total factor productivity in the long run).The PMG result findings show that the other covariates or control variables .i.e. (Human capital, economic freedom and Trade) have positive and significant effects on total factor productivity in the long run. Result findings show that there is insignificant effects of FDI inflows and control variables on total factor productivity in the short run as reported in Table 3. All results are reported in Table 2 and 3. Error correction term (ECT) is negative with significant coefficient which shows that there exits evidence of long run relationship between FDI inflows and total factor productivity (TFP).

Table 2. Pooled mean group (PMG) estimates

	Long run Pooled mean group (PMG) estimates			
	Coefficient	Std.Error	t-Statistics	P-value (Prob.*)
IFDI	-0.028191	0.037851	-0.744782	0.4572
TRADE	0.003066***	0.000144	21.30200	0.0000
DI	-0.004303***	0.000734	-5.863924	0.0000
EF	0.341522***	0.007966	42.87079	0.0000
HC	0.014756***	0.000596	24.75879	0.0000

***,** and * indicate significance at 1%, 5% and 10% level of significance.

Table 3. ECM for Pooled mean group (PMG) estimates

Short run Pooled mean group (PMG) estimates

	Coefficient	Std.Error	t-Statistics	P-value (Prob.*)
D1.IFDI	-3.147917	7.788578	-0.404171	0.6865
D1. TRADE	-0.001377	0.001335	-1.031151	0.3036
D1. DI	0.004166	0.005610	0.742639	0.4585
D1. EF	0.032089	0.075254	0.426401	0.6702
D1. HC	0.131913	0.096545	1.366336	0.1732
ECT	-0.403383***	0.068266	-5.909000	0.0000

***,** and * indicate significance at 1%, 5% and 10% level of significance.

Table 4. Country regression averages (without trend)

	[1] MG TFP	[2] AMG TFP - $\hat{\mu}_t^{va}$	[3] AMG TFP	[4] CCEMG TFP
IFDI	6.2161	-2.31546	-.69227	1.00753
	[0.69]	[-1.55]	[-0.94]	[0.73]
CDP			1.02431***	
			[13.58]	
TRADE	.00240	-.001865*	-.00149***	-.001229***
	[1.14]	[-1.67]	[-2.50]	[-2.66]
DI	-.00320	-.005084***	-.004216***	-.002550
	[-0.44]	[-2.75]	[-2.47]	[-1.50]
EF	-.01199	.014590	.025065	.034353**
	[-0.12]	[0.64]	[1.52]	[1.91]
HC	-.03789	.050563	.024673	-.030296
	[-0.68]	[1.29]	[0.97]	[-0.80]
Intercept	6.1979	.158874	2.60017	-.319183
	[1.43]	[0.05]	[1.30]	[-0.10]

Notes: t-statistics are reported in square brackets. ***,** and * indicate significance at 1%, 5% and 10% level of significance respectively. $\hat{\mu}_t^{va}$ signifies the "common dynamic process".

Table 5. Country regression averages (trend included)

	[1] MG TFP	[2] AMG TFP - $\hat{\mu}_t^{va}$	[3] AMG TFP	[4] CCEMG TFP
IFDI	5.254	1.9210	-.53204	-.07245
	[0.60]	[0.66]	[-0.67]	[-0.11]
CDP			1.02191***	
			[14.30]	
TRADE	.0023	-.00306***	-.00200***	-.008005*
	[1.12]	[-2.39]	[-2.70]	[-1.75]
DI	.0012	-.00406**	-.00414***	-.005591**
	[0.18]	[-2.25]	[-2.71]	[-2.17]
EF	.0716	-.00349	0.02101*	-.07503
	[0.67]	[-0.15]	[1.70]	[-0.70]
HC	.0048	-.02777	-.00503	.01341
	[0.03]	[-0.54]	[-0.18]	[0.33]
Country trend	-.05274	.00792	.00585**	.00356
	[-2.97]	[1.30]	[2.27]	[0.35]
Intercept	4.920	6.290	4.8416**	-8.0167*
	[0.45]	[1.62]	[2.27]	[-1.79]

Notes: t-statistics are reported in square brackets. ***,** and * indicate significance at 1%, 5% and 10% level of significance respectively. $\hat{\mu}_t^{va}$ signifies the "common dynamic process".

6. Conclusion

This paper has analyzed impact of FDI inflows on total factor productivity (TFP) in the long run in African economies over time span 2001-2014 annually. Our findings are as follows: (1) we find strong evidence of insignificant impact of FDI inflows on total factor productivity in the long run using pooled mean group and mean group estimator and (2) Augmented mean group estimator and common correlated effects mean group estimator results also strongly support insignificant impact FDI inflows on total factor productivity in the long run in African economies (3) Our result findings show that covariates or control variables and appropriate or relevant econometric technique are important determinants (factors) in defining accurate relationship between FDI inflows and total factor productivity in the econometric model. Economic policies show their effect on the application of macro and micro variables after a delay of some time span. For instance, investment made today will show its effect in the future periods. Therefore, we have also used Panel ARDL (PMG) cointegration approach proposed by Pesaran, Shin and Smith (2001) and Pesaran and Shin (1997) by using lagged values of dependent and independent variables. We find strong evidence of insignificant effects of FDI inflows on total factor productivity (TFP) in the long run in the African economies. Our result findings show that insignificant effects of FDI inflows on total factor productivity is due to weaken macro-economic environment, weak economic structure and poor economic policies in Africa countries. Sound macro-economic environment, strong economic structure and effective economic policies can play pivotal role to have significant and positive effects of FDI inflows on total factor productivity in the long run in African economies.

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