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FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH OF D8 COUNTRIES DURING THE PERIOD (2000-2014): A PANEL CO-INTEGRATION ANALYSIS

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Abstract: *Foreign direct investment (FDI) has been an important source of economic growth. FDI bringing in capital investment, technology and management knowledge needed for economic growth. This study investigates the relationship between foreign direct investments (FDI) and economic growth in D8 countries by using panel data for the period 2000 to 2014. The empirical analysis reveals that there is a positive long-run co-integrating relationship between FDI stock and economic growth. By using the Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and PMG (pooled mean group estimation methods. The elasticity of GDP with respect to FDI is 0.35%, 0.23% and 0.13% respectively. The results also indicate that the stock of foreign direct investment is a significant factor that positively affects economic growth in the D8 countries.*

JEL Classification: *C33, F21, O11.*

Keywords: *Economic growth, foreign direct investments, panel analysis.*

1. INTRODUCTION

Foreign direct investment (FDI) has played a leading role in many of the economies of the region. There is a widespread belief among policy makers that foreign direct investment (FDI) enhances the productivity of host countries and promotes development. FDI inflows contribute to economic growth through an increase in productivity by providing new investment, better technologies and managerial skills to the host countries. FDI tends to be directed at those manufacturing sectors and key infrastructures that enjoy actual and potential comparative advantage. This effect of FDI on economic growth is dependent on the level of technological advance of a host economy, the economic stability, the state investment policy, the degree of openness and the amount of human capital. Furthermore, among the variables of FDI and others determinants of economic growth like domestic investments, exports, human capital, research and development expenditures there are interactions and strong relationships. More specifically, FDI inflows can play a

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vital role in host countries due to the fact that it increases the supply of funds for domestic investments. FDI can have two potential effects on domestic investment by competing in product and financial markets. Thus FDI can increase growth in two ways:(1) it increases total investment by attracting higher levels of domestic investment,(2)through interaction of the more advanced technology with the host's human capital, FDI is more productive than domestic investment(Ewe-Ghee,2001). FDI not only boosts capital formation but also enhances the quality of capital stock (Ajayi, 2006). Further more, FDI inflows not only can increase the export capacity of the host country but also induces new job vacancies (Stamatiou & Dritsakis (2013)). FDI creates potential spill overs of knowledge to the local labor force while at the same time, the host country's level of human capital determines how much FDI it can attract and whether local firms are able to absorb the potential spillover benefits (Adefabi, 2011).

The aim of this paper is to examine the effects of FDI on economic growth using panel data methods over the period 2000-2014 in D-8 countries. Eight Islamic developing countries (D8), also known as Developing-8, is an organization for development cooperation among the following countries: Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan and Turkey. The establishment of D8 was announced officially through the Istanbul Declaration of Summit of Heads of State/Government on June 15, 1997. The objectives of D8 Organization for Economic Cooperation are to improve member states' position in the global economy, diversify and create new opportunities in trade relations, enhance participation in decision-making at international level, and improve standards of living. D8 is a global arrangement rather than a regional one, as the composition of its members reflects. Organization for Economic Cooperation (D8) is a forum with no adverse impact on bilateral and multi-lateral commitments of the member countries, emanating from their membership to other international or regional organizations.

Given that the D8 countries are developing countries, and They need to increasing economic growth and development there economy, And given the uncertainty of the effect of foreign direct investment on economic growth so it is necessary to investigated the relationship between foreign direct investment and economic growth in D8 countries.

The purpose of this study is to investigate the relationship between FDI and economic growth and estimate the effect of FDI on growth of the D8 countries over the period 2002–2012. The rest of the paper is organized as follows. Section (2) reviews the literature on the relationship between FDI and economic growth including empirical studies. Section (3) presents the empirical analysis, discusses the methodology, explains sources and data and reports the empirical results based on econometric analysis. Section (4) presents the concluding remarks.

2. LITERATURE REVIEW

The relation between FDI and growth has drawn the attention of scholar quite lately than other research works. There are several studies done on FDI and economic growth. Their findings vary from different methods used on their research, some of the researchers found that FDI has a positive effect on economic growth. For example is Balasubramanyam et al., (1996) analyzes how FDI affects economic growth in developing economies. Using cross-section data and OLS regressions he finds that FDI has a positive effect on economic growth in host countries using an export promoting strategy but not in countries using an import substitution strategy. Olofsdotter (1998) provides a similar analysis. Using cross sectional data she finds that an increase in the stock of FDI is positively related to growth and that the effect is stronger for host countries with a higher level of institutional capability as measured by the degree of property rights protection and bureaucratic efficiency in the host country.

There is further study done by Chowdhury and Mavrotas (2003) which examine the causal relationship between FDI and economic growth by using an innovative econometric methodology to study the direction of causality between the two variables. Baharumshah and Thanoon (2006) by using dynamic Impact panel models demonstrated the positive contribution of FDI on the growth process of East Asian economies. As contrary, Herzer et al., (2007) has argued that with 28 developing countries data there exists neither a long-term nor a short-term effect of FDI on growth; in fact, there is not a single country where a positive unidirectional long-term effect from FDI to GDP is found.

Yao,(2006) investigated the effect of FDI on economic growth, using a panel data set encom passing 28 Chinese provinces over the period 1978–2000. The results of the study showed that FDI have a strong and positive effect on economic growth. In the case of East European countries, similar results were found by Bhandari, Dhakal, Pradhan and Upadhyaya (2007). The conclusions are that an increase in FDI positively affects economic growth. Anwar and Nguyen(2011) in their study for 61 provinces of Vietnam over the period 1996–2005 found that FDI have positive effects on economic growth. Omri and Kahouli (2014) shows that the effect of the stock of FDI on economic growth in MENA countries is positive and statistically significant.

3. METHODOLOGY, DATA AND SOURCES

The empirical analysis is based on the following equation that links GDP to FDI, which is usually the basis of the analysis in there viewed literature:

$$\text{Log (GDP)} = a + \text{blog (FDI)} \tag{1}$$

In the following empirical analysis we estimate Eq. (1) to examine the macro economic impact of FDI on economic growth employing panel data for the period

2000–2014, for D8 countries. In particular, we employ panel estimation techniques to estimate Eq(1). and investigate if FDI is statistically significant determinant of economic growth. The dependent variable is the Gross Domestic Product(GDP) inconstant prices of 2005. The explanatory variable is the stock of foreign direct investments (FDI) as percentage of GDP. All data for the calculation of GDP and FDI have been obtained from the World Bank database (2014). All the amounts provided in local currency and current prices were divided by GDP deflators (2005 = 1) and expressed in constant 2005 prices. Both variables are expressed in logarithmic form (LGDP, LFDI).

There were no available historical data in the World Bank or somewhere else database regarding the foreign direct investments stock of all countries. Therefore, the foreign direct investments stock has been calculated by the perpetual inventory method on the basis of data for the annual foreign direct investments flows in Eurozone countries. In particular, the foreign direct investments stock at the end of each year has been calculated as the sum of the previous year's foreign direct investments stock and the current year's foreign direct investments after deducting the amount of depreciated capital, as presented in the following equation:

$$FDI_t = (1 - \partial)\, FDI_{t-1} + I_t \tag{2}$$

where FDI_t and FDI_{t-1} are the foreign direct investments stock of the current and previous year, respectively, It is the annual foreign direct investments flow in year t and δ is the annual depreciation rate of the foreign direct investments stock. The depreciation rate was set at 10% taking into account the depreciation rates used in previous studies (Wei, 1996; Subasinghe, 2003). A sensitivity analysis performed for various values of the depreciation rate from 5% to 15% resulted in no significant changes in the key qualitative conclusions of this study. The estimate of the foreign direct investments stock at the beginning of the examined period, which was necessary for the application of the perpetual inventory method, was calculated with the following formula:

$$K_1 = \frac{I_1}{(\partial + g)} \tag{3}$$

where K_1 is the estimate of the foreign direct investments stock at the end of year 1, I_1 is the annual foreign direct investments in year 1, δ is the annual depreciation rate and g is the average of yearly growth rates of foreign direct investments during the period 2002–2012.

3.1. Unit Root Tests

In the empirical analysis, first panel unit root tests were employed to examine the order of integration of the variables in the panel data setting. Different unit root tests according to Levin, Lin, and Chu (2002) (LLC), Im, Pesaran, and Shin (2003).

(IPS) and ADF and PP Fisher were estimated to test the hypothesis that each panel data series has a common unit root process. Two specifications were estimated for all tests: the first was with a constant without a trend and the second included a deterministic trend. From the above tests the most popular are those of Levin et al., (2002) (LLC) test that assumes homogeneity in the dynamics of the auto regressive (AR) coefficients for all panel members. The test of Im et al., (2003) (IPS) test is more general than the LLC test because heterogeneity is allowed in dynamic panel and inter temporal data.

Table 1
Panel unit root tests

With individual intercept in equation				
Variable	*LLC*	*IPS*	*ADF Fisher*	*PP-Fisher*
LGDP	11.327(0.000)*	4.3425(0.000)*	44.896(0.000)*	–2.877(0.000)*
LFDI	1.81470(0.035)	0.92907(0.176)	23.9602(0.09)	–0.9337(0.17)
LDGDP	–1.4539(0.073)	–3.352(0.000)	43.013(0.000)	–3.6546(0.000)
LDFDI	9.7243(0.000)*	5.5083(0.000)*	60.769(0.000)*	–4.733(0.000)*
With individual intercept and trend in equation				
LGDP	1.9710(0.024)*	7.568(0.000)*	32.857(0.007)*	–1.459(0.072)
LFDI	3.0565(0.006)	0.6249(0.2660)	23.582(0.09)	–0.4076(0.341)
LDGDP	1.6909(0.95)	0.6717(0.25)	27.800(0.033)	–1.5045(0.066)
LDFDI	7.778(0.000)*	2.8011(0.002)*	47.174(0.000)*	–3.341(0.000)*

Note:

1. *Indicate rejection of the null hypothesis at 1%
2. Panel data include all countries
3. The numbers in parentheses denote *p*-values.
4. The null hypothesis of these tests is that the panel series has a unit root (nonstationary series).
5. Lag length selection automatic based on Schwarz criterion

Table 1 presents the results of panel unit roots tests for each variable in levels and next in first differences. As can be seen from Table 1, most of the test results showed that GDP is stationary in levels, while the FDI variable contain a unit root. Most of the test results indicated that FDI variable is stationary in their first differences.

3.2. Panel Co-integration Tests

In the integration analysis, test and estimate the long-term economic relations. The main idea of co-integration analysis is that although many economic time series non-stationary (containing random processes), but may in the long term linear combination of these variables are, static (non-random process).

Panel co-integration tests were employed to test the hypothesis that a long-run relationship exists among the variables. If the variables are found to have unit roots (non-stationarity), and are of the same order of integration, the co-integrating relationship among variables determined, that is the tendency of the variables to move together in the long run is studied either by the Engle-Granger (1987) procedure or the Johansen-Juselius procedure (Johansen 1988; Johansen-Juselius 1992, 1999) to overcome the associated problem of spurious correlation and misleading inferences. If the variables are found to be co-integrated, the relationship may be interpreted as a long run relationship.

Kao (1999), Madala and Wu (1999) and Pedroni (1999, 2004) developed several tests to examine the existence of co-integration. The proposed statistics test the null hypothesis of no co-integration versus the alternative of co-integration.

Table 2
Panel co-integration tests

Co-integration Statistic value	
1. Pedroni co-integration tests	
Panel *v*-Statistic	3.5443***
Panel *p*-Statistic	1.3877
Panel *t*-Statistic (non-parametric)	1.6687**
Panel *t*-Statistic (parametric)	2.0724**
Group *p*-Statistic	3.0315
Group *t*-Statistic (non-parametric)	1.7844**
Group *t*-Statistic (parametric)	
2. Kao co-integration test	3.1511***
3. Fisher co-integration (Trace test) for one vector	154.3***
4. Fisher co-integration (Maximum Eigen value test) for one vector	168.3**

Note: ***Indicate rejection of the null hypothesis of no co-integration at 1%.
** 5% Level of significance.

Table 2 summarizes the results of panel co-integration analysis among the variables using the Pedroni, Kao and Fisher statistics. Panel co-integration test results suggest that there is a co-integrating relationship among the variables in the sample of D8 countries. Therefore we conclude that Eq. (1) finds statistical support in the panel.

3.3. Panel FMOLS and DOLS Co-integration Estimates

According to weaknesses OLS estimators for parameter estimation, experts have suggested another econometric estimators, One of these estimators that it is very easy to use, dynamic ordinary least squares estimators. This method of estimation

outperforms both bias-corrected OLS and fully modified OLS eliminating the second order bias caused by the fact that the independent variables are endogenous. DOLS estimator is generated from Eq. (1) when symmetrical lead and lag dynamic terms of the explanatory variables are included Hence, Eq. (1) is estimated using one lead and one lag of all the independent variables. The Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) methodologies are proposed by Kao and Chiang (2000) to estimate the long-run co-integration vector, for non-stationary panels. These estimators correct the standard pooled OLS for serial correlation and endogeneity of regressors that are normally present in long-run relationship.

Let us consider the following fixed effect panel regression:

$$y_{it} = \alpha_i + X\,\beta + \mu_{it},\ i = 1, \ldots, N,\ t = 1, \ldots T \tag{4}$$

where Y_{it} is a matrix (1, 1), β is a vector of slopes (1, K) dimension, α_i is individual fixed effect, u_{it} are the stationary disturbance terms. It is assumed that, x_{it} (k, 1)vector are integrated processes of order one for all i, where:

$$x_{it} = x_{it-1} + \varepsilon_{it} \tag{5}$$

Under these specifications, (Eq. 9) describes a system of co-integrated regressions, i.e. y_{it} is co-integrated with x_{it}. By examining the limiting distribution of the FMOLS and DOLS estimators in co-integrated regressions. Kao and Chiang (2000) show that they are asymptotically normal The FMOLS estimator is constructed by making corrections for endogeneity and serial correlation to the OLS estimator and is defined as:

$$\hat{\beta}_{fm} = \left[\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \overline{x_i})'\right]^{-1}\left[\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \overline{x_{it}})Y_{it}^{\hat{}+} + T\Delta_{\varepsilon\mu}^{\hat{}+}\right] \tag{6}$$

Where $\Delta_{\varepsilon\mu}^{\hat{}+}$ is the serial correlation correction term and $Y_{it}^{\hat{}+}$ is the transformed variable of Y_{it} to achieve the endogeneity correction. The serial correlation and the endogeneity can also be corrected by using DOLS estimator. The DOLS is an extension of Stock and Watson's (1993) estimator. In order to obtain an unbiased estimator of the long-run parameters. DOLS estimator uses parametric adjustment to the errors by including the past and the future values of the differenced I(1) regressors The dynamic OLS estimator is obtained from the following equation:

$$y_{it} = \alpha_i + x_{it}'\beta + \sum_{j=q_1}^{j=q_2} c_{ij}\Delta x_{i,\,t+j}\ v_{it} \tag{7}$$

Where c_{ij} is the coefficient of a lead or lag of first differenced explanatory variables. The estimated coefficient of DOLS is given by:

$$\hat{\beta}_{DOLS} = \sum_{i=1}^{N}\left(\sum_{t=1}^{T}Z_{it}Z_{it}'\right)^{-1}\left(\sum_{t=1}^{T}Z_{it}y_{it}^{\hat{}+}\right) \tag{8}$$

Where $z_{it} = \left[x_{it} - \overline{x_i}, \Delta x_{i,t-q}, ..., \Delta x_{i,t+q} \right]$ is vector of regressors $2(q+1) \times 1$ vector of regressors.

3.4. The Pooled Mean Group (PMG) by Pesaran et al., (1999)

Our final step consists in using alternative methodology the Pooled Mean Group (PMG) to estimate the co-integration relationship in Feldstein and Horioka puzzle in order to test the robustness of the previous results. There are two estimation methods commonly used with dynamic panel data models. The firs consist of averaging separate estimates for each group in the panel. According to Pesaran and Smith (1995), the mean group estimator provides consistent estimates of the parameter averages. It allows the parameters to be freely independent across groups and does not consider potential homogeneity between groups. The second method is the usual pooled method; examples are the random effects, fixed effects, and GMM methods. These models force the parameters to be identical across groups, but the intercept can differ between groups. GMM estimations of dynamic panel could lead to inconsistent and misleading long-term coefficients, a possible problem that is exacerbated when the period is broad (Pesaran, Shin, and Smith, 1999).

The PMG is an intermediate estimator because it involves both pooling and averaging. One advantage of the PMG over the FMOLS and DOLS models is that it can allow the short-run dynamic specification to differ from country to country while the long run coefficients are constrained to be the same.

The Autoregressive Distributed Lag model ARDL (p, q, q, …, q) proposed by Pesaran et al., (1999) is:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \partial_{ij}' x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{9}$$

The cross-section units (countries) are denoted by $i = 1, 2, 3, \ldots, N$, $t = 1, 2, 3, \ldots, T$ represent time periods, X_{it} (k, 1) is a vector of explanatory variables for country I, μ_i represent the fixed effect The λ_{ij} the coefficient of the lagged dependent variables, and ∂_{ij} are $k \times 1$ coefficient vectors.

It is convenient to work with the following re-parameterization of (9):

$$\Delta y_{it} = \varphi_i y_{i,t-1} + \beta_i' x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \partial_{ij}^{*} \Delta y_{i,t-j} + u_i + \varepsilon_{it} \tag{10}$$

Where $\varphi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$, $\beta_i = \sum_{j=0}^{q} \delta_{ij}$, $-\sum_{m=j+1}^{p} \lambda_{im}$, $j = 1, 2, 3, \ldots, p-1$ and $\partial_{ij}^{*} = -\sum_{m=j+1}^{q} \partial_{im}$, $j = 1, 2, \ldots q-1$

Pesaran et al., (1999) assume that the ARDL (p, q, q, …, q) model is stable if the roots of the following equation $1 - \sum_{j=1}^{p} \lambda_{ij} z^j = 0$ outside the unit circle. This assumption ensures that $\varphi_i < 0$ and hence there exists a long-run relationship between y_{it} and x_{it} defined by $y_{it} = -\left(\frac{\beta_i}{\varphi_i} x_{it} + \eta_{it} \right)$ where η_{it} is a stationary process and the long-run coefficient it $\theta_i = -\frac{\beta_i}{\varphi_i} = \theta$ are the same across the group.

Results of the FMOLS and DOLS estimated co-integration relationship are factors presented in Table 3.

Table 3
Panel FMOLS and DOLS estimates

Variables	*Methods*	
	FMOLS	*DOLS*
Log FDI	0.231	0.358
Adjusted R-squared	0.78	0.89
S.E of regression	0.060	0.094

Results of Pool mean group(PMG) estimated co-integration relationship are factors presented in Table (4).

Table 4
Pool mean group and estimations of ARDL

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.**
		Long Run Equation		
LFDI	0.137094	0.028005	4.895402	0.0000
		Short Run Equation		
COINTEQ01	–0.7685777	0.197056	-6.524918	0.0000
D(LGDP(–1))	0.493751	0.255919	1.929322	0.0591
D(LFDI)	0.077720	0.176519	0.440293	0.6615
D(LFDI(–1))	0.235136	0.086764	2.710073	0.0090
C	0.535571	0.088005	6.085703	0.0000

Note:

1. SBC (Schwarz) has been used to select the lag orders for each group.
2. The pool mean group estimates have been used as initial estimate(s) of the long-run
3. Parameter(s) for the pooled maximum likelihood estimation.

4. CONCLUSION

The main objective of this study was to analyze the relationship between the variables of FDI stock and economic growth in D8 countries. The results of the empirical literature indicate a positive relationship between FDI and economic growth. The empirical analysis reveals that there is a positive long-run co-integrating relationship between FDI stock and economic growth. By using the Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and PMG (pooled mean group estimation) methods. The long run elasticity of GDP with respect to FDI is 0.35%, 0.23% and 0.13% respectively. So, FDI plays a significant role on economic growth in D8 As was explained earlier, foreign direct investment via various channels could affect economic growth. And that this effect is more intense the infrastructure should be provided. For that reason the macroeconomic stability and the reduction of the market distortions, which are both necessary for the creation of a suitable environment to attract FDI, Probably, for all of the D8 countries, many important structural reforms in various sectors need to be implemented. Furthermore, the macroeconomic stabilization such as fiscal and monetary policies, tax system, ect is necessary to attract FDI and Positive impact on economic growth.

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