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Original Paper

The Effects of FDI on Greek Economy: An Empirical Analysis

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Abstract

This paper investigates the effect of Foreign Direct Investment (FDI) on economic growth in Greece, within a framework that also accounts unemployment rate, using annual data covering the period 1970 to 2017. Several econometric models are applied including the ARDL bound test approach for cointegration as well as ECM-ARDL model for causality. The results of the study confirm the existence of a long run relationship among the examined variables. The Granger causality results indicated a strong unidirectional causality between economic development and foreign direct investments with direction from economic development to foreign direct investments. Finally, the variance decomposition method and the impulse response functions are used to test the strength of causality between the variables. The results of the study offer new perspectives and insight for new policies for sustainable economic development, increasing investments and reducing unemployment.

Keywords

unemployment, foreign direct investment, economic growth, cointegration, causality

1. Introduction

In recent years, there is a growing interest in the relationship between foreign direct investments, unemployment and economic growth. The economic crisis which started in 2008 has created serious concerns about high unemployment rates and negative growth. Today, despite the continued recovery in most European countries, there are still countries that are facing serious problems due to high unemployment rates. In 2012, unemployment in European Union reached 26 million people (AMECO, 2014).

There are several discussions about how foreign direct investments may be a possible solution in unemployment reduction and economic growth. Many economists believe that FDI enhances private investments, encourages the creation of new jobs, transfers knowledge and technological skills in the workforce and generally boosts economic growth in host countries economies (Chowdhury & Mavrotas, 2006).

The relationship between foreign direct investments, unemployment and economic growth has been the focus of a considerable number of academic studies on both developing and developed countries. However, we cannot say that the relationships linking FDI, unemployment and economic growth are clear. Studies focusing on the long run relationships among these three variables have produced contradictory results. The purpose of this paper is to examine the links between FDI, unemployment and economic growth in Greece over the period 1970-2017.

The structure of the paper is as follows: Section 2 briefly reviews the literature. Section 3 presents data and methodology and section 4 presents the empirical results. Concluding remarks are given in the final section.

2. Literature Review

Global economic crisis has proved that under adverse conditions capital flows between countries can cause destabilization of the real economies of these countries (Thalassinos, 2008). On the other hand, there is the traditional view which supports that FDI boosts economic growth and enhances employment opportunities.

The effects of FDI in a host country economy have been extensively studied in recent years. Nevertheless, remain a key subject of discussion among policy makers. In current literature, most of the published studies examine the bivariate relationships, either theoretically or empirically, between the pairs of economic growth and unemployment, economic growth and FDI or unemployment and FDI. Despite the relationships between them, there are very few studies that have examined empirically the causality relations among these three variables.

Jayaraman and Singh (2007) investigated the relationship between FDI, employment and GDP (Gross Domestic Product) for Fiji using data for the period 1970-2003. This study found that there is a long run unidirectional casual relationship between FDI and employment with direction from FDI to employment. Also, they found that there is a short run unidirectional casual relationship between FDI and GDP with direction from FDI to GDP.

Aktar and Ozturk (2009) examined the relationship between FDI, exports, unemployment and GDP for Turkey for the period of 2000-2007. The results of the study showed that FDI does not help in reducing unemployment. They found that variations in GDP do not reduce the unemployment rate either. Variations in exports have a positive but insignificant effect on GDP.

Balcerzak and Żurek (2011) investigated the relationship between FDI, unemployment and GDP for Poland over the period of 1995-2009. This study found that FDI helps in reducing unemployment. However, this positive correlation between the two variables tended to be in the short term. They concluded, that the government should continue implements policies which attract investments.

Shaari, Hussain and Halim (2012) examined the impact of FDI on the unemployment rate and economic growth for Malaysia over the period 1980-2010. The results of the study showed that FDI helps in reducing unemployment, creating more domestic jobs and also has a positive effect on GDP.

Habib and Sarwar (2013) examined the relationship between FDI, growth and employment for Pakistan over the period 1970-2011. They found that FDI and economic growth have a positive impact on employment level.

Regarding the studies that examine the impact of foreign direct investments on economic performance in a group of countries, Hsiao and Hsiao (2006) examined the relationship between FDI, exports and GDP for eight rapidly developing East and Southeast Asian economies using data covering the period 1986-2004. Their results showed the existence of a bidirectional causality relation between exports and GDP. In addition authors argued that FDI has unidirectional effects on GDP directly and indirectly through exports.

Dritsakis and Stamatiou (2014) investigated the relationship between exports, FDI and economic growth in five Eurozone countries using data for the period 1970 to 2011. Their results revealed bidirectional causality relation between exports and economic growth. In addition authors argued that there is no causality between economic growth and FDI nor between FDI and exports, for the examined period.

Agrawal (2015) examined the relationship between FDI and economic growth in the BRICS economies over the period 1980-2012. The results of the study revealed that there is a causal relationship between FDI and economic growth in the long run, with direction from FDI to economic growth.

Dritsakis and Stamatiou (2017) examined the interactions between FDI, exports, unemployment and economic growth for thirteen new member states of European Union. Using annual data for the period 1995-2013 the argued that that there is bidirectional causal relation among exports and economic growth, in the long run. In addition they found that a unidirectional long term causal relationship between economic growth and unemployment exists, with direction from economic growth to unemployment.

Finally, the same authors (Dritsakis & Stamatiou, 2018) applied a similar study for the fifteen old EU members using data covering the period 1970-2015. Their results showed three bidirectional causalities between economic growth and exports, exports and FDI, and exports and unemployment and three unidirectional causalities running from FDI to economic growth, FDI to unemployment and from economic growth to unemployment.

Table 1. Summary of Recent Empirical Studies

Authors	Study Period and Area	Variables	Main Results
	For one Country—Time Series Analysis		
Jayaraman and Singh (2007)	Fiji 1970-2003	FDI Employment GDP	Long run causality with direction from FDI to Employment Short run causality with direction from FDI to GDP
Aktar and Ozturk (2009)	Turkey 2000-2007	FDI Exports Unemployment GDP	FDI does not reduce unemployment Variations in GDP do not reduce unemployment Variations in exports have a positive but insignificant effect on GDP
Balcerzak and Żurek (2011)	Poland 1995-2009	FDI Unemployment GDP	Positive effect of FDI on unemployment in the short run
Shaari, Hussain and Halim (2012)	Malaysia 1980-2010	FDI Unemployment GDP	Positive effect of FDI on unemployment and economic growth
Habib and Sarwar (2013)	Pakistan 1970-2011	FDI Unemployment GDP	FDI and economic growth have a positive effect on employment
	For a Group of Counties – Panel Data Analysis		
Hsiao and Hsiao (2006)	East and Southeast Asian countries 1986-2004	FDI Exports GDP	Bidirectional causality among exports and GDP Unidirectional causality with direction from FDI to GDP
Dritsakis and Stamatiou (2014)	Five Eurozone countries 1970-2011	FDI Exports GDP	Bidirectional causality among exports and GDP
Agrawal (2015)	BRICS economies		

	1980-2012	FDI GDP	Unidirectional causality with direction from FDI to GDP
Dritsakis and Stamatiou (2017)	New EU Members 1995-2013	FDI Exports Unemployment GDP	Bidirectional causality among exports and GDP Unidirectional causality with direction from GDP to Unemployment
Dritsakis and Stamatiou (2017)	Old EU Mebers 1970-2015	FDI Exports Unemployment GDP	Bidirectional causality among exports and GDP, exports and FDI, exports and Unemployment Unidirectional causality with direction from FDI to GDP, from FDI to Unemployment, GDP to Unemployment

3. Data and Methodology

3.1 Data

The variables that are used in this study are Gross Domestic Product (GDP) in constant 2010 prices express in euro, Foreign Direct Investments Inflows (FDI) in constant 2010 prices express in euro and Unemployment (UN) expressed as a percentage of civilian labor force. The sample data of this study is from 1970-2017. Data are gathered from economic databases Annual Macro-Economic Database (AMECO, 2019) and United Nations Conference on Trade and Development (UNCTAD, 2019) and converted to natural logarithms. The descriptive statistics for all variables are illustrated in Table 2.

Table 2. Descriptive Statistics

	LGDP	LFDI	LUN
Mean	5.078372	-0.482026	1.975756
Median	5.044877	-0.191316	2.097547
Maximum	5.524340	1.678010	3.314186
Minimum	4.487635	-3.729701	0.530628
Std. Dev.	0.258768	1.329623	0.771526
Skewness	-0.134011	-0.800867	-0.320593
Kurtosis	2.397676	2.987031	2.465804
Jarque-Bera	0.869259	5.131434	1.392967
Probability	0.647504	0.076864	0.498335
Observations	48	48	48

3.2 Unit Root Tests

The literature proposes several methods for unit root tests. Since these methods may give different results, we selected Dickey-Fuller (ADF) (1979, 1981), Phillips-Perron (P-P) (1988) and Elliott, Rothenberg and Stock (DF-GLS) (ERS) (1996). In all these tests, the null hypothesis is that the variable contains a unit root (i.e., it is not stationary).

3.3 ARDL Cointegration Approach

We continue by testing the long run relationships between the examined variables using the ARDL approach (Autoregressive Distributed Lag) which developed by Pesaran et al. (2001).

This method has the following econometric advantages:

1) The bounds of ARDL approach are valid regardless of whether the variables are integrated I(0) or I(1).

2) The bounds of ARDL approach provide effective and consistent empirical evidence for small data samples.

3) The ARDL model is valid by taking a sufficient number of lags. The optimal lag length for the first difference of regressions is selected by the minimum value of Akaike (AIC), Schwarz (SIC) and Hannan-Quinn (HQC).

4) The ARDL method compared with other cointegration methods can distinguish and eliminate problems between dependents and independents variables such as the problem of autocorrelation and endogeneity.

5) Moreover, a dynamic error correction model can be derived from the ARDL method through a simple linear transformation. The dynamic ECM model integrates the short run dynamic with the long run equilibrium without losing any long run information.

The autoregressive distributed lag (ARDL) cointegration technique as a general vector autoregressive (VAR) model of order p:

$$Z_t = (GDP_t, FDI_t, UN_t) \tag{1}$$

where Z_t is a column vector composed of the three variables.

Thus, before we begin with the ARDL model we find the order of the VAR model, the lag length of the variables in the VAR model. Then, we use the minimum value of Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Criterion (HQC), and Likelihood Ratio (LR) to find the optimal lag length of the variables.

The ARDL models that are used in this study are the following:

$$\Delta LUN_t = \beta_{01} + \delta_{11} LGDP_{t-1} + \delta_{21} LFDI_{t-1} + \delta_{31} LUN_{t-1} + \\ + \sum_{i=1}^{p} \alpha_{1i} \Delta LUN_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta LGDP_{t-i} + \sum_{i=0}^{c} \alpha_{3i} \Delta LFDI_{t-i} + \varepsilon_{1t} \tag{2}$$

$$\Delta LFDI_t = \beta_{02} + \delta_{12} LGDP_{t-1} + \delta_{22} LFDI_{t-1} + \delta_{32} LUN_{t-1} + + \sum_{i=1}^{p} \alpha_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta LGDP_{t-i} + \sum_{i=0}^{c} \alpha_{3i} \Delta LUN_{t-i} + \varepsilon_{2t} \quad (3)$$

$$\Delta LGDP_t = \beta_{03} + \delta_{13} LGDP_{t-1} + \delta_{23} LFDI_{t-1} + \delta_{33} LUN_{t-1} + + \sum_{i=1}^{p} \alpha_{1i} \Delta LGDP_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta LFDI_{t-i} + \sum_{i=0}^{c} \alpha_{3i} \Delta LUN_{t-i} + \varepsilon_{3t} \quad (4)$$

where Δ denotes the first difference operator and ε_{1t}, ε_{2t}, ε_{3t} are error terms assumed to be independently and identically distributed.

Since the calculation of ARDL bounds is sensitive in the selection of the lag length, we select the optimal lag length from the first difference of the dependent variables by the minimum values of criteria Akaike, Schwarz and Hannan-Quinn in accordance with the following models.

$$LUN_t = \beta_{01} + \sum_{i=1}^{p} \alpha_{1i} LUN_{t-i} + \sum_{i=0}^{q} \alpha_{2i} LGDP_{t-i} + \sum_{i=0}^{c} \alpha_{3i} LFDI_{t-i} + \mu_{1t} \quad (5)$$

$$LFDI_t = \beta_{02} + \sum_{i=1}^{p} \alpha_{1i} LFDI_{t-i} + \sum_{i=0}^{q} \alpha_{2i} LGDP_{t-i} + \sum_{i=0}^{c} \alpha_{3i} LUN_{t-i} + \mu_{2t} \quad (6)$$

$$LGDP_t = \beta_{03} + \sum_{i=1}^{p} \alpha_{1i} LGDP_{t-i} + \sum_{i=0}^{q} \alpha_{2i} LFDI_{t-i} + \sum_{i=0}^{c} \alpha_{3i} LUN_{t-i} + \mu_{3t} \quad (7)$$

where LUN_t, $LFDI_t$, and $LGDP_t$ are the dependent variables, α_{1i}, α_{2i}, and α_{3i} are the long terms and (p, q, c) are the optimal lag lengths of the ARDL model.

Pesaran et al. (2001) suggests F test for joint significance of the coefficients of the lagged level of variables. The null hypothesis of no cointegration among the variables in equations (2), (3) and (4) is:

$H_0 : \delta_{11} = \delta_{21} = \delta_{31} = 0$ against the alternative hypothesis of cointegration

$H_1 : \delta_{11} \neq \delta_{21} \neq \delta_{31} \neq 0$ and

$H_0 : \delta_{12} = \delta_{22} = \delta_{32} = 0$ against the alternative hypothesis of cointegration

$H_1 : \delta_{12} \neq \delta_{22} \neq \delta_{32} \neq 0$ and

$H_0 : \delta_{13} = \delta_{23} = \delta_{33} = 0$ against the alternative hypothesis of cointegration

$H_1 : \delta_{13} \neq \delta_{23} \neq \delta_{33} \neq 0$

Two sets of critical values for a given level significance are specified. The first critical value obtained by supposing that all variables including in the model are integrated I(0), while the second by supposing that all variables are integrated I(1). We reject the null hypothesis of no cointegration, when the F-value exceeds the critical value of upper limit. Also, we accept the null hypothesis of no cointegration when the F-value is lower that the critical value of lower limit. Finally, the decision of cointegration is unclear when the F-value is between the lower and the upper limit (Pesaran et al., 2001).

Then, we examine the long run relationships between the variables using the following equations:

$$LUN_t = \beta_{01} + \sum_{i=1}^{p} \delta_{11} LUN_{t-i} + \sum_{i=0}^{q} \delta_{21} LFDI_{t-i} + \sum_{i=0}^{c} \delta_{31} LGDP_{t-i} + e_{1t} \quad (8)$$

$$LFDI_t = \beta_{02} + \sum_{i=1}^{p} \delta_{12} LFDI_{t-i} + \sum_{i=0}^{q} \delta_{22} LGDP_{t-i} + \sum_{i=0}^{c} \delta_{32} LUN_{t-i} + e_{2t} \quad (9)$$

$$LGDP_t = \beta_{03} + \sum_{i=1}^{p} \delta_{13} LGDP_{t-i} + \sum_{i=0}^{q} \delta_{23} LFDI_{t-i} + \sum_{i=0}^{c} \delta_{33} LUN_{t-i} + e_{3t} \quad (10)$$

Moreover, a dynamic error correction model can be derived from the ARDL bounds test through a simple linear transformation. The dynamic unrestricted ECM integrates the short run dynamic with the long run equilibrium.

The dynamic unrestricted error correction model is expressed as follows:

$$\Delta LUN_t = \beta_{01} + \sum_{i=1}^{p} \alpha_{1i} \Delta LUN_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta LGDP_{t-i} + \sum_{i=0}^{c} \alpha_{3i} \Delta LFDI_{t-i} + \lambda_1 ECM_{t-1} + \varepsilon_t \quad (11)$$

$$\Delta LFDI_t = \beta_{02} + \sum_{i=1}^{p} \alpha_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta LGDP_{t-i} + \sum_{i=0}^{c} \alpha_{3i} \Delta LUN_{t-i} + \lambda_2 ECM_{t-1} + \varepsilon_t \quad (12)$$

$$\Delta LGDP_t = \beta_{03} + \sum_{i=1}^{p} \alpha_{1i} \Delta LGDP_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \Delta LFDI_{t-i} + \sum_{i=0}^{c} \alpha_{3i} \Delta LUN_{t-i} + \lambda_3 ECM_{t-1} + \varepsilon_t \quad (13)$$

where ECM_{t-1} is the error correction term. The coefficient of error correction term (ECM_{t-1}) should be negative and statistically significant. This coefficient indicates the speed of adjustment, how quickly the variables return to the long run equilibrium.

3.4 Stability of the Model

The existence of cointegration derived from equations (11), (12) and (13) does not necessarily imply that the estimated coefficients are stable. Therefore, Pesaran et al. (2001) proposed testing the parameters stability of estimated coefficients applying the cumulative sum (CUSUM), the cumulative sum of squares (CUSUMSQ) and the Recursive Residuals tests.

3.5 Granger Causality Analysis

After the long run relationship between variables, we examine the direction of causality using the ECM-ARDL model. The equations that are used to test Granger causality are the following:

$$\begin{bmatrix} \Delta LUN_t \\ \Delta LFDI_t \\ \Delta LGDP_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \\ \beta_{31} & \beta_{32} & \beta_{33} \end{bmatrix} \begin{bmatrix} \Delta LUN_{t-p} \\ \Delta LFDI_{t-p} \\ \Delta LGDP_{t-p} \end{bmatrix} + \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{bmatrix} ECM_{t-1} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{bmatrix} \quad (14)$$

where i (i=1,…p) is the optimal lag length determined by the Akaike Information Criterion (AIC), ECM_{t-1} is the lagged residual obtained from the long run ARDL relationship presented in equations (8), (9) and (10), λ_1, λ_2, λ_3 are the adjustment coefficients, and u_{1t}, u_{2t}, u_{3t} are the disturbance terms assumed to be uncorrelated with zero means $N(0,\sigma)$.

3.6 Variance Decomposition Method and Impulse Response Function

In order to obtain reliable estimations and further inferences on Granger causal relationships among the variables, we apply the Variance Decomposition Method (VDM) and the Impulse Response Functions (IRF) analysis.

The VDM allow us to evaluate the strength of causality beyond the selected sample period. This method measures the percentages of a variable's forecast error that is explained by another variable. In addition, IRF is used to determine the positive or negative responses of a variable to a one standard deviation shock of another variable, either in the short run or in the long run (Stamatiou & Dritsakis, 2019). This means that we can observe the direction, magnitude and persistence of foreign direct investments to variation in economic growth and unemployment rate.

4. Empirical Results

In the empirical analysis we use annual data concerning foreign direct investments inflows in Greece, unemployment rates and gross domestic product. We begin by testing the stationarity of three variables (FDI, UN and GDP).

4.1 Unit Root Results

Applying the unit root test of ADF by Dickey and Fuller (1979, 1981), P-P by Philips and Perron (1988) and DF-GLS by Elliott et al. (1996) we present the results in Table 3.

Table 3. Unit Root Analysis

Var.	ADF		P-P		DF-GLS	
	C	C,T	C	C,T	C	C,T
LUN	-1.03(3)	-4.04(1)**	-0.69[3]	-2.87[3]	-1.60(1)	-2.81(1)
DLUN	-4.53(1)***	-4.35(1)***	-3.32[3]**	-3.21[4]*	-2.44(1)**	-3.36(1)**
LFDI	-3.34(0)**	-5.06(0)***	-3.07[2]**	-5.01[2]***	-1.95(2)**	-4.90(0)***
DLFDI	-7.96(1)***	-7.91(1)***	-17.10[18]***	-8.82[21]***	-7.80(1)***	-7.90(1)***
LGDP	-1.90(1)	-1.65(1)	-2.45[4]	-1.50[4]	-039(1)	-1.64(1)
DLGDP	-3.82(0)***	-4.03(0)**	-3.80[4]***	-4.05[3]**	-2.99(0)***	-4.00(0)***

Notes. ***, ** and * show significant at 1%, 5% and 10% levels respectively. The numbers within parentheses followed by ADF [6,7] statistics represent the lag length of the dependent variable used to obtain white noise residuals. The lag lengths for ADF equation were selected using SIC. Mackinnon (1996) critical value for rejection of hypothesis of unit root applied. The numbers within brackets followed by PP (1988) statistics represent the bandwidth selected based on Newey West (1994) method using Bartlett Kernel. C = Constant, T = Trend.

As can be seen from Table 3, the results showed that FDI is stationary in levels in all the test that were applied which means that FDI is integrated I(0), while the other two variables are stationary in first differences which means that unemployment and GDP are integrated I(1). Therefore, we choose ARDL bounds test because there are variables with different integration order.

4.2 Cointegration Results

The process of cointegration applied to estimate the parameters of equations (2), (3) and (4) with maximum lag length 3 and optimal lag length proposed by Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Criterion (HQC), and Likelihood Ratio (LR).

The results of these criteria are presented in Table 4.

Table 4. Var Lag Order Selection Criteria (Max=3)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-431.00	NA	47840.05	19.289	19.409	19.334
1	-267.94	297.13	50.901	12.442	12.923	12.621
2	-225.71	22.583*	9.2878*	10.719*	11.808*	11.168*
3	-211.19	71.331	11.692	10.964	11.924	11.279

Note. *denotes the optimal lag selection.

All of the results showed that the optimal lag length of the variables is 2. The optimal lag length for the first differences of the variables in equations (5), (6), (7) is selected by the minimum value of AIC, SIC and HQC. All three criteria showed that optimal lag length in equations (5), (6) and (7) is (2, 1, 0), (1, 0, 0) and (1, 0, 0) respectively. Table 5 shows the cointegration results using ARDL bounds test.

Table 5. The Results of ARDL Cointegration Test

Bounds Testing to Cointegration			Diagnostic Tests			
Estimated Models	Optimal Lag	F-Stat	X^2_{NOR}	X^2_{ARCH}	X^2_{RESET}	X^2_{SERIAL}
F_{LUN}(LUN/LGDP, LFDI)	(2,1,0)	3.35	0.61	0.32[1]	1.99[1]	0.72[2]
F_{LFDI}(LFDI/LGDP, LUN)	(1,0,0)	11.65***	4.71	0.24[1]	3.48[1]	1.52[2]
F_{LGDP}(LGDP/LFDI, LUN)	(1,0,0)	4.79	10.49	0.19[1]	6.37[1]	0.49[2]
Significant Level			Critical Values (T=50)			
			Lower Bounds I(0)		Upper Bounds I(1)	
1% Level			7.337		8.643	
5% Level			5.247		6303	
10% Level			4.380		5.350	

Notes. The optimal lag length is determined by AIC. [ ] is the order of diagnostic tests. Critical values are collected from Narayan (2005). ***, ** and * show significant at 1%, 5% and 10% levels respectively.

The results of Table 5 show that there is one cointegrated vector (F-statistics seem to exceed upper critical bounds at 10%) confirming the existence of long run relationship among the series in equation (3) in the presence of structural breaks. The ARDL model fulfills the assumptions of normality autoregressive conditional heteroskedasticity (ARCH), functional forms and serial correlation of model.

4.3 Long-Run and Short-Run Relationship

Table 6 presents the results of long run and short run relationship between the variables in our model.

Table 6. Long Run-Short Run Results

Dependent variable= $LFDI_t$		
Long run analysis		
Variables	Coefficient	T-statistic
Constant	-10.204	-2.441**
$LFDI_{t-1}$	0.269	1.823*
$LGDP_t$	1.825	2.122**
LUN_t	-0.313	1.180
R^2	0.722	
F-Statistic	12.655	
D-W	2.049	
Diagnostic Test		Prob.
X^2 Normal	1.275	0.528
X^2 Serial	1.525[2]	0.229
X^2 ARCH	0.245[1]	0.622
X^2 White	0.839	0.589
X^2 Reset	3.488[1]	0.068
Dependent variable= $\Delta LFDI_t$		
Short run analysis		
Constant	0.097	0.750
$\Delta LFDI_{t-1}$	0.158	0.567
$\Delta LGDP_t$	0.755	1.846*
ΔLUN_t	-0.621	-0.529
ECM_{t-1}	-0.914	-3.338***
R^2	0.588	
F-Statistic	6.525	
D-W	2.034	
Diagnostic Test		Prob.
X^2 Normal	1.715	0.424
X^2 Serial	1.179[2]	0.318
X^2 ARCH	0.285[1]	0.595
X^2 White	0.271	0.993
X^2 Reset	3.477[1]	0.069

Notes. ***, ** and * show significant at 1%, 5% and 10% levels respectively. Δ denotes the first difference operator, X^2 Normal is for normality test, X^2 Serial for LM serial correlation test, X^2 ARCH for autoregressive conditional heteroskedasticity, X^2 White for white heteroskedasticity and X^2 Reset for Ramsey Reset test. [ ] is the order of diagnostic tests.

From the results of Table 6 we can see that in the long term equation of FDI an increase 1% of GDP will cause an increase 1.82% of FDI approximately, while a decrease in unemployment by 1% will cause an increase 0.31% of FDI. The ECM_{t-1} is negative and statistically significant which implies a long run relationship between the examined variables in the model. This means that in the short term the deviations from the long run equilibrium are adjusted by 91.4% every year. Finally, the diagnostics tests show that the error terms of the short and long run model are normally distributed and free of serial correlation, heteroskedasticity and ARCH problem. The Ramsey reset test suggests that functional form for the models is well specified.

4.4 Instability Tests

The ECM of equation (3) is selected to implement Brown et al. (1975) stability tests. The graphs of these tests are shown in the next figures (Figures 1-6).

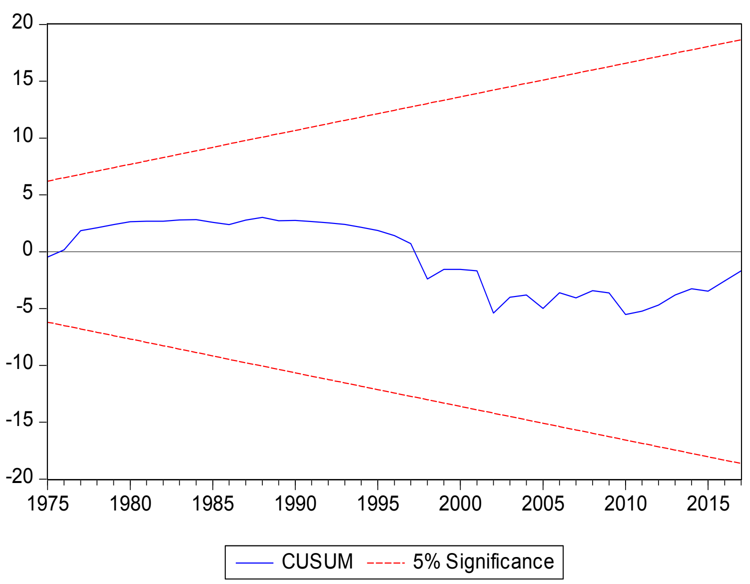

Figure 1. Plot of Cumulative Sum (long run)

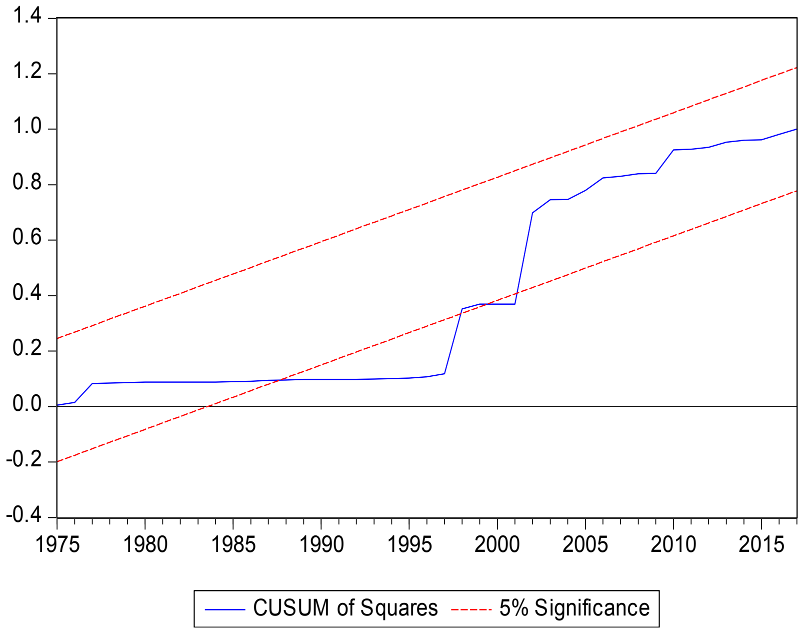

Figure 2. Plot of Cumulative Sum of Squares (long run)

Figure 3. Plot of Recursive Residuals (long run)

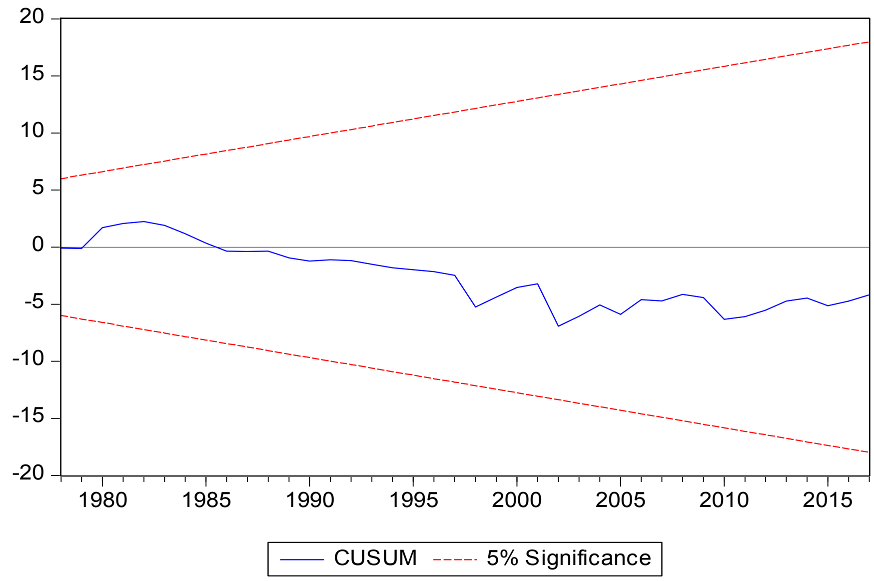

Figure 4. Plot of Cumulative Sum (short run)

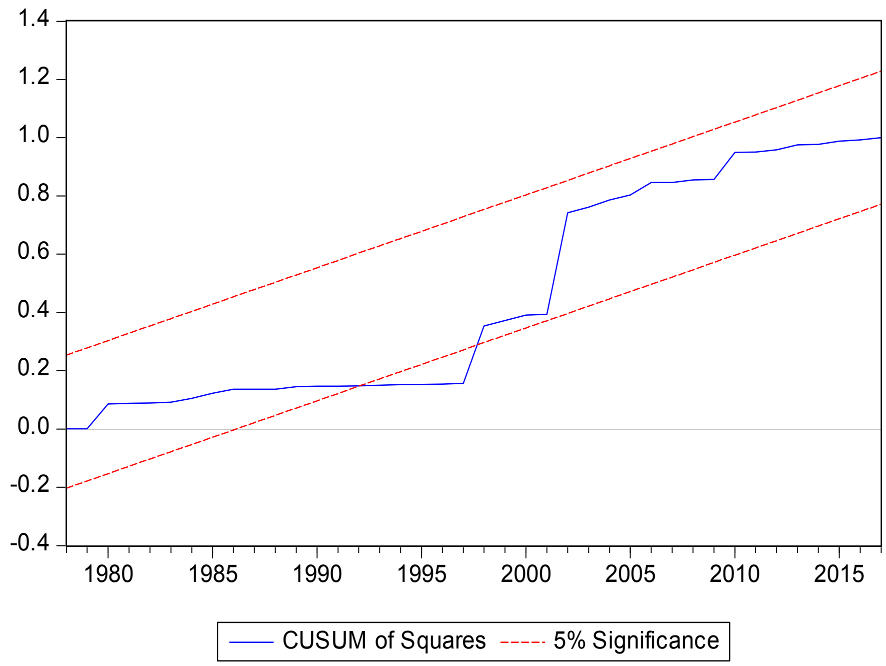

Figure 5. Plot of Cumulative Sum of Squares (short run)

Figure 6. Plot of Recursive Residuals (short run)

As can be seen from the above figures, the graphs of statistical CUSUMQ and Recursive Residuals are not within the critical values at 5% significance level, both in the short and in the long run models. This means that all the coefficients in ECM are not stable.

4.4 Causality Results

Table 7 reports the results on the direction of long and short run causality.

Table 7. The ECM-ARDL Granger Causality Analysis

	ARDL Optimal Lag					**Strong Causality (X^2)**		
			Short run (F-Stat)		Long run (t-stat)	ΔLUN ECM_{t-1}	ΔLFDI ECM_{t-1}	ΔLGDP ECM_{t-1}
		ΔLUN	ΔLFDI	ΔLGDP	ECM_{t-1}			
ΔLUN	(2,1,0)		0.56	0.18	-1.63		1.04	0.51
ΔLFDI	(1,0,0)	0.23		0.63**	-0.35**	-1.22		-2.15**
ΔLGDP	(1,0,0)	0.01	0.62		0.25	1.53	0.19	

Notes. *, ** and *** show significant at 1%, 5% and 10% levels respectively. Δ denotes the first difference operator.

From results of Table 7 we see that there is a short run, a long run and a strong unidirectional causality relation between economic development and foreign direct investments with direction from economic development to FDI. The knowledge about the direction of causality helps policy makers to develop a proper economic policy.

4.5 Variance Decomposition and Impulse Response Analysis Results

To further explore the dynamic interactions between the foreign direct investments, unemployment and economic growth we proceed with the Variance Decomposition Method (VDM) and Impulse Response Function (IRF) techniques. The results of VDM are provided on the following table.

Table 8. Variance Decomposition Approach

Variance decomposition of LFDI				
Period	S.E.	LFDI	LGDP	LUN
1	0.951568	100.0000	0.000000	0.000000
2	0.976689	99.70151	0.063701	0.234791
3	0.984536	99.36181	0.128330	0.509861
4	0.987312	98.97888	0.171831	0.849290
5	0.989522	98.57393	0.187960	1.238111
6	0.991749	98.13849	0.188972	1.672543
7	0.994129	97.66966	0.189266	2.141076
8	0.996649	97.17658	0.197020	2.626399
9	0.999226	96.67868	0.212716	3.108599
10	1.001745	96.19836	0.232121	3.569517
Variance decomposition of LGDP				
Period	S.E.	LFDI	LGDP	LUN
1	0.032122	0.256715	12.26428	87.47901
2	0.052757	0.097729	20.44079	79.46148
3	0.070054	0.465917	24.79624	74.73784
4	0.083610	1.211655	26.51145	72.27689
5	0.093392	2.074391	26.61001	71.31559
6	0.099900	2.861913	25.84290	71.29519
7	0.103950	3.462002	24.77109	71.76691
8	0.106405	3.834678	23.79055	72.37477
9	0.107968	4.003917	23.10899	72.88710
10	0.109098	4.034115	22.74467	73.22122

Variance decomposition of LUN				
Period	S.E.	LFDI	LGDP	LUN
1	0.093440	2.679643	97.32036	0.000000
2	0.168941	0.820230	96.63760	2.542173
3	0.230163	1.294801	94.88026	3.824938
4	0.272159	2.828825	93.28230	3.888872
5	0.296086	4.687596	91.86904	3.443360
6	0.307267	6.363060	90.31698	3.319960
7	0.312618	7.453489	88.19334	4.353172
8	0.317969	7.780279	85.25738	6.962345
9	0.326183	7.515397	81.70576	10.77884
10	0.337042	7.039023	78.03906	14.92192

The empirical results reveal that the most significant shocks effect of FDI (96.19%) is contributed by its own innovative shocks. The contribution of GDP to FDI is minimal and is 0.23%. In addition, a standard deviation shock stemming in unemployment attributes FDI by 3.56%.

Also, a contribution of 73.22% exists in GDP by shocks arising by its own innovative shocks. Furthermore, a quite large portion of GDP is explained by innovative shocks stemming by UN (i.e., 22.74%) and the rest is being explained by FDI (i.e., 4.03%).

Finally, the contribution of FDI and GPD to UN is 7.03% and 14.92% respectively and the rest is being explained by its own standard innovative shocks.

Figure 7 plots impulse responses that visualize the destabilization experienced by the endogenous variables (FDI, UN, GDP) in response to one external shock within other variables. Standard errors are calculated by the Monte Carlo method, with 100 repetitions (of ± 2 standard deviations).

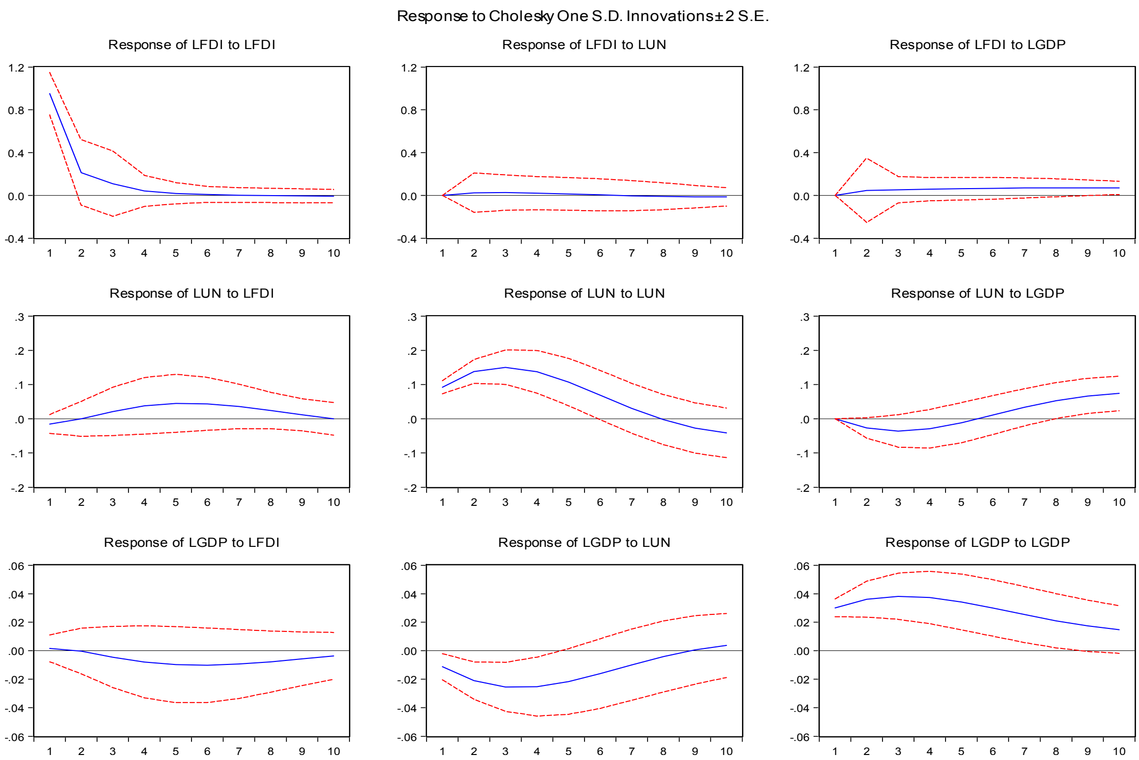

Figure 7. Impulse Response Function

From the above figure we see that FDI is found to be significantly responsive to its own shock in the first 4 years. In the long run, these effects tend to zero. Besides, shocks in UN and GDP seem to have a slight effect (minimal) on FDI during the examined period.

Shocks in FDI cause an increase on UN over the first 5 years followed by a decrease for the remaining period. In addition, shocks in GDP cause a decrease in UN for the first three years followed by a steady increase for the rest 7 years. UN is significantly and positively responsive to its own shocks in the first 3 years, whereas there is a negative impact over the remaining 7 years.

Finally, shocks in FDI and UN cause a decrease on GDP over the first 5 and 3 years respectively, followed by a an increase for the remaining period. GDP is significantly and positively responsive to its own shocks in the first 3 years, whereas there is a negative impact over the remaining 7 years.

5. Conclusions and Policy Implications

The main objective of all the governments is the connection of growth and investments. However, the connection between FDI and unemployment is not easy to be determined by policy makers. Some economists argue that FDI inflows have a positive impact in the labor market only for the skilled workforce. This means that in the long term the quality of the work force is being improved. Some other argue that green investments in high tech industries tend to have a long term improvement in the economy of a country. So, this type of FDI inflows should be the priority of governments' policy and especially in Greece with the abundant natural wealth.

In this paper we investigate the relationships between FDI, growth and unemployment in Greece over the period 1970-2012. In the empirical investigation we use ARDL approach as developed by Pesaran et al. (2001) and the ECM-ARDL model to find the casual relationships between the examined variables. In addition, for the test of the dynamic causal relationship we used the variance decomposition approach in combination with the impulse response functions.

The results of the study show that in the long term an increase 1% of growth will cause an increase 1.82% of FDI approximately, while a decrease in unemployment by 1% will cause an increase 0.31% of FDI. Finally, the causality results show both in the short and in the long run a strong unidirectional causality relationship with direction from economic development to FDI.

Based on variance decomposition method and impulse response functions we find that variations in economic growth respond more to shocks in foreign direct investments and unemployment. Economic growth seems to have negative response to shocks in FDI and unemployment rate. This implies that any policies, either active or passive, related with the labour market as well as the investment policy framework should be noted by the government in order to enhance economic growth.

The analysis of equations of FDI in the short run and in the long run shows that an increase of FDI will increase growth and will reduce unemployment. Therefore, the Greek government should immediately implement policies to attract foreign direct investments and foreign capital. The attraction of these funds in Greece is closely linked to the public debt. The reduction of debt for Greece (either by reducing interest rates, or with longer repayment, or with a haircut) will be the trigger for new capital inflows which will increase FDI, will boost economic development and will help in reducing unemployment.

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