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Foreign Direct Investment and Economic Growth: A Causality Analysis for Cyprus, 1976–2002

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Abstract: This study examines the relationship between economic growth as measured by GDP per capita and foreign direct investment for Cyprus, using the methodology of Granger causality and vector auto regression (VAR). Evidence shows that there is a unidirectional Granger causation from foreign direct investment to economic growth.

Key words: Granger causality, vector auto regression, economic growth

INTRODUCTION

Cyprus is one of the most attractive locations for foreign investments in the Middle East with its extensive network of double tax treaties and the mutual promotion and protection of investments. In the last decade, financial incentives provided to foreign investors have made the island a magnet for foreign investment. These incentives include unrestricted dividend transfers, a corporate income tax as low as 4.25%, full tax exemption on profits of offshore partnerships, tax deductions on all expenses incurred for the earning of income and full capital gains tax exemption. In addition, free trade zones and various other incentives including a ten-year tax exemption for the manufacturing of new products, investment discounts, duty free status in the free industrial zones and reduced taxation for foreign experts employed there, have also been introduced by the Cypriot government. In Cyprus, the constitution guarantees the right of private property and does not discriminate between Cypriots and non-Cypriots. Administrative procedures are simple and in most cases, foreign participation of up to 100% is permitted. In January 2000, Cyprus liberalized all foreign direct investment controls on local businesses for residents of the European Union, who may now own 100% of local companies and any company listed on the Cyprus Stock Exchange. Ventures are also actively encouraged. Personal incentives, such as low personal taxation, exemption from social insurance and defense tax, as well as duty free status, have also played a role in making the island a center of attraction for foreign investors. The success of Cyprus in attraction foreign direct investment and in adapting a market oriented economic system, in addition to the pursuance of sound macroeconomic policies by the government have placed the country in the 16th place worldwide in terms of per capita income, with a per capita income of 17,847 US dollars in 2003. The average annual rate of growth in the past five years was around 3.8%, while inflation and unemployment were 2.9 and 3.4%, respectively.

Explosion of growth in FDI over the 1990's, especially in the developing countries, has inspired a stream of literature focusing on the impact of FDI on the dynamics of growth measured by GDP in the recipient country. However, to the best of our knowledge, no study has been done to examine the existence and nature of any causal relationship between FDI and GDP in Cyprus. Therefore, the objective of this study was to examine the presence of interdependence between gross domestic product and FDI for Cyprus. In the literature on the link between FDI and economic growth, Chakraborty and Basu[1] examined the causality between FDI and output growth in India. Utilizing annual data from 1974-1996, they found that the real GDP in India is not Granger caused by FDI and the causality runs more from real GDP to FDI. Wang[2] explored what kinds of FDI are most likely to contribute significantly to economic growth. Using data from 12 Asian economies over the period of 1987-1997, she found that only FDI in the manufacturing sector has a significant and positive impact on economic growth and attributes this positive contribution to FDIs' spillover effects. Ericsson and Irandoust[3] examined the causal effects between FDI growth and output growth for the four OECD countries applying a multi-country framework

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to data from Denmark, Finland, Norway and Sweden. The authors failed to detect any causal relationship between FDI and output growth for Denmark and Finland. They suggested that the specific dynamics and nature of FDI entering these countries could be responsible for these no-causality results.

De Mello[4] attempted to find support for an FDI-led growth hypothesis when time series analysis and panel data estimation for a sample of 32 OECD and non- OECD countries covering the period 1970-1990 were made. He estimates the impact of FDI on capital accumulation and output growth in the recipient economy. Liu *et al.*[5] wherein tested the existence of a long-run relationship among economic growth, foreign direct investment and trade in China. Using a cointegration framework with quarterly data for exports, imports, FDI and growth from 1981 to 1997, the research found the existence of a bi-directional causal relationship among FDI, growth and exports. It is beyond the scope of the present study to review the literature on the FDI-GDP relationship. The interested reader should refer to de Mello[4,6] for a comprehensive survey of the nexus between FDI and growth as well as for further evidence on the FDI growth relationship.

MATERIALS AND METHODS

The econometric methodology firstly examines the stationarity properties of the univariate time series. The present study uses the Augmented Dickey-Fuller (ADF)[7] unit root test to examine the stationarity of the data series. It consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms and optionally, a constant and a time trend. This can be expressed as:

$$\Delta y_t = \beta_1 y_{t-1} + \beta_2 \Delta y_{t-1} + \beta_3 \Delta y_{t-2} + \beta_4 + \beta_{5t} \quad (1)$$

The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero then the hypothesis that y contains a unit root is rejected. Rejection of the null hypothesis implies stationarity.

Secondly, time series have to be examined for cointegration. Cointegration analysis helps to identify long-run economic relationships between two or several variables and to avoid the risk of spurious regression. Cointegration analysis is important because if two non-stationary variables are cointegrated, a VAR model in the first difference is misspecified due to the effect of a common tend. If cointegration relationship is identified, the model should include residuals from the vectors (lagged one period) in the dynamic vector error correcting mechanism (VECM) system. In this stage, Johansen[8] cointegration test is used to identify cointegrating relationship among the variables. Within the Johansen multivariate cointegrating framework, the following system is estimated:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \dots + \Gamma_{k-1} \Delta z_{t-k-1} + \Pi z_{t-1} + \mu + \varepsilon t: \; T = 1, \dots, T \quad (2)$$

where, Δ is the first difference operator, *z* denotes vector of variables, $\varepsilon_t \sim$ niid $(0,\Sigma)$, μ is a drift parameter and Π is a (p x p) matrix of the form $\Pi = \alpha\beta$, where α and β are both (p x r) matrices of full rank, with β containing the r cointegrating relationships and α carrying the corresponding adjustment coefficients in each of the r vectors. The Johansen approach can be used to carry out Granger causality tests as well. In the Johansen framework the first step is the estimation of an unrestricted, closed pth order VAR in k variables. Johansen[8] suggested two tests statistics to determine the cointegration rank. The first of these is known as the trace statistic

$$\text{trace}\ (r_0/k) = -T \sum_{i=r_0+1}^{K} \ln (1 - \hat{\lambda}_i) \quad (3)$$

where, $\hat{\lambda}_i$ are the estimated eigenvalues $\lambda_1 > \lambda_2 > \lambda_3 > \dots > \lambda_k$ and r_0 ranges from 0 to k-1 depending upon the stage in the sequence. This is the relevant test statistic for the null hypothesis r £ r_0 against the alternative r ³ $r_0 + 1$. The second test statistic is the maximum eigenvalue test known as λ_{max}; we denote it as $\lambda_{max}(r_0)$. This is closely related to the trace statistic but arises from changing the alternative hypothesis from r $r \geq r_0 + 1$ to $r = r_0 + 1$. The idea is to try and improve the power of the test by limiting the alternative to a cointegration rank which is just one more than under the null hypothesis. The λ_{max} test statistic is:

$$\lambda_{max}(r_0) = -T \text{ in } (1-\lambda i) \text{ for } i = r_0 + 1 \quad (4)$$

The null hypothesis is there are r cointegrating vectors, against the alternative of r+1 cointegrating vectors. Johansen and Juselius[9] indicated that the trace test might lack the power relative to the maximum eigenvalue test. Based on the power of the test, the maximum eigenvalue test statistic is often preferred. According to Granger[10], Y is said to "Granger-cause" X if and only if X is better predicted by using the past values of Y than by not doing so with the past values of X being used in either case. In short, if a scalar Y can help to forecast another scalar X, then we say that Y Granger-causes X. If Y causes X and X does not cause Y, it is said that unidirectional causality exists from Y to X. If Y does not cause X and X does not cause Y, then X and Y are statistically independent. If Y causes X and X causes Y, it is said that feedback exists between X and Y. Essentially, Granger's definition of causality is framed in terms of predictability.

To implement Granger test, we assume a particular autoregressive lag length k (or p) and estimate Equation (5) and (6) by OLS:

$$X_t = \lambda_1 + \sum_{i=1}^{k} a_{1i}X_{t-i} + \sum_{j=1}^{k} b_{1j}Y_{t-j} + \mu_{1t} \quad (5)$$

$$Y_t = \lambda_2 + \sum_{i=1}^{p} a_{2i}X_{t-i} + \sum_{j=1}^{p} b_{2j}Y_{t-j} + \mu_{2t} \quad (6)$$

F-test is carried out for the null hypothesis of no Granger causality H_0: $b_{i1} = b_{i2} = ... = b_{ik} = 0$, $i = 1, 2$. H_0: $b_{i1} = b_{i2} = b_{ik} = 0$, $i = 1, 2$ where, F statistic is the Wald statistic for the null hypothesis. If the F statistic is greater than a certain critical value for an F distribution, then we reject the null hypothesis that Y does not Granger-cause X (equation (1)), which means Y Granger-causes X.

A time series with stable mean value and standard deviation is called a stationary series. If d differences have to be made to produce a stationary process, then it can be defined as integrated of order d. Engle and Granger[11] state that if several variables are all I(d) series, their linear combination may be cointegrated, that is, their linear combination may be stationary. Although the variables may drift away from equilibrium for a while, economic forces may be expected to act so as to restore equilibrium, thus, they tend to move together in the long run irrespective of short run dynamics. The definition of the Granger causality is based on the hypothesis that X and Y are stationary or I(0) time series. Therefore, the fundamental Granger method for variables of I(1) can not be applied. In the absence of cointeragtion vector, with I(I) series, valid results in Granger causality testing are obtained by simply first differentiating the VAR model. With cointegration variables, Granger causality will further require inclusion of an error term in the stationary model in order to capture the short term deviations of series from their long-term equilibrium path. Hassapis *et al.*[12] show that in the absence of cointegration, the direction of causality can be decided upon via standard F-tests in the first differenced VAR. The VAR in the first difference can be written as:

$$\Delta X_t = \lambda_1 + \sum_{i=1}^{k} a_{1i}\Delta X_{t-i} + \sum_{j=1}^{k} b_{1j}\Delta Y_{t-j} + \mu_{1t} \quad (7)$$

$$\Delta Y_t = \lambda_2 + \sum_{i=1}^{p} a_{2i}\Delta X_{t-i} + \sum_{j=1}^{p} b_{2j}\Delta Y_{t-j} + \mu_{2t} \quad (8)$$

RESULTS AND DISCUSSION

The present study employs data that consists of annual observations spanning the period between 1977 and 2002. All data are obtained from the World Bank WDI database and are transformed into logarithmic returns in order to achieve mean-reverting relationships and to make econometric testing procedures valid. FDI is net inflows of investment to acquire a lasting management interest (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital as shown in the balance of payments. This series shows net inflows in the reporting economy. Data are in current U.S. dollars. GDP per capita, on the other hand, is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars. Table 1 shows the results of the ADF unit root tests on levels and in first differences of the data. Strong evidence emerges that all the time series are I(1).

Table 2 presents results from the Johansen cointegration test among the data sets. Neither maximum eigenvalue nor trace tests rejects the null hypothesis of no cointegration at the 5% level. The outcome of the Granger causality tests is shown in Table 3. Results of Granger-causality test show the null hypotheses of FDI does not granger cause GDP per capita is rejected in 1 and 2 year lags, at the 5 and 10% levels, respectively. On the

Table 1: Augmented dickey-fuller unit root test results

	FIN_IM	FIN_GDP
Test with an intercept		
Levels	1.7797	2.2245
1st differences	-5.6679	-7.5444
Test with an intercept and trend		
Levels	2.4756	2.7856
1st differences	-10.8890	-7.6623
Test with no intercept or trend		
Levels	0.2644	2.3674
1st differences	-0.7665	-10.6570

* McKinnon Critical Value

The lag length was determined using Schwartz Information Criteria (SIC)

Table 2: Johansen cointegration test results

Null hypothesis	Trace statistic	5% critical value	Maximum eigenvalue statistic	5% critical value
r = 0	30.657	41.68	19.3670	29.68
r < = 1	14.5698	24.75	8.7198	23.41

r is the number of cointegrating vectors under the null hypothesis.

Table 3: Granger causality test results

	F - Statistics			
Null hypothesis	Lag 1	Lag 2	Lag 3	Lag 4
FDI does not granger cause GDP per capita	8.12266**	5.87487*	1.6546	0.2555
GDP per capita does not granger cause FDI	0.175447	1.89679	1.7887	0.8576

* Reject the null hypothesis at the 10% level ** Reject the null hypothesis at the 5% level *** Reject the null hypothesis at the 1% level

other hand, the null hypotheses of GDP does not granger cause FDI is not rejected. This leads us to the conclusion that there is only a one-way casualty running from FDI to GDP.

CONCLUSION

The success of Cyprus in attracting FDI, as well as the adoption of a market oriented economic system and the pursuance of sound macroeconomic policies by the government has placed the country in the 16th place worldwide in terms of per capita income.

This study examines the relationship between foreign direct investment and GDP per capita in the economy of Cyprus, using the methodology of Granger causality and vector auto regression (VAR). Strong Evidence emerges that the economic growth as measured by GDP in Cyprus is Granger caused by the FDI, but not vice versa. Results further suggest that Cyprus's capacity to progress on economic development will depend on the country's performance in attracting foreign capital.

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