FDI AND UNCERTAINTY: AN EMPIRICAL APPROACH USING GREEK AND HUNGARIAN DATA

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ABSTRACT: The object of this paper is to investigate empirically the macroeconomic determinants of foreign direct investment (FDI) inflows in Greece and Hungary and to shed light on the matter of exchange rate and inflation uncertainties affecting the FDI decisions. The empirical analysis employs GARCH techniques to model the uncertainty variables as well as Granger-Causality tests in conjunction with variance decompositions to detect the relative contribution of the explanatory factors on the FDI decisions.

1. INTRODUCTION

The growth of foreign direct investment (FDI) has led to a discussion regarding the factors which affect such investment projects. Since there is no denying that one of the most important reasons of undertaking investment is for the purpose of making profits, the same holds for the FDI decision as well.

The macroeconomic determinants, which follow closely the theories of corporate investment behaviour, emphasise the importance of the size of the market (as given by the level of gross domestic product), the growth of the host market, factor prices, interest rates, profitability, and the protection afforded to investing firms by tariffs and/or other measures.

The microeconomic determinants, following from the theory of industrial organisation, have to do with those firm and industry characteristics which have been found to confer certain advantages on multinational firms compared with most of their local rivals. Such characteristics are, for example, product differentiation, technological and advertising effects, the product cycle as well as the size firm as it is measured by either its sales or its assets.

Finally, a third category of determinants refers to various other strategic and long-term factors, which have mainly indirect effects on the decision to invest abroad but are directly relevant to the profitability of the venture.

FDI is considered a key factor in the economic development of the less developed countries, since it is the only way for them to acquire capital, technology and expertise. Besides, there is a reduction in other capital inflows, such as private lending, thus stretching the need for the host governments to attract FDI flows.

The relevant international empirical literature has focused on the importance of the macroeconomic environment and more particular of the economic stability in a host country to stimulate foreign investors (Bourlakis, 1987; Culem, 1988; Cushmann 1985 and 1988; Mainardi, 1992; Papanastasiou and Pearce, 1992; Moore, 1993; Brewer, 1993; Dunning, 1993a and 1993b; Woodword and Rolfe, 1993; Bajo-Rubio and Sosvilla-Rivero, 1994).

Over the last years, the investigation of the economic uncertainty on FDI flows has gained special interest. Itagaki (1981) and Cushman (1988) have proved that the uncertainty of the exchange rate in the host country causes FDI inflows to increase, while Apergis and Katrakilidis (1996) have found that inflation uncertainty significantly causes the behaviour of FDI inflows in Spain, Portugal and Greece.

In this paper we attempt to identify the macroeconomic factors explaining the pattern of FDI inflows in Greece and Hungary. A number of empirical studies have already addressed the issue of exploring the macroeconomic determinants of the inwards FDI flows. Among them, and for the case of Greece, we should mention the work of Giannitsis (1992), Georgantas, Manos, Notis, Robolis, and Sakkas (1986), Milios and Ioakimoglou (1990), and Mourdoukoutas (1995) who claim that the major factors for attracting foreign investment inflows in Greece, among others,, are the factors of the market, the infrastructure in the host country, the educational level, the level of specialisation, and the quality of the services offered. Mardas and Varsakelis (1996) claim that especially after 1980 the state commissions composed the most powerful factor of attracting foreign investments in Greece. Katrakilidis, Karasawoglou, and Tabakis (1996), report evidence that, among the dominant factors which influence the foreign investors in Greece positively, the exchange rate uncertainty seems to be involved. Moreover, Apergis and Katrakilidis (1996) present evidence for the importance of the inflation volatility on the FDI formation in Spain, Greece, and Portugal.

As it concerns the relevant literature for the case of Hungary, the interest is rather on the importance and the benefits acquired from the establishment of foreign investments in Hungary. More specifically, Torok (1994), Vissi (1994), and Szanyi (1994) argue in favour of the positive effects of the FDIs in the industrial sectors of the economy and in the economic development of the country, mostly due to the beneficial effects on the unemployment, the GNP growth, and the improvement of the productivity through the adoption of the imported new technologies. Finally, the literature concerning the investigation of the determinants of the FDI inflows in Hungary, it is generally accepted that the geophysical location, the high quality of the labour force, and the political stability in the country mostly contribute to cause the interest of the foreign firms to invest (Szanyi, 1994; Csaki, Sass, and Szalavetz, 1996).

The present study addresses the following issues: First, to identify the most important determinants of the foreign investment inflows in Greece and Hungary; second to investigate the effects of the exchange rate uncertainty and the inflation uncertainty on the FDI decision; third to present comparative results in order to detect possible differences in the patterns of the FDI inflows behaviour in these countries.

The remainder of the study is organised as follows: Section 2 presents some general remarks concerning the course of the foreign investments in Greece and Hungary; section 3 outlines some aspects of the employed empirical methodology; section 4 reports the empirical findings of the research and, section 5 presents a brief summary with concluding remarks.

2. THE BEHAVIOUR OF FDI IN GREECE AND HUNGARY: SOME GENERAL REMARKS

Greece has historically attracted a relatively high level of foreign direct investment (FDI) inflow. The course of the inward FDIs from the late 1950s and over the 1960s and 1970s performed a rather steady upwards inclination. However, over the course of the 1980s a slow decline appeared till the second half of the decade.

The most important features of the Greek market, which seem to have positively influenced the foreign investors' decision till the 1980s, were the favourable legislative system, the tax incentives, the low labour cost, the geographical proximity of the Greek market to other permissive markets (Balkans, Middle East, Mediterranean etc.), and certainly the potential of the domestic market.

The observed slow down in the FDI inflows over the early 1980s was probably due to the unstable political environment, the recession of the economic activity, the strong inflationary pressures and, in general, to the discontinuous and ineffective economic policy followed especially during the first half of the decade.

In the light of EC integration, Greece implemented an austerity programme in 1985 and an investment incentives package in 1988, and thus succeeded in improving most of the economic indices and restoring business confidence. However, political instability in 1989-1990 resulted in a new crisis in the early 1990s, thus, forcing the government to launch medium-term adjustment programmes leading to the Convergence Plan 1993-1998, which has been approved by the Community in 1993. The above presented economic situation in Greece, explains the strong rising of the foreign inflows (with a parenthesis in the 1989) over the period 1986-1994.

As it concerns the origin of the FDI inflows, it is worth noting that the U.S. has been the major foreign investor in Greece over the 1960s and 1970s. In 1960, FDI inflows from the U.S. in Greece, accounted for a 48% of the total FDI inflows, while this percentage approximated the 70% in 1970. During the 1980s, and in particular over the second half of this period, the major part of the foreign investment inflows (about 57%), came from the EC area. Among the EC member states, the U.K. and the Netherlands were the principals investors and were followed by France and Germany. The most important sector in terms of FDI activity was that of manufacturing, which shared the 50% in total FDI. Since the share of the manufacturing sector in GDP was about 20% in the same period, FDIs relative importance in the sector may be emphasised. We should note that manufacturing and in particular the industrial sector (chemical industry, oil refineries, basic and non-ferrous metals, beverages, e.t.c.), has always been a relatively high protected sector in Greece. This fact could be considered as an explanation for the preference revealed by the foreign investors towards the above branches of industrial production.

As it concerns the orientation policies of the foreign firms in Greece, the literature provides empirical evidence that the FDIs primarily targeted the domestic market (Ioanidis, Katrakilidis, Karasawoglou and Athanasiadis, 1996; Mardas and Varsakelis, 1996). In addition, Georgakopoulos (1987) reports that the non-tariff protection in certain industries in Greece (non-ferrous metals, insulated wires and the electrical machinery) has led the foreign firms to establish a domestic affiliate in the context of an export-led orientation strategy, intending to exploit the comparative advantages of the country. In the industrial sector foreign firms represent 65% to 87% of the total sectoral exports.

Over the last years the foreign investors' strategy for Greece targeted the acquisition of leading firms in the domestic market rather than greenfield investments; thus, the major problem of establishing distribution channels has been left behind. The relatively small share of greenfield investment in Greece is in contrast with the situation in other small OECD economies.

The course of the Hungarian Economy and the FDI inflows is directly related to the regulating efforts in this country. These efforts had partly started off since 1968 by the adoption of features and mechanisms met in the free market economies. This fact led Hungary to become able to accept and assimilate the radical changes in the area at the end of the 1980s comparatively earlier than the other CEEC countries.

The FDI flow into Hungary seems to be a major success into the economic field. Since 1988, Hungary has achieved to dominate all the others CEEC countries in the region over the domain of attracting FDIs. The main source has been the U.S., followed by Germany, Austria and Italy and they were basically absorbed by manufacturing, while a significant proportion was transmitted into the services sector (trade and more recently telecommunications and road transports).

The most important changes in the course of the economy of Hungary has been the tax regulation, the liberalisation in the price system, the gradual liberalisation of imports, the flexible-adjusted exchange rate policy, the restrained fiscal policy, and the privatization of public enterprises. However, this exchange-rate policy regime has been proved rather insufficient to reduce the inflation rate and has led, after 1992, to large deficits both in the balance of trade and in the public sector. Hungary emerged from recession in 1993 and 1994, but the large deficits still press inflation upwards and keep interest rates high.

Despite this rather unstable economic performance, FDIs enter the country in any case. The explanation of this unusual behaviour is probably found in the combination of the surge in privatization and the proximity to the other countries of the EU. Furthermore, we should note that the major part of the FDI inflows in Hungary concerns greenfield investment while the share of foreign firms in Hungary's total exports is very significant. Furthermore, the prospect of Hungary joining the EU stimulates the interest of non-EU investors intending to obtain access in the EU markets.

3. METHODOLOGICAL ISSUES

The GARCH methodology

If ε is defined as the innovations in the mean for a specific stochastic process, y(t), and σ a time-varying, positive, and measurable function of the time t-1 information set, then the GARCH(p,q) model proposed by Bollerslev (1986) suggests that:

$$\sigma^2(t)=\omega+\Sigma\alpha(i)\varepsilon^2(t-i)+\Sigma\beta(i')\sigma^2(t-i)=\omega+\alpha(L)\varepsilon^2(t)+\beta(L)\sigma^2(t) \qquad (1)$$

i=1, ..., q; i=1, ..., p

All parameters in process (1) must be nonnegative, a condition that ensures stationarity of the conditional volatility. Expression (1) could be interpreted as an ARMA model for $\varepsilon^2(t)$. Following Bollerslev (1986), the identification of equation (1) is similar to that of the Box and Jenkins methodology.

The Variance Decomposition methodology

This technique involves the transformation of a system into its moving-average representation and then to obtain a vector of orthogonal innovations estimated from the data. Furthermore, the analysis traces the dynamics of an innovation in any of the involved variables over time to account for the total amount of system variation attributable to each innovation.

More specifically, according to the Wold decomposition theorem, any finite linearly regular covariance stationary process y(t), m×1, has a moving average representation

$$y(t)=\Sigma\Phi(s)u(t-s) \qquad (2)$$

s=0, ..., ∞

with Var[u(t)]=Σ.

Even although u(t) is serially uncorrelated by construction, the components of u(t) may be contemporaneously correlated, so an orthogonalizing transformation to u(t) is done so that (2) can be rewritten as[i]

$$y(t)=\Sigma\Phi(s)P^{-1}Pu(t-s)=\Sigma\Theta(s)w(t-s) \qquad (3)$$

s=0, ..., ∞; s=0, ..., ∞;

where $\Theta(s)=\Phi(s)P^{-1}$, w(t-w)=Pu(t-s) and Var[w(t)]=Var[Pu(t)]=I

When P is taken to be lower triangular matrix, the coefficients of Θ(s) represent "responses to shocks or innovations" in particular variables. We can also allocate the variance of each element in y to sources in elements of w, since w is serially and contemporaneously uncorrelated. The orthogonalization provides

$$\Sigma\Theta^2(s)_{ij}, \qquad (4)$$

s=0, ..., T

which is the components-of-error variance in the T+1 step ahead forecast of y_i which is accounted for by innovations in y_j.

4. DATA AND EMPIRICAL RESULTS

The Data

The empirical analysis is carried out using Greek and Hungarian data over the period 1989 to 1994. The variables involved are foreign direct investment, industrial index of production (as proxy for the market potential), consumer price index, wage rate, real effective exchange rate and treasury bill rate. All series are expressed in logarithms and consists of quarterly data.

Integration Analysis and Granger-Causal Inferences

Since many macroeconomic series are characterized by non-stationarities, implying that the classical t and F-tests are inappropriate, we firstly test for stationarity using the Dickey-Fuller test (ADF). The results are presented in Table 1 for Greece and Hungary and suggest that all series are non stationary in levels whereas they are stationary in first differences. One implication of these results is that first-differencing is required to induce stationarity, otherwise one could obtain spurious outcomes. Furthermore, the long-run properties between the employed series were examined in the context of multivariate cointegration, but since no evidence of cointegration was found, we proceeded with the estimation of vector autoregressive (VAR) system specifications in order to examine the information content of the involved variables. The postulated VAR systems include, as it was mentioned above, six variables, namely, the foreign direct investment, the index of industrial production, the consumer price level, the wage rate, the real effective exchange rate, and the treasury bill rate. The autoregressive lags for each variable, have been optimally determined, in a previous stage, using the Akaike's Final Prediction Error (FPE) criterion, following Hsiao's methodology as extended by Ahking and Miller (Ahking and Miller, 1985). In the next step we applied Granger-causality tests in order to investigate the major determinants of the Greek and Hungarian FDI's inflows' behaviour. The estimated, by means of seemingly unrelated regression (SUR) estimation methodology, FDI relationships associated with the Granger-causality tests are reported in Table 4. The results suggest that the FDI inflows in Greece is mainly influenced by the market growth and the changes in the real exchange rate, while in the case of Hungary the major influential factors appear to be the inflation rate, the market growth, the changes in the interest rates, the growth of the real exchange rate and to a less degree, though statistically significant at the 6% level, the growth of the wage rate.

Variance Decompositions

Since our results have been obtained using a rather small sample, we proceeded our investigation employing the variance decomposition technique so as to strengthen the robustness of our inferences.

The variance decompositions are reported in Table 5. The table presents the percentage of the variance of the n-quarter ahead forecast error of the variables that is attributable to each of the shocks for n=4, 8 and 12. According to the reported results, in the Greek case, the variance of the market growth seems to explain more than 60 percent of the variance of the FDI inflows while another 20 percent is explained by the growth of the real exchange rate.

The reported results for the Hungary, suggest that the variance of the FDI inflows is explained, albeit in a weak manner, by the variance of the market growth and the wage rate growth (about 12-16 percent and 10-14 percent respectively), while the inflation rate also contributes in a minor way (5-10 percent).

The Role of Uncertainty

In this section the analysis attempts to spread more light on the macroeconomic determinants of FDI inflows in Greece and Hungary by considering the inflation uncertainty and the exchange rate uncertainty, explicitly involved among the other explanatory factors in each country. For this purpose, the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) approach, in conjunction with ARIMA modelling, has been employed.

In particular, the first step involved the modelling of the prices and ex-rates "news" behaviour by constructing appropriate ARIMA models for Greece and Hungary and employing monthly data. The residuals from the ARIMA models were then tested for normality by examination of the kurtosis statistic. The results, reported in Table 2, suggest the rejection of the normality hypothesis for all the residual series, and thus, ARCH models seem to be appropriate to capture any deviations from normality.

In the next step, ARCH tests were performed to examine the presence of ARCH effects. The results, also reported in Table 2, confirm the existence of ARCH effects, and the specification of the appropriate ARCH or GARCH models, via the Box-Jenkins identification approach, was followed. The models and their estimates are reported in Table 3. We should note that the estimated coefficients in all equations are positive and obey the stationarity rule, i.e. their sum is less than unity.

Once conditional estimates for inflation and ex-rate volatilities were obtained, we repeated the empirical analysis, as it was performed in the previous section, having augmented the sample of variables for Greece and Hungary by the two estimated conditional volatilities as proxies for the respective "uncertainty" variables.

The inference from the Granger-causality tests (reported in Table 4), suggest that the major determinant to influence the FDI decision in Greece seem to be the uncertainty in the ex-rate growth as well as the growth of the domestic market. In the case of Hungary the findings suggest that FDI inflows are caused by the inflation uncertainty, the inflation rate, the domestic market growth and the wage inflation.

Finally, the evidence from the error decompositions, reported in Table 6, suggest that in the case of Greece the major factor explaining the variance of the FDI inflows is the volatility of the ex-rate growth (about 85%), whereas in Hungary the domestic market growth and the volatility of inflation are the main contributors (48 and 42 percent, respectively) to the explanation of the FDI inflows variance.

5. CONCLUDING REMARKS

In this paper we intended to shed light on the issue of FDI inflows in Greece and Hungary by exploring what economic determinants best explain the foreign investment variance. Among the examined determinants, the ex-rate volatility and the inflation volatility have been involved to count for the economic uncertainty related with FDI decisions.

The empirical methodology followed, first, employed GARCH modelling to estimate the conditional volatility of the ex-rate and inflation. Second, Granger-causality tests were applied to detect possible causal effects of the employed set of variables on the behaviour of the FDI inflows. Third, variance decomposition analysis was used to determine the relative contribution of each explanatory variable to the variance of the FDI variable.

The overall results suggested that for the case of Greece the domestic market growth dominates the other explanatory factors. The moderately negative effects of the exchange rate seem to turn insignificant when the exchange rate uncertainty is introduced in the analysis, which in turn causes positively FDI decisions. This justifies the increase of FDI inflows in Greece over the period under examination. As it concerns the FDI inflows in Hungary the results suggested that FDI behaviour is mainly explained by the domestic market growth, inflation, wages and inflation uncertainty. Since the course of FDI inflows in Hungary performs a steadily increasing slope, it seems possible that the negative effects of the inflation uncertainty on FDI inflows turn insignificant, mainly due to factors related to the advantageous geographical location as it was discussed in section two.

Symbols Index

GFI, HFI: Greek and Hungarian FDI, in log-levels
GY, HY: Greek and Hungarian Industrial Index of Production, in log-evels
GP, HP: Greek and Hungarian Consumer Price Index, in log-levels
GW, HW: Greek and Hungarian Wage Rate, in log-levels
GER, HER: Greek and Hungarian Real Effective Exchange Rate, in log-evels
GTB, HTB: Greek and Hungarian 3-month Treasury-Bill Rate, in log-evels
GPN, HPN: Greek and Hungarian Price 'News' from the respective ARIMAs
GERN, HERN: Greek and Hungarian Ex-Rate 'News' from the respective ARIMAs
GUP, HUP: Greek and Hungarian estimations of Inflation Uncertainty
GUER, HUER: Greek and Hungarian estimations of Ex-Rate Uncertainty
D: Operator to denote first-difference form

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APPENDIX

Table 1

Dickey-Fuller Unit Root Tests

Variables	Levels	Variables	First differences
GREECE			
GFI(2)	-1.398	DGFI(2)	-4.920
GY(3)	-1.843	DGY(2)	-12.795
GP(3)	-0.747	DGP(2)	-4.405
GW(2)	-0.874	DGW(2)	-3.704
GER(3)	-1.356	DGER(1)	-4.098
GTB(2)	-1.483	DGTB(2)	-4.409
HUNGARY			
HFI(4)	-1.171	DHFI(2)	-3.441
HY(2)	-1.597	DHY(2)	-5.361
HP(2)	-0.916	DHP(2)	-4.000
HW(2)	-2.476	DHW(2)	-4.515
HER(2)	-0.383	DHER(2)	-3.983
HTB(2)	-1.139	DHTB(2)	-3.531

Note: -The numbers in parentheses denote the appropriate number of lags to ensure absence of serial correlation.
-The critical value used for the D-F unit root-test is -2.95.

Table 2

Distributional Properties of the 'News' Variables and ARCH tests

	GREECE		HUNGARY	
Tests	GERN	GPN	HERN	HPN
Skeweness	-2.54 (0.00)	0.27 (0.22)	-0.53 (0.1)	0.053 (0.88)
Kurtosis	15.56 (0.00)	1.11 (0.01)	2.89 (0.00)	2.09 (0.006)
ARCH	$X^2(1)=7.2$ (0.00)	$X^2(1)=4.6$ (0.03)	$X^2(2)=6.2$ (0.04)	$X^2(1)=5.3$ (0.02)

Table 3

GARCH models

Variable	Order (p, q)	$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j}$
GREECE		
GUP	(0, 1)	$h_t=0.00004+0.28413\varepsilon_{t-1}^2$ (8.289) (1.963)
GUER	(0, 1)	$h_t=0.00013+0.0948\varepsilon_{t-1}^2$ (16.356) (2.204)
HUNGARY		
HUP	(1, 0)	$h_t=0.00067+0.75311h_{t-1}$ (4.399) (3.282)
HUER	(1, 0)	$h_t=0.00021+0.7378h_{t-1}$ (5.176) (5.777)

Table 4
Granger-causality Tests

	Model without volatility	Model with volatility
Explanatory Variables	Null hypothesis: FDI is not caused by:	
GREECE		
DGY	X^2=11.902 (0.0077)	X^2=7.592 (0.0058)
DGP		
DGW		
DGER	X^2=5.989 (0.0500)	
DGTB		
GUP		X^2=1.329 (0.2489)
GUER		X^2=14.739 (0.0006)
HUNGARY		
DHY	X^2=17.044 (0.0000)	X^2=32.682 (0.0000)
DHP	X^2=18.716 (0.0000)	X^2=5.119 (0.0230)
DHW	X^2=3.321 (0.0683)	X^2=30.547 (0.0000)
DHER	X^2=17.085 (0.000)	
DHTB	X^2=7.617 (0.0057)	
HUP		X^2=11.744 (0.0000)
HUER		

Note: The numbers in parentheses denote p-values.

Table 5
Variance Decompositions

GREECE					
Forecast horizon	% of variance of error due to innovations in				
	DGY	DGP	DGW	DGER	DGTB
4	65.055	2.136	4.928	18.791	0.394
8	63.480	1.964	4.845	21.285	0.224
12	63.030	1.921	4.930	21.867	0.201
HUNGARY					
Forecast horizon	% of variance of error due to innovations in				
	DHY	DHP	DHW	DHER	DHTB
4	12.139	5.943	10.813	1.174	0.000
8	14.207	9.721	12.518	1.482	0.000
12	15.922	10.287	13.861	1.713	0.000

Table 6
Variance Decomposition with Uncertainty Variables

GREECE							
Forecast horizon	Percentage of variance of error due to innovations in						
	DGY	DGP	DGW	DGER	DGTB	GUP	GUER
4	14.222	0.000	0.729	0.000	0.027	0.000	84.561
8	14.220	0.001	0.729	0.000	0.027	0.000	84.562
12	14.219	0.001	0.728	0.000	0.027	0.000	84.562
HUNGARY							
Forecast horizon	Percentage of variance of error due to innovations in						
	DHY	DHP	DHW	DHER	DHTB	HUP	HUER
4	48.699	0.186	4.880	0.000	0.000	42.664	1.717
8	48.078	0.241	5.265	0.000	0.000	42.245	2.221
12	47.968	0.251	5.333	0.000	0.000	42.172	2.309

[i] The representation (3) is obtained by decomposing Σ^{-1} as $\Sigma^{-1}=P'P$.