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Assessing the Effectiveness of the Exchange Rate Movements on the Greek Current Account Deficit: A Cointegration Analysis*

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Abstract

Using the Johansen Cointegration analysis, Error Correction Modeling (ECM) and Granger Causality on annual data over the 1963 – 2003 period, it is shown that there is a long and short run relationship between the Greek current account deficit and the real effective exchange rate of the Greek currency with the currencies of European Union (EU-15) countries, which are partners of Greece in EU-15. The empirical evidence reveals one – way causality from current account deficit to GDP, RER, GDP_{11}, M_3 and BD. The specification and diagnostic tests yield satisfactory results, indicating that the ECM estimates are consistent with the empirical framework.

JEL Classification Numbers: **F10, F32, F41**.

Keywords:

Exchange Rate, Current Account Deficit, Cointegration Analysis.

1. Introduction

Today's, Greece can be characterized as a developed country. In the world, there is not any close economy, so that Greece has not created international relationships with other countries. All economies are open to some extent, with degree of openness from one country to an other country.

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The economic policy has proved that there are constraints which may limit the growth of rate in the economy. But, if developing economies used the correct means, they would increase their competitiveness.

Devaluation of the national currency of a country is often used as an instrument for the correcting policy in the improvement of the trade account. The increase in competitiveness of exportable goods and services of a country presupposes that there is some adjustment of the exchange rate of its nominal currency. Also, devaluation as a monetary instrument aims to improve the international competitiveness of an economy (Paleologos and Georgantelis, 1997).

According to Paleologos and Georgantelis (1997), since 1970, the shift in the international monetary system from fixed exchange rate to flexible ones had a major impact on the international monetary order. After 1973, the system of Bretton Woods (fixed exchange rates) and the ‘’Gold Exchange Standard’’ were virtually abolished. This situation was bound to affect the Greek economy, which has indeed found itself in a vicious circle of devaluation and inflation.

For long period Greece had fluctuations about devaluation, inflation and other monetary instrument. For example, the fluctuations of the drachma and the ensuring devaluation of this currency after 1980 leaded to improve the competitiveness of the Greek economy, to limit the deficits of the country’s trade balance and to limit the deficits of the general government.

According to Chalikias (1989), deficits in the Greek balance of trade and general government are a chronic phenomenon and there is no prospect of their being eliminated in the foreseeable future.

In the 21st century, Greece is member of Economic and Monetary Union (EMU). The year 2002 was very important for the countries participating in the euro area, because euro banknotes and coins had to be brought into circulation, in order to complete the transition to the final phase of Economic and Monetary Union (EMU). The participation of Greece in EMU has contributed in recent years to the acceleration of the GDP growth rate, which according to estimates by the National Statistical Service of Greece, stood at 4% in 2002 and 4,2% in 2003. This occurred despite the adverse international economic environment, which has been characterized by a marked weakening of economic activity in European Union and the negative impacts of the drop of share prices in world markets.

Despite the satisfactory growth performance, the increase in employment was small and the rate of unemployment declined at a relatively slow pace. Inflation was higher than in most euro area countries. The current account deficit decreased only marginally in 2002 to 6,1% of GDP. The existence of a high current account deficit, which results in a shortfall of domestic saving relative to domestic investment is to be expected in a fast growing economy which is traditionally a net capital importer. However, the deficits recorded in recent years seem to stem also from a loss of price competitiveness.

The above observations indicate that further structural reforms and fiscal adjustment are needed in order to improve the competitiveness of the Greek economy and achieve real convergence towards the other euro area countries.

The present paper attempts to analyze if there is a long - term relationship between the Greek balance of trade and the real effective exchange rate. To this end we use a relatively new technique for cointegration developed by Johansen (1988, 1991) and Johansen and Juselius (1990, 1992) in the context of Vector Autoregressive Models (VAR Analysis).

2. A brief overview

According to the traditional Keynesian approach developed during the 1950's and 1960's, the devaluation of a currency positively affects the domestic product (expansionary devaluation hypothesis), increases exports, improves the trade balance and indirect improves the current account balance, but also increases, at least in the short run period, the price level. But, the increase of prices can have positive influence on budget deficit. In particular, budget deficit is inflationary (Dwyer, 1982).

Moreover, according to Darvat (1988) and Bahmani - Oskooee (1989), there is a relation between budget deficits and trade deficits, and they have found evidence in support of notion that the U.S. budget deficits do contribute to its trade deficits (or deficits of current account balance).

However, according to Bahmani - Oskooee (1991, p. 73), supports that budget deficits could influence trade volumes through three different channels that are all standard textbook arguments. The first channel is that deficit spending is said to be inflationary. The second channel, through which a similar conclusion is usually reached, at least on the import side, is related to the income effects of budget deficits. Finally, the third channel is through the impact of budget deficits on interest rates.

Therefore, devaluation can have negative effects on economic activity. This effect can be realized, in a Keynesian open economy model when devaluation can negatively affect the level of economic activity if the Marshall – Lerner condition is not satisfied. Consequently, the condition that the devaluation is successful only when the sum of elasticities of the demand for imports and exports in absolute, is true when it is greater than unity (for example, $e_x + e_m > 1$). In other words, this approach emphasizes the importance of prize elasticities of imports and exports (Houthaker and Magee, 1986, Wilson and Takacs, 1979). But also, Paleologos and Georgantelis (1997) and Alexander (1959) maintain that devaluation may change the terms of trade, switch expenditure from foreign to domestic goods as well as reduce domestic absorption improving in this way the trade balance.

Moreover, this traditional Keynesian view has been challenged by other economists who emphasize the supply size of the economy and suggest that devaluation tends to increase cost of production and decrease output, a fact that leads to stagflation (Krugman and Taylor, 1978, Sarantides and Paleologos, 1988). In particular, Krugman and Taylor (1978) support the idea that any favourable effect of devaluation on the trade balance will come via construction of economic activity (contractionary effect). Bilson (1978, p. 195) supports the view that devaluation does not have any long run effect on output and the trade balance, because domestic prices and costs eventually increase, neutralising any initial favourable effect of the devaluation.

In the early 1970s a growing has in spared interest in the formalization and testing of alternative models of exchange rate determination. One of the main approaches to open economy macroeconomics that has emerged since the adoption of floating exchange rates in the 1970s is the asset market approach which focus entirely of financial markets and ignores the goods market.

This approach has become the dominant model of exchange rate determination in the 1980s. According to this approach the interaction of assets demands and the given asset supplies determines the equilibrium values of the exchange rate and the interest rate. The asset market models regard the capital flows as transitory phenomena associated with the adjustment of disequilibrium capital stocks and depend upon changes in interest rate differentials. An extremely important model exchange rate determination is the so - called monetary model which belongs to the asset market framework of the exchange rate determination, which is a logical extension of the quantity theory of money in an open economy. This model arose as an outgrowth of research on monetary determinants of the balance of payments, and support that the equilibrium condition in the money market determines the exchange rate (Mundell, 1968; Johnson, 1972; Frenkel and Johnson, 1978).

According to Paleologos (1996), the exchange rate is a monetary phenomenon and it is equal to the relative prices of foreign and domestic money, but in this paper, we are going to use the exchange rate as a monetary phenomenon, which is equal to the relative prices of domestic money.

Assuming that all goods and services are perfect substitutes, that the demand for money is a stable function, and that wages and prices are flexible, devaluation increases the price level. The real balance effect is a central element of the monetary approach to devaluation. According to Dornbusch (1973), if such a real balance effect is absent, the effect of devaluation is not significant.

According to Sarantides (1970), the devaluation policy of structuralists does not positively affect the balance of payments when countries decided to proceed to currencies devaluation suffer from structural problems.

In this paper, we will attempt to do an empirical approach about current account balance deficit, budget deficit and real effective exchange rate used to the cointegration analysis.

3. Presentation of model

According to the multiplier analysis the effectiveness of the real exchange rate on the Balance of Current Account deficit is a simple relationship. The model will estimate from 1963 to 2003. Also, the model can be defined as:

$$CA = f(Y, E/P, BD) \qquad (1)$$

where CA is the current account balance, Y is the real output in prices 1995, E is the exchange rate, P is the domestic price level and BD is the budget deficit.

In particular, the equation used in this paper is of the following form:

$$CA_t = \alpha_0 + \alpha_1 Y_t = \alpha_2 RER_t = \alpha_3 Y_t^* + \alpha_4 M_t + \alpha_5 BD_t + u_t \qquad (2)$$

where CA_t is the current account balance of Greece for period 1963 - 2003, Y_t is gross domestic product (GDP) in prices 1995 of Greece for similar period, Y_t^* is gross domestic product (GDP_{11}) of Greece's main trading partners of European Monetary Union (EMU), M_t is the money supply of Greece for which we use the definition M_3 of money supply, RER_t is the real effective exchange rate, BD is the budget deficit and u_t is the disturbance term of the model.

The analysis we are going to make in this paper refers to the period 1963 to 2003 (annual data) which is characterized by a flexible exchange rate policy. The data used in the study are taken from the Monthly Bulletin of the Bank of Greece (various issues), from the European Economy (various issues), from the Journal ''The Greek Economy in Figures, 2002'' and from the ''Main National Accounts Aggregates of the Greek Economy, 1960-1999 (ESA-95)'' of the Ministry of National Economy.

The countries which we include in the sample are the European Monetary Union (EMU) countries (EU_{11}). Moreover, computer package which were used in this paper is Eviews 3.1.

4. Testing for stationery (ADF and PP) and cointegra – empirical approach

In order to examine the dynamic process among the variables included in equation (2), an unconstrained Vector Autoregressive Models (VAR Model) is used. The starting point is that if the relationship (2) is an equilibrium system, the set of variables included in the system must be cointegrated, even if the variables individually are nonstationary (Engle and Granger, 1987).

The basic idea behind cointegration is that, in the long run period, two or more variables closely together, the linear combination between them is stationary and hence we may consider those series as defining along run equilibrium relationship. A stationary time series is a variable which has no systematic change in mean or variance as time passes and exhibits no seasonal or periodic pattern of fluctuations. If two or more variables are considered as stochastic trends and if they follow a common log – run equilibrium relationship, then these variables should be cointegrated.

Engle and Granger (1987) show the two – step cointegration technique which is an alternative in time – domain time series analysis. In this approach the existence of a long run relationship among two or move non stationary processes is tested by examining the stability of deviations from the relationship using the coefficients estimated by fitting static regressions (Paleologos, 1996).

However, the tests based on this procedure suffer from a number of shortcomings. This method has implicit assumption that the cointegrating rector is unique. This assumption means that we are bound to end with a model that is a linear combination of independent cointegrating vectors. Another disadvantage of the Engle and Granger (1987) procedure is that is examines only the dominant cointegrating rector between series. An Augmented Dickey and Fuller (ADF) test on the residual of cointegrating regression imposes common factors and can lose most of its power (Kremes et al, 1992). Baherjee et al. (1986) using Monte Carlo simulations show that the procedure of Engle and Granger lacks power.

The Johansen technique performs better than the single equation methods and alternative multivariate methods (e.g. Stock and Watson, 1988, Gonzalo, 1994). Moreover, Phillips (1987) suggests that the Johansen technique may also be applicable in the presence of heterogeneously distributed error processes. Cointegratrion is a test for equilibrium between non-stationary variables integrated of the same order a variable is said to be stationary if its mean, variance, and covariance are all invariant with respeet to time. In even a case, the variable is denoted I(0), indicating in*terpretati*on of order new. A non-stationary variable requiring first-order differencing to achieve stationary is said to be I(1). This technique has the advantage that it completely captures the underlying time series properties of the data, provides estimates of all the cointegrating rectors that exist within a rector of variables and offers a test statistic for the number of cointegrating rector without imposing an a priori a normalization on the dependent variables. Johansen's procedure which is based on the full system estimation can eliminate the simultaneous equation bias and raise efficiency relative to the single equation method of Engle and Granger (1987), Golzano (1989), Phillips (1991) and also takes into account the error structure of the data processes and permits for interaction in the determination of the relevant economic variables. (Paleologos and Georgantelis, 1997). The main reason for popularity of coitegration method is that it provides a formal background for testing and estimating short and long run relationships among economic variables. According to Engle and Granger (1987), cointergrated variables must have an ECM representation. ECM and coitegration are equivalent representations.

However, before proceeding to test for cointegration and estimation of ECMs, it is necessary to establish the time series properties of the individual series used, by means of Dickey, Fuller (D-F), Augmented Dickey – Fuller (ADF) (Dickey and Fuller, 1979, 1981). Unit Root tests show whether each series is stationarity (whether the series has a stochastic trend). (Paleologos, 1996).

Two tests are employed to determine the existence of unit roots in the series. The first, the Augmented Dickey – Fuller (ADF) tests for unit roots (Dickey and Fuller, 1979, 1981) indicates whether an individual series, x_t is stationary by running OLS regression of the form

$$\Delta x_t = a + bx_{t-1} + (t_t + \sum_{i=1}^{p} di\Delta x_{t-1} + V_t,\ V_t \sim N(0, \sigma^2) \qquad (3)$$

where Δx are the first differences of the series, t is the time trend, p in the number of lags and V is the error term. A series is stationary ($x_t \sim I(0)$) if the coefficient (b) of the lagged variable is negative and significantly different than zero, while if the coefficient b is equal to zero (b = 0), a series is non – stationary in levels ($x_t \sim I(1)$ and stationary in first differences ($x_t \sim I(0)$). The second, unit root tests is the Phillips and Perron (PP) test (Phillips, 1987, Perron, 1988) which is similar to time ADF test but valid under a winder variety of stochastic behavior than the ADF.

The Phillips – Perron (PP) test involve computing the OLS regression (Perron, 1988).

$$Y_t = \mu + aY_{t-1} + B(T - t/2) + \varepsilon_t \qquad (4)$$

Where ε_t is allowed to follow a wide variety of stochastic behavior. The null hypothesis, a = 1, on (4) is tested by the statistic $Z(\tau_\mu)$ which involves along algebraic expression and follows the Dickey – Fuller τ_μ distribution. Table 1 presents both ADF and PP unit root tests on each variable included in equation (2). Results for the order of integration reported in Table 1 show that the non – stationary hypothesis is rejected for the first differences of the series concerned, thus indicating that CA, GDP, RER, GDP_{11}, M_3, and BD are all. Consequently, all these series can enter the cointegration equations and then we can apply Johansen – Juselius cointegration technique (Cuthbertson et al., 1992).

Table 1

Testing for Unit Roots: 1963 - 2003

				Phillips – Perron (PP)	
Variables	**ADF ($\hat{\tau}_{\mu}$)**	**ADF($\hat{\tau}_{\tau}$)**	**LM(4)**	**Z($\hat{\tau}_{\mu}$)**	**Z($\hat{\tau}_{\tau}$)**
ΔCA	-6,558 (1)	-6,433 (1)	0,676	-11,458	-11,182
ΔGDP	-8,137 (1)	-8,277 (1)	1,335	-10,722	-10,904
ΔRER	-7,896 (1)	-7,793 (1)	0,884	-12,634	-12,452
ΔGDP_{11}	-7,170 (1)	-7,067 (1)	0,114	-8,963	-8,826
ΔM_3	-8,115 (1)	-8,340 (1)	2,050	-10,160	-10,681
ΔBD	-7,604 (1)	-7,600 (1)	6,012	-21,405	-22,031

Figures in parentheses indicate the number of lagged dependent variables in the regression. The choice between zero and non – zero logs was based on the Lagrange multiplier (LM) test fourth order serial correlation of the residuals. The LM statistic is asymptotically distributed as x^2 (d.f. = 4). The number in the columns needed Phillips – Perron and Dickey – Fuller statistic with the transformation suggested by Phillips (1987). τ_{μ} and τ_{τ} are the test statistics allowing for constant mean, and for a time trend in mean respectively. Approximate 5% critical value. For τ_{μ} and t($\hat{\tau}_{\mu}$) is –2,89 for a sample size of n=100 and the 5% critical value for τ_{τ} and Z(τ_{τ}) is –3,43 (Fuller, 1976, p. 373). The calculation of (PP) statistics, Z(τ_{τ}) and Z(τ_{μ}) were based on 3 time lags. Figures in the column LM (4) show the marginal levels of significance. The cumulative distribution of the ADF test statistic is provided by Mackinnon's tables (1991).

There are two statistics from the Johansen vector autoregressive tests that determine the rank of the cointegration space.

One is the value of the likelihood ration (LR) test based on the maximum eigenvalue (λ_{max}) of the stochastic matrix. The other is the value of the LR test based on the trace of the stochastic matrix (Trace). The likelihood ratio test statistic developed by Johansen for the hypothesis that there are at most r cointegrating vectors is :

$$LR_{Tr} = -2\log(Q) = -T \sum_{i=r+1}^{n} \log(1 - \lambda_i) \qquad (5)$$

Where $\lambda_{r+1}, \lambda_{r+2}, \ldots, \lambda_n$ are the n-r smallest eigen values. Johansen, also, considers the following likelihood ratio test statistic for the hypothesis that there are (r) cointegrating vectors against the alternative r +1.

$$LR_{\lambda max} = -2\log(Q) = -T\log(1 - \lambda_{r+1}) \qquad (6)$$

The test statistic (5) and (6) are known as the trace test and the maximum eigenvalue test respectively. Both these statistics have non – standard distributions under the null hypothesis. Critical values for the LR statistics are given by Johansen (1988), Johansen and Juselius (1990) and extended by Osterwald – Lenum (1992), when there is a linear trend in the non – stationary part of the model, and also when there is a constant in the cointegration equation. The reported maximal eigenvalue likelihood ratio statistics, λ_{max}, are calculated within the framework established by Johansen (1991).

In addition a model with a fair lag structure was estimated and tested against the model with six lag structure.

Table 2 shows residual misspecification tests and test of the lag structure for the VAR models.

Table 2

Test of the lag structure and Residual Misspecification Test on the VAR Model (Equation 6)

Dependent Variable	**SST**	**Q(21)**	**N(2)**	**H(1)**	**σ^2**	**LR sims test**
CA	0,237	49,073	11,812 (0,002)	0,520 (0,907)	0,0267	49,721 (0,487) Lags with restrictions/ Lags without restrictions 4/6
GDP	0,636	89,078	0,0684 (0,966)	5,170 (0,001	0,070	
RER	0,667	61,539	4,342 (0,114)	0,603 (0,437)	0,079	
GDP_{11}	0,277	74,539	0,155 (0,925)	3,41 (0,001)	0,0341	
M_3	0,937	65,980	2,434 (0,296)	2,178 (0,139)	0,181	
BD	0,044	69,922	263,56 (0,006)	0,374 (0,540)	0,004	

SSE is the standard error of the equation, Q(21) is the Llung – Box statistic for serial correlation with 21 d.F. It is distributed as $x^2(21)$. N (2) is the Bera and Jarque (1986) statistic (BJ) for normality of the error terms. It is distributed as $x^2(2)$ with 2 d.f., H(1) is the Lagrange Multiplier statistic for the heteroskedasticity among the residuals. It is distributed as x^2 (1) with 1 d.f. Numbers in parentheses are the marginal level of significance.

From the above table we conclude that the marginal level of significance for both the statistics (Ljung – Box statistic and LR Sims statistic) in higher than 5% for the model with four lag structure. We decided to use this lag structure, k = 4, in the rest of analysis although a model with a shorter lag structure and have been selected. From table 2 it is obvious that K = 4 gave

VAR equations which satisfied a range of diagnostic tests for misspecification. For the estimation of the model we have included three (entered seasonal dummies while a constant is allowed to enter unrestrictedly in the VAR model following the procedure developed by Johansen (1992).

Table 3

Johansen – Juselius Cointegration Test among CA, GDP, RER, GDP11, M3, BD

H_0	n-r	T_r	T_r*	95%	H_0		λ_{max}	λ^*_{max}	95%
$r \leq 5$	1	1,27	0,52	3,76	$r \leq 5$	$r \leq 6$	1,27	0,52	2,68
$r \leq 4$	2	12,84	5,32	15,41	$r \leq 4$	$r \leq 5$	11,57	4,8	12,07
$r \leq 3$	3	35,02	14,49	29,68	$r \leq 3$	$r \leq 4$	22,18	9,17	18,59
$r \leq 2$	4	59,03	24,43	47,21	$r \leq 2$	$r \leq 3$	24,01	9,94	24,73
$r \leq 1$	5	101,44	41,99	68,52	$r \leq 1$	$r \leq 2$	42,41	17,56	30,90
$r = 0$	6	160,10	66,28	94,15	$r = 0$	$r \leq 1$	58,66	24,29	36,76

r and (n-r) indicate the number or eigenvectors and common trends respectively. Tr and λ_{max} show the trace and maximum eigenvectors statistics respectively for the unrestricted model. T_r* and λ^*_{max} denote respectively the trace and maximum eigenvalue statistics adjusted for small sample of observations for the unrestricted model. Critical values at 95% are taken from Osterwald – Lenum (1992), (tables 1* and 1).

The results from the trace and maximal eigenvalue tests are shown in table 3. The small sample adjustment of the statistics has been done according to the formula of Reimers (1991):

[(T – K*P) / T] * (Value of statistics), where T is the number of observations (41), K is the number of selected lags (4), and P is the number of equations (number of variables in the system) (6). The maximum eigenvalue likelihood ratio test statistic (λ_{max}) shows the existence of one significant cointegrating relationship, and the trace likelihood ratio test statistic (T_r) shows the appearance of one or more coinegrating relationships against the alternative hypothesis of r=0 (zero cointegrating relationship) (Paleologos and Georgantelis, 1997).

The result of table 3 provides strong evidence that there is long run relationship among the variables CA, GDP, RER, GDP_{11}, M_3 and BD, which implies that market forces push a series back to the long - run equilibrium after a drift apart due to a temporary shock. In other words, these variables do not diverge from each other in the long run. Therefore, a policy of stabilizing any one among the six variables is likely to stabilize the long run levels of the other variables. In Greece, could we use the exchange rate as an intermediate target to stabilize the current account balance in the long-run. But, today's, Greece is the partner in EMU, where the exchange rate is constant. That is, we must find the suitable fiscal policy, so that to stabilize the current account balance in the long-run.

Table 4 shows the estimates of the normalized cointegrating relationships that resulted in using the full information likelihood (FIML) technique of Johansen. The eigenvectors were normalized on the current account balance (CA). However, it is necessary to refer that the maximum likelihood cointegration procedure of Johansen, while allowing one to conclude about the appearance of long – run relationships among the variables of the VAR model, is usable to supply coefficient estimates with structural interpretation (Dickey, Jansen and Thornton, 1991; Alogoskoufis and Smith, 1991).

Table 4

Maximum likelihood estimates of Cointegrating Vectors

CA	1,00
GDP	0,130
RER	0,045
GDP_{11}	-0,017
M_3	-0,060
BD	-0,059

Table 5 shows if the individual time series used in this study are stationary by themselves. Since the number of cointegration relations increases for each stationary variable included in the cointegration space, the test result is useful as a means of identifying the minimal set of variables needed for cointegration. As in the test of long – run exclusion restrictions, the test statistic, which is likelihood ratio statistic and follows an x^2 (n-r) distribution with (n-r) d.f. is calculated for an variable.

Table 5

R	CA	GDP	RER	GDP_{11}	M_3	BD
2	15,741	19,478	15,643	15,070	8,257	37,302

The number below the variables, CA, GDP, RER, GDP_{11}, M_3 and BD, are x^2 (n-r) statistics with (n-r) d.f., where n is the number of variables and r the number of accepted significant cointegrating vectors. In our case the d.f. is equal to 4. The critical value at the 5% significance level is 11.07.

A VAR Model is able to capture all dynamic structure among the variables. In Johansen – Juselius cointegration analysis, all variables are endogenous. However in order to examine the lead – lag structure of the variables of the model it is necessary to employ exogeneity tests relying on Granger Causality test (Granger, 1969). According to Granger (1986, 1988) in a coitegrated system of two series expressed by an ECM representation, causality must run in at least one way.

In a VAR model, Granger causality tests are employed by testing the restriction that a block of coefficients for the lags of a particular variable are equal to zero. All variables are in first differences to satisfy stationarity. The selection of the number of lags, as mention previously was based on the Sims (1980) likelihood ratio (LR test) statistic.

In table 6, we attempt to show the Granger Causality tests.

Table 6

Granger Causality Tests based on OLS Estimation

Dependent Variable	**Independent Variables**					
	CA	**GDP**	**RER**	**GDP_{11}**	**M_3**	**BD**
CA	2,392 (0,006)	2,008 (0,120)	0,959 (0,444)	1,376 (0,267)	1,342 (0,278)	1,795 (0,157)
GDP	1,753 (0,166)	0,346 (0,844)	0,516 (0,724)	5,269 (0,002)	0,569 (0,686)	0,952 (0,448)
RER	1,053 (0,959)	0,635 (0,641)	0,336 (0,858)	2,901 (0,039)	0,229 (0,919)	0,340 (0,848)
GDP_{11}	1,234 (0,318)	0,140 (0,965)	0,724 (0,582)	1,834 (0,125)	0,335 (0,851)	0,515 (0,784)
M_3	0,087 (0,985)	1,049 (0,399)	1,024 (0,411)	0,783 (0,335)	1,510 (0,190)	2,316 (0,081)
BD	0,991 (0,428)	0,633 (0,642)	0,144 (0,964)	0,119 (0,974)	0,265 (0,897)	1,235 (0,078)

The null hypothesis is that the coefficients of the lagged values of the independent variable are jointly, zero. The numbers show the value of the F-test. The numbers in the parenthesis are the probabilities indicating the level of significance to reject the H_0 that there is no causal relationship.

If we concentrate our interest only on the variables CA, GDP, RER and GDP_{11}, we observe from the results of table 4, that there are short – term linkages among these variables. In other words the results allow us to determine which variables lead and response of the other variables.

Moreover, we attempt to show the Error Correction Model (ECM), while we are going to select the vector, from information criteria (AIC and SBC).

Error Correction Models were very popular in applied econometrics, due to Sargan (1964), and especially the consumption study of Davidson, Hendry, Yeo and Sbra (1978). ECM strategy provides an answer to the problem of spurious correlations (Thomas, 1993, and Enders, 1995). Recently, Alogoskoufis and Smith (1991) have provided a tentative review of ECMs to which we refer for further details on these precursors (Urbain, 1993, p. 38, Davidson, (1986)).

Consider a simple single equation ECM:

$\Delta Y_t = B_1\Delta X_t + B_2 (Y_{t-1} - X_{t-1}) + \varepsilon_t$

where we have assumed a unit long run coefficient, and ε_t is white noise disturbance term and Δ is the difference operator. If ΔY_t is stationary, the right – hand tide of the above equation should also be stationary, I(0).

The common problem that one encounters is that a model similar to this ECM can have different interpretations which are very difficult to distinguish unless the models are completed by auxiliary assumptions or by generating model for the exogenous variables. According to Alogoskoufis and Smith (1991), the first interpretation is in terms of a regression model where the parameters are defined according to

$E(\Delta Y_t / \Delta X_t, Y_{t-1}, X_{t-1}) = B_1\Delta X_t + B_2 (Y_{t-1} - X_{t-1})$

where $\varepsilon_t = \Delta Y_t - E(\Delta Y_t / \Delta X_t, Y_{t-1}, X_{t-1})$

The question arises from the interpretation of the parameters of such models and more specifically their potential relation with the theoretical parameters of interest. This is a criticism of Alogoskoufis and Smith (1991), who argue that if we do not add assumptions concerning for example expectation behaviour, then the parameters of such an ECM will likely be a mixture of equilibrium, expectation and adjustment parameters.

The second problem naturally does not arise when the single equation ECM is derived from a well defined dynamic theory in which case the parameters directly characterize how economic agents form plans and expectations.

A final interpretation which is proposed inter alia by Lubrano, Pierce and Richard (1986) is to interpret the single equation in terms of behavioural relations relating the expectation of Y_t / X_{t-1} and Z_t / X_{t-1}. This places the analysis in the realm of the Hendry and Richard (1982, 1983) frame work and has been strongly advocated by Hendry (1988) as an alternative expectation based behaviour. As misspecification tests are unimportant feature of this modeling framework, it can provide an interesting alternative to theoretical based models.

We must note that ECMs can be derived both in a stationary and in a non-stationary context.

A standard procedure employed in current account balance to allow for partial adjustment of annual current account balance to change in its determinants is the Koyck lag mechanism by introducing the lagged dependent variable as a regressor. In this partial adjustment model the distributed lag pattern is required to be identical for each explanatory variable and the full structure is summarized by the lagged dependent variable.

An alternative approach to dynamic modeling is the error correction model (ECM), which allows a more complicated adjustment pattern· than the partial adjustment model.

The ECM is a conditional model in terms of formulation and estimation and expresses all the information that wealth holders need to adjust their portfolios (Baba et al, 1992 – money demand model).

The strategy in estimating the ECM is that a general dynamic specification is chosen that includes a number of lags of the differences regressors, four lags of all notes of return and scale variables and an error correction term to derive the long run properties of the function where we use in this paper. This general specification is then reduced through an extensive search procedure to eliminate insignificant regressors. In this way, a parsimonious equation is selected that contains levels and / or differences of all or most of the variables included in the current account balance model.

The variables which are included in this model are endogenous, and this estimation technique provides consistent estimates of the parameters. The error correction estimates, however, almost always perform better. In table 7, we attempt to show the error correction estimates.

Table 7

Estimations of Error Correction Equation
Error Correction Estimates

$$\Delta CA = \underset{(2,113)}{-0,658} - \underset{(2,680)}{0,028}\Delta CA_{(-4)} - \underset{(2,015)}{0,0015}\,\Delta GDP_{(-4)} + \underset{(2,916)}{0,0819}\,\Delta RER_{(-4)} + \underset{(2,338)}{0,225}\Delta GDP_{11(-4)}$$

$$+ \underset{(2,380)}{0,014}\,\Delta M_{3(-4)} + \underset{(2,640)}{0,658}\,\Delta BD_{(-4)} - \underset{(2,355)}{0,038}\,EC_{(-4)}$$

R^2 = 0,665, $\bar{R}^2$ = 0,600, D.W. = 1,95, S.E. Equation = 0,427,

F – statistic = 6,723, AIC = 4,145, SBC = 4,541

<u>Test of Residual</u>

Jarque – Bera (JB) = 5,152

LM (4) = 2,57

<u>Ramsey Reset Test</u>: (stability tests)

F – statistic 0,572

Log Likelihood Ratio 3,038

<u>Coefficient Tests:</u>

F – statistic 2,047

Log likelihood Ratio 10,543

<u>White Heteroskedasticity Test:</u>

F – statistic: 1,327

Asymptotic t-statistics in parentheses, $\bar{R}^2$ is the adjusted R^2, D.W is the Durbin-Watson statistic, S.E. is the Standard Error of regression, JB is the Jarque – Bera test for the normality of the regression residuals, RESET is the Ramsey F – statistic for omitted variables, White is the White F – statistic for the Heteroskedasticity Test, AIC and SBC are the information criteria. LM is the Lagrange multiplier (LM) test fourth order serial correlation of the residuals. The LM statistic is asymptotically distributed as x^2 (d.f. = 4).

The diagnostic and specification test findings indicate that ECM representation is correctly specified. The RESET (Regression Specification Test) statistics reveal no serious omission of variables, indicating the correct specification of the model. LM is the Lagrange multiplier (LM) test reveal no significant serial correlation in the disturbances of the error term. The JB (Jarque – Bera) statistics suggest that the disturbances of the regressions are normality distributed. The White F – statistics show the absence of simultaneity bias in the estimates.

The error – correction term $EC_{(-4)}$ reflect long-run dynamics and appear in the set of regressors. The coefficients of the lagged values of GDP, RER, GDP_{11}, M_3 and BD are short – run parameters measuring the immediate impact of independent variable on CA. The ECM empirical findings within current account deficits (CA) has powerful long – and short – run effects on GDP, RER, GDP_{11}, M_3 and BD. The value of $CA_{(-4)}$ is statistically significant in the regression equation of ΔCA.

The EC term is negative and highly significant. The obtained value of – 0,038 means that approximately 4% of the discrepancy between the actual and the long-run domestic current account balance is corrected in each year.

5. Conclusions

The paper examines the long run equilibrium relationship among the variables CA, GDP, RER, $GDP_{11,}$ M_3 and BD using the recently proposed by Johansen and Juselius cointegration analysis. Also, this paper attempts to analyze the short - term relationship among these variables with Error Correction Model and the short term linkages among the above mentioned variables relying on Granger causality tests.

Using annual data of the Greek economy and based on cointegration analysis, ECM, and Granger causality, the authors find strong support for the conventional view both in the short and long run. The empirical evidence reveals one – way causality from current account deficit to GDP, RER, $GDP_{11,}$ M_3 and BD. The specification and diagnostic tests yield satisfactory results, indicating that the ECM estimates are consistent with the empirical framework.

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