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Testing the Degree of Openness of the Greek Capital Account: A Cointegration Analysis

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Abstract

The issue of capital mobility and the related issue of financial market integration is one of the most pronounced cases of contradiction between casual empiricism and conventional wisdom, in the one hand, and the results of formal empirical testing on the other. The question of the degree of capital mobility is an important one in economic analysis. This is because the assumptions one makes about the degree to which capital is mobile internationally can significantly influence the conclusions of the analysis. Over the past decade developing countries have experienced a continuing process of financial market liberalization and growing financial flows. Measuring the degree of capital mobility – defined as the degree of linkage between domestic and foreign interest rates – is central to our understanding and assessment of financial liberalization and its consequences. There are some methodological issues concerning the degree of capital mobility: The connection between capital mobility and market integration seems to be clear; if markets are integrated then capital will move more freely. Feldstein and Horioka (1980) have proposed to measure capital mobility using the degree of correlation between saving and investment rates. The Ferdstein-Horioka criterion also implies that capital mobility can be measured on the basis of differential (nominal and real) rates of interest. However, other researchers argued that the saving-investment correlation is not a proper measure of the degree of capital mobility and market integration (Goldstein et al, 1991), Frankel and MacArthur (1988). In this paper, following Edwards and Khan (1985), the domestic interest rate is hypothesized to depend on weighted average of domestic and foreign factos. The approach that was used is maximum likelihood cointegration analysis of Johansen (1988), and Johansen and Juseliu (1990). The results support the impact of both domestic and international influences on the domestic rate in the case of Greek economy. The evidence based on the Edwards and Khan (1985) approach seems to support the hypothesis of high (but not perfect) capital mobility in the Greek economy. The capital is highly mobile.

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1. Introduction

The conventional wisdom that capital mobility has increased at an accelerating rate since the early 1970s has been accepted by economists.The high growth of international financial transactions and capital flows is a very welcome phenomenon, raising levels of investment and encouraging economic growth at the late twentieth century.

Net private capital flows to developing countries tripled –to more than $150 billion a year during 1995–97 from roughly $50 billion a year during 1987–89. At the same time, the ratio of private capital flows to domestic investment in developing countries increased to 20% in 1996 from only 3% in 1990.

The removal of capital controls, revolutionary changes in information and communications technologies both in industrial and developing countries, greatly enhanced the financial integration and drived the countries toward economic liberalization and the globalization of trade. Although the macroeconomic capital mobility is not a necessary condition for market integration, however it is a sufficient condition for market integration or at least that a high degree of capital mobility is a positive indicator of market integration (Goldstein, Mathieson, and Lane, 1991). Capital mobility depends on the absence or inadequacy of exchange controls or the failure to implement them fully (Moosa, 1997). Economists have been interested in the degree of international capital mobility because it is widely recognized to be an important element in determining the effects of stabilization policies (including monetary, fiscal and exchange rate policies) in developing countries. For example, the extent to which public deficits crowd out domestic private investment, the effects of nominal devaluation on domestic real output, and the ability of monetary policy to affect aggregate demand all depend on the degree of capital mobility (Sinn, 1992). If capital mobility is low, a country's growth prospects will be constrained by its ability to save. Under the same condition, a fiscal deficit will lead to crowding out of investment, implying that the Ricardi an Equivalence proposition is invalid, in favor of the conventional Keynesian view. Moreover if capital mobility is high, countries cannot pursue independent monetary policies, which means that the degree of capital mobility affects the effectiveness of domestic macroeconomic policy (Eichengreen, et al., 1999, Lee, 1997). Generally, the more open is the capital account, the more difficult it will be to manipulate independent domestic monetary policy.

In this paper, capital mobility is assessed using as criterion the international parity conditions because these are superior to saving -investment correlations. This superiority is due to the fact that the former require no assumption about the exogeneity of saving, nor about the sensitivity of investment to the real interest rate. Particularly this paper employs a modified version of the model developed by Edwards and Khan (1985) to investigate the degree of capital mobility in Greek economy. This is done using cointegration and error -correction models.

The remainder of this article is organized as follows: section 2 briefly presents the model specification in order to test empirically the degree of openess of the Greek economy, as well as the data used for the estimation of the model. In section 3 we investigate the time series properties of the data using recent developments in the econometrics of non -stationarities. Unit root tests are used following the techniques of Dickey and Fuller (Fuller, 1976, Dickey and Fuller, 1979,1981). A variable is stationary if its mean, variance and covariance are all invariant with respect to time. Also, in this section we apply the maximum likelihood cointegration technique advanced by Johansen (1988,1991) and Johansen and Juselius (1990), to test for the existence of long-run equilibrium relationships among non-stationary variables used in the model which are integrated to the same order. The cointegration technique addresses the problem of spurious regression, attempting to identify conditions for which the regression relationship is not spurious (Engle and Granger, 1987, and Granger, 1986).

Finally, the last section will be present the main conclusions of this paper.

2. Model Specification

Our approach to the estimation of the degree of capital mobility builds, as it was mentioned previously on the work of Edwards and Khan (1985). Their model is based on the hypothesis that the domestic interest rate (i) is a weighted average of the uncovered interest parity rate (i*) and the domestic interest rate that would be observed if the private capital account were fully closed (i**). In other words, they assume that the domestic interest rate depends on domestic and foreign factors. Hence, the domestic interest rate is written as:

$$i_t = \theta i_t^{*} + (1-\theta) i_t^{**}, \quad 0 \leq \theta \leq 1 \qquad (1)$$

The parameter θ shows the degree of capital mobility. In the case of a fully open economy, which means that the capital mobility is complete, θ=1, and equation (1) transforms to the uncovered interest parity (UIP) relationship. In this case, foreign financial factors influence domestic interest rate. While if θ=0, equation (1) collapses to the Fisher equation (Paleologos and Georgantelis, 1999 forthcoming), which means that foreign financial factors play no role in the determination of the domestic interest rate. This is a situation which could arise if the private capital account were closed. Intermediate values of θ mean that external and domestic financial factors affect the domestic interest rate. As θ moves from zero to unity, the degree of capital mobility increases.

The equilibrium demand for money (m^d) in real terms is written as:

$$m_t^d = \alpha_0 + \alpha_1 y_t + \alpha_2 i_t + \alpha_3 (fil)_t + u_t, \quad \alpha_1 > 0, \ \alpha_2 < 0, \ \alpha_3 < 0, \qquad (2)$$

where y stands for the real income, (fil) reflects the effect of financial innovation and liberalization in Greece on the domestic demand for money, and u is an error term. All the variables in the above equation are expressed in logs, except the variable i_t. We used the variable (fil) as the more appropriate proxy variable to capture the degree of financial innovation and liberalization in Greece, measured as the log of the ratio M4 (broad money supply) to M1 (OECD, main economic indicators, various issues).

Furthermore, we suppose that the real money balances (m) follow the bellow adjusting pattern:

$$\Delta m_t = \beta\,(m^d_t - m_{t-1}),\ 0 < \beta < 1, \qquad (3)$$

From the combination of the above mentioned equations results the reduced -form equation for the domestic nominal rate of interest:

$$i_t = \delta_0 + \delta_1\, i_t^* + \delta_2 y_t + \delta_3 (fil)_t + \delta_4\, \pi^e_t + \delta_5\, m_{t-1} + \upsilon_t \qquad (4)$$

where i^*_t is, as it was mentioned previously, the uncovered interest parity rate, determined as $i_t^{***} + s_t$, (i_t^{***} is the foreign nominal interest rate, and s_t is the expected rate of depreciation of the domestic currency).

3. Data Used

The data used in this study are all taken from the IMF's International Financial Statistics, from OECD (main economic indicators, various issues), from Monthly Bulletin of Bank of Greece, and from National Statistical Service of Greece (Quarterly National Accounts of the Greek Economy).

The data are quarterly and cover the period 1980: I – 1996: IV.

The reason that motivated us to use lower frequency data in this study is that according to Shiller and Perron (1985) and Lothian and Taylor (1992) what appears to have importance is the total length of the sample period when examining the long-run properties of time series.

The money supply is taken to be the narrow money (M1) determined as the sum of currency in circulation and checkable deposits (IMF line 34).

(1) Income (y) is the Gross Domestic Product (GDP) of Greece and is taken from National Statistical Service of Greece (Quarterly National Accounts of the Greek Economy, Athens 1997), while the interest rates i and i* are taken to be the short - term rate, proxied by the 3-month treasury bill rate (Monthly Bulletin of Bank of Greece, and OECD, for Greece and US respectively, various issues). Finally, concerning the use of the unobservable variables π^e_t and s_t, these are proxied by the actual rate of inflation for Greece (percentage), measured as π^e = log CPI -log CPI (- 4), where CPI is the Consumer Price Index taken from IFS, line 64, various issues, and by exchange rate of the Greek drachma against the U.S. dollar, end of period, taken from IFS, line ae, various issues, respectively.

4. Univariate Properties of the Used Data and Testing for Cointegration -Empirical Results

Model (4) is essentially a long -run equilibrium relationship derived from economic theory. If the above equilibrium model exists, the set of variables used in the model must be cointegrated even if the individual variables are non -stationary (Engle and Granger, 1987). As it was said previously, the cointegration technique investigates the spurious regression problem. This problem occurs because many macroeconomic tim e series are non -stationary (having unit roots), and as consequence time -series regressions usually lead to the question of whether the regression equation error is non -stationary or stationary. Before proceeding to investigate the existence of cointegrated vector, it is necessary to identify the time series properties of the individual series used by means of Dickey -Fuller (DF), and Augmented Dickey -Fuller (ADF) (Dickey and Fuller, 1979, 1981).

Figures in parentheses indicate the number of lagged dependent variables in the regression. The selection between zero and non-zero lags was based on the Lagrange multiplier (LM) test fourth -order serial correlation of the residuals. The LM statistic is asymptotically distributed as $x^2(4)$, (d. f=4), (τ_μ) and (τ_τ) are the test statistics allowing for constant mean, and for a time trend n mean, respectively. Approximate 5% critical value for τ_μ is -2.89 for a sample size of n=100, and the 5% critical value for τ_τ is -3.43 (Fuller, 1976, p.373). Figures in the column LM (4) show the marginal levels of significance.

*means statistically significant value almost at the 5% level.

Results for the order of integration reported in Table 1 reveal that the non -stationarity hypothesis is rejected for the first differences of the series concerned thus indicating that i, i*, y, fil, π, m, s, are all I(1), which means that the null hypothesis of a unit root cannot be rejected for the levels of all these series.

After have investigating integration, the next step is to employ cointegration tests using Johansen (1988, 1991) and Johansen and Juselius (1990, 1992) maximum likelihood methodology.

The basic idea behind cointegration is that if, in the long-run, two or more variables move closely together, the linear combination between them is stationary and hence we may consider those series as defining a long-run equilibrium relationship. Johansen starts by defining an n-dimensional vector of I (1) variables X. In our case this vector includes the variables in model (4).

There are two statistics from the Johansen vector autoregressive tests that determine the rank of the cointegration space. One is the value of the LR test based on the maximum eigenvalue (λ_{max}) of the stochastic matrix (Trace). The LR test statistic developed by Johansen for the hypothesis that there are at most r cointegrating vectors is as follows:

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

where λ_{r+1}, λ_{r+2},...,λ_n are the n-r smallest eigenvalues.

Johansen also considers the following LR test statistic for the hypothesis that there are r cointegrating vectors against the alternative of r+1:

$$LR_{max} = -2 \log (Q) = -T\log(1-\lambda_{r+1}), \text{ (Maximum Eigenvalue Test).} \quad (6)$$

Table 2 presents Johansen's cointegration procedure based on the trace and maximal eigenvalue tests.

r and (n-r) indicate the number of eigenvectors and common trends respectively. Tr and λ_{max} show the trace and maximum eigenvectors statistics respectively. Critical values at 95% are taken from Osterwald-Lenum (1992, Tables 1 and 1*). We selected five lags in the VAR models. This selection was based on the nature of the quarterly data and the number of observations available.

The results of the above table indicate on the basis of both trace and maximum eigenvalue tests that there are possibly five cointergrating vectors. The existence of many cointegrating vectors reveals that the model under investigation is stationary in more directions and therefore more stable. According to Dickey et al (1994) " the more cointegrating vectors there are, the more stable the system is". However, among these five cointergrating vectors (r=5), only the first one can be interpreted from economic point of view. This vector is presented in the following Table 3:

The results of the above Table 3 show that all the estimated coefficients have the expected signs and are of reasonable magnitudes. The LR test leads to the rejection of the unity coefficient on i*. The coefficients on income (y) and on the real money stock (m) have a positive and negative signs respectively as expected from economic theory. The influences of income and of real money stock on domestic interest rate seems to be important. Furthermore, financial innovation and inflation were found to exert important influence on the determination of interest rate with the proper sign.

The long-run influence of the foreign interest rate (i*) on the domestic interest (i) is positive but seems to be a small magnitude (0.20). This relatively lower value suggests that an independent monetary policy has still an important role to play in Greece (during the period under review), taking into account that the full mobility of the capital in Greek economy started after 1994. This fact is consistent to the small coefficient on i* (0.20) which shows the degree of openess of the Greek capital account. This estimated value means that external and domestic financial factors affect the domestic interest rate, but the last factors play a more important role on determining i. The fact that the capital account is open in Greece is consistent to the findings of Gundlach and Sinn (1992) as well as Tesar (1991), in contrary to the findings of Feldstein and Horioka (1980). Moreover, since the capital mobility in Greece is low, a fiscal deficit will lead to crowding out of investment, implying that the Ricardian Equivalence hypothesis is not valid (Vamvoukas, 1997).

The fact that we found one sensible cointegrating vector among the variables in Equation (4) permit us to follow the error correction, EC, strategy (Engle and Granger, 1987, Hendry et al.1984, Granger, 1986)[1] constructing an EC model interpreting adjustment towards the long-run domestic interest rate. The structure of the Error Correction Models ensures the existence of a long-run equilibrium condition which is maintained despite short-run deviations which, in turn, feed back ito short-run dynamics. Engle and Granger (1987) showed that there is relationship between the procedure of cointegration and the Error Correction Models. Taking into account that the linear combination $i_t - \delta_o - \delta_1 i^*_t - \delta_2 y_t - \delta_3 (fil)_t - \delta_4 \pi^e_t - \delta_5 m_{t-1}$ is stationary, we are in a position to formulate an EC model of the following type:

[1] For an overview of EC models see Alogoskoufis and Smith (1991)

$$\Delta i_t = \sum_{i=1}^{5} \alpha_i \Delta i_{t-i} + \sum_{i=0}^{5} \gamma_i \Delta i^*_{t-i} + \sum_{i=0}^{5} \lambda_i \Delta y_{t-i} + \sum_{i=0}^{5} \kappa_i \Delta(fil)_{t-i} + \sum_{i=0}^{5} \mu_i \Delta \pi^e_{t-i} + \sum_{i=0}^{5} \nu_i \Delta m_{t-i} + zEC_{t-1} + \epsilon_t \quad (7)$$

where the term EC_{t-1} is the lagged value of the residuals from the regression model (4), and we expect $z<0$ interpreting that, if i is above, i* then i tends to decrease. In the above error-correction model (equation 7) first differences of the variables capture the short-run dynamics, while the long-run dynamics are captured by the one-lagged error-correction term, EC_{t-1}.

The EC model does not include constant since the term EC_{t-1} already contains an estimate of it.

Table (4) shows the final parsimonious EC model which was obtained by successive exclusion of insignificant variables from the original model.

The figures in parentheses show the t-ratios and those in brackets are p-values. $X^2_{sc}(4)$ is the LM statistic for residual serial correlation, $X^2_{ff}(1)$ is for functional form, and the $X^2_h(1)$ is for heteroscedasticity. *means significant at 10%.

The EC term is negative and highly significant. The obtained value of -0.057 means that approximately 6% of the previous discrepancy between the actual and long-run domestic interest rate is corrected in each quarter. Also, the EC equation indicates a significant, correctly signed coefficient on the foreign interest rate. The diagnostic tests show that EC equation is correctly specified.

5. Conclusions

This article has investigated the degree of openess of the Greek capital accountl mobility in Greece during the period 1980: I - 1996: IV. The implementation of the Johansen's and Juselius' cointegration tests lead to the important result that there exist one cointegration relationship between the domestic and the foreign interest rate with a well-defined coefficient on the foreign interest rate. Also, the degree of openess of the capital account, measured by the coefficient on the foreign interest rate was found to be 0.20 implying that both the fully closed and fully open hypotheses where rejected by the Greek data. The domestic interest rate was affected by domestic and foreign financial factors. However, the small size of the coefficient of the foreign interest rate, (0.20), indicates that the capital mobility is limited, because, as it was mentioned previously, the regime of perfect capital mobility in the Greek economy started in 1994. The fact that the capital mobility is low, during the period under review, implies that monetary policy has a role to play in stabilising the economy. Finally it was found that the impact of financial innovation and liberalisation in Greece had been large.

References

Alogoskoufis, G. and R. Smith (1991), "On Error Correction Models: Specification, Interpretation, Estimation", *Journal of Economic Surveys*, vol. 5, pp. 97-128.

Bagnai, A., and S. Manzocchi, (1996), "Unit Root Tests of Capital Mobility in the Less Developed Countries", *Weltwirtschaftliches Archiv*, 132 (3), pp. 544-557.

Dar, A.,S. Amirkhalkhali, and S. Amirkhalkhali, (1994), "On the Fiscal Policy Implications of Low Capital Mobility: Some Further Evidence from Cross-Country. "Time-Series Data", *Southern Economic Journal*, vol.61 pp.169-190.

Dickey, D.A., and W.A. Fuller, (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", *Journal of the American Statistical Association*, vol. 74, pp. 427-431.

Dickey, D.A., and W.A. Fuller, (1981), "Likelihood Statistics for Autoregressive Time Series with a Unit Root", *Econometrica*, vol.49, pp.1057-1072.

Dooley, M. J. Frankel, and D.Mathieson, (1987), "International Capital Mobility: What Do Saving-Investment Correlations Tell Us?", IMF Staff Papers, vol.34, pp. 503-530.

Edwards, S. and M. Khan, (1985), “Interest Rate Determination in Developing Countries: A Conceptual Framework”, IMF Staff Papers, vol.9, pp.337-403.

Eichengreen, B., M. Mussa, G. Dell' Ariccia, E. Detragiache, G. Milesi - Ferretti, A. Tweedie, (1999), Liberalizing Capital Movements: "Some Analytical Issues", IMF, Economic Issues, no. 17.

Engle, R. F. and C.W.J. Granger (1987), "Co - Integration and Error Correction: Representation, Estimation, and Testing", *Econometrica*, vol.55, pp. 251-276

Feldstein, M. (1983), "Domestic Saving and International Capital Movements in the Long-Run and the Short-Run", *European Economic Review*, vol.21,pp.129-151.

Feldstein, M., and C. Horioka (1980), "Domestic Saving and International Saving Flows", *Economic Journal*, vol.90, pp. 314-329.

Feldstein, M. and P. Bacchetta, (1989), "National Saving and International Investment", NBER, Working Paper, No. 3164.

Frankel, J.A. (1992), "Measuring International Capital Mobility: A Review", American Economic Review, Papers and Proceedings, vol.82, pp.197-202.

Frankel, J. and A. MacArthur, (1988), Political vs. Currency Premia in International Real Interest Differentials", *European Economic Review*, vol 32, pp.1083-1121.

Fuller, W.A., (1976), "Introduction to Statistical Time Series", John Wiley and Sons, New York.

Goldstein M., D. Mathieson, and T. Lane, (1991), "Determinants and Systematic Consequences of International Capital Flows" IMF Occasional Papers, March, No.77.

Gonzalo, J. (1994), "Five Alternative Methods of Estimating Long – Run, Equilibrium Relationships", *Journal of Econometrics*, pp. 203-233.

Granger, C. W. J. (1986), "Developments in the Study of Cointegrated Economic Variables", Oxford Bulletin of Economics and Statistics, vol. 48, pp. 213-228.

Gundlach, E. and S. Sinn (1992), "Unit Root Tests of the Current Account Balance: Implications for International Capital Mobility", *Applied Economics*, vol.24, pp. 617-625.

Haque, N. U. and P. Montiel (1990), "Capital Mobility in Developing Countries - Some Empirical Tests", IMF Working Paper, no. 117.

Hataiseree, R. and A. Phipps, (1996), "The Degree of Capital Mobility in Thailand: Some Estimates Using a Cointegration Approach", *Applied Economics Letters*, vol. 3, pp. 9-13.

Hendry, D. F., A. R. Pagan and J. D. Sargan, (1984), "Dynamic Specification" in Z. Griliches and M. D. I ntriligator (eds.) Handbook of Econometrics, North-Holland, Amsterdam.

Johansen, S. (1988), "Statistical Analysis of Cointegration Vectors", *Journal of Economic Dynamics and Control*, vol.12, pp. 231-254.

Johansen, S., (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica*, pp.1551-1580.

Johansen, S. (1992), "Determination of Cointegration Rank in the Presence of a Linear Trend" *Oxford Bulletin Of Economics and Statistics*, vol. 54, pp. 383-397.

Johansen, S., an K. Juselius, (1990), "Maximum Likelihood Estimation and Inference on Cointegration: With Applications to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, vol. 52, pp. 169-210.

Johansen, S. and K. Juselius, (1992), "Testing Structural Hypothesis in a Multivariate Cointegration Analysis of the PPP and the UIP for UK", *Journal of Econometrics*, vol. 53, pp. 211-244.

Krol, R. (1996), "International Capital Mobility: Evidence from Panel Data", *Journal of International Money and Finance*, vol.15, pp. 467-474.

Lee, Jang - Yung, (1997), "Sterilizing Capital Inflows", IMF, Economic Issues, no.7.

Little, I.M.D., R.N.Cooper, M.Corden, and S. Rajapatirana, (1993), "Boom, Crisis, and Adjustment: The Macroeconomic Experience of Developing Countries", Washington DC., The World Bank.

Lothian, J. R. and M. P. Taylor (1992), "The Behaviour of the Real Exchange Rate: The Recent Exchange Rate Float from he Perspective of the Past Two Centuries" manuscript, International Monetary Fund, Washington.

Miller, S.M. (1988), "Are Saving and Investment Cointegrated?, *Economics Letters*, vol.27, pp.31-34.

Moosa, I. A. (1996), "A Note on Capital Mobility", *Southern Economic Journal*, vol. 63, pp. 248-254.

Moosa, I.A. (1997), "Resolving the Feldstein-Horioka Puzzle", *Economia Internazionale* vol. L, August, pp.437-456.

Murphy, R.G. (1984), "Capital Mobility and the Relationship Between Saving and Investment in OECD Countries", *Journal of International Money and Finance*, vol.3, pp. 327-342.

Osterwald - Lenum, M. (1992), "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics", Oxford Bulletin Of Economics and Statistics, pp. 461-472.

Paleologos, J. M. and S. E. Georgantelis (1999), "Does the Fisher Effect Apply in Greece? A Cointegration Analysis", *Economia Internazionale* vol. LII,. no. 2, pp. 229-243.

Shiller, R. J. and P. Perron (1985), "Testing the Random Walk Hypothesis: Power versus Frequency of Observations" *Economics Letters*, vol. 8, pp. 381–388.

Sinn, S., (1992), "Saving–Investment Correlations and Capital Mobility: On the Evidence from Annual Data", *Economic Journal*, vol 102, pp.1162–1170.

Tesar, L.L., (1991), "Savings, Investment and International Capital Flows", *Journal of International Economics*, vol.31, pp. 55–78.

Thornton, J. (1997), "Investment and Saving in an Open Economy: Further Results", *Economia Internazionale*, vol.L, pp. 111–115.

Vamvoukas, G.A. (1997), "A Note on Budget Deficits and Interest Rates: Evidence from a Small Open Economy", *Southern Economic Journal*, vol.63, pp.803–811.

Table 1: *Testing for Unit Roots: 1980: I -1996 IV*

	Dickey –Fuller (DF)		**Augmented Dickey – Fuller (ADF)**		**Lagrange Multiplier (LM)**
Variables	**DF(τ_μ)**	**DF (τ_τ)**	**ADF (τ_μ)**	**ADF (τ_τ)**	**LM (4)**
I	–0.5402 (0)	–0.1122 (0)	–	–	0.521
I*	–	–	–1.4800 (1)	–2.7827 (1)	0.071
Y	–	–	–1.9425 (1)	–3.3714 (1)	0.157
fil	–	–	–1.7958 (1)	–2.3445 (1)	0.128
Π	–1.1614 (0)	–2.0100 (0)	–	–	0.590
m	–	–	–1.1738 (2)	–2.2739 (2)	0.520
s	–2.7948	–2.0131(	–	–	0.757

	(0)	0)			
Δi	−7.7159 (0)	−8.3428 (0)	–	–	0.712
Δi*	–	–	−9.9118 (1)	−9.8651 (1)	0.049*
Δy	–	–	−8.3210 (1)	−8.2686 (1)	0.111
Δfil	−14.2708(0)	−14.2875(0)	–	–	0.186
Δπ	−6.2376 (0)	−6.1947 (0)	–	–	0.296
Δm	−14.6217(0)	−14.6926(0)	–	–	0.217
Δs	−7.7367 (0)	−8.2685 (0)	–	–	0.732

Table 2: *Johansen's Cointegration Tests*

H_O:	H_A:	n-r	T_r	95%	H_O:	H_A:	λ_{max}	95%
r ≤ 5	r = 6	1	8.9049	9.2430	r ≤ 4	r = 5	17.6510	15.6720
r ≤ 4	r = 5	2	26.5559	19.9640	r ≤ 5	r = 6	8.9049	9.2430

Table 3: *Estimated Cointegrating Vectors, coefficients normalised on i in parentheses*

Vector	I	i*	y	fil	π	m
1	0.078	0.015	15.475	−0.479	9.930	−1.825
	(−1.000)	(0.200)	(197.144)	(−6.106)	(126.506)	(−23.250)

LR test of the restriction of the unity coefficient on i* is $X^2(5)$ = 20.623 [0.001]

Table 4: *Estimates of the EC model*

$$\Delta i_t = -0.231\Delta i_{t-1} + 0.246\Delta i^*_{t-2} + 0.316\Delta i^*_{t-4} + 12.210\Delta y - 11.657\Delta y_{t-1} - 21.245\Delta y_{t-2} -$$
$$(-1.551) \quad (1.670)^* \quad (2.023) \quad (2.131) \quad (-1.916)^* \quad (-2.925)$$

$$-17.519\Delta y_{t-3} - 10.470\Delta y_{t-4} + 33.275\Delta\pi - 9.047\Delta\pi_{t-1} - 23.843\Delta\pi_{t-3} + 16.076\Delta\pi_{t-4}$$
$$(-2.651) \quad (-1.959) \quad (2.659) \quad (-0.879) \quad (-2.213) \quad (1.771)^*$$

$$-2.607\Delta m - 4.532\Delta m_{t-1} - 2455\Delta m_{t-4} - 0.057EC_{t-1}$$
$$(-1.068) \quad (-2.408) \quad (-1.171) \quad (-2.256)$$

$$R^2 = 0.337, DW = 1.846, F(15,40) = 1.360,$$
$$X^2_{SC}(4) = 4.722[0.317], X^2_{ff}(1) = 0.412[0.521], X^2_h(1) = 5.93[0.388]$$