

# MEASURING EXCHANGE RATE PASS-THROUGH FOR A CANDIDATE COUNTRY OF THE EUROZONE

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## Abstract

*I provide time series multivariate cointegration evidence about the complete long run and incomplete short run, exchange rate pass-through (ERPT) on the prices of imported final goods in Hellas, from its 4 major countries-origin, during its post Bretton-Woods and pre- European Monetary Union (EMU) era 1975-1998. Also, I investigate exchange rate connection to the home industrial production. Both sets of estimations are used to assess the effectiveness of the managed float conducted by the Bank of Greece during the sample period. Full long-run ERPT estimated coefficients, in three out of four cases, are explained in the basis of the intertemporal deficit of domestic supply of capital goods within the policy trilemma framework. These estimations result in exchange rate puzzle as regards the regime's choice. In the same puzzle I end up with the estimated exchange rate connection, in three out of four cases, with domestic industrial production. Further research is needed.*

**Keywords:** exchange rate pass-through, exchange rate disconnect, managed float, EMU, exchange rate regimes, producer vs local currency pricing (PCP vs LCP).

**JEL Classification:** F32; F36; F37; C50.

## I. Introduction

One of the perennial concerns for small open economies, such as Hellas (Greece), is the choice of exchange rate regime. In February 1998 the Bank of Greece (BoG) put the national currency, Hellenic Drachma (GRD), within the Exchange Rate Mechanism II (ERM-II) limits, of the European Monetary System (EMS), so as after a two year of GRD's relative stabilisation course the country-member of the European Union (EU) could apply for adhesion to the euro-zone. In fact the Hellenic government passed the Maastricht criteria tests, and since January 1<sup>st</sup> 2001 the euro is the legal national currency in the Hellenic republic. Besides political reasons, the abolition of the GRD and the respective euro's adoption may be justified by several sets of economic criteria, e.g., through the optimum currency area (OCA) theory or the ineffectiveness of the managed float conducted by the BoG the past twenty four years (1975-1998). This policy targeted either to trade balance adjustment (1975-1987), or, through the alleged insulating power of the floating rates (Gandolfo, 2001), to keep out the domestic inflation influence from abroad (1987-1998). The effectiveness of such a foreign exchange policy may be assessed through the extent of the exchange rate pass-through (ERPT) into import prices.

The purpose of this paper is to provide time series cointegration evidence on ERPT into import prices in Hellas during its pre-European Monetary Union (EMU) era 1975-1998, and through these estimated elasticities to assess the foreign exchange policy conducted by the BoG. If this policy could be proved ineffective we might have an argument in favour of a change in the country's exchange rate regime, which would be in the absolutely opposite direction, i.e. fixed exchange rates or monetary union with a single currency that is adhesion to the euro, as EU's member-country.

In the next section we present the empirical framework, while in the third we briefly describe the theoretical model and the data used. In the fourth section we give the final estimations and justifications we made, while the fifth section concludes the paper.

## II. Conceptual underpinnings

If the managed float of the Hellenic Drachmae (GRD), could not fully pass through to import prices, then "expenditure-switching" effects get weaker, and consequently exchange rate policy did not have the suitable effectiveness in restoring external trade equilibrium. That is, the active intervention policy of the Bank of Greece (BoG) over the sample period, may not lead to much substitution effects, because the incomplete exchange rate pass-through (ERPT) on import prices, did not change the relative prices of domestic vs.

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internationally produced goods much for final users (Devereux and Engel, 2002). Accordingly, if pass-through rates were low, then these invalidate the famous Marshall-Lerner-Robinson (1923, '44, and '47) condition for the balance of trade adjustment, and consequently, the issue of exchange rate regime optimality is emerging.

If the opposite is proved true, i.e. the nominal exchange rates of the GRD to the import prices were complete, then, the danger of their endogeneity to the country's inflation performance is prevalent. Once again, the extent of this monetary policy effectiveness, which may be fragile and regime-specific (Taylor, 2000), may be assessed.

The purpose of this paper is to provide time-series evidence on GRD's pass-through into the import prices of the Hellenic bilateral trade, namely, with Germany, Italy, France and the United Kingdom (UK). Using quarterly data from 1975 through 1998, we document the producer currency pricing (PCP, i.e. complete ERPT) strategy of the foreign exporters to Greece, in the long-run and the local currency pricing (LCP, i.e. incomplete ERPT) in the short run elasticities. The aforementioned four main trade partners of Hellas cover for Europe's zone total imports, approximately and on average for the sample period, 60% of the agricultural goods (0+1+4 of the Standard International Trade Classification - SITC-), 45% of the raw materials (2+3 of the SITC), and 68% in the manufacturing goods (5+6+7+8+9 of the SITC). In addition, the intra-Europe Hellenic imports represent, approximately and on average during the sample period, 83% in agricultural goods, 28% in raw materials, and 80% in manufacturing goods, respectively, of the great total from all over the globe (OECD 1997 & 2005, see Table 1).

The conclusions may be useful, as one more argument, in assessing the GRD's adhesion to the euro-zone (EMU) since 2001, from the Hellenic authorities which abandoned their managed float (1975-1998) in the post Bretton-Woods era.

The theoretical framework we use, is discussed analytically in Koujianou-Goldberg and Knetter (1997) and treats ERPT as a macro phenomenon (Campa and Goldberg, 2002) which might manifest, (1) the high sliding GRD's rate as a necessity to raise the relative price of foreign goods enough to reduce import demand sufficiently (Krugman, 1989; Betts and Devereux, 1996); (2) the exchange rate disconnection from the domestic production (Devereux and Engel, 2002), which may also justify the regime's change towards the adoption of the euro; and (3) the foreign exporters' currency pricing strategy which may be local (LCP) in the short-run, or producer's (PCP) in the long-run, for the import prices of the Hellenic market.

**Table 1 Relative importance of the 4 main countries-origin for the Hellenic imports, 1975-1998**

|                                                                   | A            | B            | C            | D            |
|-------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| 89 Miscellaneous manufactured articles, n.e.s.                    | 0.024 (.010) | 0.031 (.010) | 0.021 (.006) | 0.045 (.020) |
| 87 Professional, scientific & controlling instruments             | 0.015 (.003) | ---          | ---          | ---          |
| 84 Articles of apparel and clothing accessories                   | ---          | 0.035 (.024) | 0.019 (.011) | 0.025 (.015) |
| 79 Other transport equipment                                      | 0.042 (.046) | ---          | 0.040 (.030) | 0.109 (.104) |
| 78 Road vehicles (including air-cushion vehicles)                 | 0.150 (.038) | 0.074 (.032) | 0.087 (.046) | 0.071 (.031) |
| 77 Electrical machinery, apparatus & appliances n.e.s.            | 0.059 (.009) | 0.049 (.005) | 0.042 (.009) | 0.029 (.004) |
| 76 Telecommunications & sound recording apparatus                 | 0.035 (.009) | 0.015 (.007) | ---          | 0.021 (.018) |
| 75 Office machines & automatic data processing equipment          | ---          | ---          | ---          | 0.026 (.016) |
| 74 General industrial machinery & equipment, and parts            | 0.048 (.009) | 0.080 (.009) | 0.043 (.013) | 0.033 (.006) |
| 72 Machinery specialized for particular industries                | 0.074 (.033) | 0.096 (.037) | 0.030 (.017) | 0.068 (.036) |
| 71 Power generating machinery and equipment                       | 0.019 (.008) | 0.017 (.007) | 0.022 (.018) | 0.019 (.009) |
| 69 Manufactures of metal, n.e.s.                                  | 0.025 (.003) | 0.042 (.006) | 0.023 (.006) | 0.018 (.004) |
| 67 Iron and steel                                                 | 0.030 (.011) | 0.047 (.009) | 0.098 (.046) | 0.075 (.048) |
| 66 Non-metallic mineral manufactures, n.e.s.                      | ---          | 0.037 (.007) | ---          | ---          |
| 65 Textile yarn, fabrics, made-up articles, related products      | 0.067 (.029) | 0.073 (.022) | 0.045 (.009) | 0.029 (.006) |
| 64 Paper, paperboard, articles of paper, paper pulp/board         | 0.022 (.008) | 0.022 (.006) | ---          | ---          |
| 61 Leather, leather manufactures, n.e.s. and dressed furskins     | 0.048 (.038) | 0.014 (.005) | ---          | ---          |
| 59 Chemical materials and products, n.e.s.                        | 0.020 (.002) | 0.017 (.005) | 0.031 (.005) | 0.022 (.005) |
| 58 Artificial resins, plastic materials, cellulose esters and ... | 0.031 (.004) | 0.048 (.010) | 0.038 (.008) | 0.026 (.008) |
| 55 Essential oils & perfume materials; toilet polishing and ...   | ---          | ---          | 0.020 (.014) | ---          |
| 54 Medicinal and pharmaceutical products                          | 0.021 (.008) | 0.016 (.005) | 0.027 (.019) | 0.038 (.011) |
| 53 Dyeing, tanning and colouring materials                        | ---          | ---          | ---          | 0.022 (.004) |
| 51 Organic chemicals                                              | 0.017 (.003) | 0.018 (.007) | 0.026 (.005) | 0.019 (.006) |

|                                                         | A                   | B                   | C                   | D                   |
|---------------------------------------------------------|---------------------|---------------------|---------------------|---------------------|
| 33 Petroleum, petroleum products and related materials  | ---                 | 0.029 (.025)        | 0.019 (.017)        | 0.021 (.017)        |
| 11 Beverages                                            | ---                 | ---                 | ---                 | 0.066 (.040)        |
| 04 Cereals and cereal preparations                      | ---                 | ---                 | 0.059 (.061)        | ---                 |
| 02 Dairy products and birds' eggs                       | 0.029 (.012)        | ---                 | 0.022 (.009)        | ---                 |
| 01 Meat and meat preparations                           | 0.044 (.037)        | 0.015 (.010)        | 0.058 (.039)        | ---                 |
|                                                         | E                   | F                   | G                   | H                   |
| 0 Food and live animals                                 | 0.441 (.112)        | 0.177 (.048)        | 0.304 (.080)        | 0.077 (.041)        |
| 1 Beverages and tobacco                                 | 0.266 (.112)        | 0.059 (.022)        | 0.090 (.023)        | 0.585 (.099)        |
| 2 Crude materials, inedible, except fuels               | 0.342 (.044)        | 0.271 (.073)        | 0.221 (.058)        | 0.166 (.036)        |
| 3 Mineral fuels, lubricants and related materials       | 0.149 (.078)        | 0.498 (.120)        | 0.202 (.093)        | 0.152 (.072)        |
| 4 Animal and vegetable oils, fats and waxes             | 0.404 (.264)        | 0.333 (.260)        | 0.206 (.126)        | 0.057 (.065)        |
| 5 Chemicals and related products, n.e.s.                | 0.378 (.035)        | 0.274 (.014)        | 0.215 (.022)        | 0.132 (.018)        |
| 6 Manufactured goods classified chiefly by material     | 0.404 (.079)        | 0.329 (.103)        | 0.175 (.047)        | 0.092 (.018)        |
| 7 Machinery and transport equipment                     | 0.483 (.045)        | 0.267 (.041)        | 0.129 (.021)        | 0.121 (.026)        |
| 8 Miscellaneous manufactured articles                   | 0.334 (.069)        | 0.389 (.089)        | 0.132 (.023)        | 0.145 (.017)        |
| 9 Commodities and transactions not elsewhere classified | 0.431 (.201)        | 0.270 (.198)        | 0.104 (.140)        | 0.195 (.239)        |
| Total                                                   | <b>0.421 (.057)</b> | <b>0.286 (.048)</b> | <b>0.171 (.011)</b> | <b>0.123 (.018)</b> |
|                                                         | I                   |                     | J                   |                     |
| 0 Food and live animals                                 | 0.418 (.107)        |                     | 0.779 (.153)        |                     |
| 1 Beverages and tobacco                                 | 0.700 (.110)        |                     | 0.893 (.049)        |                     |
| 2 Crude materials, inedible, except fuels               | 0.378 (.067)        |                     | 0.473 (.058)        |                     |
| 3 Mineral fuels, lubricants and related materials       | 0.522 (.087)        |                     | 0.093 (.027)        |                     |
| 4 Animal and vegetable oils, fats and waxes             | 0.587 (.105)        |                     | 0.824 (.099)        |                     |
| 5 Chemicals and related products, n.e.s.                | 0.630 (.027)        |                     | 0.908 (.012)        |                     |
| 6 Manufactured goods classified chiefly by material     | 0.686 (.045)        |                     | 0.826 (.039)        |                     |
| 7 Machinery and transport equipment                     | 0.730 (.038)        |                     | 0.702 (.035)        |                     |
| 8 Miscellaneous manufactured articles                   | 0.784 (.036)        |                     | 0.774 (.027)        |                     |
| 9 Commodities and transactions not elsewhere classified | 0.546 (.264)        |                     | 0.811 (.207)        |                     |
| Total                                                   | <b>0.650 (.018)</b> |                     | <b>0.653 (.082)</b> |                     |

Source: OECD (1997 and 2005), *International Trade by Commodity Statistics (ITCS)*, *Standard International Trade Classification (SITC) Revision 2*, in current USD prices.

Notes:

All numbers in brackets represent the value of the respective standard deviation.

$A$  = the average of the sample 1975-1998, of the ratio  $(\frac{M_j^{GER}}{TM^{GER}})$ , while  $M_j^{GER}$  = Hellenic imports -in thousand of USD- of  $j$  category of the SITC from Germany, and  $TM^{GER}$  = Total Hellenic imports from Germany.  $B$ ,  $C$ ,  $D$  stand for these ratios for Italy, France and the UK, respectively.  $E$  = the share of the Hellenic imports from Germany to the sum of these 4 countries.  $F$ ,  $G$ ,  $H$  stand for these shares for Italy, France and the UK, respectively.  $I$  = the ratio of the Hellenic imports from the sum of these 4 countries to the total of Europe zone.  $J$  = the ratio of the Hellenic imports from Europe zone to the World one.

Key limitations of our study may be considered (1) the partial equilibrium theoretical and therefore empirical framework; (2) the macro-level analysis which brings in question possible aggregation biases in general import prices due to sectoral heterogeneity; (3) many reforms and policy interventions, over the sample period, mainly in the trade and foreign exchange policies, used by policy makers so as to push Hellenic economy to converge in nominal terms to its European partners; some of them are taken into account through dummy variables, to deal with the lack of normality in the residuals of our Vector Error Correction (VEC) models.

Other studies, namely this of Campa and Goldberg (2002) estimated the long run ERPT on overall Hellenic import prices as near zero (-0.02), while 0.40 in the short run, which expresses a somewhat strange LCP behaviour of large foreign exporters to the small Hellenic market. The authors used the same basic ERPT equation as we do (Koujianou-Goldberg and Knetter, 1997), approximately over the same sample period (1975q1-1999q4), but they did not find cointegration probably because of the data sources. However, it seems difficult to accept that these estimated extremely low ERPT coefficients may be attributed to exporters' competition for the small Hellenic market shares (Froot and Klemperer, 1989), even if they could

restore their profit margins the next contract period (Maggee, 1973) after the devaluation. The high nominal exchange rate variability of the sliding GRD does not justify it, as Taylor's (2000) hypothesis argues, "*all else equal, ERPT would be higher for countries with more volatile monetary policy, i.e., with higher inflation rates*", as was the Hellenic case during that period, as well as Dornbusch's (1987) country size's argument says, "*ERPT may be higher if the exporters are large in number relative to the presence of local competitors*". The volatile Hellenic monetary policy until the early 90s, as well as the large foreign exporters to the local market did not match this near zero ERPT on import prices, estimated by Campa and Goldberg (2002).

Our empirical evidence is strongly supportive of partial ERPT on import prices in the short-run, defined as one quarter, and almost complete ERPT rates in the long-run; the short-run elasticities vary from 0.35 for the Hellenic-French trade through 0.75 for the Hellenic-German one, while the long-run ERPT coefficients lie between 0.45 in the French imported goods case and 1.71 in the British one, supporting, however, the PCP strategy in the three out of four cases. Our estimations do agree with those of Faruquee (2004) and Frankel et al. (2005) though they have used different methodologies.

### III. Structural Model, data description and pre-estimation tests

We use the generic regression model proposed by Koujianou-Goldberg and Knetter (1997), which is able to give answers in all three areas of research on prices and exchange rates, i.e., the low of one price (LOP), the ERPT which is of interest for this paper, and the pricing to market.

$$p_t = \alpha + \delta c_t^* + \gamma E_t + \psi y_t + \varepsilon_t \quad (1)$$

Where all variables in equation (1) are in logs and, here  $\{p\}$  is the vector of Hellenic import unit value indices (from Germany, Italy, France and the UK), drawn from the National Statistical Service of Greece (NSSG);  $\{c^*\}$  is the vector of primary "control" variables of the foreign producers cost, drawn from OECD databank, and which is referred to wage rate indices in manufacturing for Germany and Italy, and unit labour cost indices in manufacturing for France and the UK;  $\{E\}$  is the vector of the end of period fixing spot exchange rates of the GRD against all four trade partners home currencies, published by the BoG, which we transformed into indices;  $\{y\}$  represents the vector of other control variables, which in our case, is the index of Hellenic industrial production, used as a proxy for the quarterly import demand shifter, drawn from OECD's databank;  $\{\varepsilon\}$  is a vector of error terms, while the subscript  $t$  denotes the time period (quarters). All indices have the value 1 in the base year 1995.

In the first step of the pre-estimation procedure, i.e., the identification of the time series' properties, we performed formal tests for single unit roots and stationarity, i.e. Phillips-Perron (1988) test, where (PP) uses Newey-West (1987) standard errors to account for serial correlation, and the modified Dickey-Fuller  $t$ -test (DF-GLS test) proposed by Elliott, Rothenberg, and Stock (1996), who have shown that this test has significantly greater power than the previous version of the augmented Dickey-Fuller test<sup>1</sup>. The results are as usual mixed; DF-GLS tests do not reject the null hypothesis of a unit root in all thirteen variables' levels, or they look like I(1). On the other hand, PP tests support the hypothesis that import unit value indexes for Germany, Italy and France as well as the Hellenic industrial production index, are generated from trend stationary processes (TSP), while the foreign producers' cost indexes in the case of Italy, France and the UK are in fact stationary in the levels<sup>2</sup>. However, we are on the side of the sceptics on the importance of these unit root tests (e.g., Sims, 1988; Christiano and Eichenbaum, 1990), so we proceed to an I(1) analysis.

### IV. Econometric estimations

In the second step of the econometric estimation, that is, this of the co-integration analysis the 4-dimensional vector autoregressive (VAR) model is reformulated in the error correction form (VECM, equation 2 below) so as to be able to distinguish between stationarity created by linear combinations, that is the long-run "equilibrium" relationships or by differencing, i.e. the short-run dynamics,

$$\Delta x_t = \alpha \beta' x_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \Phi D_t + u_t, \quad u_t \sim iid N_p(0, \Omega) \quad (2)$$

<sup>1</sup> These unit root test have been performed by STATA release 9.

<sup>2</sup> The estimations are available upon request.

Where  $\mathbf{x}_t = (\mathbf{p}_{jt}, \mathbf{c}_{jt}^*, \mathbf{E}_{jt}, \mathbf{y}_t)'$  is the data vector to be analyzed, and where  $j$  denotes the aforementioned four trade partners;  $\{D\}$  is a vector of deterministic variables<sup>3</sup>. The model (2) has been estimated<sup>4</sup> through the reduced rank regression methodology or Johansen multivariate cointegration technique (Johansen, 1988; Johansen & Juselius, 1990). In this technique, the most difficult task is to determine the number of cointegrating relations (CVs) against the common trends, by estimating an unrestricted VAR model in the four variables  $\{x\}$  for each one of the four trade partners ( $j$ ). The trace test statistic is firstly used along with testing the adequacy of the estimated model, through graphical inspection of key properties of the variables, misspecification tests of the estimated residuals and recursive estimation procedures for investigating parameters' constancy. Because the power of the trace test can be very low for relevant alternative hypotheses in the neighbourhood of the unit circle, we used, (Juselius, 2005), as much additional information CATS software could offer us, such as (a) the characteristic roots of the model, (b) the  $t$ -values of the  $\alpha$ -coefficients to the  $r^{th}+1$  CV, (c) the graphs of the cointegrating relations, and (d) the economic interpretability of the results. This procedure indicated the presence of two CVs among the variables in each one of the four cases (panel I of Table 2).

As is shown in panel II of Table 2 the exchange rate coefficients have the correct sign and their magnitude are greater than one in the cases of Germany ( $\hat{\gamma} = 1.16$ ) and the UK ( $\hat{\gamma} = 1.71$ ) while near to the unit for Italy ( $\hat{\gamma} = 0.85$ ) and small for France (just  $\hat{\gamma} = 0.45$ ). Because we are working in the context of the "law of one price"-type model [structural equation (1)] the exchange rate coefficients in equation (2) coincide with these of ERPT (Brissimis and Kosma, 2007). Accordingly, in the two out of four Hellenic cases the empirical evidence is in favour of more than complete ERPT on prices of imported goods from Germany and the UK which is an outlier strange case. A border case seems to be the Italian ERPT coefficient which is near to one, while for France which is small, it might be characterised as incomplete ERPT coefficient.

These estimations which are logical (except in the UK case) for a small open economy like Hellas, and higher than Campa & Goldberg (2001, '02) or Campa, Goldberg and Minguez (2005), perhaps because of the different methodology used, it is quite difficult to explain, in a macro-level data used in this study. A disaggregate trade dataset is needed so as to provide the essential justification of the aforementioned results.

Thus, because in 3 out of 4 cases we have evidence in favour of complete long-run ERPT, we may conclude that, the dirty float (sterilized monetary policy conducted by the BoG) was *effective in activating expenditure-switching effects*, during the 80s when the economy was relatively closed, and that's why then that managed float exchange rate regime was preferred. Conversely, since markets' deregulation, due to EEC or EMU state's obligations, the dirty float (strong GRD policy this time) was used as an *effective anti-inflationary instrument*, and consequently fixed exchange rate regime was then preferred.

The explanation factors of these long-run ERPT estimations might also be illuminated for the change in foreign exchange intervention of the BoG towards EMU and joining Euro. These potential explanation factors may be distinguished in internal and external ones. The internal refers to the major post WW-II structural problem of the Hellenic production, i.e., the deficit of the domestic supply of capital goods (Sakkas, 1996). The external explanation factor is the gradual opening of the national economy in its course towards EMU.

The intertemporal structural problem (I>S), established the dependence of the Hellenic production on the respective imports. This dependence on imports produces;

- o First, the pattern of trade (Tsavvas, 2001), mainly expressed by the concentration of the Hellenic import trade, especially in manufacturing, from 4 main origins, (i.e. Germany, Italy, France and the UK, see Table 1), and which, might be a good forecast for the existence of a very low demand for imports' price-elasticities. The latter, may justify our long run ERPT estimations. An exception could be France's case, for which we believe that its trade composition<sup>5</sup> faces more competitive pressures in the price level in the Hellenic import

<sup>3</sup> such as a constant  $\{c\}$ , linear trend and centred seasonal  $\{seas\}$  or intervention dummies, such as,  $Di8034_t = -1_{\{t=1980q3\}} + 1_{\{t=1980q4\}}$  and  $Di8234_t = -1_{\{t=1982q3\}} + 1_{\{t=1982q4\}}$ ,  $Di8112_t = 1_{\{t=1981q1\}} - 1_{\{t=1981q2\}}$ ,  $Di8245_t = -1_{\{t=1982q4\}} + 1_{\{t=1983q1\}}$ ,  $Di9812_t = -1_{\{t=1998q1\}} + 1_{\{t=1998q2\}}$ , which are transitory intervention dummies to accommodate for, shocks in  $\mathbf{p}_{jt}$  ( $Di8034$ , and  $Di8234$ ), Hellenic pre-elections period ( $Di8112$ ), or temporary shocks in  $\mathbf{p}_{jt}$ , when

$j=UK$  ( $Di8245$  and  $Di9812$ );  $Di8385_t = 1_{\{t=1983q1\}} - 1_{\{t=1983q2\}} + 1_{\{t=1985q4\}} - 1_{\{t=1986q1\}}$  is the impulse dummy to accommodate for two de jure devaluations of the GRD in March 1983 and October 1985;  $DS861_t = 1_{\{t=1986q1\}}$ , is a shift dummy marking the deceleration of the growth rate of GRD's sliding parity by the BoG.

<sup>4</sup> We used CATS in RATS, version 2, by J.G. Dennis, H. Hansen, S. Johansen and K. Juselius, Estima 2005.

<sup>5</sup> With the exclusion of, road vehicles (78), other transport equipments (79), general industrial machinery and equipment (74), we may mention as an example, iron and steel (67), Cereals and cereal preparations (04), Meat and meat preparations (01) Textile yarn, fabrics, madeup articles, related products (65) etc.

goods' market. Moreover, in manufacturing, there are some categories of the SITC for which the domestic production, either, is non-existent<sup>6</sup>, or, it uses imports as intermediate goods<sup>7</sup> essential for its production.

○ Second, producer currency pricing (PCP) strategies of foreign exporters to Hellas, which is also compatible with full ERPT coefficients, as in our case.

In association with the deficit of domestic supply of capital goods, the external explanation factor, i.e., the country's gradual opening towards EMU (e.g. Giannitsis, 1988; Katseli, 1990) refers to the liberation of the home markets, which is also in line with our complete long-run ERPT estimations.

○ The first sub-period, i.e., from Hellenic accession to the EEC (1981) to the Unified European Act (1987<sup>8</sup>), the goods market liberation, implied, (1) pressures in the infant Hellenic industry, the FX-policy of sliding GRD's left its main protective tool, putting off the necessary real production reforms, and (2) positive wealth effects for the local distributors of foreign PCP exporters to the small domestic economy. Both effects of European imports' deregulation seem compatible with low values of price elasticities demand for imports, which justify our full ERPT estimations.

○ The money and capital home markets deregulation, especially during 1994<sup>9</sup>-98<sup>10</sup> period, provoked the famous Mundell or Policy Trilemma (Rose, 1996), which in the Hellenic case suggested a fixed exchange rate regime, or perhaps for EEC's member countries, joining Euro. This suggestion is implied because, (1) free capital movement policy was an obligation of the Common European Market which became a fact for Hellas since May 1994; (2) Monetary policy autonomy, if any for a small open economy, should be abandoned because of the home markets' deregulation (i.e., managed float does not influence the relative prices, or "...only relatively closed economies can effectively use the exchange rate instrument..." as McKinnon 1963, mentioned); (3) Exchange rate stability was another understanding for application to the EMU. In total, in the framework of the policy trilemma it should be clear that given the authorities' choice for free capital movement and FX-stability (GRD's real appreciation to keep inflation in check through disinflation-competitiveness policy), the complete ERPT estimations, easily emerge as "natural", because of the monetary policy dependence and the competitiveness of foreign exporters.

The substitution effects of the Hellenic foreign exchange intervention were only transitory, as it may be verified from the short run (one quarter) incomplete ERPT into import prices estimations (Table 2, panel IV), which vary between 0.35 (France case), 0.61 (UK) and 0.76 (for Germany). Even though relatively low, these estimated coefficients they do not translate local currency pricing (LCP) behaviour.

These short-run estimated coefficients may be explained within the "contract period" terminology (Magee, 1973) and according to the aforementioned nature of Hellenic imports, as well as from the gradual restoration of local distributors' (of foreign exporters –PCP-) margins so as not to lose their markets' shares.

As regards our estimations of the exchange rate connection or dis-connection to the real Hellenic industrial production these can be seen in Table 2, panel II. These coefficients ( $\Delta y/\Delta E$ ) which are statistically significant and have the right sign, indicate low (0.17 for imported goods from UK and 0.21 for those from France) or zero (for Italian case) reaction of the domestic production to the GRD's crawling peg shocks. However, this low connection of the home production to exchange rate changes became greater (0.58) for the German imported goods. These estimations are almost alike when we restricted the VECM to exclude foreign producers' cost  $\beta_2(c^*) = 0$  (or the constant  $\beta_5(cnst) = 0$ ) from the CVs.

Explanation factors of long-run exchange rate elasticities of income, for Germany, France and UK cases, might be that these imports referred to mainly intermediate goods, necessary for domestic manufacturing, while, there may be present positive wealth effects and moral hazard of local distributors of foreign exporters. The relative Italian coefficient may be due to the fact that imports from this origin do not face domestic substitutes.

Hence, in 3 out of 4 cases the empirical evidence of even low exchange rate connection from the real production (Devereux and Engel, 2002), is equivalent with expenditure-changing effects (Germany, France, UK), pre-requiring non-autonomous monetary policy of the BoG (Laursen-Metzler, 1950, effect, for the alleged insulating power of floating rates, Gandolfo, 2001) and ineffectiveness of managed float, which suggests fixed exchange rate regime, or perhaps joining euro for an EEC member state case. However, the opposite seems true for the Italian case of exchange rate disconnect from the real Hellenic production,

<sup>6</sup> For instance, road vehicles (78), machinery specialized for particular industries (72), other transport equipments (79), general industrial machinery and equipment (74).

<sup>7</sup> For instance, electrical machinery (77), Textile yarn, fabrics, made up articles, related products (65), Leather, leather manufactures, n.e.s. and dressed furs (61), Telecommunications & sound recording apparatus (76), Artificial resins, plastic materials, cellulose esters and ethers (58) etc.

<sup>8</sup> Abolition of Hellenic import tariffs or other trade barriers for intra-EEC imports.

<sup>9</sup> Liberation of Hellenic money and capital markets for intra-EEC trades.

<sup>10</sup> Entrance of the GRD in the Exchange Rate Mechanism II (ERM II) of the European Monetary System (EMS), after its de jure devaluation of 15% against ECU, so as to satisfy the EMU agreement criteria for two years monetary stability before a member state's application.

equivalent with expenditure-switching effects, which, given Optimum Currency Area's single (Ishiyama, 1975) criteria (Mundell, 1961, McKinnon, 1963 and Kenen, 1969), suggests flexible exchange rate regime.

Herein, emerges a kind of exchange rate puzzle, with regard to regime's choice, because in 3 out of 4 cases fixed exchange rate regime is suggested, while, in the Italian case it seems better to choose flexible rates.

The same puzzle is also present in the full long-run ERPT estimated coefficients, which suggest, first, flexible exchange rate regime for the 80s, when Hellenic economy was relatively closed, while, fixed exchange rate regime in the 90s and the deregulation of the domestic markets due to EMU target.

**Table 2 Testing exchange rates pass through into import prices**

|                                                                 | Hellenic-German model |                  | Hellenic-Italian model |                  | Hellenic-French model |                 | Hellenic-UK model     |                 |
|-----------------------------------------------------------------|-----------------------|------------------|------------------------|------------------|-----------------------|-----------------|-----------------------|-----------------|
| No of CVs                                                       | 2                     |                  | 2                      |                  | 2                     |                 | 2                     |                 |
| Trace testa                                                     | 11.55 [20.16]         |                  | 18.14 [20.16]          |                  | 21.38 [20.16]         |                 | 12.57 [20.16]         |                 |
| Exactly identifying restrictions (normalizations)               |                       |                  |                        |                  |                       |                 |                       |                 |
| Coefficients on CVs' variables                                  |                       |                  |                        |                  |                       |                 |                       |                 |
|                                                                 | $\hat{\beta}_1$       | $\hat{\beta}_2$  | $\hat{\beta}_1$        | $\hat{\beta}_2$  | $\hat{\beta}_1$       | $\hat{\beta}_2$ | $\hat{\beta}_1$       | $\hat{\beta}_2$ |
| <i>P</i>                                                        | - 0.29                | 1.00             | -0.05                  | 1.00             | 1.00                  | 0.40            | -0.04                 | 1.00            |
| <i>C*</i>                                                       | 1.72                  | 0.24             | 0.67                   | -0.43            | 0.20                  | -0.42           | -0.02                 | 2.10            |
| <i>E</i>                                                        | <b>-0.58</b>          | <b>-1.16</b>     | <b>0.06</b>            | <b>-0.85</b>     | <b>-.45</b>           | <b>-0.21</b>    | <b>-0.02</b>          | <b>-1.71</b>    |
| <i>Y</i>                                                        | 1.00                  | 1.87             | 1.00                   | -0.09            | -2.1                  | 1.00            | 1.00                  | -3.37           |
| <i>constant</i>                                                 | -0.64                 | -0.32            | -0.22                  | -0.04            | -1.1                  | 0.10            | 0.03                  | -0.06           |
| Tests of the same exactly identifying restrictions on all CVs   |                       |                  |                        |                  |                       |                 |                       |                 |
| Coefficients on CVs' variables                                  |                       |                  |                        |                  |                       |                 |                       |                 |
|                                                                 | $\beta_2(c^*) = 0$    |                  |                        |                  |                       |                 | $\beta_5(cnst) = 0$   |                 |
| <i>P</i>                                                        | - .24                 | 1.00             | 0.33                   | 1.00             | 1.00                  | 0.33            | 0.11                  | 1.00            |
| <i>C*</i>                                                       | 0.00                  | 0.00             | 0.00                   | 0.00             | 0.00                  | 0.00            | -0.04                 | 3.91            |
| <i>E</i>                                                        | <b>0.34</b>           | <b>-1.06</b>     | <b>-0.04</b>           | <b>-1.50</b>     | <b>-.41</b>           | <b>-0.49</b>    | <b>-0.17</b>          | <b>-2.14</b>    |
| <i>Y</i>                                                        | 1.00                  | 2.01             | 1.00                   | -0.79            | -1.6                  | 1.00            | 1.00                  | -8.29           |
| <i>constant</i>                                                 | - .17                 | -0.28            | -0.19                  | 0.14             | -.92                  | 0.03            | ---                   | ---             |
| $\chi^2(2)^b$                                                   | 3.90 [0.14]           |                  | 4.45 [0.11]            |                  | 1.76 [0.41]           |                 | 3.61 [0.16]           |                 |
| Estimates of the short-run dynamics ( $\Gamma 1$ ) <sup>c</sup> |                       |                  |                        |                  |                       |                 |                       |                 |
|                                                                 | $\Delta p$ -eq.       | $\Delta y$ -eq.  | $\Delta p$ -eq.        | $\Delta y$ -eq.  | $\Delta p$ -eq.       | $\Delta y$ -eq. | $\Delta p$ -eq.       | $\Delta y$ -eq. |
| $\Delta p_{t-1}$                                                | -0.09<br>(-0.34)      | 0.03<br>(1.85)   | 0.056<br>(.59)         | -.006<br>(-.30)  | -0.15<br>(-2.1)       | 0.058<br>(2.43) | -0.44<br>(-4.7)       | 0.00<br>(0.02)  |
| $\Delta c^*_{t-1}$                                              | -0.52<br>(-0.50)      | -0.83<br>(-0.29) | -0.555 (-<br>.49)      | -.548 (-<br>2.3) | 1.72<br>(1.92)        | -0.05<br>(-.17) | -1.26<br>(-1.8)       | 0.24<br>(1.47)  |
| $\Delta E_{t-1}$                                                | <b>0.76</b><br>(2.60) | -0.07<br>(-0.92) | <b>0.49</b><br>(1.46)  | .104<br>(1.46)   | <b>0.35</b><br>(1.90) | -0.07<br>(-1.1) | <b>0.61</b><br>(2.20) | 0.04<br>(0.63)  |
| $\Delta y_{t-1}$                                                | -0.37<br>(-1.16)      | -0.25<br>(-2.88) | -0.347<br>(-.77)       | -.392 (-<br>4.1) | 0.59<br>(2.09)        | -0.29<br>(-2.9) | -0.78<br>(-1.8)       | -0.15<br>(-1.4) |

Where CVs=cointegrating vectors, eq.=equation.

<sup>a</sup> Numbers in brackets are critical values at the 5% significance level.

<sup>b</sup> Numbers in brackets are p-values.

<sup>c</sup> These are referred to the unrestricted model. Numbers in parentheses report t-values.

## V. Concluding remarks

In this article we have examined ERPT into general import index prices for the major four trade Hellenic partners, namely Germany, Italy, France and the UK, during 1975-1998. By means of time series cointegration techniques we showed that almost complete long run ERPT was verified in three out of four cases (Germany Italy and the UK), and incomplete long run ERPT detected in the case of France. The intertemporal deficit of domestic supply of capital goods, as well as the intervention policies in the context of the policy trilemma, empirically resulted from the country's course towards EMU, provided the framework for the justification of these estimations. These full long run ERPT estimations produce an exchange rate

puzzle, because it suggests flexible rates in the 80s with relatively closed domestic economy, while fixed exchange rate regime in the 90s with the deregulation of the home markets in the effort to accomplish EMU criteria. The incomplete short run (just one quarter) ERPT estimations verified the transitory substitution effects of the managed float of the GRD. In addition the detected exchange rate connection (in almost three out of four cases) from the real Hellenic production lays an argument against managed float and in favour of fixed exchange rates or perhaps joining euro. An exchange rate puzzle again is obviously present here, so a further research, with panel cointegration is needed.

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