Hellenic Export Prices and European Monetary Integration, 1970-1995.

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Abstract

We aim to explain the variability of the Hellenic Export Index Unit Value, during the period 1970-1995. The Hellenic index of unit labour cost, an effective index of unit value of European competitors' exports and the effective exchange rate of the Greek Drachma (GRD) are used as explanatory variables, suggested by the literature and much more by the consequences of the Hellenic accession into the EEC. We found evidence with regards to the sample's split in the accession's year 1981 and the equilibrium relationship between Hellenic export prices and exchange rate of GRD during the second sub-period. In addition, in spite of the small size of the Hellenic economy we detected the Greek exporters' discreet pricing policy, for the first sub-period, this was possible due to the diversification of their destination markets and for the second, the sliding rate policy of the Bank of Greece. The latter policy combined with the European competitors' pricing policy re-established their margins, with at the most a year lag, whenever the Hellenic labour cost was increased.

Keywords: Decomposition Approach; Export Prices Equations; Discreet Pricing Policy; Incompatible Trilogy Theory; European Monetary Integration; Integration and Co-integration Analysis.
JEL Classification: F310; F320; F360; C500.

1. Introduction

The Decomposition Approach, proposed by the economic theory, constitutes a trade balance adjustment process through exchange rate policy. According to this traditional approach, the influence of the foreign exchange policy on the price and volume of external trade is examined. The literature (Sadier, 1994, Stamatopoulos, 1999a)[1] may be divided into "Direct" and "Indirect" methods, depending on whether the exchange rate is included or not in the explanatory variables. As regards to the "Indirect Method", this may also be divided into "strong" methods, where the exchange rate doesn't use it at all, in the right hand side variables (Goldstein and Khan, 1978; Herd, 1987) and into "weak" methods, where the competitors' export price index is constructed via the exchange rate (Artus, 1974; Spencer, 1984). As regards to the "Direct" methodology, this also may be divided into "mix" methods, where the exchange rate is included into the explanatory variables (Kravis and Lipsey, 1977; Spitaller, 1980; Ahluwalia and al., 1975) and into "pure" methods where the exchange rate constitutes the sole right hand side variable (Robinson and al., 1979; Krugman and Baldwin, 1987).

Thus, in a partial equilibrium framework, we identify single equation models of the Hellenic Export Index Unit Value $\{xuv_t\}$, using as explanatory variables the indices of the Hellenic unit labour cost $\{ulc_t\}$, the competitors' export unit value of Greece $\{xuvc_t\}$ and an external trade weighted effective index of the Greek drachma (GRD) $\{e_t\}$.

This theoretical selection can also be confirmed by the economic developments during the sample period 1970-1995, which were mainly determined by Greece's accession into the EEC as well as by its course in the European Monetary Integration, which in its turn, may be explained in terms of the "inconsistent triad" (fixed exchange rates, perfect capital mobility and monetary independence).

Since January 1981, when Greece became a full member state of the EEC, its commercial transactions centralised gradually to the European markets with significant negative effects on its external trade deficit (Georgakopoulos, 1995). Thus, during the seventies the part of total Hellenic exports that went to EEC member states was 47%, whereas in the mid nineties this ratio increased to 66%, reducing correspond-

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[1] Just for a survey.

ingly the previous export diversification. Therefore, that structural change justifies the use of an effective index of export unit value of Hellenic competitors[2] $\{xuvc_t\}$, in its major export[3] destination European markets[4] (Stamatopoulos, 1999a).

In addition, the increasing degree of openness of the Hellenic economy[5] gives additional reasons to use, in the Decomposition Approach framework, a nominal effective exchange rate of GRD $\{e_t\}$ as an explanatory variable in our models' specification. More serious reasons which predict the significance of $\{e_t\}$ in explaining the variability of $\{xuv_t\}$ come from economic developments in EEC after Greece's accession in 1981. Both the small size and the open Hellenic economy can explain why its monetary policy is dependent on its European partners, and in addition, outside the reasons of its obligations due to the EMS (despite the fact that the GRD did not participate in the ERM, while it was part of the ECU). Thus, given the monetary policy co-ordination and the liberation of capital movements in Europe[6], under the requisition of the Unified European Act and Delors' Report respectively, the exchange rate policy remained the only instrument, in terms of the "inconsistent triad", for the Hellenic authorities to achieve their economic targets, i.e. the GDP's growth promotion as well as the Trade Balance's deterioration restrain (Apergis-Soldatos, 1998).

Furthermore, we also use in the right hand side variables, the Hellenic unit labour cost in manufacturing $\{ulc_t\}$, as a good proxy of the exports' production cost, given the fact that its light industry is labour intensive.

The paper is organised as follows. Section two covers economic as well as econometric methodological issues, while in section three we present the time series used and their properties. Empirical results and comments on their significance are given in section four. Finally section five concludes the paper.

2. Methodological Issues

We identify three linear models of export price equations based on the theoretical contributions of Kravis and Lipsey (1977) and Spitaller (1980) as regards the "Direct" method and Herd (1987) and Spencer (1984) as regards the "Indirect".

Using aggregate data with no distinction about the Greek export market destination, the following equation mainly stems from Herd (1987):

$$xuv_t = a + \beta_1 ulc_t + \beta_2 xuvc_t + \varepsilon_t \qquad (1)$$

Where $\{xuv_t\}$ denotes Hellenic index of export unit value at time t, $\{ulc_t\}$ is the Hellenic index of unit labour cost for the manufacture at time t, $\{xuvc_t\}$ is an effective index of export unit value of Greece's competitors at time t, weighted according to Spitaller (1980) taking into account both the markets destination of the Hellenic exports and our competitors' share in them. Where ε_t is an error term.

Taking elements, from the "Indirect" e.g. Herd, 1987 and "Direct" e.g. Kravis and Lipsey, 1977 export price equations, we consider the second equation:

$$xuv_t = a + \beta_1 ulc_t + \beta_2 xuvc_t + \beta_3 e_t + v_t \qquad (2)$$

Where e_t denotes an effective exchange rate index for the GRD at Hellenic major export markets destination, v_t is an error term.

In the third equation the impact of the Central Bank's exchange rate policy is taken into account indirectly through the Hellenic competitors' export prices ($xuvc_t$) expressed in national currency (GRD), that is:

$$xuv_t = a + \beta_1 ulc_t + \beta_2 xuvcdr_t + u_t \qquad (3)$$

Where $xuvcdr_t \equiv xuvc_t \cdot e_t$ and u_t is an error term.

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[2] Germany, Italy, France, UK, the Netherlands, Belgium-Luxembourg, Spain, USA, Japan, Turkey.

[3] Germany (47%), Italy (25%), France (16%), UK (12%), see Section 3.

[4] These cover the 56% of total Hellenic exports, on the average, for the sample's period (1970-95).

[5] During the 70s the average ratio of imports (exports) of goods and services to the GDP was approximately 17% (14%), while in mid-90s these rose to 33% (23%) (Leventakis, 1995).

[6] Starting from July 1990 in most country-members whereas May 1993 - May 1994 for Greece.

As regards the Econometric Methodology, first, we pre-test the variables for their order of integration. In order to avoid serious problems of misspecification (over or under-differencing) we apply several methodologies searching for unit roots. Secondly, we detrend $\{ulc_t\}$, $\{xuvc_t\}$ and $\{xuvcdr_t\}$ specifying, estimating and assessing models' adequacy for each of the two sub-samples (1970q1-1980q4 and 1981q1-1995q4) indicated by Chow tests. Thirdly, we apply structural stability test (Chow test using dummy variables) in the co-integrating regression (1970q1-1995q4) of $\{xuv_t\}$ on $\{e_t\}$. Finally, we use Engle-Granger (1987) co-integration technique for the specification of the appropriate Error Correction Model (ECM), distinguished according to the three above equations suggested by economic theory and the sub-periods' used.

3. Time Series Used and their Properties

The sample of quarterly data covers the period 1970q1-1995q4. The dependent variable is always the Hellenic export unit value $\{xuv_t\}$, which is obtained, from the database of IMF (IFS line l.74). As it is already mentioned, we assume as good proxy of the exporters' production cost (Herd, 1987) in Greece, the index of unit labour cost in manufacturing $\{ulc_t\}$, which is obtained from the database of OECD (MEI). In addition, like Spitaller (1980), we construct competitors' weighted index of export unit value $\{xuvc_t\}$ using (Stamatopoulos, 1999a) as destination markets of Hellenic exports, the countries[7] Germany (47%), Italy (25%), France (16%) and UK (12%), while the shares of our competitors (Germany, Italy, France, UK, the Netherlands, Belgium-Luxembourg, Spain, USA, Japan and Turkey) in these markets, were calculated from the database of OECD (International Trade by Commodity Statistics, ITCS). However, the ten indices of export unit value of Hellenic competitors were taken from the IMF's database (IFS, l.74). The nominal effective exchange rate of the GRD $\{e_t\}$, is an external trade weighted index, which was computed using, on the one hand, the Monthly Bulletin of the Bank of Greece's database, for the nominal fixing exchange rates of the GRD vis a vis the currencies of the countries[8], Germany, Italy, France, UK and USA, and on the other hand the OECD's database of ITCS, for the weight's calculation of each country. The product $\{xuvc_t \cdot e_t \equiv xuvcdr_t\}$ is used as the competitors' index of export unit value in domestic currency. The year 1990 is referred as the base 1 of all indices. Lower case letters denote variables expressed in natural logarithms.

Results from Dickey-Pantula (1987) multiple unit root tests and the Hylleberg, Engle, Granger and Yoo -H.E.G.Y.- (1990) seasonal unit root tests, are given in Table 1: Unit Root tests (1970q1-1995q4), Panels I and II respectively. The results confirm that there are no unit roots of higher order than 1, i.e. I(1) and that all of them are non-seasonal with deterministic seasonality. Because of the well known low power of a single DF or ADF-tests (e.g. Cambell and Perron, 1991), in Panel III of the same Table 1, we apply three different methodologies trying to gain additional confirmation about the existence or not of a unit root, that is, we search if the data generating processes (DGP) which gave us these sampling series are the Difference (DSP) or the Trend (TSP) Stationary Processes. Hence, from the application of Bhargava (1986), Dolado et al. (1990) and Phillips-Perron (1988) methodologies to our sample data series we concluded that only $\{xuv_t\}$ and $\{e_t\}$ came from DSP, i.e. are I(1), while $\{ulc_t\}$, $\{xuvc_t\}$ and $\{xuvcdr_t\}$ came from TSP, i.e. are I(0).

Because of these properties of the series, the first difference of the first two makes them stationary (of course, in the sense of the weak stationarity) while in the three remaining, we fitted trend models (Table 2) to achieve stationarity.
The residuals of these models constitute the detrended series $\{DTulc_t\}$, $\{DTxuvc_t\}$and $\{DTxuvcdr_t\}$.

[7] In parentheses are the weights for the 56% of the average total Hellenic exports (1970-1995).
[8] Referring to Hellenic Exports' destination markets plus the USD as "vehicle-currency".

4. Empirical Results

Before running the co-integrating regression (CR) of $\{xuv_t\}$ on $\{e_t\}$, given the results from Table 1, we test its structural stability (Chow-test using dummy variables). Thus, we estimate by OLS the model: $xuv_t = \alpha + \beta_1 e_t + \gamma_1 D81 + \gamma_2 eD81 + \sum_{i=1}^{4} \delta_i xuv_{t-i} + v_t$ during the full sample period. Applying F-test for the H_0: $\gamma_1=\gamma_2=0$, we found F(2,92) = 5,47 [0,0057], so it is strongly rejected. Thus, we should test for co-integration dividing the sample in 1981q1, i.e. from Greece's accession into the EEC.

Table 3, gives reports of the two sub-periods, on the one hand, the long-run or co-integrating regression (CR) of the $\{xuv_t\}$ on $\{e_t\}$, the OLS regression yields a "super-consistent" estimator of the co-integrating parameters α and β (Stock, 1987), and on the other hand, the Augmented Engle-Granger (AEG) and Engle-Granger (EG) residual-based tests for co-integration.
The results provide slight evidence in favour of CI(1,1) for the examined variables, in the second sub-period.

In Table 4 we present the short-run estimations or ECM, if there is co-integration which is confirmed by the significance of the residuals ($R1_{t-1}$ from CR for 1970q1-1980q4 and $R2_{t-1}$ from CR for 1981q1-1995q4), for the equations (1), (2) and (3).
The long run join covariance of $\{xuv_t\}$ and $\{e_t\}$ is also justified through the significance of the error correction mechanism $\{R2_{t-1}\}$ in both three equations, during second[9] sub-period (1981q1-1995q4), which gave us estimations of spherical error terms. This verifies that the Bank of Greece's exchange rate policy supported the price competitiveness of domestic production in European destination exports' markets. In exogenous shock the short-run deviation of $\{xuv_t\}$ and $\{e_t\}$ from their long-run equilibrium is covered by 15% during the current quarter. However, when we add to the independent variables, the growth of exchange rate $\{\Delta e_t\}$, the speed of short-run adjustment to the long-run equilibrium, is multiplied so that 75% of this distance is covered in the current period. An important empirical result is the significance of the restriction "the coefficients of the variables which are the major constraint of exporters, i.e. $\{ulc_t\}$ and $\{xuvc_t\}$ sum to unity", for the period after Greece's accession into the EEC (1981q1-'95q4). In other words, given the support of the exchange rate policy of the Bank of Greece, it seems that the cumulative factors in the exporters' pricing policy was, on the one hand, the labour cost ($-0,8 \leq \eta_{ulc}^{\Delta xuv} \leq -0,5$), and on the other, the price-competitiveness in European destination markets ($1,5 \leq \eta_{xuvc}^{\Delta xuv} \leq 1,8$)[10].

Thus for the first equation, during the second sample's sub-period, in which the Bank of Greece's exchange policy is present via the stationary linear combination $\{R2_{t-1}\}$, an 1% raise of $\{ulc_t\}$ seems to cause 0,8% reduction of $\{xuv_t\}$'s growth rate, after a 3 months' period, since $\{xuvc_t\}$ enables it to raise only 6-12 months later. That is, our data says that in a given raise of production cost, Greek exporters reduce their margins for 3-9 months until the competition in Europe enables them to re-establish them. However, from Equation 2, during the same sub-period, it's remarkable that the short-run margins' restriction is in fact zero, since the exporters exploited the GRD's crawling peg, which enabled them to pass the rise of the $\{ulc_t\}$ onto the export prices, simultaneously. Thus, 6 months later they increased their margins with the excuse of the rise in the competitors' prices.
The substantial decrease of $\eta_{xuvc}^{\Delta xuv}$ since 1981 vis a vis 70's may be explained by structural changes in the Hellenic international commercial transactions (Hellenic trade pattern), during the sample period, as the weak demand that Greek exports faced in European markets (Giannitsis, 1994) and the abolition of governmental export subsidies from 1987 (Georgakopoulos, 1995), under the requisition of EEC's directives.

[9] The significance of first sub-period ECMechanism $\{R1_{t-1}\}$ is probably accidental given the residual-based tests for cointegration presented in Table 3.
[10] Where $\eta_{ulc}^{\Delta xuv}$, $\eta_{xuvc}^{\Delta xuv}$ denotes growth export prices' elasticity vis a vis unit labour cost (competitors' export prices).

4. Concluding Remarks

In this paper we investigated the determinants of the Hellenic index of export unit value $\{xuv_t\}$, during the period 1970-1995. Using three single equations' log-linear models, in the Decomposition Approach's to the Balance of Payment and in co-integration's framework as well, we found the indices of the Hellenic unit labour cost $\{ulc_t\}$, the competitors' export unit value $\{xuvc_t\}$ and an external trade weighted effective exchange rate of Greek Drachma $\{e_t\}$, as statistically significant explanatory variables. Greece's accession to the EEC in 1981 splits our sample data set in two sub-periods 1970q1-1980q4 and 1980q1-1995q4. The Greek exporters' diversification of their destination markets (Arabic as well as Ex-socialist and of course European), until 1980, gave them the possibility to implement discreet pricing policy, which in our empirical analysis appears through the abnormally high elasticity of the Hellenic export prices vis a vis its European competitors' with a 3 months lag ($\eta_{DTxuvc(t)}{}^{\Delta xuv(t)} \approx 4$). The same reason combined with the exchange rate regimes adopted by the Bank of Greece (1970-'73 Bretton-Woods, 1973-'75 US dollar peg) may explain why we did not find the dependent $\{xuv_t\}$ and the effective exchange rate $\{e_t\}$ as co-integrated this first sub-period 1970q1-1980q4.

However, these crucial variables of our investigation proved co-integrated during 1981q1-1995q4. This fact could have the following economic interpretation, in the context of the inconsistent triad; the small size of the Hellenic economy, its degree of openness, and moreover its centralised commercial transactions with the EEC, after 1981, could explain why it wasn't necessary to co-ordinate through European Agreements (e.g. Unified Act for Common Market and Delors's Committee report for European Union) since 1987, monetary policy to that of its Europeans partners, since the Hellenic one could not be independent of them. The liberation of capital movements, which took place from July 1990 for most of the EU's member-countries, was being applied gradually in Greece from May 1993 to May 1994. Therefore, the Bank of Greece had, until then, the possibility to use as a policy instrument the exchange rate to achieve at least the target of balance of trade restrain.

During the same sub-period (1981q1-1995q4) the coefficients' summation to unity restriction of the Hellenic labour cost $\{ulc_t\}$ and the competitors' prices $\{xuvc_t\}$ was also confirmed. This finding may explain the pricing policy of Greek exporters, who when faced with labour cost increases restrained either simultaneously or with a 3 months delay their margins to half or 80%, waiting to re-establish them either, within 3-6 months, to its respective price rise of their European competitors' or simultaneously with the sliding GRD policy of the Bank of Greece. Here again, the discreet pricing policy of the Greek exporters was detected, as is seen by the high (even though moderated vis a vis the first sub-period) elasticities with a 6-12 months lag ($\eta_{DTxuvc(t-2)}{}^{\Delta xuv(t)} \approx 1{,}5$)

Finally, further research should be applied in order to gain additional confirmation about our conclusions however along new lines, first by using dis-aggregate data with micro-perspectives and secondly by taking into account the switch of the Bank of Greece's exchange rate policy, at the end of 1987, which is empirically (e.g. Kirikos, 1998, Stamatopoulos, 2001) confirmed too.

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Table 1: Unit Root Tests

Panel I: Multiple Unit Root Tests

	$\{xuv_t\}$	$\{ulc_t\}$	$\{xuvc_t\}$	$\{e_t\}$	$\{xuvcdr_t\}$
Dickey and Pantula (1987)					
τ_μ {H_0: y_t~I(2)} (-2,89)	-12,87	-13,58	-3,87	-10,1	-9,07
τ_μ {H_0: y_t~I(1)} (-2,89)	$\tau_\mu(\gamma_1)$= -12,99 $\tau_\mu(\gamma_2)$= -1,48	$\tau_\mu(\gamma_1)$= -13,5 $\tau_\mu(\gamma_2)$= -0,48	$\tau_\mu(\gamma_1)$= -4,38 $\tau_\mu(\gamma_2)$= -2,08	$\tau_\mu(\gamma_1)$= -10,08 $\tau_\mu(\gamma_2)$= -0,68	$\tau_\mu(\gamma_1)$= -9,07 $\tau_\mu(\gamma_2)$= -0,78
Conclusions					
	I(1)	I(1)	I(1)	I(1)	I(1)

Panel II: Seasonal Unit Root Tests

	$\{xuv_t\}$ (L=0)	$\{ulc_t\}$ (L=12)	$\{xuvc_t\}$ (L=0)	$\{e_t\}$ (L=8)	$\{xuvcdr_t\}$ (L=8)
H.E.G.Y. (1990)					
{H_0: ∃ nonseas.UR} (-2,95)	-1,54	-2,71	-2,20	-0,83	-1,44
{H_0: ∃ UR - semi-annual frequency} (-2,94)	4,41	4,15	6,21	6,20	5,60
{H_0: ∃ UR - annual frequency} (6.57)	55.32	19.79	46.84	23.11	17.22
Conclusions					
	∃ nonseas. UR with Determ. Seas.				

Panel III: Single Unit Root Tests (1970q1-1995q4)

	$\{xuv_t\}$	$\{ulc_t\}$	$\{xuvc_t\}$	$\{e_t\}$	$\{xuvcdr_t\}$
Bhargava (1986)					
τ_τ (-3,45)	2,74 ⇒ ∃ UR ⇔ DSP	6,96* ⇒ ∄ UR ⇔TSP	9,75* ⇒ ∄ UR ⇔TSP	3,02 ⇒ ∃ UR ⇔ DSP	3,39 ⇒ ∃ UR ⇔ DSP
Dolado et al. (1990)					
Step 1					
τ_τ (-3,45)	-0,73	-1,36	-1,43 (L=1)	-2,07	-1,65
φ_2 (4,88)	3,37	3,66	3,67 (L=1)	3,37	3,23
Step 2					
$\tau_{\beta\tau}$ (2,79)	-1,57	-0,66	-1,62 (L=1)	0,02	-1,01
φ_3 (6,49)	1,49	1,15	2,35 (L=1)	2,13	1,89
τ_τ using normal distrib.	---	---	---	---	---
Step 3					

τ_μ (-2,89)	-1,66	-0,8	-2,08 (L=1)	-0,37	-1,25
$\tau_{\alpha\mu}$ (2,54)	2,66*	2,94*	2,06 (L=1)	2,39	2,41
φ_1 (4,71)	4,97*	4,62	5,54* (L=1)	2,89	3,7
τ_μ using normal distrib.	-1,65 [0,10] $\Rightarrow \exists$ UR	-0,8 [0,42] $\Rightarrow \exists$ UR	-2,08* [0,04] $\Rightarrow \nexists$ UR	---	---
Step 4					
τ (-1,95)	---	-1,99 [0,049] $\Rightarrow \nexists$ UR	-3,2* [0,002] $\Rightarrow \nexists$ UR	-1,81 [0,073] $\Rightarrow \exists$ UR	-2,21* [0,029] $\Rightarrow \nexists$ UR
Phillips-Perron (1988)					
$Z(ta_1^*)$ with a constant (-2,89)	0,29 $\Rightarrow \exists$ UR	4,52* $\Rightarrow \nexists$ UR	-1,51 $\Rightarrow \exists$ UR	2,51 $\Rightarrow \exists$ UR	3,15* (L=2) $\Rightarrow \nexists$ UR
$Z(t\tilde{a}_1)$ with a const. & a lin.trend (-3,45)	-2,42 $\Rightarrow \exists$ UR	-0,84 $\Rightarrow \exists$ UR	-0,91 $\Rightarrow \exists$ UR	-1,84 $\Rightarrow \exists$ UR	-1,53 (L=2) $\Rightarrow \exists$ UR
Conclusions					
	I(1)	I(0)	I(0)	I(1)	I(0)

Where: The figures in parentheses of the first column indicate the critical values of Augmented Dickey-Fuller (ADF), for significance level α=5% sample size N=100, while numbers in brackets give the p-values. Sources: Fuller (1976), for statistics τ_τ, $\tau_{\beta\tau}$, ta_1^*, τ_μ, $\tau_{\alpha\mu}$, $t\tilde{a}_1$, τ and Dickey-Fuller (1981), for statistics φ_2, φ_3, φ_1. L : Number of lags in ADF tests. At Table 1 (L=4) except if marked otherwise. The choice was based on the criteria LM-test, or Ljung-Box Q-statistic (LB-test), or Akaike Information Criterion (AIC) or Schwartz Bayesian Criterion (SBC). * Designates significance on the predetermined level (95%).

Table 2: Trend Models

$\{ulc_t\}$1970q1-1980q4

Stepwise Regression (method= backward, slstay=0,05)

$$\mathbf{ulcA}_t = \underset{(3,44)}{5{,}4e\text{-}04\,T} + \underset{(6,58)}{0{,}07\,SEAS_{t-3}} + \underset{(9,56)}{0{,}79\,ulc_{t-1}} + \underset{(2,46)}{0{,}2\,ulc_{t-2}}$$

R_2=0,9987	Q(4)=7,3 [0,12]	J-B(2)=11,29 [0,0035]
SEE=0,04	Q(8)=15,3 [0,05]	HE(1,37)=13,5 [4,0e-04]
	Q(12)=24,1 [0,02]	ARCH(1)= 1,0e-04 [0,99]

$\{ulc_t\}$1981q1-1995q4

Stepwise Regression (method= backward, slstay=0,05)

$$\mathbf{ulcB}_t = \underset{(-2,45)}{-0{,}06} + \underset{(5,45)}{0{,}07\,SEAS_{t-3}} + \underset{(2,57)}{0{,}02\,SEAS_{t-1}} + \underset{(2,46)}{0{,}042\,D81_{t-4}}$$

$$+ \underset{(3,56)}{0{,}05\,D87_{t-1}} + \underset{(6,87)}{0{,}67\,ulc_{t-1}}$$

R_2=0,9982	Q(4)= 3,09 [0,54]	J-B(2)=7,50 [0, 023]
SEE=0,05	Q(8)=6,6 [0,58]	HE(1,58)=0,52 [0,47]
	Q(12)=7,69 [0,81]	ARCH(1)= 0,005 [0,94]

$\{xuvc_t\}$1970q1-1980q4

Stepwise Regression (method= backward, slstay=0,05)

$$\mathbf{xuvcA}_t = \underset{(2,36)}{0{,}005\ SEAS_{t-3}} + \underset{(5,34)}{0{,}055\ D74_t} + \underset{(27,67)}{1{,}65\ xuvc_{t-1}} - \underset{(-11,27)}{0{,}65\ xuvc_{t-2}}$$

R_2=0,9992	Q(4)=3,29 [0,51]	J-B(2)=1,82 [0,40]
SEE=0,009	Q(8)=6,16 [0,62]	HE(1,37)=0,321 [0,57]
	Q(12)=6,57 [0,88]	ARCH(1)= 1,55 [0,21]

$\{xuvc_t\}$1981q1-1995q4

Stepwise Regression (method= backward, slstay=0,05)

$$\mathbf{xuvcB}_t = \underset{(-2,53)}{-\ 0{,}02} + \underset{(2,50)}{2{,}48e\text{-}04\ T} + \underset{(20,71)}{1{,}23\ xuvc_{t-1}} - \underset{(-6,60)}{0{,}327\ xuvc_{t-3}}$$

R_2=0,9795	Q(4)=1,12 [0,89]	J-B(2)=2,95 [0,23]
SEE=0,008	Q(8)=5,29 [0,72]	HE(1,58)=0,60 [0,44]
	Q(12)=11,59 [0,48]	ARCH(1)= 4,4e-04 [0,98]

$\{xuvcdr_t\}$1970q1-1980q4

Stepwise Regression (method=backward, slstay=0,05)

$$\mathbf{xuvcdrA}_t = \underset{(3,64)}{0{,}027\ SEAS_{t-3}} - \underset{(-2,20)}{0{,}054\ D8891_{\ t-3}} + \underset{(-2,20)}{0{,}053\ D8891_{\ t-4}}$$

$$+ \underset{(30,32)}{1{,}19\ xuvcdr_{\ t-1}} - \underset{(-5,19)}{0{,}193\ xuvcdr_{\ t-4}} + \underset{(4,87)}{1{,}138\ BJ\_res1}$$

R_2=0,9989	Q(4)= 3,79 [0,44]	J-B(2)=10,01 [0, 0067]
SEE=0,033	Q(8)=5,62 [0,69]	HE(1,37)=0,086 [0,77]
	Q(12)=7,68 [0,80]	ARCH(3)= 3,86 [0,28]

$\{xuvcdr_t\}$1981q1-1995q4

Stepwise Regression (method= backward, slstay=0,05)

$$\mathbf{xuvcdrB}_t = \underset{(4,25)}{2{,}59e\text{-}04\ T} + \underset{(117,74)}{0{,}952\ xuvcdr_{\ t-1}} + \underset{(3,63)}{0{,}95\ BJ\_res2}$$

R_2=0,9942	Q(4)=3,79 [0,43]	J-B(2)=1,12 [0,57]
SEE=0,038	Q(8)=7,14 [0,52]	HE(1,58)=1,39 [0,24]
	Q(12)=16,74 [0,16]	ARCH(1)= 1,57 [0,21]

Where: $SEAS_t$: quarterly seasonal dummy variables, such that the value of $SEAS_t$=1 in season t and zero otherwise. T : linear time trend. $D81_t$: level dummy variable, such that $D81_t$ =1 if $t \geq$ 1981q1 and 0 otherwise. $D87_t$: level dummy variable, such that $D87_t$ =1 if $t \geq$ 1987q4 and 0 otherwise. $D74_t$: pulse dummy variable, such that $D74_t$ =1 if t = 1974q1 and 0 otherwise. $D8891_t$: level dummy variable, such that $D8891_t$ =1 if 1988q4 $\leq t \leq$ 1991q4 and 0 otherwise. *BJ_res1* : is an ARMA(||2,10||,||2||) fitted model for residuals from the previous step regression (e.g. $u_t = \theta_2 u_{t-2} + \theta_{10}\, u_{t-10} + \varphi_2 v_{t-2}$). *BJ_res2* : is an ARMA(||11||,||12||) fitted model for residuals from the previous step regression (e.g. $u_t = \theta_{11} u_{t-11} + \varphi_{12} v_{t-12}$). SEE : standard error of estimate. Q(t) : Ljung-Box Q-statistics for testing the autocorrelation of the residuals. Marginal significance level is given in brackets and t-statistics is given in parentheses. J-B(2) : is the Jarque-Bera statistic which under the null hypothesis of normality of residuals, is distributed χ^2 with 2 degrees of freedom. HE : is an F-test for heteroskedasticity based on the regression of squared residuals on squared fitted values. ARCH(q) : estimated coefficient (and p-value in brackets) for the autoregressif q term of the residuals' conditional variance.

Table 3 : CR and AEG & EG-tests

1970q1-1980q4 CR	$xuv_t = 2{,}18 + 2{,}81\ e_t$ (7,94) (15,93)	R_2=0,8546 SEE=0,17	Q(11-0)=89,84 [0,000]
AEG & EG-tests	τ_τ = - 2,37 [-3,8]	τ_μ = - 2,21 [-3,37]	τ = - 2,22 [-2,76]
1981q1-1995q4 CR	$xuv_t = -0{,}12 + 0{,}98\ e_t$ (-9,35) (39,20)	R_2=0,9630 SEE=0,088	Q(15-0)=135,9 [0,000]
AEG & EG-tests	τ_τ = - 2,83 [-3,8]	τ_μ = - 2,93 [-3,37]	τ = - 2,95* [-2,76]

Note: The numbers in brackets expresses the Phillips-Ouliaris (1990) critical values at a=5%.

Table 4

Short-run estimations or ECMs

Panel I: Equation (1) $xuv_t = a + \beta_1 ulc_t + \beta_2 xuvc_t + \varepsilon_t$

1970q1-1980q4

Stepwise Regression (method= backward, slstay=0,05)

$$\Delta xuv_t = \underset{(5,25)}{0{,}056} - \underset{(-2,60)}{0{,}455\ DTulc_{t-3}} + \underset{(4,60)}{4{,}683\ DTxuvc_{t-3}} - \underset{(-2,73)}{0{,}456\ \Delta xuv_{t-1}}$$

F(1,32)=11,01 [0,0023]	Q(4)=3,47 [0,48]	J-B(2)=1,69 [0,43]
R_2=0,3771	Q(8)=10,05 [0,26]	HE(1,35)=1,17 [0,28]
SEE=0,053	Q(12)=13,52 [0,33]	ARCH(1)= 1,99 [0,16]

1981q1-1995q4

Stepwise Restricted ECM (method= backward, slstay=0,2)

$$\Delta xuv_t = \underset{(2,71)}{0{,}023} - \underset{(-1,58)}{0{,}132\ R2_{t-1}} - \underset{(2,57)}{0{,}813\ DTulc_{t-1}} + \underset{(1,78)}{1{,}063\ DTxuvc_{t-2}}$$

$$+ \underset{(1,25)}{0{,}75\ DTxuvc_{t-4}} - \underset{(-1,81)}{0{,}234\ \Delta xuv_{t-2}} + \underset{(2,51)}{0{,}288\ \Delta xuv_{t-4}}$$

F(1,49)=0,91 [0,35]	Q(4)= 1,48 [0,83]	J-B(2)=0,96 [0,62]
R_2=0,2687	Q(8)=2,70 [0,95]	HE(1,54)=0,13 [0,72]
SEE=0,05	Q(12)=5,05 [0,95]	ARCH(1)= 0,09 [0,76]

Panel II: Equation (2) $xuv_t = a + \beta_1 ulc_t + \beta_2 xuvc_t + \beta_3 e_t + v_t$

1970q1-1980q4

Stepwise Regression (method= backward, slstay=0,1)

$$\Delta xuv_t = \underset{(2,64)}{0{,}033} - \underset{(-2,15)}{0{,}332\ DTulc_{t-2}} - \underset{(-2,39)}{0{,}384\ DTulc_{t-3}} + \underset{(3,88)}{4{,}276\ DTxuvc_{t-3}}$$

$$+ \underset{(1,76)}{0{,}637\ \Delta e_{t-3}} - \underset{(-2,27)}{0{,}361\ \Delta xuv_{t-1}} + \underset{(2,10)}{0{,}345\ \Delta xuv_{t-2}}$$

R_2=0,5094	Q(4)= 2,30 [0,68]	J-B(2)=1,87 [0,39]
SEE=0,0472	Q(8)=5,82 [0,67]	HE(1,34)=0,019 [0,89]
F(1,29)=6,33 [0,0176]	Q(12)=18,78 [0,09]	ARCH(1)= 0,176 [0,67]

1981q1-1995q4

Stepwise Restricted ECM (method= backward, slstay=0,2)

$$\boldsymbol{\Delta xuv_t} = -0{,}76\,R2_{t-1} - 0{,}49\,DTulc_t + 1{,}49\,DTxuvc_{t-2} + 0{,}45\,\Delta e_t$$
$$(-3{,}04) \quad (-1{,}71) \quad (5{,}20) \quad (2{,}49)$$

$$+ 0{,}57\,\Delta xuv_{t-1} - 0{,}22\,\Delta xuv_{t-2}$$
$$(2{,}56) \quad (-1{,}90)$$

F(1,50)=0,0095 [0,93]	*Q(4)= 4,41 [0,35]*	*J-B(2)=0,64 [0,73]*
R_2*=0,2222*	*Q(8)=7,69 [0,46]*	*HE(1,54)=0,75 [0,39]*
SEE=0,0542	*Q(12)=9,89 [0,62]*	*ARCH(1)= 1,23 [0,27]*

Panel III: Equation (3) $xuv_t = a + \beta_1 ulc_t + \beta_2 xuvcdr_t + u_t$

1970q1-1980q4

Stepwise ECM (method= backward, slstay=0,12)

$$\boldsymbol{\Delta xuv_t} = 0{,}062 - 0{,}173\,R1_{t-1} + 0{,}024\,DTxuvcdr_{t-1} + 0{,}32\,\Delta xuv_{t-1}$$
$$(2{,}06) \quad (-3{,}82) \quad (1{,}68) \quad (2{,}24)$$

$$+ 0{,}35\,\Delta xuv_{t-2} - 0{,}34\,\Delta xuv_{t-3} + 0{,}75\,\Delta xuv_{t-4}$$
$$(2{,}67) \quad (-2{,}33) \quad (4{,}72)$$

R_2*=0,6360*	*Q(4)= 1,80 [0,77]*	*J-B(2)=1,27 [0,53]*
SEE=0,040	*Q(8)=2,98 [0,94]*	*HE(1,37)=0,1067 [0,75]*
	Q(12)=3,92 [0,98]	*ARCH(3)= 6,70 [0,08]*

1981q1-1995q4

Stepwise ECM (method= backward, slstay=0,2)

$$\boldsymbol{\Delta xuv_t} = 0{,}021 - 0{,}148\,R2_{t-1} - 0{,}75\,DTulc_t - 0{,}196\,\Delta xuv_{t-2}$$
$$(2{,}48) \quad (-1{,}71) \quad (-2{,}56) \quad (-1{,}49)$$

$$+ 0{,}289\,\Delta xuv_{t-4}$$
$$(2{,}42)$$

R_2*=0,2118*	*Q(4)= 1,17 [0,88]*	*J-B(2)=1,12 [0,57]*
SEE=0,055	*Q(8)=1,89 [0,98]*	*HE(1,58)=0,027 [0,87]*
	Q(12)=3,62 [0,99]	*ARCH(4)= 7,31 [0,12]*