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Trade Balance and Exchange-Rate for a Small Open Economy during the EMS: The Hellenic Case 1983:1-1995:12

Dr. Theodoros V. Stamatopoulos*
Ass. Researcher CEFI-Mediterranean University, Aix-Marseille-II.

Abstract

We are interested on assessing the effectiveness of the Bank of Greece (BoG) exchange rate policy, to achieve the objective of adjusting balance of payments des-equilibrium, during the period 1983:1-1995:12. The traditional theory of the balance of payments adjustment process through exchange rate changes is used for this purpose. We found evidence, first, about the doubtful effectiveness of this policy due to the marginal verification of the critical elasticities condition; second, about the success of the exchange rate policy in the short-run, since the monthly data of bilateral exchange rates (USD, DEM, ITL, FRF, GBP, JPY) of the Hellenic Drachma (GRD) Granger cause the respective trade balances; third, about the significant co-movement in the series which in the long-run, are driven by the same stochastic trend. We are much aware of the tentative nature of these conclusions. However, our findings suggest that the loss of the exchange rate policy was costly in the case of Hellas because an efficient policy sacrificed by the BoG to the European Central Bank (ECB).

Keywords

Optimum Currency Area, EMS, EMU, Traditional Adjustment Process for Merchandise Payments, Granger Causality, Integration and Co-integration Analysis.

JEL Classification: F32, F36, F41, E58, C32.

1. Introduction

In March 1998 the Hellenic monetary authorities, i.e., the Bank of Greece (BoG), devalued the Drachma (GRD) by nearly 15% against ECU and joined the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS). The exchange rate stability of a country-member's currency within ERM at least two years before its application to joining European Monetary Union (EMU) it's a critical criterion of the Maastricht Treaty. Indeed, the Hellenic candidature was carried unanimously by the European organs, in June 2000 so that Greece constitutes the twelfth member of the EMU since 1.1.2001. Thus, by definition the BoG, besides other issues, will turn over to the European Central Bank (ECB) its exchange rate policy too.

These developments for the whole EMU members have revived interest in Optimum Currency Area (OCA) theory (Mundell 1961, Kenen 1969) which suggests that the basic criterion, for countries' benefit in a monetary union, is the similarity of

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their economic structure. It is obvious that this was not the case for Greece vis-a-vis its European “insiders” (Rubin and Thygesen 1996) partners. Most studies on OCA in Europe, focus on the measurement of shocks seeking to determine to what extent they have been symmetric rather than asymmetric (e.g. Bayoumi and Eichegreen 1992, Bini-Smaghi and Vori 1993). Here, we follow a different approach. Using the cost/benefit approach (e.g. Ishiyama 1975, Tower and Willet 1976, Allen and Kenen 1980, Robson 1987), we focus on the loss of BoG exchange rate policy’s autonomy; hence, in a partial equilibrium framework, using monthly data for bilateral spot exchange rates of GRD against the six most important currencies for merchandise trade (*Rj, j=USD,DEM,ITL,FRF,GBP,JPY*) and the respective trade balances (*TBj*) in GRD value, our target is to assess the effectiveness of the BoG management of the GRD float, in adjusting one of its objectives, i.e., the trade balance dis-equilibrium (Apergis and Agorastos 1998).

Thus, the focal point of this research is to measure if there was an economic cost from the abolition of the Hellenic exchange rate policy to the ECB, given the degree of its effectiveness especially in adjusting the external merchandise dis-equilibrium. Our starting point is the verification of the critical elasticities condition (i.e., the well known as Marshall-Lerner condition) in the Hellenic case, during the sample period 1983:1-1995:12 to adjust the balance of payments. From our data set we identified marginal satisfaction of this condition. Given these results, we proceed with doubts in evaluating the effectiveness of the BoG exchange rate policy, via the research of (1) the short-run dynamics of the series, using VAR modeling and (2) the long-run equilibrium path of them using co-integration analysis. In the former case we obtained evidence that GRD exchange rates Granger cause the respective bilateral trade balances whereas in the latter the series are found to be co-integrated and some of them respond from the deviations of their common stochastic trend. Taking into account the limitations of this research, i.e., the partial equilibrium framework and the Engle-Granger (1987) procedure for co-integrated variables, these findings seems to be interpreted as a statistical confirmation of the effectiveness of the Hellenic exchange rate policy in the short as well as in the long-run. In addition, these empirical results were robust in both sub-periods of the data set (i.e., 1981:1-1987:12 and 1988:1-1995:12) when there was a regime shift (Kirikos, 1999) of the BoG, following the EMS functioning.

In turn, even though we are aware about the preliminary nature of our conclusions, it seems that the abolition of the Hellenic exchange rate policy due to Greece’s participation in the EMU, was costly, ceteris paribus, based on its verified effectiveness, during the sample period (1983-1995).

The paper is organized as follows. In the next section we discuss methodological issues based on the theoretical background as well as its empirical verification. We describe our data set and we present evidence about the sample’s split as well as short run dynamics of the series in the third section. In section 4 the results of the integration and the co-integration analyses are presented. Concluding remarks are contained in the final section.

2. Methodology

From the economic point of view, this empirical study relies on a particular case of the Traditional theory of Balance-of-Payments adjustment process, in which the monetary authorities (in this case, the Bank of Greece) intervene in the foreign exchange market to manage the spot exchange rate's float (here, the GRD), so as to keep it consistent with their general economic policy objectives. By definition, the demand for and the supply of foreign exchange, as a function of the exchange rate are derived exclusively from merchandise trade, the disequilibria of which is considered as a pure flow one (first of all deriving from imbalances of exports and imports of goods and services), given the "ceteris paribus" clause. The managed or dirty float limited-flexibility regime (here, adopted by the Bank of Greece since the collapse of the Bretton-Woods) is also considered (expenditure switching/reducing policy, in Johnson's (1958) terminology). Furthermore, the explicit assumption of neglecting money and the other financial assets as playing no essential role, for a small "open" economy, like the Hellenic one, (here, 1983-1995), may be justified by the foreign exchange control which was in force by the policy-makers, until May-1994.

Hence, we use the well known idea behind this traditional adjustment process, through exchange rate management: a change in the terms of trade, ceteris paribus (especially the national income and the stock of money being equal), brings about a change in the flows of exports and imports which hopefully adjust the dis-equilibrium in the balance of payments. It should be stressed that the ceteris paribus clause which is imposed when the exchange rate varies, constitutes an implicit assumption in this partial equilibrium analysis, and enables us to consider it (the exchange rate) as the sole cause of changes in the merchandise trade.

Thus, under these assumptions the critical elasticities condition (Bickerdicke 1920, Robinson 1937, Lerner 1944) can be obtained by differentiating the trade balance (*TB*) with respect to the spot exchange rate (*R*) and ascertaining the conditions for $(dTB/dR)>0$. Given the definitions of a) the balance of payments in domestic currency $TB=P_xX-RP_mM$ where $P_x(P_m)$ represents export (import) prices in terms of domestic (single reference foreign) currency, $X(M)$ designates the quantity of exports (imports) and R is the exchange rate of the country under consideration, b) the exchange-rate elasticities of exports n_x and imports n_m $n_x \equiv \frac{\Delta X/X}{\Delta R/R}$, $n_m \equiv -\frac{\Delta M/M}{\Delta R/R}$ where Δ denotes a change; in the second fraction we use the minus sign to make it a positive number. Therefore, the condition is written as,

$$\{[(P_xX)/(RP_mM)]n_x + n_m\} > 1 \tag{1}$$

In addition if we denote by $E_m=RP_mM$ ($E_x=P_xX$) the domestic-currency value of import (export) expenditure, we may write (Gandolfo, 1995), these elasticities as follows,

$$n_x = (\Delta E_x / E_x)/(\Delta R/R) \text{ and } n_m = 1-[(\Delta E_m / E_m)/(\Delta R/R)] \tag{2}$$

For the Hellenic case, (see Table 1) our estimations are shown for the critical elasticities condition (Panel III) which were calculated on the basis of relation (1) for six bilateral trade balances (*TBj*, *j=USD,DEM,ITL,FRF,GBP,JPY*). This table also contains estimations for the three components of inequality's (1); hence, in Panel I we state the ratios in GRD value of exports/imports expenditures [*(X/M)j*] plus the GRD's yearly average growth rate vis-a-vis the six main foreign exchanges (ΔRj). In Panel II, the exchange rate elasticities of exports and imports (n_x, n_m) are described.

The general conclusion is that the Critical Elasticity Condition are (1) marginally satisfied until 1987, i.e., during first stage of EMS, and (2) it is not satisfied during the 1988-'95 sub-period when a strong Drachma policy was undertaken by the Bank of Greece. This may conduct us to expect that the managed float of the GRD should be ineffective in adjusting the trade balance, in the long-run; in econometric terminology, we expect the exchange rates of GRD and the associated payments balances not to be co-integrated. It is also to be stressed that these *ex-post* elasticities are in fact zero for exports and unity for imports (both with positive signs). These values mean that the devaluation of GRD was brought about with an analogous increase in imports' payments in GRD while it did not affect the receipts from exports in domestic currency. The latter can explain, ceteris paribus, the deterioration of the balances for USD, ITL and FRF. However, the slight improvement (except JPY's balance) of exports/imports ratio for DEM, GBP and JPY, conditioning on the above elasticities' values, may be interpreted by the relative switch in the domestic customers' expenditures from one country to another.

From the applied econometrics point of view, the study is structured at two levels, (the short and log-run) to evaluate the effectiveness of the exchange rate policy conducted by the Hellenic policy-makers. In the former case we apply the so-called *Chow-tests* to confirm the shift of the policy and then, in a VARs framework, we investigate the *Granger causalities*: from the exchange rates to the trade balances. In the latter, after the integration analysis suggested by *Dolado et al.* (1990), we work on *Engle-Granger* (1987) two stages co-integration procedure in detecting the equilibrium long-run time path of the variables involved. The well known bivariate VAR(1) system in standard form may be written as:

$$\begin{aligned} TBj_t &= a_{10} + a_{11} TBj_{t-1} + a_{12} Rj_{t-1} + e_{1t} \\ Rj_t &= a_{20} + a_{21} TBj_{t-1} + a_{22} Rj_{t-1} + e_{2t} \end{aligned} \tag{3}$$

3. Time Series Used and Short Run Dynamics.

The sample period starts in January 1983 and ends at the end of 1995 (1983:01-1995:12), that is, in terms of EMS functioning, it covers mainly the exchange rate stability period (1987:01-middle 1992), the improved Bretton-Woods system at the EEC level (1983:01-1987:01), as well as the target zone period, after the deep crisis of September 1992 till July 1993 (middle 1993-end 1995). The monthly frequency of the data was dictated by our interest in examining in detail the dynamic characteristics. The data concern the bilateral (1) spot exchange rates of the Greek drachma (GRD) vis-a-vis the six main foreign currencies (*Rj, j=USD, DEM, ITL, FRF, GBP, JPY*) and (2) their associated trade balances (*TBj*). The "fixing" rates of GRD, at the end of periods, against *USD, DEM, FRF* and *GBP* was obtained from various issues of the Monthly Bulletin of the Bank of Greece (BoG), while those against *ITL* and *JPY* which are crosses through *USD* are found in the Main Economic Indicators of OECD Bulletin. As regards the data in GRD value of the trade balances, of export receipts and import payments, for all six currencies, concern unpublished records, of the three biggest commercial banks in Athens, submitted to the Hellenic regulator (BoG[1]) from which we found them (Stamatopoulos, 1999). Finally, lower case letters denote variables expressed in common logs.

The shift in the exchange rate policy of the BoG since 1988, due to the developments within the European Monetary System, is tested by the *Chow test*, i.e., we test the hypothesis that all the regression coefficients are different in subsets (1983:1-1987:12 and 1988:1-1995:12) of the data. The results of these *Chow tests* that are in favour of the split of the data in 1988:1 are shown in Table 2.

In Table 3 (tables 3a and 3b related to the two sub-periods, 1983:01-1987:12 and 1988:01-1995:12, respectively) we report the empirical results for *Granger causality* analyses, using the vector autoregression (VAR) methodology (Sims 1980). Six VAR(p) systems are estimated for each sub-period. The main results are as follows: for the first sub-period, we find one-way Granger causalities from the exchange rates to the respective trade balances (*Rj* $\rightarrow$ *TBj*) in the cases of *USD, DEM* and *FRF*. In these cases, the lagged values of the GRD's exchange rates are found to be significant in equations of the respective trade balances although the opposite was not confirmed. The same type of results were also found in the second sub-period; here, the Granger causalities (*Rj* $\rightarrow$ *TBj*) are found for the cases of *USD, DEM, ITL* and *GBP*, though we did not expect it to this extent because the BoG broadly declared a strong GRD policy since 1988. Thus, these findings confirm that the management of the flexible GRD by the BoG was successful in the short-run between 1983 and 1995. Therefore the facts that (1) the GRD enjoyed the privilege of not participating in the Exchange Rate Mechanism (ERM) of the EMS, although it was part of the ECU, (2) the abolition of the measures of exchange control in Greece was concluded in July 1994 and (3) the monetary discipline for Greece was delayed due to pure political disturbances from early 1989 to April 1990, enabled Hellenic policy-makers to exploit the devaluation policy in adjusting the merchandise balance of payments dis-equilibria.

4. Co-integration Analysis

In the first step of the *Engle-Granger* (1987) testing procedure for cointegration we pre-test the variables for their order of integration. Table 4 reports the estimations applying the *Dolado et al.* (1990) procedure for univariate single unit root tests, given that the data-generating processes of our variables are unknown.

It is to be pointed out that, (1) in only three cases we find both variables, i.e., the *TBj* and the respective exchange rates, to be integrated in the same order; these are the *USD, FRF* and *DEM* cases, the first two are stationary, while I(1) is that of *DEM*, (2) in contrast, we discover that the cases of *ITL, GBP* and *JPY* are integrated in different order; hence, we may conclude that they are not cointegrated.

In Tables 5 (a and b) we proceed to the second step of Engle-Granger (1987) procedure for estimating the long-run equilibrium relationships between trade balances and exchange rates. Calculated values of DW statistics along with the critical ones, (Sargan and Bhargava 1983) are displayed in Table 5; hence, the null of no

[1] The BoG's Officer who gave us these confidential data (aggregate for all three banks, and only for research purposes) assured us that in total these exceed the 70% of the Hellenic demand for and supply of the respective foreign exchanges for traded goods and services.

cointegrated variables is binding, the CRDW criterion concludes in favour of cointegration in all cases. The deviations from long-run equilibrium, i.e., the estimated residuals are found to be stationary in the Engle-Granger tests for cointegration reported in Table 6. The latter offers us an additional confirmation that trade balances and exchange rates are cointegrated.

In the light of our investigation so far we proceed to estimate the error correction models (Table 7) using the residuals from the equilibrium regression. The main empirical results from the VECM's estimates (Table 7) are as follows: first, all residual series approximate white noise. Second, the variables of interest, i.e., trade balances (*TBj*) and exchange rates of the GRD (*Rj*) are found to be co-integrated in every single system, in both sub-periods; the speed of adjustment coefficients are significantly different from zero, in the *USD, ITL* and *FRF* systems while in the remaining cases (*DEM,GBP,JPY*) only those of *TBj* equations do; consequently, in the former case both variables respond to a deviation from long-run equilibrium, in time (*t*-1), though in the later, (*DEM,GBP,JPY*) only the *TBj* are. In the second sub-period, 1988-1995, the speed of adjustment coefficients were proved significant in both equations of the USD, ITL, FRF and GBP systems while in only one equation of the DEM and JPY systems, these of TBRDEM and RJPY. Thirdly, the signs of the speed of adjustment coefficients are in accord with convergence toward the long-run equilibrium only in the GBP model during 1983-1987 sub-period as well as in the DEM, ITL, FRF and JPY models during 1988-1995; these evidence, in particular of the first period, confirm previous research about the GRD's divergence from its equilibrium time path, after an exogenous shock (Stamatopoulos, 2000); thus, as it is expected from the economic theory, in response to a positive discrepancy in error correction in time (*t*-1), for instance, the *TBGBP* tend to decrease and the *gbp* to increase (devaluation of the *GRD*). Fourthly, from these co-integrated systems the following were found, (1) orthodox Granger causalities ($Rj \rightarrow TBj$) in DEM, GBP and JPY models for the first sub-period while only for DEM in the second one, (2) feed back effects in USD (α=10%) and FRF systems during 1983-1987 though in ITL and GBP systems during 1988-1995 and (3) reverse Granger causalities ($TBj \rightarrow Rj$) in ITL system over the 1983-1987 period while this one in the second sub-period was confirmed for USD, FRF and JPY models. This fourth category of empirical results may be interpreted as statistical confirmation of the monetary discipline applied by the Hellenic authorities during the exchange rate stability period of EMS; that is, rather than using the devaluation policy for the objective of Trade Balance adjustment they use a strong GRD policy to fight the high inflation rate aiming to achieve payments adjustment through de-inflation.

In total, the combined effect of the results obtained from the VECM seems to confirm the fact that the Hellenic policy-makers managed the GRD float to achieve their economic policy objectives, i.e., the trade balance adjustment until 1987 whilst the de-inflation from 1988 and later on.

5. Concluding Remarks

From the foregoing analysis of monthly market data for bilateral trade balances (*TBj* in GRD value, for the six major currencies *j*=USD, DEM, ITL, FRF, GBP, JPY) and spot exchange rates (*Rj*) over the 1983:1-1995:12 period, we drew evidence about the effectiveness of the Hellenic exchange rate policy in adjusting the external merchandise[2] dis-equilibrium. The later was the authorities' actual exchange rate policy objective over that period. This objective was achieved in general through intervention.

First, the split of the sample period at the end of the 1987 when it was observed that the BoG shifted the exchange rate policy (from the devaluation-competitiveness to the des-inflation-competitiveness through the overvalued GRD), which is confirmed by the appropriate Chow-tests for the whole set of six pairs (*TBj-Rj*).

Second, in a partial equilibrium framework as it is anticipated from the traditional theory of the balance of payments adjustment process, the critical elasticities condition is estimated. The *ex-post* exchange rate elasticities of the Hellenic exports (imports) were found approximately zero (unit), so that the condition was marginally satisfied. Thus, this evidence relevant to the economic theory makes us doubt the effectiveness of the Hellenic exchange rate policy, during the sample period.

However, as it is shown from the VAR analysis, in many cases (in USD,DEM and FRF during the first sub-period and in USD,DEM,ITL and GBP over the second one) the bilateral exchange rates Granger cause the respective trade balances, confirming the management of the GRD float as effective in the short-run. The wide-spread protectionism (other than taxes which were suppressed since the Hellenic accession in the EEC in 1981, e.g., subsidies of exports, financial obstacles enforced through the banking system to restrict imports as well as exchange control etc.) which was cut out gradually from January 1988 to July 1994 enabled the short-run success of the BoG policy.

Fourthly, from integration and co-integration analyses, the long-run effectiveness of the Hellenic exchange rate policy was confirmed the paired variables (*TBj-Rj*) in every one of the twelve estimated Vector Error Correction Models are found to be cointegrated. However, the degree of the above policy effectiveness was neither uniform for every *j* currency nor the same during the two sub-periods. The shift of the BoG exchange rate policy during 1987 affiliated with the course of the EMS country-members toward the EMU, which Greece follows (BoG did not participate in the ERM till 1998 while GRD was part of the ECU etc) seems to be a fairly good source in explaining our evidences derived from the estimated VECMs and in particular the observed GRD peg to the DEM since 1988. In this context the effective monetary discipline of the BoG during the second sub-period is confirmed from the significant as well as with correct signs speed of adjustment coefficients in both equations in four of the six models.

Finally, during the sample period Greece and its European partners were engaged in parallel efforts to manage their economies in a convergent ways (first of all in their monetary policy) towards the EMU. Thus, the observed degree effectiveness of the BoG policy may be seen as a first approximation in evaluating the main economic cost of the Hellenic participation in the EMU, that is, the costly abolition of the exchange rate policy for a supra-national Central Bank (ECB). It is self-evident that this preliminary result came to light focusing solely on that particular kind of cost for participation the EMU. However, it is already widely accepted that giving up exchange rate flexibility (though not against the *USD* and the *JPY*, in fact the EU may be able to better manage the dollar rate with its combined reserves than Greece could do alone) and interest rate flexibility *are costs if there are asymmetric shocks*. The

[2] The concentration on trade balance is justified given the exchange control regime until May 1994.

point is that the benefits, lower rates of interest in a lower inflation area and reduced transactions costs, and possibly also greater exchange rate stability against both EU trading partners (fixed) and also against the USD and JPY etc. may well outweigh the above costs. There is no doubt that further research in this direction is required and especially in association with other late entrant 'periphery' countries (Portugal, Spain and perhaps Ireland).

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Table 1

Estimations of the Critical Elasticities Condition's for Greece

Panel I	*(X/M)USD*	*(X/M)DEM*	*(X/M)ITL*	*(X/M)FRF*	*(X/M)GBP*	*(X/M)JPY*
AVG_8387	0,864	0,512	0,725	0,584	0,614	0,025
AVG_8895	0,592	0,546	0,444	0,390	0,644	0,332
DIFF.	*-0,272*	*0,034*	*-0,281*	*-0,194*	*0,029*	*0,307*
	Δ*usd*	Δ*dem*	Δ*itl*	Δ*frf*	Δ*gbp*	Δ*jpy*
AVG_8387	0,042	0,076	0,058	0,060	0,055	0,094
AVG_8895	0,033	0,040	0,016	0,039	0,024	0,046
DIFF.	-0,009	-0,036	-0,041	-0,021	-0,032	-0,049
Panel II	n_x_USD	n_x_DEM	n_x_ITL	n_x_FRF	n_x_GBP	n_x_JPY
AVG_8387	0,026	0,022	0,032	0,018	0,032	---
AVG_8895	-0,004	-0,003	-0,004	-0,005	-0,004	0,007
	n_m_USD	n_m_DEM	n_m_ITL	n_m_FRF	n_m_GBP	n_m_JPY
AVG_8387	0,982	0,991	0,988	0,989	0,988	1,004
AVG_8895	0,999	1,001	0,997	1,000	0,999	1,003
Panel III	Estimations of Critical Elasticities Condition's					
AVG_8387	1,004	1,002	1,011	0,999	1,008	---
AVG_8895	0,997	0,999	0,995	0,998	0,996	1,006

Note: The description of the data used as well as the split of the examined period at the end of 1987, so as to take into account the shift of the exchange rate policy by the Hellenic authorities, are given in Section 2. Where AVG_8387 (8895) is the average value of a variable over the 1983-1987 (1988-1995) period while DIFF denotes difference.

Table 2

Chow Tests for structural change

TBUSD, usd	F(2,152)=8,23 [4,03E-04]	*TBFRF, frf*	F(2,152)=22,98 [0E-05]
TBDEM, dem	F(2,152)=11,9 [1,4E-05]	*TBGBP, gbp*	F(2,152)=40,98 [0E-05]
TBITL, itl	F(2,152)=37,64 [0E-05]	*TBJPY, jpy*	F(2,152)=6,49 [1,97E-03]

Notes: Numbers in brackets show the marginal significance level.

Table 3a
Granger causality tests
First subset, 1983:1-1987:12

Lag length	Endogenous	Exogenous	F-Tests		Conclusions
2-VAR(1) χ^2_4=3,6 [0,46]	*TBUSD* *usd*	*constant,* *time trend,* jpy_{t-i} *(i=0,1,2)*	*TBUSD* (endog.) *usd* *TBUSD* *usd* (endog.)	F=0,195 [0,82] F=5,724 [0,0058] F=0,274 [0,7615] F=340,5 [0,0000]	*usd* ➔ *TBUSD* *usd* → *usd*
2-VAR(2) χ^2_4=26,23 [2,8E-05]	*TBDEM* *dem*	*constant,* *time trend,* *seas.*	*TBDEM* (endog.) *dem* *TBDEM* *dem* (endog.)	F=12,14 [0E-05] F=6,726 [0,0031] F=1,215 [0,3076] F=170,16 [0E-05]	*dem* ➔ *TBDEM* *TBDEM*→ *TBDEM* *dem* → *dem*
2-VAR(1) χ^2_4=6,45 [0,1682]	*TBITL* *itl*	*constant,* *time trend,* dem_{t-i} *(i=0,1,2)*	*TBITL* (endog.) *itl* *TBITL* *itl* (endog.)	F=0,541 [0,4654] F=0,659 [0,4205] F=0E-04 [0,9940] F=3,385 [0,0716]	∄ *Granger* causality
2-VAR(1) χ^2_4=6,30 [0,1775]	*TBFRF* *frf*	*constant,* *time trend,* usd_{t-i} dem_{t-i} *(i=0,1,2)* jpy_{t-1}	*TBFRF* (endog.) *frf* *TBFRF* *frf* (endog.)	F=0,063 [0,8036] F=7,428 [0,0088] F=3,261 [0,0768] F=12,37 [0,0009]	*frf* ➔ *TBFRF* *frf* → *frf*
2-VAR(4) χ^2_4=3,04 [0,55]	*TBGBP* *gbp*	*time trend,* dem_{t-i} *(i=0,1,2)* usd_{t-i} *(i=2,3)* jpy_{t-i} *(i=0,1,2,3)*	*TBGBP* (endog.) *gbp* *TBGBP* *gbp* (endog.)	F=1,392 [0,2558] F=3,739 [0,0118] F=2,884 [0,0356] F=36,31 [0,0000]	*gbp* → *gbp, TBGBP* → *TBGBP* *gbp* ↔ *TBGBP*
2-VAR(2) χ^2_4=11,93 [0, 0178]	*TBJPY* *jpy*	*constant,* *time trend,* usd_{t-i} dem_{t-i} *(i=0,1,2,3)*	*TBJPY* (endog.) *jpy* *TBJPY* *jpy* (endog.)	F=6,201 [0,0043] F=0,707 [0,4987] F=0,049 [0,9587] F=41,53 [0,0000]	*jpy* → *jpy,* *TBJPY* → *TBJPY*

Notes: In first column the calculated value of χ^2_v (v=d.f. equal to lag length of the restricted model) and its significance level in brackets concern the Likelihood Ratio to test the null that the restricted model has the appropriate lag length.

Table 3b
Granger causality tests
Second subset, 1988:1-1995:12.

Lag length	Endogenous	Exogenous	F-Tests		Conclusions
2-VAR(2) χ^2_4=9,61 [0,0475]	*TBUSD* *usd*	*const., trend,* *jpy_{t-i} (i=0,1,2),* *itl_{t-i} (i=1,2)* *dem_{t-i} (i=4,6,9)*	*TBUSD* (endog.) *usd* *TBUSD* *usd* (endog.)	F=0,380 [0,6848] F=3,365 [0,0394] F=0,415 [0,6615] F=118,35 [0,000]	*usd* ➔ *TBUSD* *usd* → *usd*
2-VAR(1) χ^2_4=9,4948 [0,0408]	*TBDEM* *dem*	*const., trend, seas.* *usd_{t-1}* *jpy_{t-i} (i=0,1)*	*TBDEM* (endog.) *dem* *TBDEM* *dem* (endog.)	F=8,583 [0,0044] F=6,447 [0,0130] F=0,013 [0,9108] F=2443 [0E-05]	*dem* ➔ *TBDEM* *TBDEM*→ *TBDEM* *dem* → *dem*
2-VAR(1) χ^2_4=10554 [0E-05]	*TBITL* *itl*	*time trend*	*TBITL* (endog.) *itl* *TBITL* *itl* (endog.)	F=8,949 [0,0035] F=15,34 [0,0001] F=14,82 [0,7011] F=26430 [0E-05]	*itl* ➔ *TBITL* *TBITL*→ *TBITL* *itl* → *itl*
2-VAR(3) χ^2_4=15,34 [0,004]	*TBFRF* *frf*	*constant,* *time trend,* *dem_{t-i} (i=0,1,2)* *jpy_t*	*TBFRF* (endog.) *frf* *TBFRF* *frf* (endog.)	F=2,787 [0,0456] F=0,557 [0,6448] F=0,403 [0,7510] F=1,508 [0,2184]	*TBFRF* → *TBFRF*
2-VAR(3) χ^2_4=3,04 [0,55]	*TBGBP* *gbp*	*time trend,* *dem_{t-1}* *usd_t*	*TBGBP* (endog.) *gbp* *TBGBP* *gbp* (endog.)	F=1,538 [0,1985] F=2,808 [0,0305] F=1,108 [0,3582] F=201,1 [0,0000]	*gbp* ➔ *TBGBP* *gbp* → *gbp*
2-VAR(2) χ^2_4=10,18 [0, 0374]	*TBJPY* *jpy*	*constant,* *time trend,* *itl_t* *dem_t*	*TBJPY* (endog.) *jpy* *TBJPY* *jpy* (endog.)	F=21,43 [0,0000] F=1,771 [0,1761] F=0,533 [0,5885] F=520,8 [0,0000]	*jpy* → *jpy,* *TBJPY* → *TBJPY*

Notes: See Table 3a.

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Table 4

Univariate Single Unit Root Tests

(Dolado et al. 1990)

	τ_τ (-3,45)	φ_2 (4,88)	$\tau_{\beta\tau}$ (2,79)	φ_3 (6,49)	τ_μ (-2,89)	$\tau_{\alpha\mu}$ (2,54)	ö_1 (4,71)	ô (-1,95)	concl.
TBUSD	-10,5	37,1	-6,92	55,64	-3,2	-2,75	5,19	-0,86	I(0)
TBDEM	-2,16	1,63	-0,25	2,44	-3,0	-2,96	4,51	-0,49	I(1)
TBITL	-5,19	9,12	-4,32	13,65	-1,69	-1,66	1,55	-0,58	I(0)
TBFRF	-4,45	-6,74	-3,71	9,95	-1,06	-1,48	1,32	0,67	I(0)
TBGBP	-4,79	7,74	-0,98	11,6	-4,72	-3,87	11,12	-5,00	I(0)
TBJPY	-2,57	2,53	2,36	3,58	-1,59	-1,11	1,67	-1,45	I(1)
usd	-2,78	4,92	2,34	4,37	-1,78	1,92	4,51	2,29	I(0)
dem	-1,36	7,21	1,1	1,67	-1,45	1,97	10,19	4,02	I(1)
itl	-0,76	3,88	0,07	1,71	-1,85	2,23	5,86	2,56	I(1)
frf	-2,4	6,12	2,27	3,04	-0,96	1,41	6,43	3,29	I(0)
gbp	-2,29	4,54	1,81	4,15	-2,2	2,38	6,07	3,30	I(1)
jpy	-1,87	5,91	1,54	2,57	-1,66	2,12	7,62	3,25	I(0)

Notes: The numbers in parentheses of the first row denote DF and ADF critical values (α=0,05, n=100); namely those of $\text{ô}_{\text{ô}}$, $\text{ô}_{\text{âô}}$, $\text{ô}_{\text{ì}}$, $\text{ô}_{\text{áì}}$ and ô are drown from Fuller (1976) while ö_2, ö_3 and ö_1 from Dickey-Fuller (1981). The first four statistics[3] $\text{ô}_{\text{ô}}$, ö_2, $\text{ô}_{\text{âô}}$ and ö_3 were estimated from a random walk with drift and time trend $\Delta y_t = \mu + \beta t + (\rho - 1) y_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \varepsilon_t$ (for which μ denotes the constant and t the time trend), i.e., ADF-test; for the following three ones ($\text{ô}_{\text{ì}}$, $\text{ô}_{\text{áì}}$ and φ_1)[4] a random walk with drift was used whilst the last one (τ) was estimated from a pure random walk. The optimal lag length[5] for the ADF regression was chosen by adding lags until a Lagrange Multiplier test fails to reject no residual serial correlation at level 0,05.

Table 5a

Long-Run Relationships and

Co-integrating Regression Durbin-Watson (CRDW) Test

1983:01-1987:12

	TBUSD	*TBDEM*	*TBITL*	*TBFRF*	*TBGBP*	*TBJPY*
Constant	0,12 (0,13)	-1,69 (-4,65)	-1,68 (-3,91)	0,61 (1,54)	-6,76 (-3,82)	-21,16 (-7,91)
usd	-0,06 (-0,32)	---	---	---	---	---
dem	---	0,25 (2,75)	---	---	---	---
itl	---	---	0,64 (3,05)	---	---	---

[3] To test the hypotheses: $\rho=1$ $\{\tau_\tau\}$, $\mu=\beta=(\rho-1)=0$ $\{\varphi_2\}$, $\beta=0/\rho=1$ $\{\tau_{\beta\tau}\}$ and $\beta=(\rho-1)=0$ $\{\varphi_3\}$.

[4] To test the hypotheses: $\rho=1$ $\{\tau_\mu\}$, $\mu=0/\rho=1$ $\{\tau_{\alpha\mu}\}$ and $\mu=(\rho-1)=0$ $\{\varphi_1\}$.

[5] For each of the three equations used these (L) were: *TBUSD* (0,2,4), *TBDEM* (11,5,5), *TBITL* (1,3,3), *TBFRF* (1,4,4), *TBGBP* (1,1,0), *TBJPY* (2,5,5), *usd* (1,1,1), *dem* (1,1,1), *itl* (1,1,1), *frf* (0,0,0), *gbp* (6,9,2) and *jpy* (1,1,1).

frf	---	---	---	-0,43 (-3,03)	---	---
gbp	---	---	---	---	1,19 (3,48)	---
jpy	---	---	---	---	---	3,84 (5,90)
$\bar{R}^2$	0,0154	0,1007	0,1232	0,1219	0,1584	0,3646
DW (0,386)	1,67	1,08	1,46	1,60	1,43	2,56
Concl.	∃CI	∃CI	∃CI	∃CI	∃CI	∃CI

Notes: The numbers in parentheses below the estimated (OLS) parameters express the *t*-statistics while those of the first column below DW is the critical value (n=100, α=0,05) provided by Sargan and Bhargava (1983) to test the null of *d=0* or ∄ CI.

Table 5b

Long-Run Relationships and
Co-integrating Regression Durbin-Watson (CRDW) Test
1988:01-1995:12

	TBUSD	*TBDEM*	*TBITL*	*TBFRF*	*TBGBP*	*TBJPY*
Constant	5,46 (5,89)	0,66 (2,00)	6,56 (6,58)	4,13 (9,52)	11,33 (11,37)	-9,76 (-4,49)
usd	-1,15 (-2,05)	---	---	---	---	---
dem	---	0,27 (-3,87)	---	---	---	---
itl	---	---	-2,88 (-7,57)	---	---	---
frf	---	---	---	-1,47 (-12,31)	---	---
gbp	---	---	---	---	-2,06 (-11,89)	---
jpy	---	---	---	---	---	1,47 (3,42)
$\bar{R}^2$	0,3034	0,1288	0,3723	0,6130	0,5965	0,1010
DW (0,386)	1,60	1,44	0,65	1,16	1,27	0,73
Concl.	∃CI	∃CI	∃CI	∃CI	∃CI	∃CI

Notes: See those of Table 5a.

Table 6a

Engle-Granger (EG) Tests for Co-integration

1983:01-1987:12

	ÄRes1á	*ÄRes2á*	*ÄRes3á*	*ÄRes4á*	*ÄRes5á*	*ÄRes6á*
τ_{τ} (-4,16)	-7,99	-8,31	-11,07	-7,48	-6,83	-10,41
$\tau_{ì}$ (-3,77)	-8,01	-8,23	-10,97	-7,42	-6,92	-10,49
τ (-3,27)	-8,07	-8,26	-10,95	-7,48	-6,96	-10,57
Conclusions	∃CI	∃CI	∃CI	∃CI	∃CI	∃CI

Notes: *ΔRes1jα* denote the first difference of the estimated residual taken from the respective (*j=usd,dem,itl,frf,gbp,jpy)* co-integrating regression of Table 4a. The numbers in parentheses are the critical values reported by Phillips and Ouliaris (1990) for the EG-test for co-integration in the case of one regressor and a constant included in the already mentioned co-integrating regression. There wasn't any need to apply ADF regressions, the DF ones had already been proved appropriate.

Table 6b

Engle-Granger Tests for Co-integration

1988:01-1995:12

	ÄRes1â	*ÄRes2â*	*ÄRes3â*	*ÄRes4â*	*ÄRes5â*	*ÄRes6â*
τ_{τ} (-4,16)	-7,90	-1,82	-4,95	-6,14	-6,72	-4,19
$\tau_{ì}$ (-3,77)	-7,87	-4,63	-4,24	-6,15	-6,59	-4,17
τ (-3,27)	-7,92	-4,65	-4,26	-6,18	-6,63	-4,20
Conclusions	∃CI	∃CI	∃CI	∃CI	∃CI	∃CI

Notes: See those of Table 6a.

Table 7a

Estimated Error Correction VARs

1983:01-1987:12

Dep.	*TBUSD*			Dep.	*usd*		
smpl size 59	d.f. 54			smpl size 59	d.f. 54		
adj.R^2	0,2037	DW-st	1,8796	adj.R^2	0,9859	DW-st	1,7517
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBUSD{1}	26,979	3,4320	0,0012	*TBUSD{1}*	1,3913	1,8823	0,0652
usd{1}	0,4129	1,7685	0,0826	*usd{1}*	1,0716	48,819	0,0000
jpy	-0,593	-0,578	0,5655	*jpy*	0,3771	3,9064	0,0003
jpy{1}	1,2741	1,2617	0,2125	*jpy{1}*	-0,398	-4,199	0,0001
Res1USD{1}	-27,08	-3,434	0,0011	*RES1USD{1}*	-1,388	-1,872	0,0666
	F-Stat	Signif			F-Stat	Signif	
TBUSD	11,778	0,0012		*TBUSD*	3,5432	0,0652	
usd	3,1277	0,0826		*usd*	2383,3	0,0000	
Dep.	*TBDEM*			Dep.	*dem*		
smpl size 59	d.f. 54			smpl size 59	d.f. 54		
adj.R^2	0,2130	DW-st	1,3386	adj.R^2	0,9976	DW-st	1,5382
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBDEM{1}	1,0687	5,8801	0,0000	*TBDEM{1}*	-0,015	-0,857	0,3952
dem{1}	0,9804	2,3005	0,0253	*dem{1}*	0,9008	20,783	0,0000
jpy	-0,486	-0,763	0,4487	*jpy*	0,5451	8,4175	0,0000
jpy{1}	-0,430	-0,590	0,5572	*jpy{1}*	-0,452	-6,095	0,0000
Res1DEM{1}	-0,850	-4,286	0,0001	*Res1DEM{1}*	-0,001	-0,049	0,9606
	F-Stat	Signif			F-Stat	Signif	
TBDEM	34,575	0,0000		*TBDEM*	0,7344	0,3952	
dem	5,2921	0,0253		*dem*	431,94	0,0000	
Dep.	TBRITL			Dep.	*itl*		
smpl size 59	d.f. 55			smpl size 59	d.f. 55		
adj.R^2	0,1232	DW-st	1,7274	adj.R^2	0,9923	DW-st	1,9511
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBITL{1}	2,1428	2,4535	0,0173	*TBITL{1}*	0,7262	10,432	0,0000
itl{1}	-3,237	-1,689	0,0968	*itl{1}*	-0,648	-4,243	0,0001
dem	1,8022	1,6725	0,1001	*dem*	0,9289	10,814	0,0000
Res1ITL{1}	-2,152	-2,434	0,0182	*Res1ITL{1}*	-0,736	-10,45	0,0000
	F-Stat	Signif			F-Stat	Signif	
TBITL	6,0194	0,0173		*TBITL*	108,83	0,0000	
itl	2,8547	0,0968		*itl*	18,007	0,0001	
Dep.	*TBFRF*			Dep.	*frf*		
smpl size 58	d.f. 51			smpl size 58	d.f. 51		
adj.R^2	0,3469	DW-st	2,2400	adj.R^2	0,9958	DW-st	2,2640
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBFRF{1}	-14,30	-3,302	0,0018	*TBFRF{1}*	-0,862	-2,695	0,0095
frf{1}	-10,27	-3,365	0,0015	*frf{1}*	0,0200	0,0884	0,9299
TREND	-0,037	-3,263	0,0020	*TREND*	-0,000	-0,775	0,4419
dem	0,1628	0,0973	0,9228	*dem*	0,6294	5,0921	0,0000
dem{1}	2,5327	0,8901	0,3776	*dem{1}*	0,3601	1,7127	0,0928

dem{2}	2,5909	1,5543	0,1263	*dem{2}*	-0,420	-3,416	0,0013
Res1FRF{1}	14,340	3,3527	0,0015	*Res1FRF{1}*	0,8450	2,6734	0,0101
	F-Stat	Signif			F-Stat	Signif	
TBFRF	10,904	0,0018		*TBFRF*	7,2649	0,0095	
frf	11,325	0,0015		*frf*	0,0078	0,9299	
Dep.	*TBGBP*			Dep.	*gbp*		
smpl size 57	d.f. 48			smpl size 57	d.f. 48		
adj.R^2	0,3693	DW-st	2,1597	adj.R^2	0,9879	DW-st	2,2990
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBGBP{1}	1,2042	2,3358	0,0237	*TBGBP{1}*	-0,019	-0,752	0,4555
TBGBP{2}	-0,172	-1,282	0,2058	*TBGBP{2}*	0,0181	2,6125	0,0120
TBGBP{3}	-0,037	-0,321	0,7495	*TBGBP{3}*	-0,018	-3,030	0,0039
gbp{1}	-2,258	-0,889	0,3781	*gbp{1}*	1,6031	12,282	0,0000
gbp {2}	-3,543	-0,861	0,3934	*gbp {2}*	-0,934	-4,417	0,0001
gbp {3}	4,9586	1,8171	0,0754	*gbp {3}*	0,3122	2,2247	0,0308
jpy{3}	-4,046	-3,074	0,0035	*jpy{3}*	-0,019	-0,293	0,7706
dem{3}	5,3783	3,4742	0,0011	*dem{3}*	0,0451	0,5669	0,5734
Res1GBP{1}	-1,066	-2,096	0,0414	*Res1GBP{1}*	0,0072	0,2737	0,7855
	F-Stat	Signif			F-Stat	Signif	
TBGBP	2,3532	0,0838		*TBGBP*	4,8463	0,0050	
gbp	3,9693	0,0132		*gbp*	441,38	0,0000	
Dep.	*TBJPY*			Dep.	*jpy*		
smpl size 44	d.f. 34			smpl size 44	d.f. 34		
adj.R^2	0,6271	DW-st	2,2470	adj.R^2	0,9965	DW-st	1,6132
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBJPY{1}	-3,120	-3,537	0,0012	*TBJPY{1}*	0,0117	0,8421	0,4056
jpy{1}	19,034	2,3301	0,0259	*jpy{1}*	0,6881	5,3535	0,0000
TREND	0,3317	4,2430	0,0002	*TREND*	0,0002	0,2025	0,8407
dem	4,8677	0,4735	0,6389	*dem*	1,0184	6,2959	0,0000
dem{1}	2,7472	0,1648	0,8701	*dem{1}*	-0,956	-3,645	0,0009
dem{2}	-21,14	-1,947	0,0597	*dem{2}*	0,1933	1,1317	0,2657
usd	-12,36	-1,389	0,1739	*usd*	0,3765	2,6882	0,0110
usd{1}	17,725	1,3311	0,1920	*usd{1}*	-0,339	-1,621	0,1143
usd{2}	-17,72	-2,102	0,0430	*usd{2}*	0,0339	0,2559	0,7996
Res1JPY{1}	2,7805	3,3074	0,0022	*Res1JPY{1}*	-0,013	-1,048	0,3019
	F-Stat	Signif			F-Stat	Signif	
TBJPY	12,513	0,0012		*TBJPY*	0,7091	0,4056	
jpy	5,4293	0,0259		*jpy*	28,659	0,0000	

Table 7b
Estimated Error Correction VARs
1988:01-1995:12

Dep.	*TBUSD*			Dep.	*usd*		
smpl size 95	d.f. 87			smpl size 95	d.f. 87		
adj.R^2	0,3629	DW-st	1,9774	adj.R^2	0,9848	DW-st	2,0317
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBUSD{1}	1,1340	3,8760	0,0002	*TBUSD{1}*	0,0669	3,1078	0,0025
TBUSD{2}	0,0233	0,2203	0,8262	*TBUSD{2}*	0,0078	1,0008	0,3197
usd{1}	1,4564	1,0835	0,2816	*usd{1}*	1,1893	12,034	0,0000
usd{2}	-1,443	-1,068	0,2882	*usd{2}*	-0,309	-3,119	0,0025
jpy	1,2469	2,0753	0,0409	*jpy*	0,0640	1,4480	0,1512
itl{1}	1,4852	2,0952	0,0391	*itl{1}*	0,0185	0,3548	0,7236
dem{1}	-2,144	-2,775	0,0067	*dem{1}*	0,0649	1,1431	0,2561
Res2USD{1}	-1,044	-3,467	0,0008	*Res2USD{1}*	-0,059	-2,675	0,0089
	F-Stat	Signif			F-Stat	Signif	
TBUSD	8,2046	0,0005		*TBUSD*	6,4357	0,0025	
usd	0,6013	0,5504		*usd*	307,19	0,0000	
Dep.	*TBDEM*			Dep.	*dem*		
smpl size 95	d.f. 88			smpl size 95	d.f. 88		
adj.R^2	0,2121	DW-st	2,0356	adj.R^2	0,9983	DW-st	1,7164
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBDEM{1}	3,0534	2,7433	0,0074	*TBDEM{1}*	-0,042	-0,610	0,5432
dem{1}	0,9878	2,4091	0,0181	*dem{1}*	0,9987	38,750	0,0000
usd	-0,122	-0,172	0,8632	*usd*	-0,123	-2,772	0,0068
usd{1}	-0,622	-0,883	0,3796	*usd{1}*	0,1406	3,1728	0,0021
jpy	0,3737	0,5462	0,5863	*jpy*	0,0949	2,2069	0,0299
jpy{1}	-0,276	-0,413	0,6800	*jpy{1}*	-0,115	-2,746	0,0073
Res2DEM{1}	-2,836	-2,505	0,0141	*Res2DEM{1}*	0,0366	0,5144	0,6083
	F-Stat	Signif			F-Stat	Signif	
TBDEM	7,5255	0,0074		*TBDEM*	0,3726	0,5432	
dem	5,8035	0,0181		*dem*	1501,6	0,0000	
Dep.	*TBITL*			Dep.	*itl*		
smpl size 95	d.f. 89			smpl size 95	d.f. 89		
adj.R^2	0,7228	DW-st	2,0677	adj.R^2	0,9525	DW-st	2,0848
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBITL{1}	1,5530	6,9073	0,0000	*TBITL{1}*	-0,039	-2,005	0,0479
itl{1}	5,3077	4,7665	0,0000	*itl{1}*	0,7022	7,2774	0,0000
usd	-1,546	-2,264	0,0260	*usd*	0,1871	3,1599	0,0022
dem	-2,188	-3,139	0,0023	*dem*	0,0882	1,4604	0,1477
jpy	1,0254	1,9095	0,0594	*jpy*	-0,130	-2,795	0,0064
Res2ITL{1}	-1,256	-4,960	0,0000	*Res2ITL{1}*	0,0418	1,9059	0,0599
	F-Stat	Signif			F-Stat	Signif	
TBITL	47,710	0,0000		*TBITL*	4,0229	0,0479	
itl	22,719	0,0000		*itl*	52,960	0,0000	
Dep.	*TBFRF*			Dep.	*frf*		
smpl size 95	d.f. 90			smpl size 95	d.f. 90		

adj.R^2	0,7459	DW-st	2,1408	adj.R^2	0,9876	DW-st	2,0998
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBFRF{1}	1,3097	4,7333	0,0000	*TBFRF{1}*	-0,217	-6,652	0,0000
frf{1}	2,1954	1,6460	0,1033	*frf{1}*	-0,102	-0,652	0,5159
dem	-0,679	-0,707	0,4811	*dem*	0,8462	7,4674	0,0000
jpy	-0,829	-3,424	0,0009	*jpy*	-0,070	-2,463	0,0157
Res2FRF{1}	-1,056	-3,214	0,0018	*Res2FRF{1}*	0,2052	5,2931	0,0000
	F-Stat	Signif			F-Stat	Signif	
TBFRF	22,403	0,0000		*TBFRF*	44,248	0,0000	
frf	2,7092	0,1033		*frf*	0,4255	0,5159	
Dep.	*TBGBP*			Dep.	*gbp*		
smpl size 95	d.f. 88			smpl size 95	d.f. 88		
adj.R^2	0,7101	DW-st	2,0266	adj.R^2	0,9889	DW-st	1,8735
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBGBP{1}	0,6213	3,8234	0,0002	*TBGBP{1}*	0,0322	2,7335	0,0076
TBGBP{2}	-0,154	-1,481	0,1420	*TBGBP{2}*	0,0043	0,5716	0,5690
gbp{1}	2,4390	1,7765	0,0791	*gbp{1}*	1,2568	12,615	0,0000
gbp{2}	-0,856	-0,620	0,5366	*gbp{2}*	-0,319	-3,192	0,0020
dem{1}	-0,952	-2,365	0,0202	*dem{1}*	0,0577	1,9727	0,0517
usd	-0,926	-2,582	0,0114	*usd*	0,0209	0,8015	0,4250
Res2GBP{1}	-0,488	-3,177	0,0021	*Res2GBP{1}*	-0,023	-2,137	0,0354
	F-Stat	Signif			F-Stat	Signif	
TBGBP	7,4298	0,0010		*TBGBP*	4,6334	0,0122	
gbp	10,917	0,0001		*gbp*	708,56	0,0000	
Dep.	*TBJPY*			Dep.	*jpy*		
smpl size 95	d.f. 87			smpl size 95	d.f. 87		
adj.R^2	0,5145	DW-st	2,0121	adj.R^2	0,9952	DW-st	1,8938
	Coeff.	*t*-stat.	Signif.		Coeff.	*t*-stat.	Signif.
TBJPY{1}	0,4073	0,8144	0,4177	*TBJPY{1}*	0,0303	2,7221	0,0078
TBJPY{2}	0,2688	2,6790	0,0088	*TBJPY{2}*	-0,001	-0,492	0,6234
jpy{1}	-8,589	-1,857	0,0667	*jpy{1}*	1,0876	10,553	0,0000
jpy{2}	8,9093	2,2095	0,0298	*jpy{2}*	-0,311	-3,471	0,0008
usd	-2,441	-1,028	0,3065	*usd*	0,1409	2,6639	0,0092
dem	2,8764	1,3513	0,1801	*dem*	0,1955	4,1217	0,0001
itl	-1,193	-0,580	0,5629	*itl*	-0,176	-3,854	0,0002
Res2JPY{1}	0,0082	0,0167	0,9867	*Res2JPY{1}*	-0,032	-2,923	0,0044
	F-Stat	Signif			F-Stat	Signif	
TBJPY	4,0485	0,0208		*TBJPY*	3,7652	0,0270	
jpy	2,4554	0,0918		*jpy*	128,39	0,0000	

Notes: where *Res1(2)j{1}*, (*j=USD,DEM,ITL,FRF,GBP,JPY*) estimated residuals from the long-run regressions (Tables 5) for the first (second) sub-period, in time (*t*-1).