Academy of Economic Studies, Bucharest
Doctoral School of Finance and Banking DOFIN

Dissertation Paper

Purchasing Power Parity. A Survey on East European Countries (1995-2001)

MSc Student: Ioana Ceanga
Supervisor: Professor Moisa Altar

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1.Introduction

In this paper I tried to apply the theory of purchasing power parity (all the three forms of it: absolute, semi-strong and relative) to explore the behavior of Romania's, Hungary's, Poland's and Czech Republic's bilateral exchange rates with United States. The study is based on a sample of monthly data for the period 1995:01 – 2001:12.

The PPP hypothesis has been widely discussed and analyzed since it was first put forward by Cassel, and criticism of its validity has been intense on both theoretical and empirical grounds. Yet its intuitive appeal and simplicity make the PPP hypothesis one of the most popular economic theories of all the time. A strict interpretation of this concept is that, in the long run, exchange rate trends are determined predominantly by relative price developments at home and abroad.

The theory of purchasing power parity is based on the notion of arbitrage across goods markets and the **Law of One Price**. This law states that on the assumptions of a Perfect Capital Market (no transaction costs, no trade barriers and complete certainty) homogenous goods will sell for the same price on the home and foreign market after conversion into a common numeraire:

$$P_i = SP_i^*$$

Here P_i is the price of a good i expressed in domestic currency, S is the nominal exchange rate expressed in units of domestic currency per unit of foreign currency (or the price of the foreign currency) and P_i^* is the price of good i expressed in foreign currency. If this law holds for one good, than it should hold for a basket of goods, too:

$$P_t = S_t P_t^*$$

Here P_t is the domestic price index at time t, P_t^* is the foreign price index at time t and (2) represents the equation for the absolute purchasing power parity. This postulates that variation in prices between countries will be matched by exchange rates; that is, nominal exchange rates will reflect differences in inflation rates among countries. An alternative representation, where continuous compounding is assumed, is:

$$s_t = p_t - p_t^*$$

where s_t, p_t and p_t^* are the natural log of S_t, P_t and P_t^* respectively.

A weaker version of PPP, based on the relaxation of the homogeneity and symmetry conditions can be expressed as:

$$s_t = \alpha + \beta p_t - \gamma p_t^*$$

where the coefficients α, β and γ are positive constants. A semi-strong form, which imposes the restriction $\beta=\gamma$, shows a stable relationship between the nominal exchange rate and prices.

After 1970 researchers have focused on the relative PPP:

$$\Delta\%S = \Delta\%P - \Delta\%P^*$$

Empirical support for long run PPP has been established by many researchers. Niso Abuaf and Philippe Jorion (1990) analyzed 80 years of USD/GBP and USD/FRF exchange rates and concluded that the nominal exchange rate had no tendency to return to any particular level over the entire period. On the contrary, the real exchange rate proved a clear tendency to return to its central value. Maurice Obstfeld (1995) studied the exchange rate changes and inflation over a period of 20 years (1973-1993) using data for 22 OECD countries and concluded that the long-run variation in exchange rate changes across countries is largely dependent on differences in rates of inflation.

Alan Taylor investigated PPP since the late nineteenth century for a panel of 20 countries over one hundred years. The evidence for long-run PPP was favorable using univariate and multivariate tests of higher power. McCloskey and Zecher (1984) argued that PPP worked very well under the Anglo-American gold standard before 1914. Diebold, Husted and Rush (1991) explored a very long run of nineteenth century data for six countries, and found support for PPP based on the low-frequency information lacking in short-sample studies. Lothian and M. P. Taylor verified studied two centuries of dollar-franc-sterling data and verified PPP. Lothian (1990) also found evidence that real exchange rates were stationary for JPY, USD, GBP and FRF for the period 1875-1986.

Lee (1978) and Officer (1982) found strong evidence in favor of PPP based on analysis of long time-series running from 1914 to the managed float of the 1970s, too.

Recent empirical research, mostly based on the time-series analysis of short spans of data for the floating-rate era led many to conclude that PPP failed to hold, and that the real exchange rate followed a random walk, with no mean-reversion property (the tendency for a series to wander away from its stationary value and then return at later points in time). However, new and higher-powered techniques have been used and proved that in the long run PPP does indeed hold: it appears from these studies that real exchange rates exhibit mean reversion with half-life of deviations of four to five years.

Razzaghipour, Fleming and Heaney found evidence of PPP analyzing quarterly-series of five countries of East Asia during the period 1971:4-1997:2. Tang and Butiong (1994) also examined the bilateral exchange rates of eleven developing Asian countries during the period of 1973-1990 using an error correction model and found strong evidence for PPP being a long run constraint for five of the countries. Hardouvelis and Malliaropulos (2000) test long run PPP as a relationship between the exchange rate and long-run equilibrium price differentials and apply this methodology to monthly data for the Greek drachma, finding support for their version of PPP.

2. Data and methods

In order to see if the absolute PPP and the semi-strong PPP hold I used the Johansen Test for Cointegration. In this way I studied the existence of unrestricted stationary relationships linking bilateral nominal exchange rates and consumer price indexes. Johansen's cointegration model framework has the advantage of allowing for joint determination of nominal exchange rates and CPIs, takes into account short term dynamics of these variables while allowing for the return of the system to a long-term equilibrium in line with PPP theory.

In order to apply this test all the variables I use have to be integrated of order one (I(1)). The purpose of cointegration test is to determine if a group of non-stationary series are cointegrated or not. The presence of a cointegrating relation forms the basis of the VEC specification. The methodology developed by Johansen starts from considering a VAR of order p:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \dots A_p y_{t-p} + B + \varepsilon_t \tag{8}$$

where y_t is a vector of non-stationary variables, B is a constant and ε_t is a vector of random disturbances assumed to be identically and independently normally distributed. All A_i terms represent coefficient matrices. We can rewrite the equation (8) as followed:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + B + \varepsilon_t \tag{9}$$

where $\Pi = \sum_{i=1}^{p} A_i - I$, and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$.

The purpose of the cointegration model is to establish the number of long run stationary relations among the variables contained in y_t. In other words in this way we may determine the number of cointegrated vectors by studying the rank of the matrix Π.

If the matrix mentioned above has rank zero, this means that there is no cointegrating relationship between the variables. On the contrary, if the matrix Π has the rank equal to n (the dimension of the vector y_t) then y_t is stationary. If the rank of Π is bigger than one, but less than n, then the matrix can be decomposed into to full rank matrices: $\alpha \in M_{nxr}$ and $\beta \in M_{rxn}$ with $\Pi=\alpha\beta`$. The α matrix represents the matrix of adjustment or error-correction coefficients. Its elements indicate the speed at which endogenous variables return to equilibrium after a shock on the exogenous ones. The β matrix is called the matrix of cointegrating vectors and r is the number of cointegrating relations.

To determine the number of cointegrating relations conditional on the assumptions made about the trend, we can proceed sequentially from r=0 to r=k-1 until we fail to reject the null hypothesis. In order to test the null hypothesis we have to calculate the followed statistic:

trace-statistic = $-T\sum_{i=r+1}^{n} Log(1-\lambda_i)$,

and to compare it with the 5% or 1% critical values from Osterwald-Lenum (1992). Each λ_I represents the i-th largest eigenvalue of the matrix Π.

In order to verify the relative form of PPP I used an OLS estimation and I checked through a Wald test if the coefficients estimated this way can be 1 or –1.

For the special case of a linear regression model

$y = x\beta+\varepsilon$

and linear restrictions

$H_0 : R\beta - r = 0$

where R is a qxk matrix, and r is a q vector, respectively, the Wald statistic reduces to:

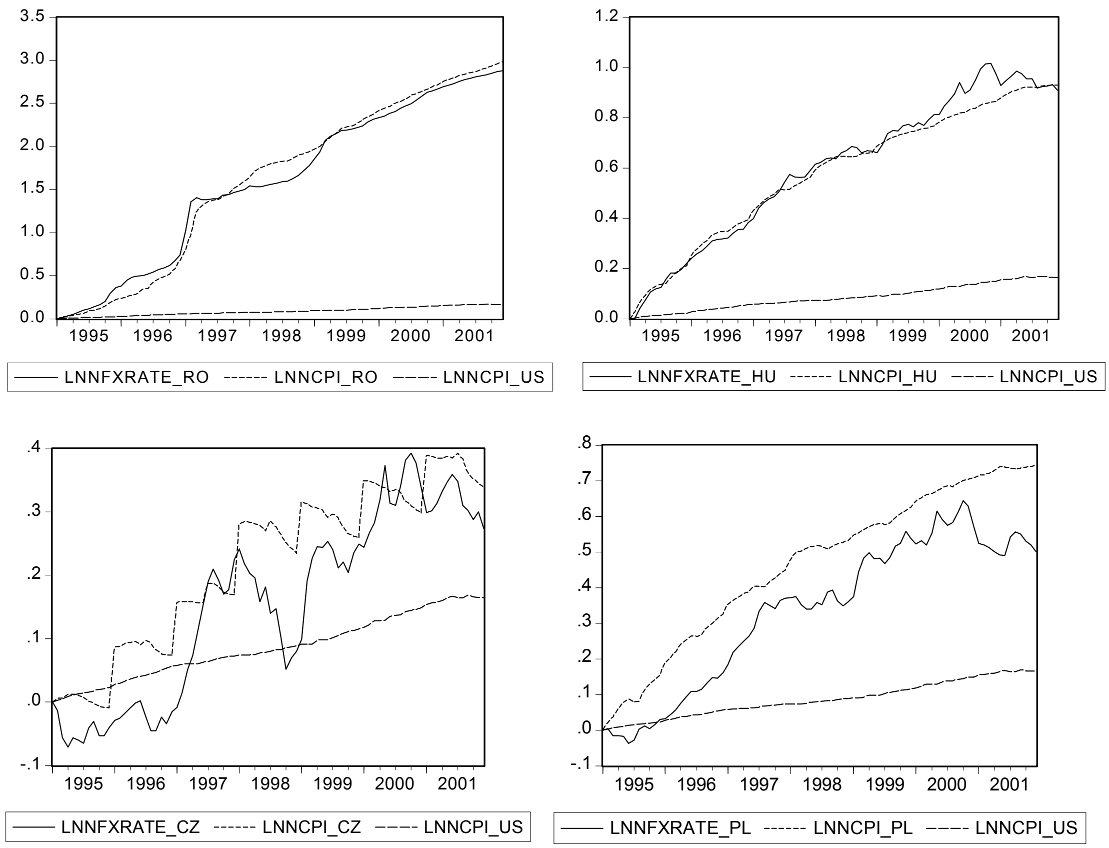
$$W = (Rb-r)`\left(s^2R(X`X)^{-1}R`\right)^{-1}(Rb-r).$$

Bilateral exchange rates between the East European countries and United States dollar, spanning the first month of 1995 to the twelfth month of 2001 were extracted from the time series published by every central bank (Central Bank of Romania, Central Bank of Poland, Central Bank of Hungary, Central Bank of Czech Republic and New York Fed). The exchange rates are monthly average units of national currency per USD. The consumer price indexes that I used for Romania, Czech Republic, Hungary, Poland and United States cover the same period (1995:01-2001:12) and are set to 100 in 1994:12 for all the countries. All initial data sets were normalized by dividing them with the corresponding value in 1995:01. In order to linearize the relationships after normalizing the series I converted them to natural logarithm.

3. Data and Econometric Results

3.1. Testing the strong form of PPP

Graph 1. Nominal exchange rates and consumer price indexes



I began analysis by testing the order of integration of the variables involved using the ADF test. The results are shown in Table 1:

Table 1. ADF test for nominal exchange rates and consumer price indexes

	ADF Test Statistic	Critical values		
		1%	5%	10%
lnnfxrate_ro (3 lags)	-2.258792	-4.0756	-3.4659	-3.1593
dlnnfxrate_ro (2 lags)	-2.935320	-2.5922	-1.9443	-1.6179
lnncpi_ro (1 lag)	-1.508789	-4.0727	-3.4645	-3.1585
dlnncpi_ro (1 lag)	-2.350734	-2.5915	-1.9442	-1.6178
lnnfxrate_cz (1 lag)	-2.762903	-4.0727	-3.4645	-3.1585
dlnnfxrate_cz (1 lag)	-5.422746	-2.5915	-1.9442	-1.6178

lnncpi_cz (1 lag)	-2.713272	-4.0727	-3.4645	-3.1585
dlnncpi_cz (1 lag)	-6.540104	-2.5915	-1.9442	-1.6178
lnnfxrate_pl (2 lags)	-0.560377	-4.0742	-3.4652	-3.1589
dlnnfxrate_pl (1 lag)	-5.981128	-2.5915	-1.9442	-1.6178
lnncpi_pl (1 lag)	-1.158228	-4.0727	-3.4645	-3.1585
dlnncpi_pl (3 lags)	-1.992845	-2.5922	-1.9443	-1.6179
lnnfxrate_hu (1 lag)	-1.034491	-4.0727	-3.4645	-3.1585
dlnnfxrate_hu (1 lag)	-4.643873	-2.5915	-1.9442	-1.6178
lnncpi_hu (2 lags)	-1.237540	-4.0742	-3.4652	-3.1589
dlnncpi_hu (1 lag)	-3.058606	-2.5915	-1.9442	-1.6178
lnncpi_us (0 lags)	-1.334844	-4.0713	-3.4639	-3.1581
dlnncpi_us (1 lag)	-3.120513	-2.5915	-1.9442	-1.6178

Table 2. Johansen cointegration test for Romania

Sample: 1995:01 2001:12
Included observations: 78
Test assumption: Linear deterministic trend in the data
Series: LNNFXRATE_RO LNNCPI_RO LNNCPI_US
Lags interval: 1 to 5

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.238821	30.14110	29.68	35.65	None *
0.062167	8.855936	15.41	20.04	At most 1
0.048156	3.849620	3.76	6.65	At most 2 *

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_RO	LNNCPI_RO	LNNCPI_US
-2.517660	1.727848	12.96837
-0.443834	0.775963	-8.339995
0.040549	-0.256231	2.034686

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_RO	LNNCPI_RO	LNNCPI_US	C
1.000000	-0.686291	-5.150962	-0.047947
	(0.04205)	(0.87199)	
Log likelihood	773.5274		

Table 3. Johansen cointegration test for Czech Republic

Sample: 1995:01 2001:12
Included observations: 82
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_CZ LNNCPI_CZ LNNCPI_US
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.312883	47.29511	34.91	41.07	None **
0.122493	16.52460	19.96	24.60	At most 1
0.068398	5.809628	9.24	12.97	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_CZ	LNNCPI_CZ	LNNCPI_US	C
0.453419	-0.252629	-0.963023	0.241994
1.951553	-2.070303	-0.380633	0.157147
-0.862068	-1.801182	6.174077	0.013245

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_CZ	LNNCPI_CZ	LNNCPI_US	C
1.000000	-0.557164	-2.123911	0.533709
	(0.93296)	(2.49595)	(0.36344)
Log likelihood	783.1281		

Table 4. Johansen cointegration test for Poland

Sample: 1995:01 2001:12
Included observations: 76
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_PL LNNCPI_PL LNNCPI_US
Lags interval: 1 to 7

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.481465	67.09009	34.91	41.07	None **
0.144478	17.17720	19.96	24.60	At most 1
0.067580	5.317867	9.24	12.97	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_PL	LNNCPI_PL	LNNCPI_US	C
1.835776	-3.712288	3.904466	1.183911

-3.220260	4.832239	-10.14059	-0.422439
-1.582787	-0.691088	10.96620	-0.116973

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_PL	LNNCPI_PL	LNNCPI_US	C
1.000000	-2.022191	2.126875	0.644911
	(0.28204)	(0.97097)	(0.13292)
Log likelihood	911.0401		

Table 5. Johansen cointegration test for Hungary

Sample: 1995:01 2001:12
Included observations: 74
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_HU LNNCPI_HU LNNCPI_US
Lags interval: 1 to 9

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.238779	27.76385	24.31	29.75	None *
0.092527	7.574298	12.53	16.31	At most 1
0.005250	0.389534	3.84	6.51	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_HU	LNNCPI_HU	LNNCPI_US
4.855466	-5.454728	3.375489
6.017830	-3.346298	-20.59468
-1.792162	2.135273	1.653253

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_HU	LNNCPI_HU	LNNCPI_US
1.000000	-1.123420	0.695194
	(0.14604)	(1.06643)
Log likelihood	914.2528	

3.2. Testing the semi-strong form of PPP

For testing the semi-strong form of PPP I applied the cointegration techniques on an equation like:

$$s_t = \alpha + \gamma d_t + \varepsilon_t$$

where $d_t = p_t - p_t^*$ represents bilateral relative prices (in logs), and the rest of the notations remain the same as before except γ, the parameter on prices.

Table 6. ADF tests for bilateral relative prices

	ADF Test Statistic	Critical values		
		1%	5%	10%
ndif_ro (1 lag)	-1.517107	-4.0727	-3.4645	-3.1585
dndif_ro (0 lags)	-2.937144	-2.5912	-1.9442	-1.6178
rer_ro (2 lags)	-1.484116	-2.5915	-1.9442	-1.6178
ndif_cz (0 lags)	-1.810165	-3.5101	-2.8963	-2.5851
dndif_cz (0 lags)	-9.188934	-2.5912	-1.9442	-1.6178
rer_cz (0 lags)	-1.734112	-2.5909	-1.9441	-1.6178
ndif_pl (1 lag)	-1.097155	-4.0727	-3.4645	-3.1585
dndif_pl (1 lag)	-3.134822	-2.5915	-1.9442	-1.6178
rer_pl (1 lag)	-3.354781	-4.0727	-3.4645	-3.1585
ndif_hu (2 lags)	-1.245060	-4.0742	-3.4652	-3.1589
dndif_hu (2 lags)	-2.630884	-2.5919	-1.9443	-1.6179
rer_hu (1 lag)	-2.148677	-4.0727	-3.4645	-3.1585

Table 7. Johansen cointegration test for Romania (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 80
Series: LNNFXRATE_RO NDIF_RO
Lags interval: 1 to 3

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	0	0	0	0	0

Table 8. Johansen cointegration test for Czech Republic (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 82
Series: LNNFXRATE_CZ NDIF_CZ
Lags interval: 1 to 1

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	0	0	0	0	0

Table 9. Johansen cointegration test for Poland (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 77
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_PL NDIF_PL
Lags interval: 1 to 6

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.463406	52.99429	19.96	24.60	None **
0.063612	5.060822	9.24	12.97	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level
Unnormalized Cointegrating Coefficients:

LNNFXRATE_PL	NDIF_PL	C
1.273475	-1.286809	0.569549
2.609852	-1.692821	0.048741

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_PL	NDIF_PL	C
1.000000	-1.010470	0.447240
	(0.09238)	(0.12170)
Log likelihood	466.4346	

Table 10. Johansen cointegration test for Hungary (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 76
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_HU NDIF_HU
Lags interval: 1 to 7

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.541533	66.09440	19.96	24.60	None **
0.085882	6.824503	9.24	12.97	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level
Unnormalized Cointegrating Coefficients:

LNNFXRATE_HU	NDIF_HU	C
0.938251	-2.488686	1.153454
-3.394593	4.443984	-0.131305

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_HU	NDIF_HU	C
1.000000	-2.652475	1.229366
	(0.51365)	(0.45779)
Log likelihood	512.1518	

3.3. Testing the relative form for PPP

The first step was to verify if the time-series are stationary or not. In this purpose I used ADF test with the number of lags indicated by Akaike and Schwarz information criterion. The results are shown in the Table 11:

Table 11. ADF test for the growth of nominal exchange rates and CPIs

	ADF Test Statistic	Critical values		
		1%	5%	10%
dfxrate_ro (2 lags)	-2.885920	-2.5919	-1.9443	-1.6179
dcpi_ro (0 lags)	-3.028379	-2.5912	-1.9442	-1.6178
dfxrate_cz (0 lags)	-6.383729	-2.5912	-1.9442	-1.6178
dcpi_cz (0 lags)	-9.046063	-2.5912	-1.9442	-1.6178
dfxrate_pl (1 lag)	-5.956909	-2.9515	-1.9442	-1.6178
dcpi_pl (1 lag)	-6.426192	-4.0742	-3.4652	-3.1589
dfxrate_hu (0 lags)	-5.537619	-2.5912	-1.9442	-1.6178
dcpi_hu (1 lag)	-5.828259	-4.0742	-3.4652	-3.1589
dcpi_us (2 lags)	-1.712843	-2.5919	-1.9443	-1.6179

Considering the fact that all the time-series proved to be stationary I can estimate using the Ordinary Least Squares Method the coefficients of the equation from below:

$$y_t = \alpha + \beta_1 x_{1t} + \beta_2 x_{2t} + \varepsilon_t \qquad (19)$$

where, y_t is the growth of nominal exchange rates, x_{1t} is the growth of the nationa CPI, x_{2t} is the growth of foreign CPI, α is the constant term, β_1 and β_2 are the coefficients to be estimated and ε_t is the residual.

Table 12. OLS estimation for Romania

Dependent Variable: DFXRATE_RO
Method: Least Squares
Sample(adjusted): 1995:03 2001:12
Included observations: 82 after adjusting endpoints
Convergence achieved after 17 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_RO	1.441633	0.186418	7.733327	0.0000
DCPI_US	0.935242	2.371850	0.394309	0.6944
DUMMY97	-0.385495	0.051071	-7.548178	0.0000
C	-0.014492	0.010531	-1.376118	0.1728
AR(1)	0.354268	0.120943	2.929219	0.0045

R-squared	0.620423	Mean dependent var	0.036883
Adjusted R-squared	0.600705	S.D. dependent var	0.056969
S.E. of regression	0.035999	Akaike info criterion	-3.751618
Sum squared resid	0.099786	Schwarz criterion	-3.604867
Log likelihood	158.8163	F-statistic	31.46434
Durbin-Watson stat	1.860417	Prob(F-statistic)	0.000000
Inverted AR Roots	.35		

Table 13. OLS estimation for Czech Republic

Dependent Variable: DFXRATE_CZ
Method: Least Squares
Sample(adjusted): 1995:03 2001:12
Included observations: 82 after adjusting endpoints
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_CZ	-0.064435	0.099534	-0.647362	0.5193
DCPI_US	-2.092252	1.657075	-1.262618	0.2105
C	0.008106	0.005320	1.523691	0.1316
AR(1)	0.343691	0.108289	3.173819	0.0022

R-squared	0.121388	Mean dependent var	0.003843
Adjusted R-squared	0.087596	S.D. dependent var	0.026544
S.E. of regression	0.025355	Akaike info criterion	-4.464130
Sum squared resid	0.050144	Schwarz criterion	-4.346729
Log likelihood	187.0293	F-statistic	3.592141
Durbin-Watson stat	1.958837	Prob(F-statistic)	0.017271
Inverted AR Roots	.34		

Table 14. OLS estimation for Poland

Dependent Variable: DFXRATE_PL
Method: Least Squares
Sample(adjusted): 1995:03 2001:12
Included observations: 82 after adjusting endpoints
Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_PL	0.002853	0.324303	0.008796	0.9930
DCPI_US	-3.375148	1.358318	-2.484800	0.0151
C	0.012650	0.004978	2.540992	0.0130
AR(1)	0.394150	0.107843	3.654855	0.0005

R-squared	0.188240	Mean dependent var	0.006315
Adjusted R-squared	0.157019	S.D. dependent var	0.022327
S.E. of regression	0.020499	Akaike info criterion	-4.889317
Sum squared resid	0.032777	Schwarz criterion	-4.771916
Log likelihood	204.4620	F-statistic	6.029173
Durbin-Watson stat	1.793403	Prob(F-statistic)	0.000953
Inverted AR Roots	.39		

Table 15. OLS estimation for Hungary

Dependent Variable: DFXRATE_HU
Method: Least Squares
Sample(adjusted): 1995:02 2001:12
Included observations: 83 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_HU	0.596563	0.231386	2.578219	0.0118
DCPI_US	-1.661401	1.267730	-1.310532	0.1938
C	0.007752	0.003801	2.039535	0.0447

R-squared	0.082698	Mean dependent var	0.011209
Adjusted R-squared	0.059765	S.D. dependent var	0.019396
S.E. of regression	0.018807	Akaike info criterion	-5.073658
Sum squared resid	0.028297	Schwarz criterion	-4.986230
Log likelihood	213.5568	F-statistic	3.606121
Durbin-Watson stat	1.644034	Prob(F-statistic)	0.031659

4. Conclusions

Tests performed in this paper for the East European developing countries (Romania, Czech Republic, Poland and Hungary) indicate that the absolute, semi-strong and relative forms of PPP relative to US dollar do not hold.

The reasons why PPP does not hold are plenty. One of them refers to the fact that the assumption of no transaction costs is unrealistic. The large geographical distance between United States and the East European countries I have studied is very important. This implies sometimes very big transportation costs. In this case arbitrage will not take place to take advantage of a deviation from parity unless the absolute magnitude of the deviation is greater than the transport costs involved in undertaking the arbitrage. This constraint has the effect of creating a "neutral band" within which no arbitrage transactions will occur. So we'll find the persistence of deviations from the PPP that are smaller than transport cost.

The lack of commercial barriers imposed by the governments (like taxes) in order to protect the domestic economy represents another assumption not found in real life. These tariffs reduce the effective amount of funds available for arbitrage by an amount $(1-\tau)$ where τ is the percentage tariff rate. Collecting a tax will widen the neutral band within which no profitable arbitrage opportunities are available making more difficult the PPP theory to hold.

According to Romania, another aspect that makes PPP not to hold is the Romanian National Bank policy, which lately played a big part on the foreign exchange market buying US dollars in order to increase the currency reserve which grew up to almost 4 billion US dollars in the last few years. Also Romanian National Bank intervened on the foreign exchange market almost every time there were pressures on the national currency to appreciate.

Another problem with the PPP theory is represented by the costs of nontraded-goods. Many items that are homogeneous, nevertheless sell for different prices because they require a non-tradable input in the production process.

The law of one price assumes that individuals have good, even perfect, information about the prices of goods in other markets. Only with this knowledge will profit-seekers begin to export goods to the high price market and import goods from the low priced market. Where there is imperfect information the law of one price may not hold for some products which would imply that PPP would not hold either.

Notice that in the PPP equilibrium stories, it is the behavior of profit-seeking importers and exporters that forces the exchange rate to adjust to the PPP level. But the amount of daily currency transactions is more than ten times the amount of daily trade. This fact would seem to suggest that the primary effect on the daily exchange rate must be caused by the actions of investors rather than importers and exporters. Thus, the participation of other traders in the foreign exchange market, who are motivated by other concerns, may lead the exchange rate to a value that is not consistent with PPP.

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Appendix 1

Table 1.1. The normalized series converted to natural logarithm

	ROMANIA		HUNGARY		POLAND		CZECH REP.		USA
Month	s_t	p_t	s_t	p_t	s_t	p_t	s_t	p_t	p_t
Jan-95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Feb-95	1.01	1.01	1.00	1.03	1.00	1.02	0.99	1.01	1.00
Mar-95	1.03	1.02	1.04	1.07	0.98	1.04	0.94	1.01	1.00
Apr-95	1.05	1.04	1.08	1.10	0.98	1.06	0.93	1.01	1.01
May-95	1.08	1.05	1.11	1.12	0.98	1.08	0.95	1.01	1.01
Jun-95	1.10	1.06	1.13	1.14	0.96	1.09	0.94	1.01	1.01
Jul-95	1.12	1.09	1.13	1.15	0.97	1.08	0.94	1.01	1.01
Aug-95	1.15	1.10	1.17	1.15	1.00	1.08	0.96	1.00	1.02
Sep-95	1.18	1.12	1.20	1.17	1.01	1.12	0.97	1.00	1.02
Oct-95	1.22	1.16	1.20	1.20	1.00	1.14	0.95	0.99	1.02
Nov-95	1.35	1.21	1.22	1.22	1.02	1.15	0.95	0.99	1.02
Dec-95	1.44	1.25	1.25	1.24	1.03	1.17	0.96	0.99	1.02
Jan-96	1.46	1.27	1.27	1.29	1.03	1.21	0.97	1.09	1.03
Feb-96	1.56	1.29	1.29	1.32	1.05	1.23	0.98	1.09	1.03
Mar-96	1.62	1.31	1.31	1.34	1.06	1.25	0.98	1.10	1.03
Apr-96	1.64	1.34	1.33	1.37	1.08	1.27	0.99	1.10	1.04
May-96	1.65	1.41	1.36	1.39	1.10	1.29	1.00	1.10	1.04
Jun-96	1.68	1.42	1.37	1.41	1.12	1.30	1.00	1.09	1.04
Jul-96	1.72	1.53	1.37	1.41	1.12	1.30	0.98	1.10	1.04
Aug-96	1.77	1.59	1.38	1.42	1.12	1.31	0.96	1.10	1.04
Sep-96	1.80	1.63	1.40	1.44	1.14	1.33	0.96	1.09	1.05
Oct-96	1.86	1.68	1.43	1.46	1.16	1.35	0.98	1.08	1.05
Nov-96	1.96	1.78	1.43	1.47	1.16	1.37	0.97	1.08	1.05
Dec-96	2.10	1.96	1.47	1.48	1.17	1.38	0.98	1.08	1.06
Jan-97	2.79	2.23	1.49	1.54	1.20	1.42	0.99	1.17	1.06
Feb-97	3.88	2.65	1.55	1.57	1.24	1.44	1.01	1.17	1.06
Mar-97	4.07	3.46	1.59	1.60	1.27	1.45	1.05	1.17	1.06
Apr-97	3.97	3.70	1.61	1.62	1.28	1.47	1.08	1.17	1.06
May-97	3.99	3.86	1.63	1.64	1.30	1.48	1.12	1.17	1.06
Jun-97	4.04	3.95	1.66	1.67	1.33	1.50	1.17	1.17	1.06
Jul-97	4.03	3.98	1.72	1.67	1.40	1.49	1.21	1.21	1.07
Aug-97	4.19	4.12	1.77	1.67	1.43	1.50	1.23	1.21	1.07
Sep-97	4.24	4.25	1.76	1.70	1.42	1.52	1.21	1.20	1.07
Oct-97	4.34	4.53	1.75	1.72	1.41	1.53	1.19	1.19	1.07
Nov-97	4.40	4.73	1.76	1.74	1.44	1.55	1.19	1.19	1.07
Dec-97	4.48	4.94	1.81	1.76	1.45	1.57	1.25	1.18	1.08
Jan-98	4.67	5.18	1.85	1.81	1.45	1.62	1.27	1.32	1.08
Feb-98	4.63	5.55	1.86	1.84	1.45	1.64	1.24	1.33	1.08
Mar-98	4.62	5.76	1.89	1.86	1.42	1.65	1.22	1.33	1.08

Apr-98	4.72	5.92	1.90	1.88	1.40	1.67	1.22	1.32	1.08
May-98	4.77	6.06	1.89	1.90	1.40	1.67	1.17	1.32	1.08
Jun-98	4.83	6.14	1.94	1.91	1.43	1.68	1.20	1.31	1.08
Jul-98	4.90	6.22	1.95	1.91	1.42	1.67	1.15	1.33	1.08
Aug-98	4.94	6.25	1.99	1.90	1.47	1.66	1.16	1.32	1.09
Sep-98	5.10	6.42	1.98	1.91	1.48	1.68	1.11	1.30	1.09
Oct-98	5.28	6.67	1.93	1.93	1.44	1.69	1.05	1.29	1.09
Nov-98	5.58	6.80	1.95	1.93	1.42	1.69	1.07	1.27	1.09
Dec-98	5.93	6.95	1.95	1.94	1.43	1.70	1.08	1.26	1.09
Jan-99	6.39	7.16	1.94	1.99	1.45	1.73	1.10	1.37	1.10
Feb-99	6.91	7.36	2.00	2.01	1.56	1.74	1.21	1.37	1.09
Mar-99	7.91	7.84	2.09	2.04	1.62	1.75	1.26	1.36	1.10
Apr-99	8.33	8.21	2.11	2.06	1.64	1.77	1.28	1.36	1.10
May-99	8.58	8.65	2.11	2.07	1.62	1.78	1.28	1.35	1.10
Jun-99	8.87	9.09	2.15	2.08	1.62	1.78	1.29	1.34	1.10
Jul-99	8.96	9.24	2.17	2.10	1.60	1.78	1.27	1.35	1.11
Aug-99	9.07	9.35	2.14	2.11	1.62	1.79	1.24	1.34	1.11
Sep-99	9.21	9.65	2.18	2.12	1.68	1.81	1.25	1.32	1.11
Oct-99	9.41	10.06	2.16	2.13	1.69	1.83	1.23	1.30	1.12
Nov-99	9.82	10.46	2.21	2.14	1.75	1.85	1.27	1.30	1.12
Dec-99	10.13	10.76	2.25	2.15	1.71	1.87	1.28	1.30	1.12
Jan-00	10.33	11.23	2.25	2.19	1.69	1.90	1.28	1.42	1.12
Feb-00	10.53	11.47	2.33	2.21	1.70	1.92	1.31	1.42	1.13
Mar-00	10.81	11.68	2.39	2.23	1.68	1.94	1.33	1.41	1.14
Apr-00	11.13	12.24	2.45	2.25	1.74	1.94	1.38	1.40	1.14
May-00	11.48	12.46	2.56	2.26	1.85	1.96	1.45	1.40	1.14
Jun-00	11.84	12.81	2.45	2.27	1.81	1.97	1.37	1.39	1.14
Jul-00	12.16	13.36	2.48	2.30	1.78	1.98	1.36	1.40	1.15
Aug-00	12.62	13.60	2.58	2.31	1.79	1.98	1.40	1.39	1.15
Sep-00	13.29	13.98	2.70	2.34	1.84	2.00	1.46	1.37	1.15
Oct-00	13.82	14.37	2.75	2.35	1.90	2.01	1.48	1.36	1.16
Nov-00	14.13	14.78	2.76	2.36	1.87	2.02	1.46	1.35	1.16
Dec-00	14.42	15.14	2.65	2.37	1.77	2.03	1.40	1.35	1.16
Jan-01	14.78	15.71	2.53	2.41	1.69	2.04	1.35	1.48	1.17
Feb-01	15.10	16.07	2.58	2.44	1.68	2.05	1.35	1.47	1.17
Mar-01	15.37	16.39	2.62	2.46	1.67	2.06	1.37	1.47	1.17
Apr-01	15.70	16.83	2.68	2.48	1.65	2.07	1.39	1.47	1.17
May-01	16.04	17.12	2.65	2.50	1.64	2.09	1.41	1.47	1.18
Jun-01	16.30	17.39	2.59	2.51	1.63	2.09	1.43	1.47	1.18
Jul-01	16.53	17.62	2.60	2.51	1.72	2.08	1.42	1.48	1.18
Aug-01	16.78	18.00	2.50	2.51	1.74	2.08	1.36	1.47	1.18
Sep-01	17.02	18.35	2.52	2.52	1.73	2.08	1.35	1.44	1.18
Oct-01	17.33	18.79	2.52	2.53	1.70	2.09	1.33	1.42	1.18

Nov-01	17.62	19.29	2.54	2.53	1.68	2.09	1.35	1.41	1.18
Dec-01	17.77	19.72	2.48	2.53	1.65	2.10	1.31	1.40	1.18

Appendix 2

Table 2.1. ADF test for nominal exchange rates and consumer price indexes

	ADF Test Statistic	Critical values		
		1%	5%	10%
lnnfxrate_ro (3 lags)	-2.258792	-4.0756	-3.4659	-3.1593
dlnnfxrate_ro (2 lags)	-2.935320	-2.5922	-1.9443	-1.6179
lnncpi_ro (1 lag)	-1.508789	-4.0727	-3.4645	-3.1585
dlnncpi_ro (1 lag)	-2.350734	-2.5915	-1.9442	-1.6178
lnnfxrate_cz (1 lag)	-2.762903	-4.0727	-3.4645	-3.1585
dlnnfxrate_cz (1 lag)	-5.422746	-2.5915	-1.9442	-1.6178
lnncpi_cz (1 lag)	-2.713272	-4.0727	-3.4645	-3.1585
dlnncpi_cz (1 lag)	-6.540104	-2.5915	-1.9442	-1.6178
lnnfxrate_pl (2 lags)	-0.560377	-4.0742	-3.4652	-3.1589
dlnnfxrate_pl (1 lag)	-5.981128	-2.5915	-1.9442	-1.6178
lnncpi_pl (1 lag)	-1.158228	-4.0727	-3.4645	-3.1585
dlnncpi_pl (3 lags)	-1.992845	-2.5922	-1.9443	-1.6179
lnnfxrate_hu (1 lag)	-1.034491	-4.0727	-3.4645	-3.1585
dlnnfxrate_hu (1 lag)	-4.643873	-2.5915	-1.9442	-1.6178
lnncpi_hu (2 lags)	-1.237540	-4.0742	-3.4652	-3.1589
dlnncpi_hu (1 lag)	-3.058606	-2.5915	-1.9442	-1.6178
lnncpi_us (0 lags)	-1.334844	-4.0713	-3.4639	-3.1581
dlnncpi_us (1 lag)	-3.120513	-2.5915	-1.9442	-1.6178

Table 2.2. Determination of optimal number of lags for Romania

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_RO LNNCPI_RO LNNCPI_US
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 74

Lag	LogL	LR	FPE	AIC	SC	HQ
0	207.2131	NA	8.05E-07	-5.519274	-5.425866	-5.482013
1	652.2696	841.9987	6.13E-12	-17.30458	-16.93095	-17.15554
2	693.6793	74.98513	2.56E-12	-18.18052	-17.52667*	-17.91969*
3	703.5606	17.09206	2.50E-12	-18.20434	-17.27026	-17.83173
4	717.5437	23.05309	2.20E-12*	-18.33902	-17.12471	-17.85462
5	723.7108	9.667446	2.40E-12	-18.26245	-16.76793	-17.66627
6	735.8967	18.11416*	2.23E-12	-18.34856*	-16.57381	-17.64059
7	738.4513	3.590288	2.71E-12	-18.17436	-16.11938	-17.35460
8	741.3964	3.900251	3.29E-12	-18.01071	-15.67551	-17.07917
9	745.7842	5.455064	3.86E-12	-17.88606	-15.27063	-16.84273
10	755.1267	10.85745	4.00E-12	-17.89532	-14.99967	-16.74020

Table 2.3. Determination of optimal number of lags for Czech Republic

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_CZ LNNCPI_CZ LNNCPI_US
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 74

Lag	LogL	LR	FPE	AIC	SC	HQ
0	362.1073	NA	1.22E-08	-9.705603	-9.612195	-9.668342
1	700.1664	639.5712	1.68E-12*	-18.59909*	-18.22546*	-18.45004*
2	708.0169	14.21587	1.74E-12	-18.56803	-17.91417	-18.30719
3	711.9632	6.825984	2.00E-12	-18.43144	-17.49736	-18.05882
4	722.3378	17.10413*	1.93E-12	-18.46859	-17.25429	-17.98419
5	726.6092	6.695657	2.22E-12	-18.34079	-16.84626	-17.74460
6	733.2344	9.848290	2.40E-12	-18.27661	-16.50185	-17.56864
7	743.5258	14.46362	2.37E-12	-18.31151	-16.25653	-17.49175
8	748.0765	6.026507	2.74E-12	-18.19126	-15.85605	-17.25972
9	760.4613	15.39732	2.59E-12	-18.28274	-15.66731	-17.23941
10	771.6843	13.04295	2.56E-12	-18.34282	-15.44717	-17.18771

Table 2.4. Determination of optimal number of lags for Poland

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_PL LNNCPI_PL LNNCPI_US
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 74

Lag	LogL	LR	FPE	AIC	SC	HQ
0	385.7133	NA	6.46E-09	-10.34360	-10.25019	-10.30634
1	824.6280	830.3792	5.81E-14	-21.96292	-21.58929*	-21.81387*
2	836.0639	20.70823	5.45E-14	-22.02875	-21.37490	-21.76792
3	842.7180	11.50976	5.83E-14	-21.96535	-21.03127	-21.59274
4	853.3806	17.57889	5.60E-14	-22.01029	-20.79598	-21.52589
5	858.2660	7.658191	6.32E-14	-21.89908	-20.40455	-21.30290
6	870.6354	18.38698	5.86E-14	-21.99015	-20.21539	-21.28218
7	888.4903	25.09325*	4.70E-14*	-22.22947*	-20.17449	-21.40971
8	897.3781	11.77033	4.85E-14	-22.22643	-19.89123	-21.29489
9	902.7896	6.727813	5.54E-14	-22.12945	-19.51402	-21.08612
10	908.7940	6.978106	6.29E-14	-22.04849	-19.15284	-20.89338

Table 2.5. Determination of optimal number of lags for Hungary

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_HU LNNCPI_HU LNNCPI_US
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 74

Lag	LogL	LR	FPE	AIC	SC	HQ
0	386.5429	NA	6.32E-09	-10.36603	-10.27262	-10.32876
1	827.8571	834.9187	5.33E-14	-22.05019	-21.67656*	-21.90115*
2	837.4344	17.34261	5.25E-14	-22.06579	-21.41194	-21.80496
3	845.6270	14.17109	5.38E-14	-22.04397	-21.10989	-21.67136
4	855.1950	15.77425	5.33E-14	-22.05932	-20.84502	-21.57492
5	858.8144	5.673569	6.23E-14	-21.91390	-20.41937	-21.31772
6	880.4408	32.14738	4.49E-14	-22.25516	-20.48040	-21.54719
7	895.0386	20.51583	3.94E-14	-22.40645	-20.35147	-21.58669
8	913.2934	24.17536	3.15E-14	-22.65658	-20.32138	-21.72504
9	931.1953	22.25630*	2.57E-14*	-22.89717*	-20.28174	-21.85384
10	934.3989	3.723106	3.15E-14	-22.74051	-19.84486	-21.58540

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2.6. Johansen cointegration test for Romania

Sample: 1995:01 2001:12
Included observations: 78
Test assumption: Linear deterministic trend in the data
Series: LNNFXRATE_RO LNNCPI_RO LNNCPI_US
Lags interval: 1 to 5

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.238821	30.14110	29.68	35.65	None *
0.062167	8.855936	15.41	20.04	At most 1
0.048156	3.849620	3.76	6.65	At most 2 *

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_RO	LNNCPI_RO	LNNCPI_US
-2.517660	1.727848	12.96837
-0.443834	0.775963	-8.339995
0.040549	-0.256231	2.034686

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_RO	LNNCPI_RO	LNNCPI_US	C

1.000000	-0.686291	-5.150962	-0.047947
	(0.04205)	(0.87199)	
Log likelihood	773.5274		

Table 2.7. Estimated VEC for (lnnfxrate_ro, lnncpi_ro, lnncpi_us)

D(LNNFXRATE_RO) = - 0.2907547863*(LNNFXRATE_RO(-1) - 0.6862912733*LNNCPI_RO(-1) - 5.150961917*LNNCPI_US(-1) - 0.04794697665) + 0.9798504677*D(LNNFXRATE_RO(-1)) - 0.715630526*D(LNNFXRATE_RO(-2)) + 0.3987505767*D(LNNFXRATE_RO(-3)) - 0.02010604964*D(LNNFXRATE_RO(-4)) + 0.3951618513*D(LNNFXRATE_RO(-5)) + 0.620328767*D(LNNCPI_RO(-1)) + 0.1276815544*D(LNNCPI_RO(-2)) - 0.355187963*D(LNNCPI_RO(-3)) - 0.4572106337*D(LNNCPI_RO(-4)) + 0.2971998072*D(LNNCPI_RO(-5)) + 4.837993163*D(LNNCPI_US(-1)) + 3.177777702*D(LNNCPI_US(-2)) + 1.69965485*D(LNNCPI_US(-3)) + 0.504789438*D(LNNCPI_US(-4)) - 2.792475451*D(LNNCPI_US(-5)) - 0.02509245054

D(LNNCPI_RO) = 0.0453207507*(LNNFXRATE_RO(-1) - 0.6862912733*LNNCPI_RO(-1) - 5.150961917*LNNCPI_US(-1) - 0.04794697665) + 0.4140074194*D(LNNFXRATE_RO(-1)) - 0.03618840998*D(LNNFXRATE_RO(-2)) - 0.255531141*D(LNNFXRATE_RO(-3)) - 0.06038974788*D(LNNFXRATE_RO(-4)) - 0.04567100852*D(LNNFXRATE_RO(-5)) + 0.2530252818*D(LNNCPI_RO(-1)) + 0.4248832999*D(LNNCPI_RO(-2)) + 0.1269288892*D(LNNCPI_RO(-3)) - 0.1488072012*D(LNNCPI_RO(-4)) + 0.08421678589*D(LNNCPI_RO(-5)) + 1.636301145*D(LNNCPI_US(-1)) + 2.728500187*D(LNNCPI_US(-2)) - 0.5998073633*D(LNNCPI_US(-3)) + 1.022056226*D(LNNCPI_US(-4)) - 2.142415246*D(LNNCPI_US(-5)) + 0.004280139555

D(LNNCPI_US) = 0.006291130401*(LNNFXRATE_RO(-1) - 0.6862912733*LNNCPI_RO(-1) - 5.150961917*LNNCPI_US(-1) - 0.04794697665) + 0.001195734952*D(LNNFXRATE_RO(-1)) - 0.001603451068*D(LNNFXRATE_RO(-2)) + 0.002425195995*D(LNNFXRATE_RO(-3)) + 0.003093132199*D(LNNFXRATE_RO(-4)) - 0.01010358754*D(LNNFXRATE_RO(-5)) - 0.008847765966*D(LNNCPI_RO(-1)) - 0.01591815256*D(LNNCPI_RO(-2)) + 7.110363272e-05*D(LNNCPI_RO(-3)) + 0.007061071856*D(LNNCPI_RO(-4)) + 0.008055961783*D(LNNCPI_RO(-5)) + 0.05074119816*D(LNNCPI_US(-1)) - 0.2424440435*D(LNNCPI_US(-2)) + 0.4081486169*D(LNNCPI_US(-3)) + 0.2375381225*D(LNNCPI_US(-4)) + 0.197605476*D(LNNCPI_US(-5)) + 0.001104046951

Table 2.8. Johansen cointegration test for Czech Republic

Sample: 1995:01 2001:12
Included observations: 82
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_CZ LNNCPI_CZ LNNCPI_US
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.312883	47.29511	34.91	41.07	None **
0.122493	16.52460	19.96	24.60	At most 1
0.068398	5.809628	9.24	12.97	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_CZ	LNNCPI_CZ	LNNCPI_US	C
0.453419	-0.252629	-0.963023	0.241994
1.951553	-2.070303	-0.380633	0.157147
-0.862068	-1.801182	6.174077	0.013245

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_CZ	LNNCPI_CZ	LNNCPI_US	C
1.000000	-0.557164	-2.123911	0.533709
	(0.93296)	(2.49595)	(0.36344)
Log likelihood	783.1281		

Table 2.9. Estimated VEC for (lnnfxrate_cz, lnncpi_cz, lnncpi_us)

D(LNNFXRATE_CZ) = - 0.007399003598*(LNNFXRATE_CZ(-1) - 0.5571642272*LNNCPI_CZ(-1) - 2.123910877*LNNCPI_US(-1) + 0.5337092732) + 0.3326271786*D(LNNFXRATE_CZ(-1)) + 0.1511737549*D(LNNCPI_CZ(-1)) + 1.75752095*D(LNNCPI_US(-1))

D(LNNCPI_CZ) = 0.009814160202*(LNNFXRATE_CZ(-1) - 0.5571642272*LNNCPI_CZ(-1) - 2.123910877*LNNCPI_US(-1) + 0.5337092732) + 0.1444492271*D(LNNFXRATE_CZ(-1)) - 0.03367971593*D(LNNCPI_CZ(-1)) + 0.1887649466*D(LNNCPI_US(-1))

D(LNNCPI_US) = 0.004549679719*(LNNFXRATE_CZ(-1) - 0.5571642272*LNNCPI_CZ(-1) - 2.123910877*LNNCPI_US(-1) + 0.5337092732) - 0.0009751669295*D(LNNFXRATE_CZ(-1)) - 0.002662968159*D(LNNCPI_CZ(-1)) + 0.1143994998*D(LNNCPI_US(-1))

Table 2.10. Johansen cointegration test for Poland

Sample: 1995:01 2001:12
Included observations: 76
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_PL LNNCPI_PL LNNCPI_US
Lags interval: 1 to 7

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.481465	67.09009	34.91	41.07	None **
0.144478	17.17720	19.96	24.60	At most 1
0.067580	5.317867	9.24	12.97	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_PL	LNNCPI_PL	LNNCPI_US	C
1.835776	-3.712288	3.904466	1.183911
-3.220260	4.832239	-10.14059	-0.422439
-1.582787	-0.691088	10.96620	-0.116973

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_PL	LNNCPI_PL	LNNCPI_US	C
1.000000	-2.022191	2.126875	0.644911
	(0.28204)	(0.97097)	(0.13292)
Log likelihood	911.0401		

Table 2.11. Estimated VEC for (lnnfxrate_pl, lnncpi_pl, lnncpi_us)

D(LNNFXRATE_PL) = - 0.04036419297*(LNNFXRATE_PL(-1) - 2.022190661*LNNCPI_PL(-1) + 2.126875215*LNNCPI_US(-1) + 0.6449106971) + 0.495007583*D(LNNFXRATE_PL(-1)) - 0.1293892853*D(LNNFXRATE_PL(-2)) - 0.05388162017*D(LNNFXRATE_PL(-3)) - 0.1291402978*D(LNNFXRATE_PL(-4)) + 0.1925203409*D(LNNFXRATE_PL(-5)) + 0.003062334063*D(LNNFXRATE_PL(-6)) - 0.05091211014*D(LNNFXRATE_PL(-7)) + 0.5219669784*D(LNNCPI_PL(-1)) + 0.02781567556*D(LNNCPI_PL(-2)) + 0.342160105*D(LNNCPI_PL(-3)) - 0.1251768166*D(LNNCPI_PL(-4)) + 0.4017093727*D(LNNCPI_PL(-5)) - 0.2752631613*D(LNNCPI_PL(-6)) + 0.5934835077*D(LNNCPI_PL(-7)) + 0.4035078414*D(LNNCPI_US(-1)) + 4.151977287*D(LNNCPI_US(-2)) - 2.421588625*D(LNNCPI_US(-3)) - 0.6629754854*D(LNNCPI_US(-4)) - 1.775168471*D(LNNCPI_US(-5)) - 1.508379283*D(LNNCPI_US(-6)) + 1.381147672*D(LNNCPI_US(-7))

D(LNNCPI_PL) = 0.06101562661*(LNNFXRATE_PL(-1) - 2.022190661*LNNCPI_PL(-1) + 2.126875215*LNNCPI_US(-1) + 0.6449106971) - 0.04097330186*D(LNNFXRATE_PL(-1)) - 0.01877065317*D(LNNFXRATE_PL(-2)) - 0.0699449129*D(LNNFXRATE_PL(-3)) - 0.03234688639*D(LNNFXRATE_PL(-4)) + 0.01853754948*D(LNNFXRATE_PL(-5)) - 0.05950447588*D(LNNFXRATE_PL(-6)) + 0.08772681484*D(LNNFXRATE_PL(-7)) + 0.04878045752*D(LNNCPI_PL(-1)) + 0.004491097166*D(LNNCPI_PL(-2)) -

0.007071998541*D(LNNCPI_PL(-3)) + 0.1433611674*D(LNNCPI_PL(-4)) -
0.07918343867*D(LNNCPI_PL(-5)) - 0.4685424334*D(LNNCPI_PL(-6)) -
0.06746076067*D(LNNCPI_PL(-7)) - 0.4060618702*D(LNNCPI_US(-1)) +
0.02376812128*D(LNNCPI_US(-2)) - 0.3341304254*D(LNNCPI_US(-3)) +
0.4300089305*D(LNNCPI_US(-4)) + 0.4869418941*D(LNNCPI_US(-5)) +
0.3833479766*D(LNNCPI_US(-6)) + 0.1966932551*D(LNNCPI_US(-7))

D(LNNCPI_US) = 0.002890273018*(LNNFXRATE_PL(-1) - 2.022190661*LNNCPI_PL(-1) +
2.126875215*LNNCPI_US(-1) + 0.6449106971) - 0.007951504009*D(LNNFXRATE_PL(-1)) +
0.006039526464*D(LNNFXRATE_PL(-2)) - 0.02155028776*D(LNNFXRATE_PL(-3)) +
0.03696512096*D(LNNFXRATE_PL(-4)) - 0.02946244229*D(LNNFXRATE_PL(-5)) +
0.01101148208*D(LNNFXRATE_PL(-6)) + 0.01125461806*D(LNNFXRATE_PL(-7)) +
0.001190419042*D(LNNCPI_PL(-1)) - 0.02425494755*D(LNNCPI_PL(-2)) -
0.017007277*D(LNNCPI_PL(-3)) + 0.04197460459*D(LNNCPI_PL(-4)) -
0.03653833092*D(LNNCPI_PL(-5)) + 0.04082945007*D(LNNCPI_PL(-6)) -
0.02744420963*D(LNNCPI_PL(-7)) + 0.2528199214*D(LNNCPI_US(-1)) -
0.2026574149*D(LNNCPI_US(-2)) + 0.4374412951*D(LNNCPI_US(-3)) +
0.1895015986*D(LNNCPI_US(-4)) + 0.09304870157*D(LNNCPI_US(-5)) -
0.1511530897*D(LNNCPI_US(-6)) + 0.1193541581*D(LNNCPI_US(-7))

Table 2.12. Johansen cointegration test for Hungary

Sample: 1995:01 2001:12
Included observations: 74
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_HU LNNCPI_HU LNNCPI_US
Lags interval: 1 to 9

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.238779	27.76385	24.31	29.75	None *
0.092527	7.574298	12.53	16.31	At most 1
0.005250	0.389534	3.84	6.51	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_HU	LNNCPI_HU	LNNCPI_US
4.855466	-5.454728	3.375489
6.017830	-3.346298	-20.59468
-1.792162	2.135273	1.653253

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_HU	LNNCPI_HU	LNNCPI_US
1.000000	-1.123420	0.695194
	(0.14604)	(1.06643)
Log likelihood	914.2528	

Table 2.13. Estimated VEC for (lnnfxrate_hu, lnncpi_hu, lnncpi_us)

D(LNNFXRATE_HU) = - 0.2366759823*(LNNFXRATE_HU(-1) - 1.123420155*LNNCPI_HU(-1) + 0.6951936788*LNNCPI_US(-1)) + 0.2981580494*D(LNNFXRATE_HU(-1)) + 0.1408791248*D(LNNFXRATE_HU(-2)) - 0.1374268646*D(LNNFXRATE_HU(-3)) + 0.08100524522*D(LNNFXRATE_HU(-4)) + 0.4860635318*D(LNNFXRATE_HU(-5)) - 0.02108759325*D(LNNFXRATE_HU(-6)) + 0.1799154051*D(LNNFXRATE_HU(-7)) + 0.381969713*D(LNNFXRATE_HU(-8)) - 0.1219436291*D(LNNFXRATE_HU(-9)) + 0.4030081132*D(LNNCPI_HU(-1)) - 0.07220258538*D(LNNCPI_HU(-2)) - 0.5813762782*D(LNNCPI_HU(-3)) - 0.1028315605*D(LNNCPI_HU(-4)) - 0.2031325398*D(LNNCPI_HU(-5)) - 0.2560033732*D(LNNCPI_HU(-6)) + 0.1208383356*D(LNNCPI_HU(-7)) - 0.5921538353*D(LNNCPI_HU(-8)) - 0.4023481722*D(LNNCPI_HU(-9)) + 0.3393745404*D(LNNCPI_US(-1)) + 3.769481138*D(LNNCPI_US(-2)) + 0.09892637957*D(LNNCPI_US(-3)) - 2.830693918*D(LNNCPI_US(-4)) + 2.565406288*D(LNNCPI_US(-5)) - 1.196117071*D(LNNCPI_US(-6)) + 0.3523440259*D(LNNCPI_US(-7)) + 5.401000873*D(LNNCPI_US(-8)) - 0.2461781037*D(LNNCPI_US(-9))

D(LNNCPI_HU) = - 0.05000773191*(LNNFXRATE_HU(-1) - 1.123420155*LNNCPI_HU(-1) + 0.6951936788*LNNCPI_US(-1)) - 0.008498087477*D(LNNFXRATE_HU(-1)) + 0.01136336839*D(LNNFXRATE_HU(-2)) - 0.03038546435*D(LNNFXRATE_HU(-3)) + 0.07175210078*D(LNNFXRATE_HU(-4)) + 0.1193051114*D(LNNFXRATE_HU(-5)) + 0.0965030465*D(LNNFXRATE_HU(-6)) - 0.02056965328*D(LNNFXRATE_HU(-7)) + 0.0633961115*D(LNNFXRATE_HU(-8)) + 0.05904285313*D(LNNFXRATE_HU(-9)) + 0.01005083006*D(LNNCPI_HU(-1)) + 0.2866755381*D(LNNCPI_HU(-2)) + 0.2406691994*D(LNNCPI_HU(-3)) + 0.1788422201*D(LNNCPI_HU(-4)) - 0.3195159714*D(LNNCPI_HU(-5)) - 0.4340278112*D(LNNCPI_HU(-6)) - 0.3518979993*D(LNNCPI_HU(-7)) + 0.353755896*D(LNNCPI_HU(-8)) + 0.1545987514*D(LNNCPI_HU(-9)) + 0.1710023093*D(LNNCPI_US(-1)) - 0.5197118433*D(LNNCPI_US(-2)) + 0.7955152547*D(LNNCPI_US(-3)) + 0.5349140237*D(LNNCPI_US(-4)) + 0.8228678686*D(LNNCPI_US(-5)) - 0.1293973481*D(LNNCPI_US(-6)) - 0.03680164122*D(LNNCPI_US(-7)) - 0.5462756529*D(LNNCPI_US(-8)) + 1.213066825*D(LNNCPI_US(-9))

D(LNNCPI_US) = 8.33354705e-05*(LNNFXRATE_HU(-1) - 1.123420155*LNNCPI_HU(-1) + 0.6951936788*LNNCPI_US(-1)) + 0.004912487283*D(LNNFXRATE_HU(-1)) + 0.02160806257*D(LNNFXRATE_HU(-2)) - 0.02637482427*D(LNNFXRATE_HU(-3)) + 0.03851455667*D(LNNFXRATE_HU(-4)) - 0.008006817027*D(LNNFXRATE_HU(-5)) + 0.02529881264*D(LNNFXRATE_HU(-6)) - 0.008708306224*D(LNNFXRATE_HU(-7)) + 0.02275681828*D(LNNFXRATE_HU(-8)) + 0.0038868297*D(LNNFXRATE_HU(-9)) - 0.04752920626*D(LNNCPI_HU(-1)) + 0.03011052144*D(LNNCPI_HU(-2)) - 0.01688043449*D(LNNCPI_HU(-3)) + 0.008052955628*D(LNNCPI_HU(-4)) - 0.00381042826*D(LNNCPI_HU(-5)) + 0.00537367421*D(LNNCPI_HU(-6)) - 0.01748295035*D(LNNCPI_HU(-7)) + 0.008522946179*D(LNNCPI_HU(-8)) - 0.003700791659*D(LNNCPI_HU(-9)) + 0.3296530063*D(LNNCPI_US(-1)) - 0.3483645551*D(LNNCPI_US(-2)) + 0.5304157693*D(LNNCPI_US(-3)) - 0.001025760828*D(LNNCPI_US(-4)) + 0.3003157986*D(LNNCPI_US(-5)) - 0.09405995445*D(LNNCPI_US(-6)) - 0.02078459589*D(LNNCPI_US(-7)) + 0.1356653407*D(LNNCPI_US(-8)) - 0.1287106376*D(LNNCPI_US(-9))

Appendix 3

Table 3.1. Determination of optimal number of lags for Romania (semi-strong form)

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_RO NDIF_RO
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 76

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-30.41791	NA	0.008045	0.853103	0.914438	0.877615
1	285.2126	606.3428	2.21E-06	-7.347700	-7.163694	-7.274162
2	327.0007	78.07785	8.17E-07	-8.342125	-8.035449*	-8.219562
3	334.0687	12.83395	7.54E-07	-8.422861	-7.993515	-8.251273
4	342.0023	13.98815*	6.81E-07*	-8.526376*	-7.974360	-8.305764*
5	345.0915	5.284102	6.99E-07	-8.502407	-7.827721	-8.232770
6	348.5571	5.745604	7.10E-07	-8.488344	-7.690987	-8.169681
7	349.3548	1.280652	7.76E-07	-8.404075	-7.484048	-8.036388
8	352.4872	4.863436	7.98E-07	-8.381243	-7.338546	-7.964531

Table 3.2. Determination of optimal number of lags for Czech Re. (semi-strong form)

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_CZ NDIF_CZ
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 76

Lag	LogL	LR	FPE	AIC	SC	HQ
0	175.5951	NA	3.56E-05	-4.568292	-4.506957	-4.543779
1	342.6009	320.8270	4.88E-07	-8.857919	-8.673914*	-8.784382*
2	348.1579	10.38276*	4.68E-07*	-8.898892*	-8.592216	-8.776330
3	348.2357	0.141306	5.20E-07	-8.795677	-8.366331	-8.624089
4	350.0266	3.157535	5.51E-07	-8.737541	-8.185525	-8.516929
5	350.8044	1.330611	6.01E-07	-8.652749	-7.978063	-8.383111
6	352.4801	2.778031	6.41E-07	-8.591581	-7.794225	-8.272919
7	357.1473	7.492155	6.32E-07	-8.609140	-7.689114	-8.241453
8	358.3751	1.906246	6.83E-07	-8.536186	-7.493490	-8.119474

Table 3.3. Determination of optimal number of lags for Poland (semi-strong form)

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_PL NDIF_PL
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 76

Lag	LogL	LR	FPE	AIC	SC	HQ
0	117.0802	NA	0.000166	-3.028426	-2.967091	-3.003914
1	430.1382	601.4008	4.87E-08	-11.16153	-10.97753*	-11.08799
2	438.0341	14.75300	4.40E-08	-11.26406	-10.95738	-11.14149*
3	440.5129	4.500860	4.58E-08	-11.22402	-10.79468	-11.05244
4	443.8099	5.813127	4.67E-08	-11.20552	-10.65351	-10.98491

5	445.0275	2.082740	5.04E-08	-11.13230	-10.45762	-10.86266
6	449.9783	8.207993	4.93E-08	-11.15732	-10.35997	-10.83866
7	463.8377	22.24800*	3.81E-08	-11.41678	-10.49676	-11.04910
8	468.0925	6.606077	3.81E-08*	-11.42349*	-10.38079	-11.00677

Table 3.4. Determination of optimal number of lags for Hungary (semi-strong form)

VAR Lag Order Selection Criteria
Endogenous variables: LNNFXRATE_HU NDIF_HU
Exogenous variables: C
Sample: 1995:01 2001:12
Included observations: 74

Lag	LogL	LR	FPE	AIC	SC	HQ
0	162.8053	NA	4.44E-05	-4.346088	-4.283816	-4.321247
1	456.0393	562.6923	1.79E-08	-12.16322	-11.97641*	-12.08870
2	464.1445	15.11521	1.60E-08	-12.27418	-11.96282	-12.14997
3	465.0349	1.612342	1.74E-08	-12.19013	-11.75423	-12.01625
4	466.6828	2.894966	1.86E-08	-12.12656	-11.56611	-11.90299
5	467.6684	1.678177	2.02E-08	-12.04509	-11.36010	-11.77184
6	480.5907	21.30435	1.59E-08	-12.28624	-11.47670	-11.96330
7	494.5731	22.29611	1.22E-08	-12.55603	-11.62195	-12.18341
8	505.3372	16.58263*	1.02E-08*	-12.73884*	-11.68022	-12.31655*
9	507.2461	2.837501	1.09E-08	-12.68233	-11.49916	-12.21035
10	508.2280	1.406510	1.19E-08	-12.60076	-11.29304	-12.07909

Table 3.5. Johansen cointegration test for Romania (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 80
Series: LNNFXRATE_RO NDIF_RO
Lags interval: 1 to 3

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	0	0	0	0	0

Table 3.6. Johansen cointegration test for Czech Republic (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 82
Series: LNNFXRATE_CZ NDIF_CZ
Lags interval: 1 to 1

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	0	0	0	0	0

Table 3.7. Johansen cointegration test for Poland (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 77
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_PL NDIF_PL
Lags interval: 1 to 6

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.463406	52.99429	19.96	24.60	None **
0.063612	5.060822	9.24	12.97	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_PL	NDIF_PL	C
1.273475	-1.286809	0.569549
2.609852	-1.692821	0.048741

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_PL	NDIF_PL	C
1.000000	-1.010470	0.447240
	(0.09238)	(0.12170)
Log likelihood	466.4346	

Table 3.8. Estimated VEC for (lnnfxrate_pl, ndif_pl)

D(LNNFXRATE_PL) = 0.01431809153*(LNNFXRATE_PL(-1) - 1.010469899*NDIF_PL(-1) + 0.4472395156) + 0.3970121179*D(LNNFXRATE_PL(-1)) - 0.2852306563*D(LNNFXRATE_PL(-2)) + 0.03307408258*D(LNNFXRATE_PL(-3)) - 0.187827552*D(LNNFXRATE_PL(-4)) + 0.09439241982*D(LNNFXRATE_PL(-5)) + 0.08529537259*D(LNNFXRATE_PL(-6)) - 0.03232609677*D(NDIF_PL(-1)) + 0.01221008998*D(NDIF_PL(-2)) + 0.2611633397*D(NDIF_PL(-3)) - 0.03852020094*D(NDIF_PL(-4)) + 0.1851123702*D(NDIF_PL(-5)) - 0.121671165*D(NDIF_PL(-6))

D(NDIF_PL) = 0.07338068699*(LNNFXRATE_PL(-1) - 1.010469899*NDIF_PL(-1) + 0.4472395156) - 0.05144517896*D(LNNFXRATE_PL(-1)) +

0.01120970315*D(LNNFXRATE_PL(-2)) - 0.09789799689*D(LNNFXRATE_PL(-3)) - 0.07558210707*D(LNNFXRATE_PL(-4)) + 0.01282346736*D(LNNFXRATE_PL(-5)) - 0.02936931907*D(LNNFXRATE_PL(-6)) + 0.1693673408*D(NDIF_PL(-1)) + 0.01569425241*D(NDIF_PL(-2)) - 0.03876654271*D(NDIF_PL(-3)) + 0.08516262601*D(NDIF_PL(-4)) - 0.1090007874*D(NDIF_PL(-5)) - 0.4629617323*D(NDIF_PL(-6))

Table 3.8. Johansen cointegration test for Hungary (semi-strong form)

Sample: 1995:01 2001:12
Included observations: 76
Test assumption: No deterministic trend in the data
Series: LNNFXRATE_HU NDIF_HU
Lags interval: 1 to 7

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.541533	66.09440	19.96	24.60	None **
0.085882	6.824503	9.24	12.97	At most 1

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNNFXRATE_HU	NDIF_HU	C
0.938251	-2.488686	1.153454
-3.394593	4.443984	-0.131305

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNNFXRATE_HU	NDIF_HU	C
1.000000	-2.652475	1.229366
	(0.51365)	(0.45779)
Log likelihood	512.1518	

Table 3.9. Estimated VEC for (lnnfxrate_hu, ndif_hu)

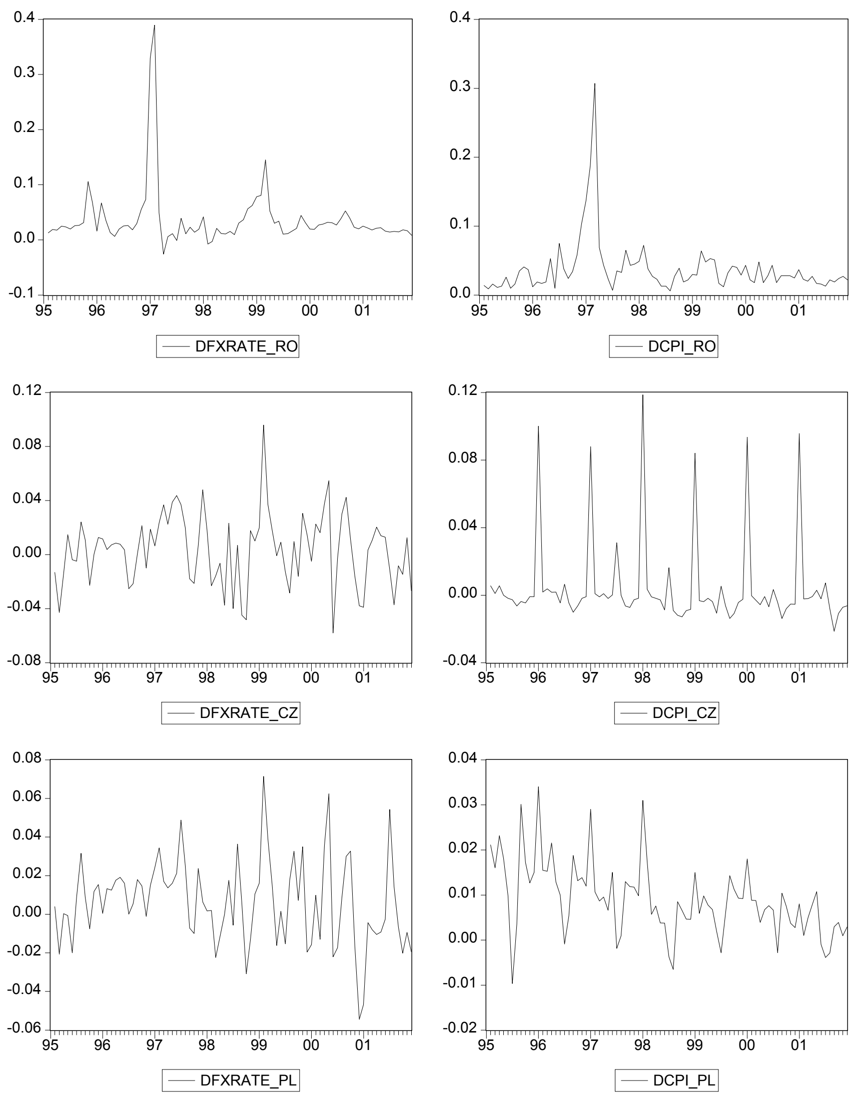
D(LNNFXRATE_HU) = - 0.005497219556*(LNNFXRATE_HU(-1) - 2.65247458*NDIF_HU(-1) + 1.229366404) + 0.1584826009*D(LNNFXRATE_HU(-1)) - 0.1392156957*D(LNNFXRATE_HU(-2)) - 0.02729351303*D(LNNFXRATE_HU(-3)) - 0.09408636661*D(LNNFXRATE_HU(-4)) + 0.246059966*D(LNNFXRATE_HU(-5)) + 0.09811404295*D(LNNFXRATE_HU(-6)) + 0.1072547917*D(LNNFXRATE_HU(-7)) + 0.6736939918*D(NDIF_HU(-1)) + 0.3329889305*D(NDIF_HU(-2)) + 0.001883731872*D(NDIF_HU(-3)) + 0.1478034778*D(NDIF_HU(-4)) - 0.2277228816*D(NDIF_HU(-5)) - 0.05495183715*D(NDIF_HU(-6)) + 0.09282180497*D(NDIF_HU(-7))

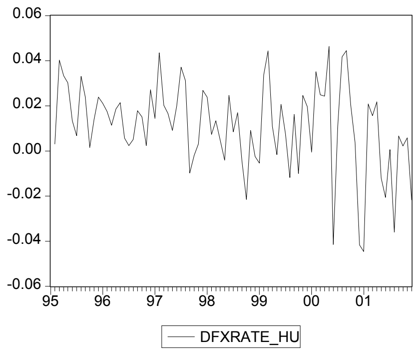
D(NDIF_HU) = 0.03723054549*(LNNFXRATE_HU(-1) - 2.65247458*NDIF_HU(-1) + 1.229366404) - 0.02420576313*D(LNNFXRATE_HU(-1)) - 0.03941495496*D(LNNFXRATE_HU(-2)) - 0.06694851427*D(LNNFXRATE_HU(-3)) - 0.01599720763*D(LNNFXRATE_HU(-4)) + 0.05675418251*D(LNNFXRATE_HU(-5)) + 0.02354050234*D(LNNFXRATE_HU(-6)) + 0.007430310541*D(LNNFXRATE_HU(-7)) - 0.05317471876*D(NDIF_HU(-1)) - 0.06786780112*D(NDIF_HU(-2)) +

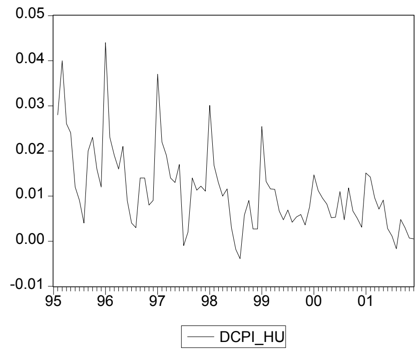
0.0713407206*D(NDIF_HU(-3)) + 0.2080451456*D(NDIF_HU(-4)) - 0.2244156136*D(NDIF_HU(-5)) - 0.4069095092*D(NDIF_HU(-6)) - 0.3892532421*D(NDIF_HU(-7))

Appendix 4

Graph 1. The plot of the growth of nominal exchange rates and of CPIs







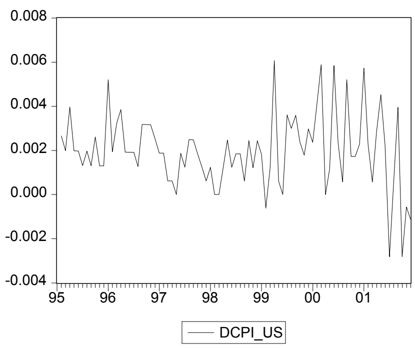


Table 4.1. OLS estimation for Romania

Dependent Variable: DFXRATE_RO
Method: Least Squares
Sample(adjusted): 1995:03 2001:12
Included observations: 82 after adjusting endpoints
Convergence achieved after 17 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_RO	1.441633	0.186418	7.733327	0.0000
DCPI_US	0.935242	2.371850	0.394309	0.6944
DUMMY97	-0.385495	0.051071	-7.548178	0.0000
C	-0.014492	0.010531	-1.376118	0.1728
AR(1)	0.354268	0.120943	2.929219	0.0045

R-squared	0.620423	Mean dependent var	0.036883
Adjusted R-squared	0.600705	S.D. dependent var	0.056969
S.E. of regression	0.035999	Akaike info criterion	-3.751618
Sum squared resid	0.099786	Schwarz criterion	-3.604867
Log likelihood	158.8163	F-statistic	31.46434
Durbin-Watson stat	1.860417	Prob(F-statistic)	0.000000
Inverted AR Roots	.35		

Table 4.2. OLS estimation for Czech Republic

Dependent Variable: DFXRATE_CZ
Method: Least Squares
Sample(adjusted): 1995:03 2001:12
Included observations: 82 after adjusting endpoints
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_CZ	-0.064435	0.099534	-0.647362	0.5193
DCPI_US	-2.092252	1.657075	-1.262618	0.2105
C	0.008106	0.005320	1.523691	0.1316
AR(1)	0.343691	0.108289	3.173819	0.0022
R-squared	0.121388	Mean dependent var		0.003843
Adjusted R-squared	0.087596	S.D. dependent var		0.026544
S.E. of regression	0.025355	Akaike info criterion		-4.464130
Sum squared resid	0.050144	Schwarz criterion		-4.346729
Log likelihood	187.0293	F-statistic		3.592141
Durbin-Watson stat	1.958837	Prob(F-statistic)		0.017271
Inverted AR Roots	.34			

Table 4.3. OLS estimation for Poland

Dependent Variable: DFXRATE_PL
Method: Least Squares
Sample(adjusted): 1995:03 2001:12
Included observations: 82 after adjusting endpoints
Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_PL	0.002853	0.324303	0.008796	0.9930
DCPI_US	-3.375148	1.358318	-2.484800	0.0151
C	0.012650	0.004978	2.540992	0.0130
AR(1)	0.394150	0.107843	3.654855	0.0005
R-squared	0.188240	Mean dependent var		0.006315
Adjusted R-squared	0.157019	S.D. dependent var		0.022327
S.E. of regression	0.020499	Akaike info criterion		-4.889317
Sum squared resid	0.032777	Schwarz criterion		-4.771916
Log likelihood	204.4620	F-statistic		6.029173
Durbin-Watson stat	1.793403	Prob(F-statistic)		0.000953
Inverted AR Roots	.39			

Table 4.4. OLS estimation for Hungary

Dependent Variable: DFXRATE_HU
Method: Least Squares
Sample(adjusted): 1995:02 2001:12
Included observations: 83 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCPI_HU	0.596563	0.231386	2.578219	0.0118
DCPI_US	-1.661401	1.267730	-1.310532	0.1938
C	0.007752	0.003801	2.039535	0.0447

R-squared	0.082698	Mean dependent var	0.011209
Adjusted R-squared	0.059765	S.D. dependent var	0.019396
S.E. of regression	0.018807	Akaike info criterion	-5.073658
Sum squared resid	0.028297	Schwarz criterion	-4.986230
Log likelihood	213.5568	F-statistic	3.606121
Durbin-Watson stat	1.644034	Prob(F-statistic)	0.031659

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