Academy of Economic Studies Bucharest
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Uncovered interest parity and deviation from uncovered interest parity

-Dissertation paper-

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Abstract

Considering that foreign exchange markets are the deepest markets in the world and in case of Romania there are daily transactions summing up to 100 millions USD (a very low level comparably with those existing in foreign markets), explaining deviations from UIP seems to me an interesting and important task to do even in the case of Romania.

However, UIP deviations in transition and emerging market countries have received much less attention than in industrialized countries. This is surprising, given the growing importance of transition and emerging market countries in world capital markets, with increasingly open capital accounts and flexible exchange rate.

In this paper I'll ask two questions. First, does UIP relation work? Second, if there are deviations from UIP, why do they occur?

I have studied UIP because this relation is the cornerstone of international finance. The main fact to be kept in mind is that it appears as a key behavioral relationship in almost all of the prominent current-day models of exchange rate determination. This includes not only small models used in theoretical analysis, but also a number of carefully specified models of today's array of multi-country econometric models as those used by international organizations. Among recently constructed systems that incorporate both UIP and rational expectations are the IMF's MULTIMOD (Masson, Symansky and Meredith, 1990) and MULTIMOD MARK III (1997).

Introduction

The paper is organized as follows. Section I presents UIP hypothesis and reviews basic identities regarding the UIP proposition and other parity conditions. Here are presented the main directions in literature regarding UIP. Sections II discusses the main elements that determine UIP deviations from a theoretical point of view and the research in this field. Deviations from UIP are generated by foreign exchange risk premia, systematic forecast errors, transaction costs and by intervention in the foreign exchange. In sections III we estimate UIP and study the reasons for UIP deviations presenting empirical results. Section IV presents some conclusions.

For the discussion of UIP and others related to UIP and UIP deviations we will need some notation. Accordingly, let:

- ✓ S_t – nominal spot exchange rate at time t expressed as the price, in “home-country” monetary units, of foreign exchange (ROL against USD);
- ✓ S_t^e – expected nominal spot exchange rate at time t;
- ✓ i_t, respective r_t – nominal interest rate at time t, respective real interest rate at time t in home country;
- ✓ i_t^*, respective r_t^* – nominal interest rate at time t, respective real interest rate at time t in foreign country.

For this entire notation let lower case letters denote the log of the spot exchange rate (expected spot exchange rate).

Methodology, data and empirical results

Empirical analysis has been made using monthly data from 1995/01 to 2000/12 for the average nominal exchange rate, average passive interest rate used by banks for LEI operations (dpm), loan interest rate in USA (Bank prime loan rate) (mprime). The graphs of the series used are presented in figures 1, 2, 3 and 4.

The nominal exchange rate is expressed, as ROL against USD in units of home currency per foreign currency and it is an average exchange rate. For the price level in USA I have used CPI- all urban consumers, seasonally adjusted series.

Figure 1 Nominal exchange rate (ROL against USD) from 1995:01 to 2001:12

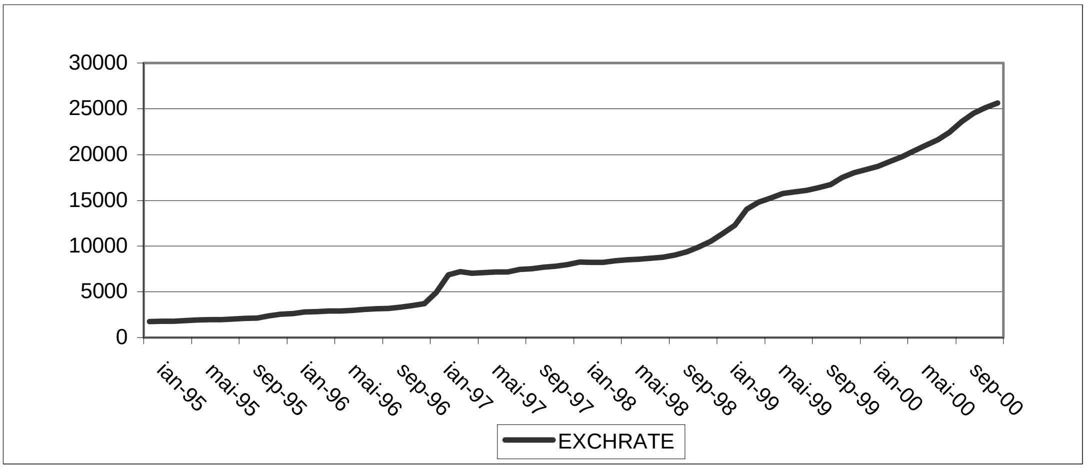


Figure 2 Nominal exchange rate change (in logarithms)

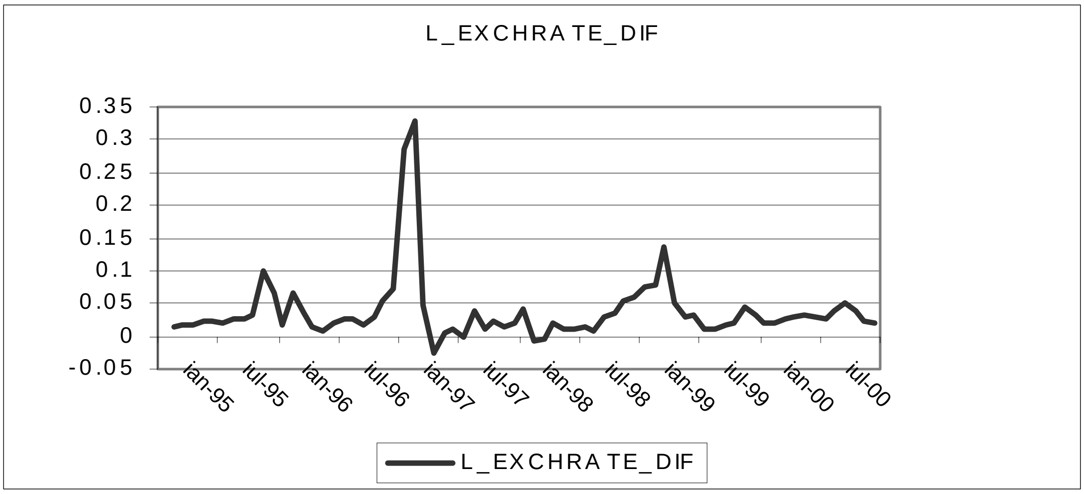


Figure 3 Average interest rate used by banks with their clients

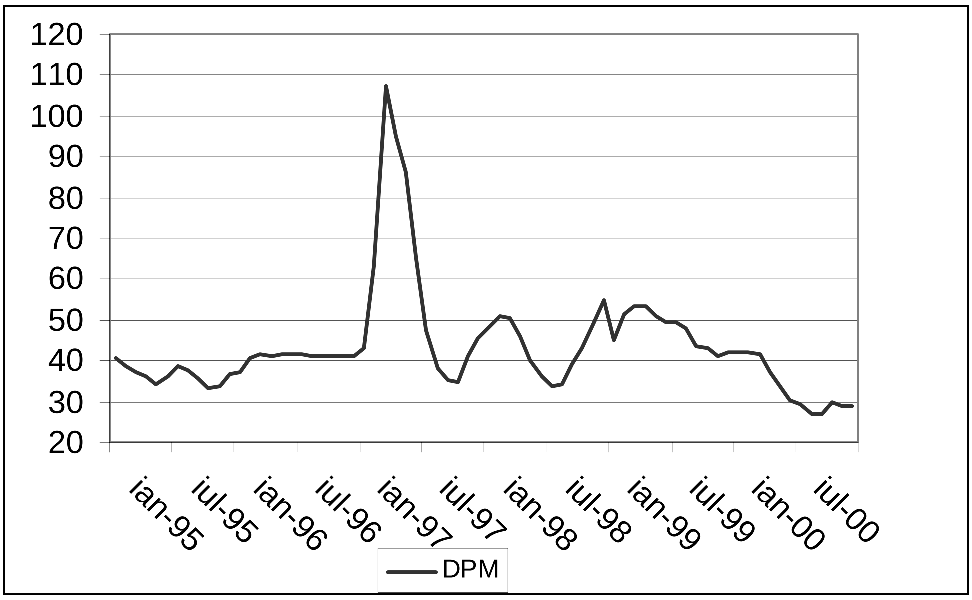
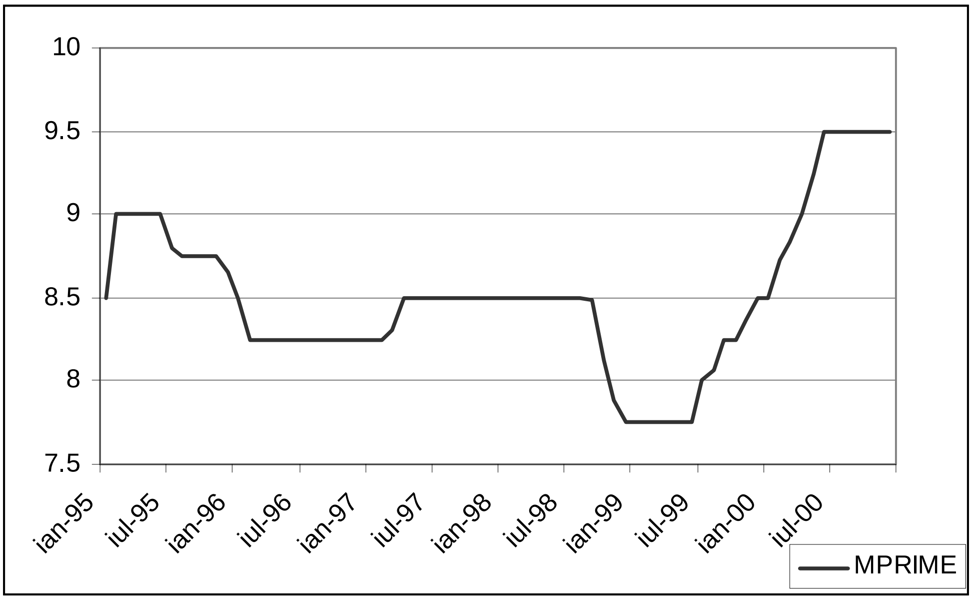


Figure 4 Interest rate in USA (Bank prime loan rate) –averages of daily figures



While the PPP condition is based on a comparison of the returns on identical goods, the UIP condition is concerned with the returns on perfectly substitutable financial assets across countries showing the degree of integration between capital markets.

The UIP hypothesis may be written:

$$1 + i_t = \left(1 + i_t^{*}\right)\frac{S^{e}{}_{t+1}}{S_t} \quad \textbf{Equation 1}$$

Expression which in logarithmic form yields:

$$s^{e}{}_{t+1} - s_t = i_t - i_t^{*} \quad \textbf{Equation 2}$$

I used in regression the approximation $\ln\left(1 + i_t\right) = i_t$ even if in the case of Romania the interest rate was and still is very high. This is because I obtained better statistical indicators without approximation.

In testing UIP I specified the regression according to Flood and Rose (1994) and Meredith and Chinn (1998). I have regressed the following equation:

$$s_{t+k} - s_t = \alpha + \beta\left(i_t - i_t^{*}\right) + \varepsilon_t \quad \textbf{Equation 3}$$

The above equation incorporates rational expectations. To test a theory like (2) the measurement of expectations posses difficulties. This paper uses a common assumption, namely that of rational expectations ($s_{t+1}{}^{e} = s_{t+1} + \varepsilon_t$). In this situation expected value of s_{t+1} and realized value of s_{t+1} will differ by an error term ε_t (white noise).

By considering *k=1* I have avoided the possibility for ε_t to have a moving average overlapping observation structure. Since ε_t represents the forecast error, we will suppose that ε_t is stationary and orthogonal to the information set at time *t*, including interest differential. In such a case OLS will be a consistent estimator of β.

According to the nominal spot exchange rate (monthly data) we changed the interest rate series from annual percent to monthly percent. In this purpose we used two methods

$$i_t = \frac{i_t^{a}}{12} \text{ or } i_t = \sqrt[12]{1 + i_t^{a}} - 1,$$

where i_t^{a} is monthly interest rate expressed as percent per annum. For comparison reasons we took into consideration both methods and the results were better in first case.

Figure 5 Change in exchange rate (in logarithm) with respect to interest differential

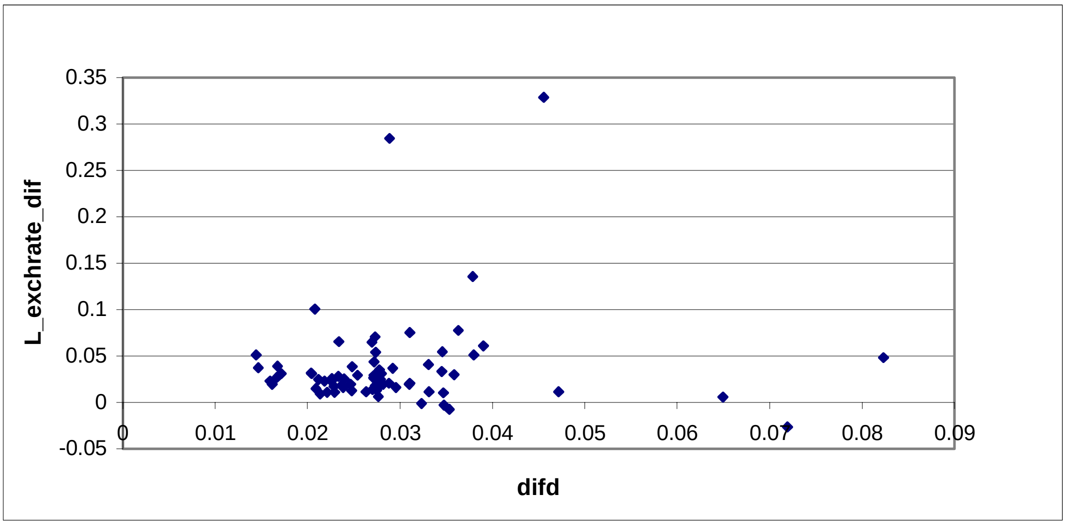


Figure 6 Change in exchange rate (in logarithm) and the interest differential

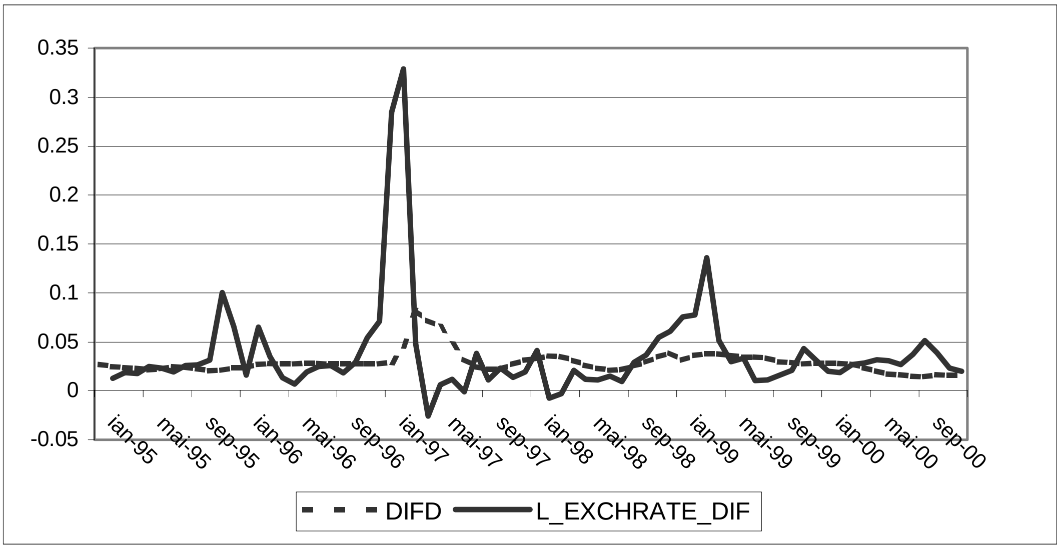


Figure 5 appears to be a cloud of observations without any clear pattern. There does not appear to be a clear tendency for the observations to be sloped in any particular way.

In figure 6 we can see very clear that there is a connection between this two variables, with the exception of certain areas, but in general this connection is exactly the opposite to that implied by UIP.

Before testing the regression we need to see which are the properties of the regression variables. For this purpose we will perform unit-root tests to determine the integration order of the series. We will use the Augmented Dickey-Fuller and Phillips-Perron.

As applied to the time series, y_t τ_μ statistic is the t-ratio of β in the regression equation:

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta y_{t-i} + \phi_t \quad \textbf{Equation 4}$$

Since the augmentation terms are added to remove serial correlation, the criterion that is adopted to determine the order of the augmented Dickey-Fuller test (the value of m) is that it should be the smallest number necessary to remove serial correlation.

For the change in monthly nominal exchange rate (in log) we get:

Table 1 Unit-root test for exchange rate change (in log)

ADF Test Statistic	-5.539160	1% Critical Value*		-3.5267
		5% Critical Value		-2.9035
		10% Critical Value		-2.5889
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(L_EXCHRATE_DIF)				
Method: Least Squares				
Date: 06/28/01 Time: 02:52				
Sample(adjusted): 1995:04 2000:12				
Included observations: 69 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
L_EXCHRATE_DIF(-1)	-0.594665	0.107357	-5.539160	0.0000
D(L_EXCHRATE_DIF(-1))	0.359579	0.114752	3.133527	0.0026
C	0.022682	0.006459	3.511810	0.0008

Null hypothesis of unit-root is rejected at 1% significance level and the series is stationary (I(0)). The same results we get for the interest rate differential and again at 1% significance level.

Table 2 Unit-root test for nominal interest rate differential

ADF Test Statistic	-3.617141	1% Critical Value*		-3.5253
		5% Critical Value		-2.9029
		10% Critical Value		-2.5886
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(DIFD)				
Method: Least Squares				
Date: 06/28/01 Time: 02:57				
Sample(adjusted): 1995:03 2000:12				
Included observations: 70 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIFD(-1)	-0.218912	0.060521	-3.617141	0.0006
D(DIFD(-1))	0.462095	0.109592	4.216504	0.0001
C	0.006355	0.001894	3.354396	0.0013

It is interesting to note that change in exchange rate is stationary if we use Phillips-Perron, but the interest rate differential is not. The second series is stationary at 10% significance level for 1, 2, 3 and 4-truncation lag.

From change in exchange rate graph we see that there were times when exchange rate was very volatile. The periods that can be seen represent some shocks with unforeseeable size and apparition. They disturb exchange rate changes, but this thing has nothing to do with interest rate differential, which is the independent variable in the regression. As a result we have to take into consideration two dummy variable: **d97** for the shock from the first three months of 1997 and **d99** for the shock in the last two months of 1998 and first three of 1999.

The shocks are a result of price liberalization and foreign exchange market liberalization in early 1997 (for **d97**) and for the increased market pressure between September 1998 and June 1999 considering the appreciation of real exchange rate (starting since March 1997 until to September 1998) and high service of external debt in early 1999 (for **d99**).

Once the variables and error term fulfill condition to apply OLS, we estimate the equation:

$$s_{t+1} - s_t = \alpha + \beta\left(i_t - i_t^*\right) + \delta_1 \cdot d97 + \delta_2 \cdot d99 + \varepsilon_t \quad \textbf{Equation 5}$$

Basically, the constant term reflects the risk premium, but also and other factors like transaction costs. We say that UIP hold strictly if $\alpha = 0$ and $\beta = 1$.

The coefficients are statistically significant, including for both dummy variables (this justifies their role in the equation). An estimated $\beta < 0$ is a standard result in empirical literature of international finance and constitutes the "forward discount puzzle".

Table 3 UIP estimation

Dependent Variable: L_EXCHRATE_DIF				
Method: Least Squares				
Date: 07/04/01 Time: 20:04				
Sample(adjusted): 1995:02 2000:11				
Included observations: 70 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.071911	0.009911	7.255774	0.0000
DIFD	-1.679299	0.334462	-5.020892	0.0000
D97	0.236367	0.018631	12.68695	0.0000
D99	0.068999	0.013421	5.141064	0.0000
R-squared	0.724832	Mean dependent var		0.037837
Adjusted R-squared	0.712324	S.D. dependent var		0.052703
S.E. of regression	0.028268	Akaike info criterion		-4.238751
Sum squared resid	0.052738	Schwarz criterion		-4.110265
Log likelihood	152.3563	F-statistic		57.95119
Durbin-Watson stat	2.000283	Prob(F-statistic)		0.000000

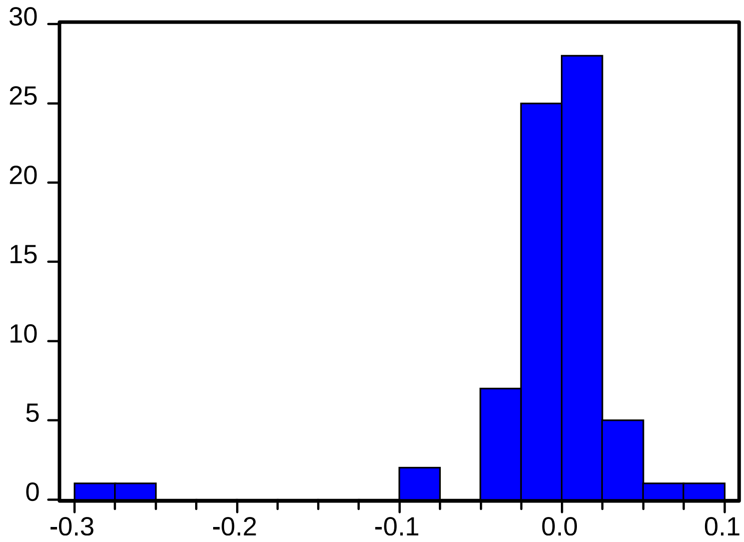
In case of Romania, the estimated β is negative (β=-1,67), but statistic significant. This means that UIP doesn't hold.

Estimated α is very low (α=0,0719) and indicates the risk premium, transaction costs or irrational expectations. The hypothesis α=0 with a Wald test is rejected decisively. This could be seen in figure 5 where we see a negative correlation between change in the log of exchange rate and interest differential.

We could test if UIP works with a very simple test. We test whether the sample mean of ω_t (derivations from UIP) is statistically different from zero. To see whether ω_t fluctuates around a mean or drifts boundlessly we test for stationarity with ADF and PP.

We write ex post deviations from UIP (in rational expectations hypothesis) as follows:

$$\omega_t = i_t - i_t^* + s_t - s_{t+1}$$ **Equation 6**



Series: DEVIATION01	
Sample 1995:02 2000:12	
Observations 71	
Mean	-0.008510
Median	-0.000495
Maximum	0.098154
Minimum	-0.283265
Std. Dev.	0.052682
Skewness	-3.437390
Kurtosis	18.26626
Jarque-Bera	829.2841
Probability	0.000000

If UIP holds strictly, then E(ω)=0 in the hypothesis of perfect capital mobility. Table 3 suggests that UIP works in two senses. First, the mean of ω is not statistically different from zero and the *t*-ratio (the mean of ω dividend by it's standard deviation) is very low (t=-0,1615). Second, ω is stationary (at 1% significance level for both tests). This finding is especially striking in light of wide use of capital controls in case of Romania (this finding suggest that, to control rates of return, capital controls are ineffective).

Why do deviations occur?

Obviously we ask ourselves which are the reasons for UIP deviations in case of Romania. In what follows I'll try to give some plausible explanations.

UIP equation can be written in terms of the real interest rate differential and real exchange rate growth.

$$s_{t+1}^{\ e} - s_t = \ln\left(\frac{(1+r_t)\cdot(1+\pi_t^{\ e})}{(1+r_t^{\ *})\cdot(1+\pi_t^{\ e*})}\right) \quad \textbf{Equation 7}$$

where $\pi_t^{\ e}$ and $\pi_t^{\ e*}$ are expected inflation rate in Romania and USA, respectively. The corresponding ex post deviation from PPP is:

$$\omega_t = rd_t + \Delta q_t \quad \textbf{Equation 8}$$

where $rd_t = r_t - r_t^{\ *}$ is the real interest rate differential and . $q_t = s_t - p_t + p_t^{\ *}$ is the logarithm of the real exchange rate and $\Delta q_t = q_{t+1} - q_t$ is its growth rate. Thus, expression (7) shows that the deviation from UIP equals the real interest rate differential plus the logarithmic change in the real exchange rate. Fama (1984) suggested that deviation from UIP ($\omega_t = 0$) represent either a risk premium (as measured by the real interest differential) or an unexpected change in the real exchange rate.

To formalize this idea we will decompose real exchange rate growth into anticipated and unanticipated components. Taking an atheoretical approach, market participants may estimate a regression like:

$$q_{t+1} = \gamma_0 + \gamma_1 \cdot q_t + \gamma_i \cdot Z_t + \varepsilon_t \quad \textbf{Equation 9}$$

where Z_t is a matrix with variable known at or before time *t*, γ_i is a vector with coefficients and ε_t error term. I included in Z_t inflation differential, interest rate differential and nominal exchange rate changes.

For $\gamma_1 = 1$ I estimated:

$$\Delta q_t = \gamma_0 + \gamma_i \cdot Z_t + \varepsilon_t \quad \textbf{Equation 10}$$

to see the effect of current information dataset on Δq.

Table 4 Estimation of real exchange rate

Dependent Variable: L_EXCHRATE_REALD
Method: Least Squares
Date: 06/29/01 Time: 00:44
Sample(adjusted): 1995:02 2000:12
Included observations: 71 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002365	0.000923	-2.562331	0.0127
DIFD	-0.005104	0.034512	-0.147897	0.8829
DIF_INFL	-0.880121	0.010539	-83.51211	0.0000
L_EXCHRATE_DIF	0.986210	0.007002	140.8413	0.0000

R-squared	0.997200	Mean dependent var	0.001389
Adjusted R-squared	0.997075	S.D. dependent var	0.046291
S.E. of regression	0.002504	Akaike info criterion	-9.087498
Sum squared resid	0.000420	Schwarz criterion	-8.960023
Log likelihood	326.6062	F-statistic	7954.866
Durbin-Watson stat	2.208492	Prob(F-statistic)	0.000000

The conclusion is that real exchange rate change is not a random walk. The test reveals that UIP deviations are predictable, but doesn’t show how important is the predictable component.

Tanner (1998) decomposes ex post deviations from UIP further into anticipated and unanticipated components of real exchange rate growth: $\varepsilon_t = \Delta q_t - \gamma_0 - \gamma_i \cdot Z_t$ and $\theta_t = \gamma_0 + \gamma_i \cdot Z_t$ ($\Delta q_t = \varepsilon_t + \theta_t$)

Because of the high inflation in Romania, the approximation $\ln(1+x) = x$ leads to loss of information so we computed a new series for ω which has a variance of 0.0035.

Table 5 Sources of variances in UIP deviations

Variance				Var(.) as part of $\mathrm{var}(\omega)$				
$\mathrm{var}(\omega)$	$\mathrm{var}(rd)$	$\mathrm{var}(\varepsilon)$	$\mathrm{var}(\theta)$	$\mathrm{var}(rd)$	$\mathrm{var}(\varepsilon)$	$\mathrm{var}(\theta)$	$\mathrm{cov}(rd,\varepsilon)$	$\mathrm{cov}(rd,\theta)$
0.00359	0.000994	0.000006	0.0021	0.277	0.00164	0.5868	0.00177	0.12

What we see in table (4) is that the variation in real exchange growth (anticipated and unanticipated) accounts for nearly 60% of $\mathrm{var}(\omega)$, while $\mathrm{var}(rd)$ accounts for 27.7%. However, the anticipated component alone accounts for 58.6%.

Joint tests of three parity conditions

The joint test refers to UIP, PPP and RIP. The test consists of parameter restrictions based on knowing that risk premia only affect nominal and real interest rate differential, but not inflation differential, while systematic forecast errors of exchange rate only affect nominal interest differential and inflation differential, but not real interest differential.

The system that connects deviations from parity conditions to the current information set (I included here interest rate differential and inflation differential) is as follows:

$$i_t - i_t^* - \Delta s_{t+1} = \gamma_0 + \gamma \cdot Z_t - u_{1t}$$ **Equation 11**

$$\Delta p_t - \Delta p_t^* - \Delta s_t = \lambda_0 + \lambda \cdot Z_t + u_{2t}$$ **Equation 12**

$$r_t - r_t^* = \varphi_0 + \varphi \cdot Z_t + u_{3t}$$ **Equation 13**

The three equations are linked by an identity so I tested jointly only two of them (results obtained are in Appendix).

I tested also cross equation restrictions and interpret them in terms of common factors that determine deviations from parity conditions.

Wald Test:
System: SYS01

Null Hypothesis:	C(2)=0		
Chi-square	30.41684	Probability	0.000000

Wald Test:
System: SYS01

Null Hypothesis:	C(2)=0		
Chi-square	30.41684	Probability	0.000000

Wald Test:
System: SYS01

Null Hypothesis:	C(6)=0		
Chi-square	265.1743	Probability	0.000000

My results are that there are no common factors to generate deviations from two parity conditions. I found evidence of systematic departures from all three parity condition and this is consistent with the coexistence of both foreign exchange risk premia and systematic forecast errors in the foreign exchange markets.

Conclusions

This paper examined one of the most basic statements in international finance, namely UIP. Its importance resides from the fact that UIP is a cornerstone in most exchange rate determination models.

The first conclusion that we can infer is that although the interest rate differential is large (Romania compared to USA) it does not necessarily lead to a an inflow of foreign investors who will always look first at the macroeconomic situation of the country. A rise in interest rates does not necessarily lead to a depreciation of the national currency because the NBR controls the evolution of the exchange rate and depreciated gradually in line with inflation. The evolution of the exchange rate is very important to Romania because a depreciation fulfills the inflationary expectations.

Being a fundamental idea the validity of UIP has been subject to large debates even during the most recent years. If UIP held monetary assets would keep their value during periods of exchange rates variation because the interest rate has a compensation effect. *Ex post* deviations from UIP show us what was better to borrow or to invest. If UIP deviations don't follow a random walk this could mean unexploited profit opportunities, but this explanation of the deviations isn't convincing.

In line with results of other studies UIP doesn't hold for Romania either. Besides all explanations given in the paper, which are well known we must take into account for Romania, that the capital markets aren't fully integrated with the internationals ones and there are bounds imposed to natural and legal persons regarding their investments in other countries. The capital account isn't fully liberalized meaning that there are allowed only transactions that correspond to a real economic activity such as imports of goods and services. while the free movement of capital overseas isn't permitted yet.

By decomposing the variances of deviations from UIP I showed which is the main component of these deviations: the variance of the real exchange rate; the risk premium bears an important influence too. A significant result is the much higher importance of the expected variations as opposed to unexpected ones in explaining the deviations, a problem which still remains open for debate. In the case of developed countries deviations from UIP are explained to a great extent by the unforcasted variances of the real exchange rate, while for Romania the interest rate differential is very significant. This fact is due to the high variance of inflation in Romania, but can be attributed to the restrictions regarding the movement of capital, the higher risk that foreign investors faces or to all these factors.

The simultaneous testing of the parity conditions UIP, PPP, RIP showed that for Romania it is impossible to attribute the deviations from UIP only to the risk premium or forecast errors. The results strongly suggests that both factors are present on the foreign exchange market. The study showed that if both factors are important (both the risk premium and the forecast errors), then the cross coefficient restrictions are rejected. Since the cross coefficient restrictions are rejected it means that deviations from the parity conditions are related to the variables that belong to the current set of information (the interest differential and the inflation differential).

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Appendix

Dependent Variable: DEVIATION01
Method: Least Squares
Date: 07/05/01 Time: 13:58
Sample(adjusted): 1995:02 2000:12
Included observations: 71 after adjusting endpoints
DEVIATION01=C(1)+C(2)*DIF_INFL+C(2)*DIFD+ C(7)*D97+C(8)*D99

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.038697	0.008450	-4.579408	0.0000
C(2)	0.707907	0.128357	5.515147	0.0000
C(7)	-0.314968	0.032576	-9.668771	0.0000
C(8)	-0.053372	0.015227	-3.505002	0.0008

R-squared	0.631657	Mean dependent var	-0.008510
Adjusted R-squared	0.615164	S.D. dependent var	0.052682
S.E. of regression	0.032681	Akaike info criterion	-3.949341
Sum squared resid	0.071560	Schwarz criterion	-3.821866
Log likelihood	144.2016	F-statistic	38.29858
Durbin-Watson stat	1.589725	Prob(F-statistic)	0.000000

Dependent Variable: L_CPICUM_DIF-L_CPICUMUSA_DIF-
L_EXCHRATE_DIF
Method: Least Squares
Date: 07/05/01 Time: 13:59
Sample(adjusted): 1995:02 2000:12
Included observations: 71 after adjusting endpoints
L_CPICUM_DIF - L_CPICUMUSA_DIF -
L_EXCHRATE_DIF=C(3)+C(4)*DIF_INFL+C(4)*DIFD

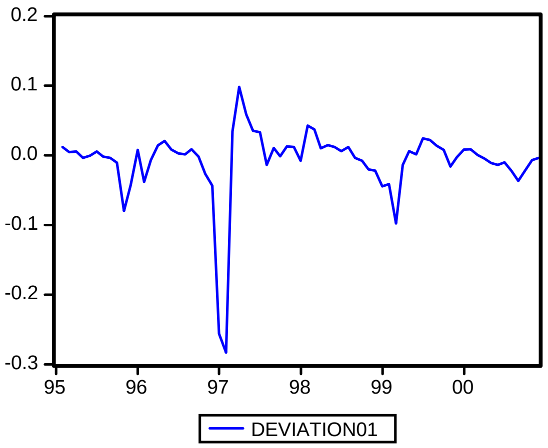
	Coefficient	Std. Error	t-Statistic	Prob.
C(3)	-0.020429	0.008650	-2.361830	0.0210
C(4)	0.285242	0.102990	2.769599	0.0072

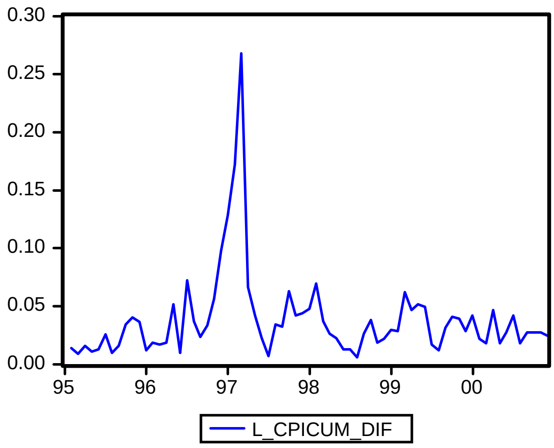
R-squared	0.100047	Mean dependent var	-0.001389
Adjusted R-squared	0.087004	S.D. dependent var	0.046291
S.E. of regression	0.044232	Akaike info criterion	-3.370986
Sum squared resid	0.134994	Schwarz criterion	-3.307249
Log likelihood	121.6700	F-statistic	7.670681
Durbin-Watson stat	1.399714	Prob(F-statistic)	0.007204

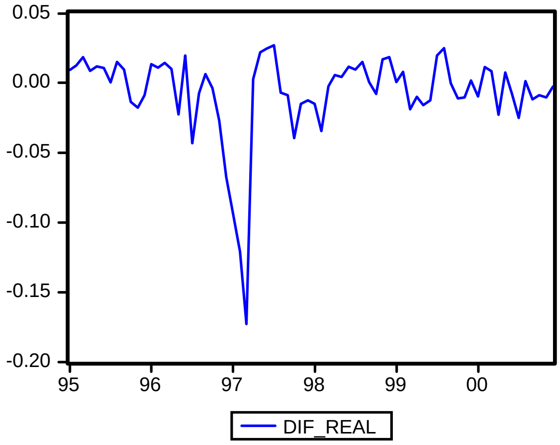
Dependent Variable: DIF_REAL
Method: Least Squares
Date: 07/05/01 Time: 13:39
Sample: 1995:01 2000:12
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003694	0.000849	-4.349817	0.0000
DIF_INFL	-0.854752	0.008626	-99.09160	0.0000
DIFD	0.986914	0.032670	30.20821	0.0000

R-squared	0.993885	Mean dependent var	-0.006997
Adjusted R-squared	0.993708	S.D. dependent var	0.031592
S.E. of regression	0.002506	Akaike info criterion	-9.099441
Sum squared resid	0.000433	Schwarz criterion	-9.004580
Log likelihood	330.5799	F-statistic	5607.141
Durbin-Watson stat	1.803577	Prob(F-statistic)	0.000000







System: SYS01
Estimation Method: Least Squares
Date: 07/05/01
Time: 13:29
Sample: 1995:01 2000:12

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.038697	0.008450	-4.579408	0.0000
C(2)	0.707907	0.128357	5.515147	0.0000
C(7)	-0.314968	0.032576	-9.668771	0.0000
C(8)	-0.053372	0.015227	-3.505002	0.0006
C(5)	0.029584	0.002825	10.47084	0.0000
C(6)	-0.550574	0.033810	-16.28417	0.0000
Determinant residual covariance		1.44E-07		

Equation: DEVIATION01=C(1)+C(2)*DIF_INFL+C(2)*DIFD+C(7)*D97+C(8)*D99
Observations: 71

R-squared	0.631657	Mean dependent var	-0.008510
Adjusted R-squared	0.615164	S.D. dependent var	0.052682
S.E. of regression	0.032681	Sum squared resid	0.071560
Durbin-Watson stat	1.589725		

Equation: DIF_REAL=C(5)+C(6)*DIF_INFL+C(6)*DIFD
Observations: 72

R-squared	0.791153	Mean dependent var	-0.006997
Adjusted R-squared	0.788170	S.D. dependent var	0.031592
S.E. of regression	0.014540	Sum squared resid	0.014799
Durbin-Watson stat	0.606820		

System: SYS02
Estimation Method: Least Squares
Date: 07/05/01
Time: 13:30
Sample: 1995:01 2000:12

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.038697	0.008450	-4.579408	0.0000
C(2)	0.707907	0.128357	5.515147	0.0000
C(7)	-0.314968	0.032576	-9.668771	0.0000
C(8)	-0.053372	0.015227	-3.505002	0.0006
C(3)	-0.061555	0.007013	-8.776876	0.0000
C(4)	1.139478	0.106529	10.69640	0.0000
C(9)	-0.269374	0.027036	-9.963462	0.0000
C(10)	-0.064116	0.012638	-5.073396	0.0000
Determinant residual covariance		1.23E-07		

Equation: DEVIATION01=C(1)+C(2)*DIF_INFL+C(2)*DIFD+C(7)*D97+C(8)*D99
Observations: 71

R-squared	0.631657	Mean dependent var	-0.008510
Adjusted R-squared	0.615164	S.D. dependent var	0.052682
S.E. of regression	0.032681	Sum squared resid	0.071560
Durbin-Watson stat	1.589725		

Equation: L_CPICUM_DIF - L_CPICUMUSA_DIF - L_EXCHRATE_DIF=C(3)+C(4)*DIF_INFL +C(4)*DIFD+ C(9)*D97+C(10)*D99
Observations: 71

R-squared	0.671394	Mean dependent var	-0.001389
Adjusted R-squared	0.656681	S.D. dependent var	0.046291
S.E. of regression	0.027124	Sum squared resid	0.049291
Durbin-Watson stat	1.909253		

System: SYS03
Estimation Method: Least Squares
Date: 07/05/01
Time: 13:32
Sample: 1995:01 2000:12

	Coefficient	Std. Error	t-Statistic	Prob.
C(3)	-0.061555	0.007013	-8.776876	0.0000
C(4)	1.139478	0.106529	10.69640	0.0000
C(9)	-0.269374	0.027036	-9.963462	0.0000
C(10)	-0.064116	0.012638	-5.073396	0.0000
C(5)	0.029584	0.002825	10.47084	0.0000
C(6)	-0.550574	0.033810	-16.28417	0.0000

Determinant residual covariance 1.37E-07

Equation: L_CPICUM_DIF - L_CPICUMUSA_DIF - L_EXCHRATE_DIF=C(3)+C(4)*DIF_INFL
+C(4)*DIFD+ C(9)*D97+C(10)*D99
Observations: 71

R-squared	0.671394	Mean dependent var	-0.001389
Adjusted R-squared	0.656681	S.D. dependent var	0.046291
S.E. of regression	0.027124	Sum squared resid	0.049291
Durbin-Watson stat	1.909253		

Equation: DIF_REAL=C(5)+C(6)*DIF_INFL+C(6)*DIFD
Observations: 72

R-squared	0.791153	Mean dependent var	-0.006997
Adjusted R-squared	0.788170	S.D. dependent var	0.031592
S.E. of regression	0.014540	Sum squared resid	0.014799
Durbin-Watson stat	0.606820		