The impact of the financial crisis on the interbank money markets behavior. Evidence from several CEE transition economies

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The impact of the financial crisis on the interbank money markets behavior. Evidence from several CEE transition economies[1]

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Abstract
The liquidity problems that appeared on the interbank money markets during the financial crisis caused an increased volatility of the interbank interest rates, especially after September 2008. Banking institutions from the Euro zone have avoided the mutual funding, which resulted in a reduction of the interbank interest rates due to the excess liquidity on the interbank money markets. In these conditions we want to analyze the behavior of interbank interest rates for several CEE transition countries, responding to the following question: will they return to the long run equilibrium or will they follow a random walk? In our research we deal with unit root tests taking into consideration structural breaks and the persistence of the volatility. We also examine the long run equilibrium between the term structures of interest rates appealing at the cointegration analysis and proposing some Vector Autoregressive models. Finally, we assess the cointegration between the interbank money markets from Euro zone, Bulgaria, Czech Republic, Hungary, Poland and Romania and propose some volatility transmission models.

Keywords: interbank interest rates, volatility, cointegration, structural breaks, persistence
JEL codes: E43, E47, C13, C32, C52

1. Introduction

The launch of the euro and the transformation of the national money markets into a single market has offered many benefits to the European interbank markets, but also a risky framework which can affect the stability of the banking system. In this situation the ability of the national central banks in the Euro zone to conduct independent monetary policies is no longer possible. The liquidity problems that appeared on the interbank money markets during the financial crisis caused an increased volatility of the interbank interest rates, especially after September 2008. Banking institutions from the Euro zone have avoided the mutual funding, which resulted in a reduction of the interbank interest rates due to the excess liquidity on the interbank money markets. According with to Fecht, Grüner and Hartmann (2007) banks contribute to inter-regional risk sharing. They suggest that the risk sharing through secured and unsecured interbank trading depends on the size of the interbank market, because each banks' incentives to reveal liquidity shocks decrease as its own contribution to aggregate

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liquidity becomes smaller. Due to their role in the implementation of the monetary policy, overnight rates are an anchor for the term structure of interest rate. Using LIBOR for several currencies, Kotomin et al. (2008) highlighted that the liquidity preference at the end of the year or trimester is the main factor that drives the interest rates' behavior on short term. The calendar effects on EONIA (the overnight interbank offered rate in the Euro zone) have also been studied by Benito et al. (2005), Linzert (2007) and Fecht et al. (2007) which signaled the presence of a sharpen volatility at the end of month or trimester due to an increased demand of liquidity from the banks in order to transfer money to clients or other financial institutions. Koukouritakis (2009) investigated the term structure of interest rates in four CE countries that are EU members: the Czech Republic, Hungary, Poland and Slovakia, in 1996-2005 periods. Using the two-break minimum LM unit root test, Lee and Strazicich (2003) found that that all interest rates are non stationary and allow for two structural breaks, which occurred during the transition period of these countries from centrally planned economies to full EU members. Cerrato et al. (2010) found that the Euro zone monetary policy is transmitted into CEE interest rates. They developed a framework that accounts for the influence of global monetary shocks in order to assess the effects of the financial crisis on monetary integration in Europe. Nautz and Offermanns (2008) have analyzed the transmission of volatility on the European money market, from EONIA to the long term interest rates in 2004-2006 periods, finding that the new Basel framework has reduced the volatility. Also the ECB's monetary policy is affected by the expectations regarding the term structure of interest rates and by its new monetary policy framework.

In these conditions we want to analyze the behavior of interbank interest rates for several CEE transition countries and to examine the long run equilibrium between the term structures of interest rates appealing at the cointegration analysis and propose some Vector Autoregressive models. Finally, we assess the cointegration between the interbank money markets from Euro zone, Bulgaria, Czech Republic, Hungary, Poland and Romania and propose some volatility transmission models. The paper is organized as follows. Section 2 discusses the presence of structural breaks, long memory and persistence in the selected CEE overnight interbank money market rates. Section 3 outlines the long run equilibrium between the term structures of interbank money market rates. In section 4 we assess the cointegration between the interbank money markets from the CEE transition economies and propose some volatility transmission models. Section 5 concludes.

2. Structural breaks and persistence in the interbank money market rates

We have analyzed some overnight interbank offered rates for several CEE economies in comparison with EONIA (the overnight interbank offered rate in the Euro zone, published by ECB) in the period 2005-2010. The monthly rates are: SOFIBOR for Bulgaria, PRIBOR for Czech Republic, BUBOR for Hungary, WIBOR for Poland and ROBOR for Romanian interbank money market (the rates were extracted from the national banks' websites of each country). Some of them have registered an increased volatility during this period, especially BUBOR and ROBOR which have the highest standard deviation from the mean. The descriptive statistics are presented Table 1.

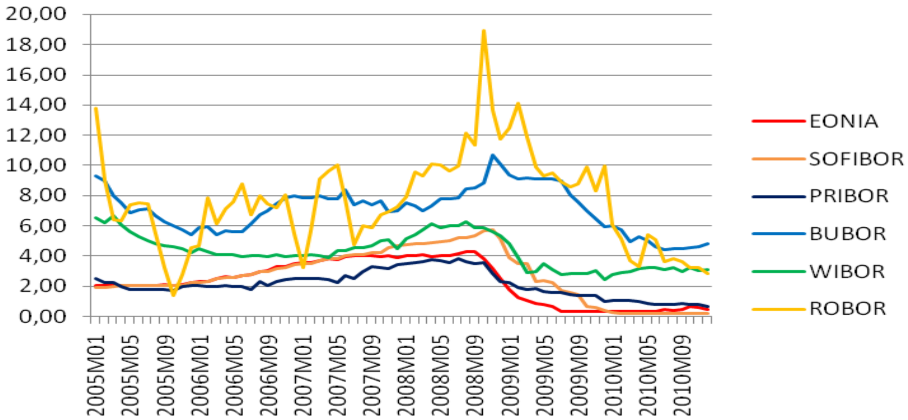
Table 1: Descriptive statistics of the overnight interbank offered rates

Moments	EONIA	SOFIBOR	PRIBOR	BUBOR	WIBOR	ROBOR
Mean	2.300833	2.697917	2.112639	7.089167	4.309306	7.582222
Median	2.305000	2.520000	1.995000	7.335000	4.105000	7.485000
Maximum	4.300000	5.770000	3.800000	10.71000	6.630000	18.89000
Minimum	0.340000	0.170000	0.650000	4.390000	2.460000	1.360000
Standard Deviation	1.415200	1.683404	0.876620	1.512115	1.107284	3.189002
Skewness	-0.137112	-0.013622	0.271541	-0.009865	0.294906	0.623890
Kurtosis	1.561073	1.961559	2.232318	2.325353	2.048097	3.963454

Source: authors' calculations

The level of ROBOR in October 2008 after the Lehman Brother collapse, when it reached a peak of 49.81%, was determined by the lack of liquidity on the Romanian interbank money market. After October 2008 we can see a downward trend (Figure 1) of the interest rates, following EONIA, because banking institutions from the Euro zone have avoided the mutual funding, which resulted in a reduction of the interbank interest rates due to the excess liquidity on the interbank money markets.

Figure 1: Overnight interbank offered rates from several CEE countries



Source: authors' calculations

In order to see if the overnight rates return to the long run mean or if they follow a random walk we have applied the unit root test ADF (Dickey and Fuller, 1979) and the stationarity test KPSS (Kwiatkowski, Phillips, Schmidt and Shin, 1992). If interest rates have a unit root, then an innovation would be permanent to them and its consequences can't be eliminated in time. Regarding the ADF test, with the exception of SOFIBOR which should be differenced two times in order to become stationary, all other rates are integrated by order 1, which means that they have a unit root in their levels (Table 2). The results of KPSS test, which is less restrictive, are in contradiction with ADF for SOFIBOR, BUBOR and ROBOR, showing that the rates aren't stationary at the first order difference. This contradiction highlights the possibility of fractional integration because of the long memory which is present in rates, result found also by Cassola and Morana (2009). Applying fractional integrated techniques they showed that the order of integration around 0.25 is appropriate for several European interbank rates.

Table 2: Testing the stationarity for the overnight interbank offered rates

Overnight rates	Test	ADF[a] (level)	ADF (I diff)	KPSS[b] (level)	KPSS (I diff)
EONIA	c,t	-1.799401	-3.448361*	0.241378***	0.107797
SOFIBOR	c	-1.460732	-2.324083	0.325234	0.369695*
PRIBOR	c	-1.227390	-2.799066*	0.344537*	0.231608
BUBOR	c,t	-1.250651	-7.045669***	0.168089**	0.146397**
WIBOR	c,t	-1.670028	-7.300722***	0.121849*	0.118494
ROBOR	c,t	-2.814047	-9.277568***	0.167756**	0.131738*

*** H_0 is rejected at 1%; ** H_0 is rejected at 5%; * H_0 is rejected at 10%;

(c) test with constant; (c,t) test with constant and trend;

[a] ADF Test, H_0: the series has a unit root; H_1: the series is stationary; the lag length was choosen in respect to the Schwartz information criterion; the critical values for the test with constant and trend are: -4.09 (1%), -3.47 (5%) and -3.16 (10%); the critical values for the test with constant are: -3.53 (1%), -2.90 (5%) şi -2.58 (10%);

[b] KPSS Test, H_0: the series is stationary; H_1: the series has a unit root; the band witdh was choosen in respect with the Newey-West criterion using Kernell estimator; the critical values for the test with constant and trend are: 0.21 (1%), 0.14 (5%) and 0.11 (10%); the critical values for the test with constant are: 0.34 (1%), 0.46 (5%) and 0.73 (10%);

Source: authors' calculations

Taking into account the extreme volatilities registered on the interbank money markets in the last years we wanted to see if there is any structural break within the overnight interest rates. A structural break appears when the parameters that characterize a series are unstable in time, due to the influence of the extreme events. Applying the model C of Zivot-Andrews test (1992), which detects the presence of a structural break in constant and in trend; we found that its values are statistically significant for almost all rates, with the exception of SOFIBOR. The structural breaks for these rates were detected at the beginning of the financial crisis.

Table 3: Detecting structural breaks with Zivot-Andrews[#] test

Overnight rates	Structural break	Observation	Test value
EONIA	2008M10	46	-5.42667**
SOFIBOR	2007M08	34	-4.86113
PRIBOR	2008M10	46	-10.6220***
BUBOR	2008M07	55	-8.25212***
WIBOR	2008M08	44	-9.22353***
ROBOR	2008M10	46	-8.20196***

*** H_0 is rejected at 1% significance level (critical value: -5,57);

** H_0 is rejected at 5% significance level (critical value: -5,08);

\# Zivot Andrews test has the null hypothesis H_0: the series has a unit root without a structural break and H_1: the series has a structural break (in constant and trend for model C).

Source: authors' calculations

Another objective of our analysis is to identify possible dependences in the long run fluctuations of interest rates, in order to see the impact of monetary policy decisions on overnight interest rates. Through a correct anticipation of the market needs, central banks could assure an efficient management and the deviations of the interbank rates from the monetary policy rate could be reduced. But, if the volatility of interest rates is persistent in time, the shocks that appear on the market would decrease the influence of the central banks. To detect the persistence of interest rates we have applied the Hurst exponent and the GPH method (Gewake and Porter Hudak, 1983) for the entire period, as well as before and after the structural breaks. The results are presented in Table 4.

Table 4: Testing the persistence of the overnight interbank offered rates

Overnight rates	***All period***		***Before the structural break***		***After the structural break***	
	Hurst Exponent[a]	$\hat{d}$ (GPH[b] method)	Hurst Exponent[a]	$\hat{d}$ (GPH[b] method)	Hurst Exponent[a]	$\hat{d}$ (GPH[b] method)
EONIA	0.95348	0.98797 (0.28186)	0.84756	0.50899 (0.36676)	0.73800	0.40874 (0.27865)
SOFIBOR	0.91650	0.58458 (0.15635)	0.76774	1.02325 (0.32235)	0.84213	0.99847 (0.28872)
PRIBOR	0.81715	0.49813 (0.39465)	0.76750	-0.11202 (0.24708)	0.84634	-0.04038 (0.20916)
BUBOR	0.72534	0.74042 (0.46082)	0.81954	0.45099 (0.35802)	0.88162	0.68737 (0.27246)
WIBOR	0.83668	0.37020 (0.27580)	0.77215	0.60286 (0.21419)	0.78121	0.25769 (0.43860)
ROBOR	0.75150	0.06579 (0.23468)	0.84317	-0.57075 (0.21867)	0.83035	-0.11987 (0.42432)

() standard deviation in paranthesis;

[a] Hurst Exponent is calculated using R/S statistic; 0.5 indicates a random walk; if $0 \leq H < 0.5$ the series is antipersistent; if $0.5 < H \leq 1$ the series is persistent;

[b] GPH method test the null hypothesis H_0: d=0 (random walk) versus H_1: d>0 or d<0; if H_0 is rejected and $-0.5<d<0$ the series is antipersistent; if $0<d<0.5$ the series has long memory and if $0.5<d<1$ the series is stationary in the mean.

Source: authors' calculations

The Hurst exponent (whose values are between 0.5 and 1) indicate the presence of long memory in the interest rates series for all periods. The results of GPH method are very different, indicating the persistent behavior for PRIBOR, WIBOR and ROBOR for the entire period. Before the structural break PRIBOR and ROBOR are antipersistent and BUBOR presents long memory. After the structural break PRIBOR and ROBOR are still antipersistent and WIBOR and EONIA have long memory.

3. The long run equilibrium between the term structures of interbank money market rates

Another point which we want to explore is the volatility transmission from the overnight market to the l mouth and 3 mouth money markets. The term structure of interest rates is one of the main economics principles that govern the monetary policy transmission mechanism. Each central bank conduct the monetary policy by adjusting the short term rate, but its efficiency depends on the possibility to influence the long term rates. Even though the overnight rates and the 1 month, respectively the 3 month rates aren't stationary, they could have an equilibrium relationship on the long term, in which case it is said that the rates are cointegrated (Johansen, 1990). The deviations from the long run equilibrium relationship are just temporary. In order to test cointegration between the overnight rates and the 1 month, respectively 3 month rates we applied Gregory-Hansen methodology (1996) that tests the cointegration between variables in the presence of a structural break in the cointegrating relationship. We found that the results are statistically significant for almost all rates. The null hypothesis of no cointegration isn't rejected just for SOFIBOR, the other overnight rates are all cointegrated with the 1 month and 3 month counterparties, in the presence of a structural break in the cointegrating relationship. The majority of structural breaks appeared at the beginning of the financial crisis. (Table 5).

Table 5: Gregory-Hansen cointegration test between overnight interest rates and 1 month interest rates/3 month interest rates

Cointegration (overnight rate; 1 month rate)	***Moment of break***	***t statistic***	***Cointegration (overnight rate; 3 month rate)***	***Moment of break***	***t statistic***
EONIA	2008M09	-7.32877***	EONIA	2008M09	-8.21764***
SOFIBOR	2007M10	-3.31736	SOFIBOR	2008M01	-3.33876
PRIBOR	2008M10	-7.32877***	PRIBOR	2008M10	-6.31415***
BUBOR	2006M12	-7.09689***	BUBOR	2008M09	-7.12127***
WIBOR	2008M10	-7.07357***	WIBOR	2010M02	-5.95664***
ROBOR	2007M02	-5.23308**	ROBOR	2006M03	-4.75943*

*** H_0 is rejected at 1%; ** H_0 is rejected at 5%; * H_0 is rejected at 10%;

Gregory-Hansen (the model with structural break in constant and trend) tests H_0: the series aren't cointegrated versus H_1: the series are cointegrated in the presence of a structural break.

The critical values of the test are: -5,45 (1%), -4,99 (5%) şi -4,72 (10%).

Source: authors' calculations

The cointegrating relationship between variables could be described by VAR models (Vector Autoregressive), which explain the behavior of a variable as a function of its past values and the past values of other variables. In accordance with the Schwartz and Hannan-Quinn information criterions we have estimated a VAR model for each pair of rates (the number of lags were chosen in order to minimize the criterions). The results from Table 6 reveal a positive relation between the 1 month interest rate and the corresponding overnight rate. For EONIA, PRIBOR and BUBOR the coefficients of the overnight rates are greater than 1, which means that an increase in the overnight rate will determine the 1 month rate to increase more, if the constant is zero. For SOFIBOR, WIBOR and ROBOR the situation is opposite. In order to see if the models are correctly specified we have conducted two residual diagnostic tests for serial correlation and autocorrelation. With the exception of SOFIBOR, for all long term relationships the correlation of the residuals has been removed.

Table 6: Long-run relationships between 1 month and overnight interbank offerd rates

Rates	VAR^a model	Normalized cointegrating relationship [IR_{1m}; ct; IR_{OVN}]			Portmanteau Autocorrelation Test		Autocorrelation LM test	
		IR_{1m}	ct	IR_{OVN}	Q(10)[b]	Q(20)	LM(10)[c]	LM(20)
EONIA	VAR(2)	1	-0.088818 (0.04486)	-1.036514 (0.01639)	39.07	68.42	10.36**	4.00
SOFIBOR	VAR(2)	1	-3.506404 (0.89868)	-0.040186 (0.29650)	57.12***	111.17***	14.41***	0.79
PRIBOR	VAR(2)	1	-0.061392 (0.10967)	-1.067327 (0.04713)	32.62	71.29	2.45	1.13
BUBOR	VAR(2)	1	-0.034874 (0.38456)	-1.059797 (0.05286)	31.68	84.02	3.60	3.49
WIBOR	VAR(2)	1	-1.855099 (0.46792)	-0.620907 (0.10574)	40.09	76.75	7.05	2.50
ROBOR	VAR(1)	1	-1.028846 (0.05577)	-0.849554 (0.05836)	28.31	55.73	1.96	1.01

*** H_0 is rejected at 1%; ** H_0 is rejected at 5%; * H_0 is rejected at 10%;
() standard errors in paranthesis;
[a] The number of lags used in the model was choosen in respect with Schwarz Criterion;
[b] Q(10) stands for the Ljung-Box statistic for the 10^{th} order serial correlation;
[c] LM(10) stands for Lagrange Multiplier statistic for the 10^{th} order autocorrelation.
Source: authors' calculations

Regarding the relationship between the overnight interest rates and the corresponding 3 month rates, Table 7 reveals a positive cointegrating relationship between almost all rates, with the exception of WIBOR, whose cointegrating coefficient is positive (this means that the relationship between rates is a negative one). An increase in the overnight rate of EONIA and PRIBOR will determine the corresponding 3 month rates to increase more and a decrease in the overnight rate will determine the 3 month rates to decrease more because the coefficient is greater than 1. In the case of SOFIBOR, BUBOR and ROBOR, an increase in the overnight rates will determine the corresponding 3 month rates to increase less. The residual test confirms the lack of autocorrelation, except for BUBOR.

Table 7: Long-run relationships between 3 month and overnight interbank offerd rates

Rates	VAR^a model	Normalized cointegrating relationship [IR_{3m}; ct; IR_{OVN}]			Portmanteau Autocorrelation Test		Autocorrelation LM test	
		IR_{3m}	ct	IR_{OVN}	Q(10)[b]	Q(20)	LM(10)[c]	LM(20)
EONIA	VAR(2)	1	-0.365743 (0.14634)	-1.012041 (0.05370)	44.10*	69.79	16.17***	3.10
SOFIBOR	VAR(2)	1	-4.372006 (0.66904)	-0.026537 (0.22412)	41.11	87.46	11.38**	2.54
PRIBOR	VAR(2)	1	-0.186775 (0.18764)	-1.091572 (0.08073)	47.66**	84.47	3.30	1.40
BUBOR	VAR(1)	1	-1.409265 (0.72852)	-0.899819 (0.10008)	54.86**	111.37***	8.07*	6.11
WIBOR	VAR(2)	1	-4.830015 (1.52552)	0.087618 (0.34474)	34.22	72.33	5.83	3.66
ROBOR	VAR(1)	1	-1.558025 (0.62539)	-0.964551 (0.07620)	29.95	62.76	2.32	0.25

*** H_0 is rejected at 1%; ** H_0 is rejected at 5%; * H_0 is rejected at 10%;
() standard errors in paranthesis;
[a] The number of lags used in the model was choosen in respect with Schwarz Criterion;
[b] Q(10) stands for the Ljung-Box statistic for the 10^{th} order serial correlation;
[c] LM(10) stands for Lagrange Multiplier statistic for the 10^{th} order autocorrelation.
Source: authors' calculations

4. Cointegration between the interbank money markets from the CEE economies and volatility transmission

In order to see if there are long run relationships between all overnight interest rates we have applied the Johansen cointegration technique (Johansen & Juselius, 1991) based on the maximum likelihood method. Using Trace and Maximum Eigenvalue statistics we have tested the number of cointegrating relationships, using two lags in order to minimize the Schwartz information criterion.

Table 8: Johansen Cointegration Test between the overnight interbank interest rates

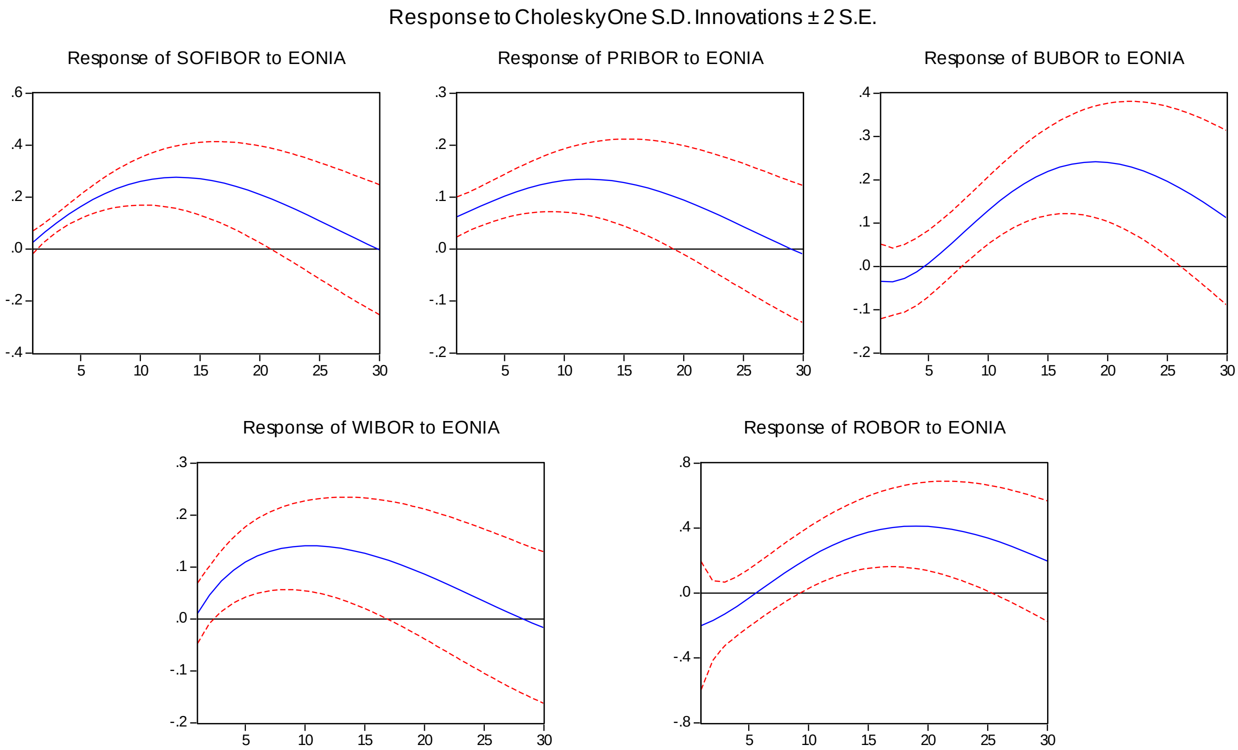
Hypothesis tested (number of cointegration relationships)	Trace Statistic[a]	Critical value (5%)	p-value[#]	Maximum Eigenvalue Statistic[b]	Critical value (5%)	p-value[#]
None *	152.9123***	95.75366	0.0000	60.62119***	40.07757	0.0001
At most 1 *	92.29113***	69.81889	0.0003	39.24255**	33.87687	0.0104
At most 2 *	53.04858**	47.85613	0.0150	24.09271	27.58434	0.1315
At most 3	28.95587*	29.79707	0.0623	18.64122	21.13162	0.1077
At most 4	10.31464	15.49471	0.2573	6.701825	14.26460	0.5250
At most 5	3.612817	3.841466	0.0573	3.612817	3.841466	0.0573

*** H_0 is rejected at 1%; ** H_0 is rejected at 5%; * H_0 is rejected at 10%; [#] critical values of MacKinnon-Haug-Michelis (1999); [a] Trace statistic tests H_0: number of cointegrating relationships $\leq$ r versus H_1: number of cointegrating relationships > r; [b] Maximum Eigenvalue statistic tests H_0: number of cointegrating relationships = r versus H_1: number of cointegrating relationships = r+1;

Source: authors' calculations

The results from Table 8 indicate three cointegrating relationship between the overnight interest rates, which means that there is a long run equilibrium between them and any deviation from these cointegrating relationships lasts only a short period.

Figure 2: Impulse-response functions between EONIA and the other interbank offered rates



Source: authors' calculations

Interesting to analyze is the impact that a unit shock to Eonia has on the volatility of the other overnight interest rates. Using impulse response functions based on Cholesky decomposition we could see that a shock to Eonia has a positive impact on the other rates especially in the next ten days, after which the impact dies away (Figure 2).

Aiming to propose some volatility transmission models on the interbank money markets for each country we appealed to the GARCH class. GARCH (Generalised Auto-Regressive Conditional Heteroscedasticity) models were proposed by Engle (2001) and introduced by Bollerslev (1986). They are used in predicting the financial markets evolutions and have many versions. It encompasses a broad class of models that estimate and predict the volatility and the correlations between different assets.

The GARCH (1,1) can be described as follows:

$$h_t^2 = c + \beta \cdot h_{t-1}^2 + \alpha \cdot X_{t-1}^2 \tag{1}$$

where h is the volatility, c, α and β are the predicted parameters. α and β show the persistence of the volatility. If the parameters are higher than the average volatility is also high.

The EGARCH (Exponential GARCH) considers the asymmetric effects of positive and negative values of variables and uses the recorded log values to relax the constraints on the coefficients. The formula for the Exponential GARCH model is:

$$\log h_t = = c + \beta \log h_{t-1} + \alpha \left[V_{t-1} + \gamma\{|V_{t-1}| - E|V_{t-1}|\}\right] \tag{2}$$

The results presented in Table 9 indicate that the volatility is persistent and the current information is relevant in predicting the future volatility. The largest value of Garch parameter appears at SOFIBOR and the lowest at WIBOR. According with Ljung-Box statistics the first order autocorrelation between residuals and between the standardized residuals has been removed for EONIA, PRIBOR, WIBOR and ROBOR. The first order heteroscedasticity have been eliminated for almost all rates with the exception of BUBOR.

Table 9: GARCH parameters and residual diagnostics

Rates	***EONIA***	***SOFIBOR***	***PRIBOR***	***BUBOR***	***WIBOR***	***ROBOR***
Model	***Egarch(1,1,1)***	***Egarch(1,1,1)***	***Garch(1,1)***	***Garch(1,1)***	***Garch(1,1)***	***Egarch(1,1,1)***
c	-3.386108 (0.916227)	-3.209861 (0.433841)	-0.046354 (0.015376)	4.912139 (0.021000)	0.869627 (0.017398)	-0.953108 (0.323653)
α	4.253297 (0.034545)	3.862252 (0.073730)	0.929180 (0.115298)	0.797198 (0.052888)	0.883177 (0.095942)	3.295188 (0.069721)
γ	-0.871546 (0.007085)	-0.723674 (0.014085)	-	-	-	-1.494800 (0.031695)
β	0.988346 (0.881298)	1.019620 (1.200683)	0.070144 (0.009985)	0.060102 (0.003203)	0.046361 (0.005704)	0.791403 (1.322397)
Q(10)[a]	14.705	32.960***	13.604	48.789***	12.273	5.84
$Q^2(10)$[b]	14.020	20.055***	14.217	44.758***	11.327	4.13
ARCH-LM(1)[c]	2.370	0.668	0.097	9.986***	0.311	0.148

*** H_0 is rejected at 1%; ** H_0 is rejected at 5%; * H_0 is rejected at 10%;

() standard errors in paranthesis;

[a] Q(10) stands for the Ljung-Box statistic for the 10th order serial correlation of residuals;

[b] Q(10) stands for the Ljung-Box statistic for the 10th order serial correlation of standardized residuals;

[c] ARCH-LM(1) stands for the first order heteroscedasticity.

Source: authors' calculations

5. Conclusion

Analyzing some overnight interbank offered rates form several CEE economies (SOFIBOR for Bulgaria, PRIBOR for Czech Republic, BUBOR for Hungary, WIBOR for Poland and ROBOR for Romania) in comparison with EONIA in the period 2005-2010 we have found an increased volatility after the beginning of financial crisis especially for BUBOR and ROBOR. Applying the Zivot-Andrews test we detected the presence of structural breaks at the beginning of financial crisis for almost all rates, with the exception of SOFIBOR. The rates also present long memory, according with the Hurst exponent. We also found long run equilibrium relationships between the overnight rates and the corresponding 1 month and 3 month rates. These are valid in the presence of a structural break in the contegrating relationship due to Gregory-Hansen test. Using impulse response functions based on Cholesky decomposition we have seen that a shock to Eonia has a positive impact on the other rates especially in the next ten days, after which the impact dies away.

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