TESTING THE EXPECTATIONS HYPOTHESIS IN THE ROMANIAN INTERBANK MONEY MARKET

by

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Abstract

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This thesis uses cointegration and vector error correction models in order to test the validity of the Expectations Hypothesis in the Romanian interbank money market in the period 2003-2012. The methodology involves tests of cointegration between the shortest and the longest money market rates and tests of cointegrating vector restrictions. Vector error correction models are estimated on the entire sample period 2003-2012, on the pre-EU accession (2003-2006) and post-EU accession (2007-2012) periods as well as on rolling subsamples in order to assess the stability of liquidity premia and cointegrating vector parameters.

The validity of the Expectations Hypothesis is supported by the empirical evidence during the post-EU accession period, associated with relatively stable liquidity premia. The hypothesis is rejected for the entire sample period 2003-2012 and for the period 2003-2006, associated with fluctuating liquidity premia. The data utilized in the research consists of daily interbank money market interest rates published by the National Bank of Romania.

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The author is also very grateful to his parentsfor their strong support and encouragement throughout his life.

LIST OF ABBREVIATIONS

EH. Expectations Hypothesis

ON. Overnight Interest Rate

Chapter 1

INTRODUCTION

The main idea of the proposed research is to test whether the expectations hypothesis (EH) of the term structure holds on the Romanian interbank money market. The expectations theory, which constitutes one of the main building blocks of financial and macroeconomic theory, assumes that long-term interest rates are merely averages of the expected short-term interest rates and risk premia are constant or unpredictable (Cochrane and Piazzesi, 2005) and forward rates are perfect predictors of future spot rates. In this thesis I will research whether the behavior of the Romanian interbank money market term structure is consistent with the expectations hypothesis.

Understanding the dynamics of the interest rates is an important issue in modern finance and macroeconomics. Interest rates are one of the main factors that determine the investment and savings decision of businesses and households, monetary policy and government borrowing policies. Therefore, term structure offers valuable information about the future stance of the economy (Ang et al., 2006). The yield curve is often used in the analysis of real economic activity (Anderson, 2006). The slope of the term structure is considered to be leading indicator for the phases of the business cycle (Estrella and Trubin, 2006). Namely, the "inverted shape" of the yield curve is considered to be a predictor of a future recession (Estrella and Mishkin, 1996).

Furthermore, the fact that the term structure of the interest rates is the central preoccupation of the central banks in most countries speaks for the importance of the topic. The models that are able to explain the behavior of the term structure of interest rates have implications for monetary policy, as they reveal the

interdependence of long-term interest rates that influence consumer decisions and consequently impact aggregate demand and short-term rates that are the object of monetary policy (Rudebusch and Wu, 2004). The most important objective of the monetary policy in most countries is to manipulate the long end of the yield curve, or long term interest rates. While long rates cannot be targeted directly, central banks perform open market operations to impact short term rates thereby influencing long term rates.

Another argument for the study of term structure of interest rates is the wide application of the term structure models in finance for derivatives pricing and risk management. The behavior of interest rates and the interrelationships between the interest rates of different maturities are studied by traders in order to identify and exploit the mispricing along the term structure of interest rates. In addition, the term structure of interest rates can influence the prices of other assets. For example, Campbell (1987) found that the shape of the term structure predicts the returns on the stock market.

Consequently, a plenty of research in financial economics has been devoted to the study how interest rates are formed and interrelated. Several theories of term structure of interest rates have been devised, the expectations hypothesis being the most widely accepted and consequently the most empirically tested. According to the expectations hypothesis, the information about market participant's expectations regarding future interest rates can be extracted from the current term structure and used to predict the dynamics of the interest rates (Russell, 1992). Thus, long-term rates constitute weighted averages of the expected future short-term rates and the movement of the short term rate (or more precisely the long-short spread) can perfectly predict changes in the term structure (Campbell and Shiller, 1991). The expectations hypothesis can be generalized by adding a risk premium for each maturity that should be constant in

time, this version sometimes being known as the liquidity preference hypothesis or the general version of the expectation hypothesis, as opposed to the 'pure' expectations hypothesis that ignores term premia.

The validation of the expectations hypothesis on the Romanian interbank money market would allow making conclusions about the way interest rates are established on the interbank market and about the dynamic relation between the interest rates of different maturities. If the expectations hypothesis is not rejected, the expectations of the future short term rates by market participants can be extracted from the term structure, as well as the information about future movements of the interest rates. Consequently, the validation of the expectations hypothesis could have deep implications for monetary policy and trading. The targeting of short term rates through open market operations in order to impact the long term rates is one of the transmission channels of the monetary policy. The invalidation of the expectations hypothesis would indicate that the long term rates are not formed as expected future short term rates and the central bank's ability to influence the long term rates, which are at the basis of investment decisions, is limited. Conversely, if the EH is not rejected, the National Bank of Romania could effectively influence the entire term structure by manipulating the short rate. In addition, the understanding of the theory behind the term structure would allow market participants to exploit mispricing.

The majority of the studies conducted on the US government bond market, such as the studies of Fama and Bliss (1987), Campbell and Shiller (1991), Bekaert et al. (1996) and others, reject the expectations hypothesis. The studies conducted on other markets, such as the ones conducted by Hardouvelis (1994), Cuthbertson and Bredin (2000), Lange (1999), Gerlach and Smets (1997) and Lopes et al. (2007) conducted for G7, Ireland, Canada, the Eurozone, and Portugal respectively, often reveal that the behavior of interest rates is sometimes

consistent with the expectations hypothesis. The results of the studies conducted in emerging economies are inconclusive. Among the studies that do not reject the expectations hypothesis are Elshareif and Tan (2010) and Ghazali and Low (2002) on the Malaysia government bond market and Buigut and Rao (2010) on the Hong Kong government bond market. Other studies, such as Mubin and Mahmood (2005) for Malaysia and Liau and Yang (2009) for Taiwan, reject the hypothesis. Thus, on the one hand, the evidence against the expectations hypothesis is stronger for the US market than for other developed and emerging countries and on the other hand, the validity of the hypothesis is country specific.

The number of studies of the expectations theory performed directly on Romanian money market is limited. The known studies were conducted by Koukouritakis (2005, 2008) and Stefan (2008). The study by Koukouritakis (2005) examines the dynamics of the interest rates of the countries that acceded to the EU in 2004 and of the two countries that at that time were planning to accede in 2007, focusing on the interdependence of their monetary policies. This research was extended by Koukouritakis (2008) through decomposition of the interest rate series and the examination of the interdependence of the term structures of the 12 new EU members. Stefan (2008) includes a test of the expectations hypothesis on the Romanian government bond market before 2008 using panel regression. The studies, except Koukouritakis (2008) reject the expectations hypothesis of the Romanian government bond term structure.

This thesis is meant to supplement the existing knowledge on the behavior of the Romanian term structure of interest rates. First, the proposed research will rely on the tests ofcointegration and of the restriction on the coefficients of the cointegrating vector, methodology derived straightly from the formulation of the expectations hypothesis. While this is the most traditional approach, there are no recent works that investigate the cointegration of Romanian interest rates.

Koukouritakis (2005, 2008) adopted a similar approach, nevertheless, focusing on the dependence of monetary policies and term structure movements of new EU members and candidates. Second, in the proposed research the cointegrating vector and the risk premium will be estimated for different time periods using a rolling VECM and by segmenting the sample explicitly in the pre-accession and post-accession periods. This procedure will allow the investigation of the stability of the liquidity premium in time, constituting a strong argument for the validation or for the invalidation of the expectations hypothesis even in case the rates turn to be cointegrated. Alternatively, even if the expectations hypothesis is not rejected for the whole sample, periodically the behavior of the interest rates may depart significantly from the predictions of the EH due to the changes in liquidity premiums. It should be noted that neither of the previous researches included an analysis of the time-variability of term premiums and of the cointegrating relationship. Third, the utilization of daily rates instead of monthly averages could yield different results that will shed some light on the short run dynamics of the term structure of interest rates. And fourth, the data period is extended significantly to 2003-2012, incorporating recent developments of the Romanian interbank market, which allows drawing conclusions about the contemporary characteristics of Romanian money market term structure and examine the behavior of the interest rates in the period right before and after EU accession. It is suspected that the EU accession increased the attractiveness of Romanian capital markets for domestic and international investors and the liquidity premiums are supposed to stabilize during 2007-2012. In addition, the research on the EH in the short end of the yield curve may have implications for the validity of the EH over the entire Romanian term structure of interest rates as in case the hypothesis is rejected for overnight and 12 month rates it cannot be expected that the EH holds for the long end (Longstaff, 2000). It should be also noted that the conclusions of the research for the Romanian interbank market

could be valid as well for countries with similar market structures and monetary regimes, namely Bulgaria and the Republic of Moldova.

The following Chapter presents a review of the literature on the topic and Chapter 3 describes the methodology and the data. Next, Chapter 4 provides the empirical results and Chapter 5 concludes and discusses the economic implications of the results.

Chapter 2

LITERATURE REVIEW

The two classical studies that stand at the base of the research of bond risk premia are the papers of Fama and Bliss (1987) and Campbell and Shiller (1991). According to Fama and Bliss (1987) the spreads between the long term and short term yields have significant predictive power for the risk premia of the long term bonds. Campbell and Shiller (1991) confirmed the results of Fama and Bliss (1987) concluding that future interest rate dynamics can be predicted using yield spreads. Both studies suggest that the bond risk premia exist and are time-varying and also predictable, the facts that invalidate the expectations hypothesis according to which the risk premia should be constant for each maturity (in the weak or generalized formulation). The approach of Fama and Bliss (1987) is a generalization of the approach of Fama (1984) and deals with the forecast performance of the forward rates for future interest rate movements,by regressing the difference between future and current spot rates on the difference between the implied forward rates and spot rates.

Campbell and Shiller, (1991) regressed the change in the interest rate for a given maturity on the long-short spread (a measure of the slope of the term structure) and found that interest rate movements can be predicted by the slope of the term structure. Campbell and Shiller (1991) also concluded that under expectations hypothesis in case of non-stationarity, the long and short rates are cointegrated with the vector (1;-1). This result implies that there exists a long-run relationship between the short and long rates and the short-long spread predicts the change in the short rate one-to-one. The existence of the long-run equilibrium would make the case for not rejecting the expectations hypothesis. Thus, the majority of models employed to test the expectations hypothesis are either single equation

tests that can be reduced to cointegrating equations or are testing cointegration directly and utilize restricted VAR (Campbell and Shiller, 1987) and VECM models: (Thornton, 2004), (Cuthbertson and Bredin,2000) and many others.

The majority of empirical studies, such as Fama (1984), Campbell and Shiller (1986, 1987, 1991), Campbell (1987),Shiller and McCulloch (1987), Froot (1989), Bekaert et al. (1996), Cochrane and Piazessi (2005), Thornton (2006), Tang and Xia (2008)and others reject the expectations hypothesis of term structure on the US government bond market. The existence and predictability of risk premia is the main evidence against the expectations hypothesis, despite the fact that "some studies suggest that the yield spread does predict interest rate movements in roughly the way one would expect if the expectations hypothesis was true" (Campbell and Shiller, 1991). Nevertheless, the approach of Campbell and Shiller (1991) exhibits a number of statistical and econometric problems, examined and partially resolved in Dai and Singleton (2004) and Thornton (2006).

The tests of the expectations hypothesis of the term structure, conducted on developed markets, such as Hardouvelis (1994), Cuthbertson and Bredin (2000), Lange (1999), Gerlach and Smets (1997), Jondeau and Ricart (1999), and Lopes et al. (2007) conducted using the cointegration approach, VECM and restricted VAR models, for G7, Ireland, Canada, the Eurozone, France and UK, and Portugal respectively, often find evidence in support of the expectations hypothesis in either strong or weak/asymptotic form (Lopes et al., 2007). The studies conducted on the government bond markets of emerging economies also frequently find evidence supporting the expectations hypothesis, but the results are often conflicting. Elshareif and Tan (2010) and Ghazali and Low (2002) utilize cointegration approach for Malaysian bond market data and Buigut and Rao (2010) utilize the Hong Kong bond data, the three studies confirming that the behavior of the interest rates is in line with the predictions of the expectations

hypothesis. Nevertheless, a number of other studies, such as Mubin and Mahmood (2005) for Malaysia and Liau and Yang (2009) for Taiwan, reject the hypothesis, making the evidence for the expectations hypothesis of the term structures in emerging markets inconclusive.

The behavior of the Romanian term structure of interest rates is an under-researched topic.The earliest test of the expectations hypothesis of the Romanian term structure was performed byKoukouritakis (2005). In this paper, the cointegration of long and short average monthly commercial bank lending rates was tested for the period of 1997-2003. Although, some weak evidence supporting the expectations hypothesis was obtained, the endogeneity of the short rate was rejected invalidating the expectations hypothesis of Romanian term structure. The study is focused mainly on the analysis of short and long run interdependence of the monetary policies and yield curve movements of new EU members and candidates. In the extension of this research (Koukouritakis, 2008) interest rate series were decomposed into long-run and transitory components and the interdependence of the term structures of the 12 new EU members was examined in detail. Koukouritakis (2008) does not reject the expectations hypothesis for Romania for the whole sample. The research of Stefan (2008) on the Romanian yield curve includes a test of the expectations hypothesis, but in a less traditional formulation. In addition, the test was performed on a mixture of primary and secondary market data of T-bill and money market rates. The results of a panel regression allow the rejection of the expectations hypothesis for the period of 2006-2008.

Thus, it can be concluded that the evidence for or against the expectations hypothesis of the Romanian term structure is weak and inconclusive. The tests of the restrictions on the cointegrating vector were not performed and the cointegrating relationship was not examined in dynamics. In addition, the time

period used in the previous research didn't allow capturing the post-EU accession developments, namely the possible stabilization of liquidity premia that could result from the increased attractiveness of the Romanian fixed income market for international and domestic investors. The proposed thesis will fill the existing gaps by performing comprehensive tests of the expectations hypothesis on the short end of the Romanian term structure of daily money market interest rates by testing the cointegration of the overnight and 12 month rates, the restrictions imposed by the EH on the cointegrating vector and the time-variability of the liquidity premiums.

Chapter 3

DATA DESCRIPTION

The research will be doneutilizing the data from the Romanian daily money market rates published by the National Bank of Romania for 2003-2012. The overnight (ON) rate will be utilized as the short rate and the 12 month (see Table 1) ratewill serve as the long rate as in (Elshareif and Tan, 2010) and (Buigut and Rao, 2010).

Table 1: Summary Statistics for the Romanian Money Market Interest Rates (January 2003-April 2012):

	Overnight Rate	12 Month Rate
Mean	8.662	11.180
Median	7.380	9.140
Maximum	28.500	51.970
Minimum	0.500	5.200
Std. Dev.	5.548	4.873
Skewness	0.609	1.238
Kurtosis	2.301	5.923
Sum	20599.38	26585.42
Observations	2378	2378

The short rate is ROBID overnight and the long rate is ROBOR 12 month rate. It does not make a difference for the analysis whether the two rates are from the same side of the market (both either ROBOR or ROBID) while the current combination allows the construction of the longest possible dataset and avoidance of issues with omitted observations (see Figure 1).

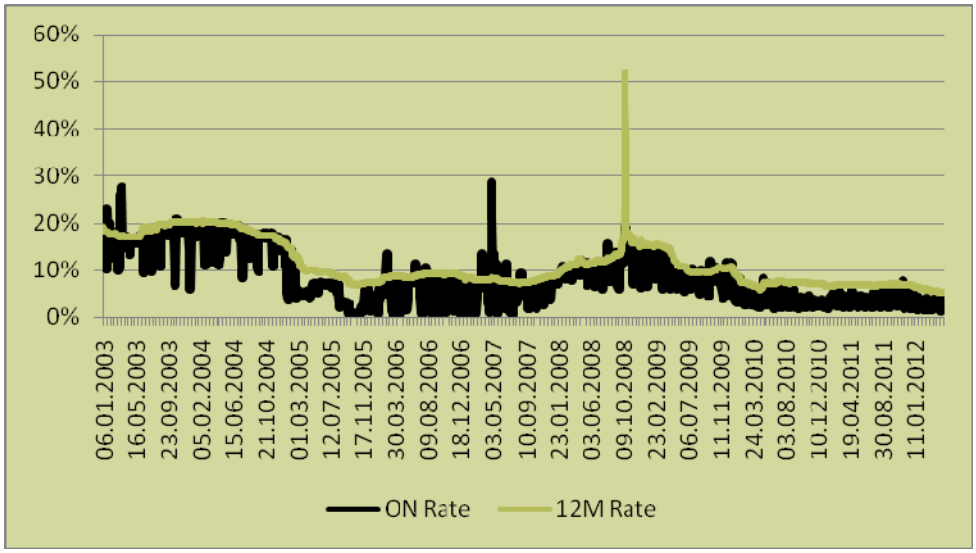


Figure 1: Overnight and 12 month interest rates on the Romanian interbank money market (January 2003-April 2012)

In the wake of the financial crisis in the middle of October 2008 the 12 month rate surged from 16% to 52% and returned back below 20% in 5 days. The overnight rate has a similar period of high volatility that lasted 3 days in April 2007. As the exclusion of the abnormally high rates from the series does not impact the results of the stationarity and cointegration tests, both periods were left in the sample.

Based on the two stationarity tests (see Table 2) it can be concluded that both interest rate series are non-stationary on the whole sample period 2003-2012.

Table 2: Augmented Dicky-Fuller and Kwiatkowski-Phillips-Schmidt-Shin stationarity tests for the yield time series[1]:

		2003-2012	
Options	Test	ADF	KPSS
Intercept	ON	-1.596	2.796***
	12M	-1.931	2.916***
Intercept and trend	ON	-2.081	0.527***
	12M	-2.886	0.571***
None	ON	-1.453	X
	12M	-1.439	X

Where the results of the ADF and KPSS test are conflicting, the KPSS test is preferred as a more powerful one.The tests deliver conflicting results on the two subsamples for the overnight rate, but as the KPSS test is always significant at 1% level, while the results of the ADF are borderline, the stationarity of the series is rejected. Thus, non-stationarity over the sample period 2003-2012 is safely assumed for cointegration testing purposes (see Table 3).

[1]The lags are automatically selected based on Schwarz Information Criterion; *-significant at 10% level, **-significant at 5% level, ***-significant at 1% level for KPSS and ***, **, * insignificant at the 10%, 5% and 1% level correspondingly for ADF

Table 3: ADF and KPSS stationarity tests-statistics for the yield time series in the two subsamples 2003-206 and 2007-2012[2]:

		2003-2006		2007-2012	
Options	Test	ADF	KPSS	ADF	KPSS
Intercept	ON	-2.876**	3.092***	-4.470	2.066***
	12M	-0.328	3.402***	-2.848*	1.483***
Intercept and trend	ON	-6.832**	0.426***	-6.369***	0.658***
	12M	-0.643	0.486***	-3.297*	0.628***
None	ON	-1.327	X	-1.964**	X
	12M	-2.803***	X	-1.106	X

[2] The lags are automatically selected based on Schwarz Information Criterion

Chapter 4

METHODOLOGY

The expectations hypothesis stated as in Campbell and Shiller (1991) is:

(1)

where $r_{t,n}$ is the n-period long-term rate, $r_{t,m}$ is the m-period short rate, $\alpha_{n,m}$ is the liquidity risk premium, constant in time and k equals n/m. Non-stationarity of the short rate implies (Thornton, 2006):

$$r_{t,m} = \rho r_{t-1,m} + \varepsilon_t$$, where ϱ=1 and ɛt is white noise (2)

or, alternatively:

$$\Delta r_{t,m+i} = \varepsilon_{t+i}, \text{for } i = 1, 2 \ldots$$

Thus, (1) under non-stationarity (2) and the assumption that the short-rate is observed before the long rate, or equivalently , as in (Thornton, 2006) is reduced to:

$$r_{t,n} = r_{t,m} + \alpha_{n,m}$$ (3)

The intuitive interpretation is that under the expectations hypothesis and given that the short rate is I(1), the long rate equals the short rate plus a time-invariant liquidity premium. However, if the long- and short-term rates are cointegrated and are both jointly endogenous, then the Vector Error Correction Model can be explicitly derived:

$$\Delta y_t = \Pi y_{t-1} + A(L)\Delta y_t + \varepsilon_t$$, where yt= (rt,n, rt,m) (4)

If the rank of Π not full, the rates are cointegrated, or, equivalently there exists a long-run equilibrium relationship between short and long-term rates, as postulated by the expectations hypothesis and $\Pi = \gamma\lambda'$, where $\lambda = (1, \beta, \alpha)$ is the cointegrating vector and the vector of coefficients γ denotes the loading parameters that measure the speed of adjustment.

In addition, the cointegrating vector λ under the EH is (1;-1; α), where α is the constant liquidity premium.

$$r_{t,n} - r_{t,m} = \frac{1}{k}\sum_{i=0}^{k-1} E_t[\Delta r_{t+mi,m}] + \alpha_{n,m} \quad (5)$$

By subtracting $r_{t,m}$ from both sides of the equation (1) a I(0) term of is obtained on the right hand side of (5) and thus the left hand side has to be I(0), which leads to the cointegration of $r_{t,n}$ and $r_{t,m}$ with the vector (1,-1, α).

Therefore, the test of the expectations hypothesis based on cointegration and VECM is performed in two steps: first, the Johansen test for cointegration is performed in order to determine whether there is an equilibrium relationship between short and long-term rates, and second, the restriction λ' = (1, -1)[3] is tested (Campbell and Shiller, 1987, 1991).

The rejection of any of the two hypotheses would invalidate the expectations theory of the term structure on the given market as it would imply that either the rates do not have a common stochastic trend and thus no long run equilibrium or that the combination of the rates is stationary not in the direction of the cointegration vector implied by the expectations hypothesis.

[3] The liquidity premium α will be omitted further from the notation of the cointegrating vector. The premium is included in the cointegrating relationship as a constant.

In the proposed research, for the purpose of testing the expectations hypothesis on the Romanian interbank money market (short end of the yield curve), the overnight rate will be assumed as the short-term rate and the 12 month rate will be utilized as the long rate. First, the pair will be tested for the number of cointegrating relationships using the Johansen max and trace tests. As recommended by Johansen and Juselius (1990) the results of the trace test will be preferred when the test results will be conflicting. The decision on the lag length will be based on the Schwarz Information Criterion, as the one which is consistent and imposes a higher penalty for additional parameters, as opposed to Akaike IC and Hannan-Quinn IC.

The liquidity premium will be included in the cointegration equation as a constant; while the VAR model will be estimated with no deterministics as the rates are assumed not to have any deterministic trend.

In case of stationarity of both rates the number of linearly independent cointegrating vectors will be 2, or the matrix Π will have full rank (r). Also, if both rates are I(1) but there is no long-run equilibrium the rank r=0. In both cases, there is no sign of cointegration between the rates and the expectations hypothesis does not hold. In case the rank r=1, there is a common stochastic trend behind the two time series. Second, for the cointegrated pairs the restriction of the cointegrating vector to (1,-1), after the adjustment for the liquidity premium (included in the cointegrating equation as a constant), will be tested. In case of the rejection of the restriction, the expectation hypothesis is also rejected.

The analysis above will be performed on the whole sample period 2003-2012 as well as on the subsamples 2003-2006 and 2007-2012.

In addition, the rolling VECM will be estimated over subsamples of 1000 observations (roughly 4 business years) in order to examine the

cointegrationrelationship dynamically. The procedure will allow the investigation of the time-variability of the liquidity premium. It is necessary to conduct this analysis as the EH may hold for the entire sample period, but in shorter subsamples the departures from the predictions of the hypothesis may be large as a result of a non-constant term premium.

Chapter 5

EMPIRICAL RESULTS

The trace and max tests are performed over the three sample periods with the lag length being selected according to the AIC, BIC and HQIC information criteria. The decision rule is based on the HQIC and trace test, as suggested by Johansen and Juselius (1990).

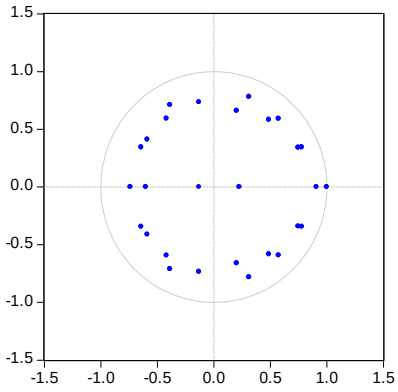
The results of the tests indicate that the overnight and the 12 month rates have a common stochastic trend over the entire sample period as well as over both subsamples in accordance with the predictions of the EH (see Table 4). The VEC models are estimated with the lags indicated by the BIC and the restriction of the cointegrating vector to (1;-1) is tested using the Likelihood Ratio test.

Table 4: The number of cointegrating relationships of the overnight and the one year rates indicated by the trace and max tests at 5% significance level:

Pair/Period	2003-2012			2003-2006			2007-2012		
Criterion	AIC	**BIC**	HQIC	AIC	**BIC**	HQIC	AIC	**BIC**	HQIC
Trace test	1 (12)	**1** **(8)**	1 (8)	1 (6)	**1** **(1)**	1 (1)	1 (8)	**1** **(6)**	1 (8)
Max test	1 (12)	**1** **(8)**	1 (8)	1 (6)	**1** **(1)**	1 (1)	1 (8)	**1** **(6)**	1 (8)

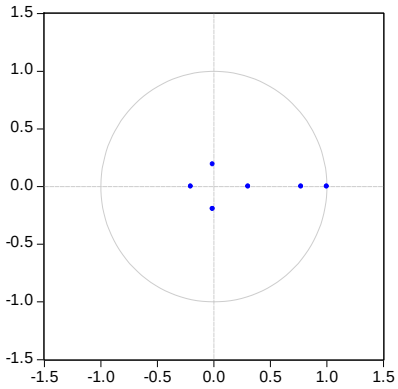
When the vector error correction models are estimated using the lags indicated by the BIC, the residuals are found to be autocorrelated. Therefore, additional lags are added to remove the autocorrelation. Namely, the restricted and unrestricted VEC models for the sample 2003-2012 and the two subsamples 2003-2006 and

2007-2012 are estimated with 13, 2 and 7 lags respectively. It turns out that the specification of VECM with a higher number of lags does not have a significant impact on the estimated parameters or on the conclusions regarding the validity of the EH. The inverted roots of lag polynomial lie inside the unit circle all except one, indicating that the estimated models are stable (see Figure 2 and Figure 3).



a)

003-2012



b)

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Figure 2: Inverse roots of the lag polynomial for the estimated VEC models

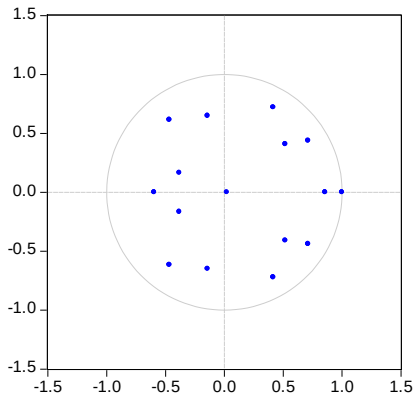

Figure 3: Inverse roots of the lag polynomial for VEC model 2007-2012

Based on the LR test the cointegrating vector restriction is rejected at the 5% level for the sample period 2003-2012 and the subsample 2003-2006 (see Table 5). It can be concluded that despite a common stochastic trend, the linear combination of the rates is non-stationary in the direction of the vector (1;-1), consistent with the expectations hypothesis.

Nevertheless, although the discrepancy is statistically significant, the cointegrating vector is close to the one implied by the EH. In addition, the positive liquidity premiums α in all the models are in line with the predictions of the EH. The adjustment coefficients γ that denote the speed of adjustment to the long run equilibrium have the expected signs and magnitudes as the long rate should adjust in the opposite direction and supposedly slower than the short rate, because according to the EH it is a mean value (the average of future expected short term rates). Consequently, although the expectations hypothesis is rejected because of the failure of the restrictions on the cointegrating vector, the behavior of the

overnight and 12 month rates is close to the predictions of the EH over 2003-2012 and 2003-2006.

For the post-EU accession period 2007-2012, the EH is not rejected for the term structure of Romanian interbank money market rates (see Table 5). In the unrestricted regression the cointegrating vector is not statistically different from the one implied by the EH. Consequently, the restriction is also not rejected based on the LR test. It can be concluded that there is significant evidence in the support of the expectations hypothesis for 2007-2012.

Table 5: The parameters of the cointegrating vector (1, β, α), the adjustment coefficients γ and the LR test-statistic[4]:

	Unrestricted VECM			Restricted VECM			
	Γ	β	α	γ	β	α	LR
2003-2012	-0.115 (short) (0.019) 0.027 (long) (0.005)	-1.088 (0.038)	3.448 (0.461)	-0.116 (short) (0.018) 0.025 (long) (0.005)	-1	2.467 (0.188)	5.147 (0.023)
2003-2006	-0.234 (short) (0.023) 0.004 (long) (0.001)	-1.154 (0.040)	4.362 (0.600)	-0.208 (short) (0.022) 0.003 (long) (0.001)	-1	2.193 (0.233)	12.961 (0.000)
2007-2012	-0.124 (short) (0.019) 0.037 (long) (0.008)	-0.939 (0.061)	1.969 (0.594)	-0.117 (short) (0.019) 0.037 (long) (0.008)	-1	2.525 (0.208)	0.854 (0.355)

[4] The for the LR test the p-values are provided in brackets, while for the coefficients the standard errors are provided in brackets.

The coefficient β of the cointegrating vector estimated by rolling VECM is statistically different from the value -1, for the first 1000 subsamples. Nevertheless, the hypothesis is not rejected for almost 450 last subsamples, corresponding to the period starting in the second half of 2006-2012 (see Figure 4), the cointegrating vector coefficients for the subsamples in the corresponding period being in line with the EH predictions.

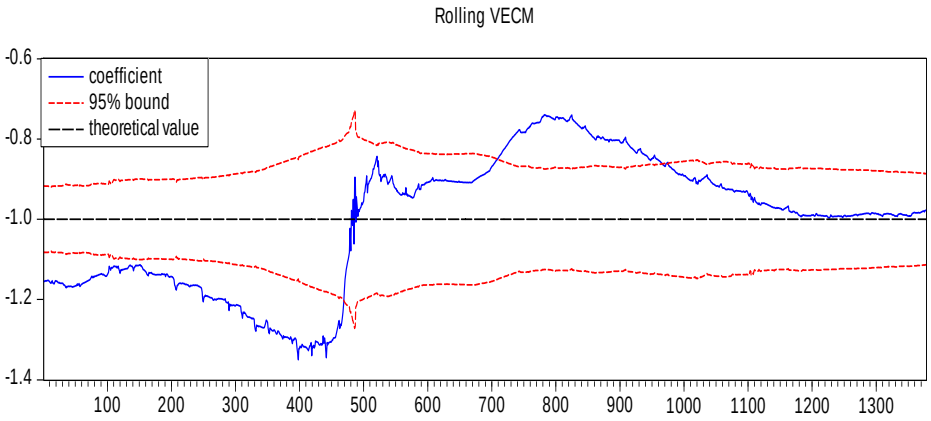

Figure 4: The coefficient β and the 95% confidence bounds for the theoretical value -1 estimated by a rolling VECM

The liquidity premium is also not constant through the sample period 2003-2012. However, the estimates of the liquidity premium corresponding to the period starting in the second half of 2007-2012 are relatively stable (Figure 5), which is consistent with the restrictions implied by the EH.

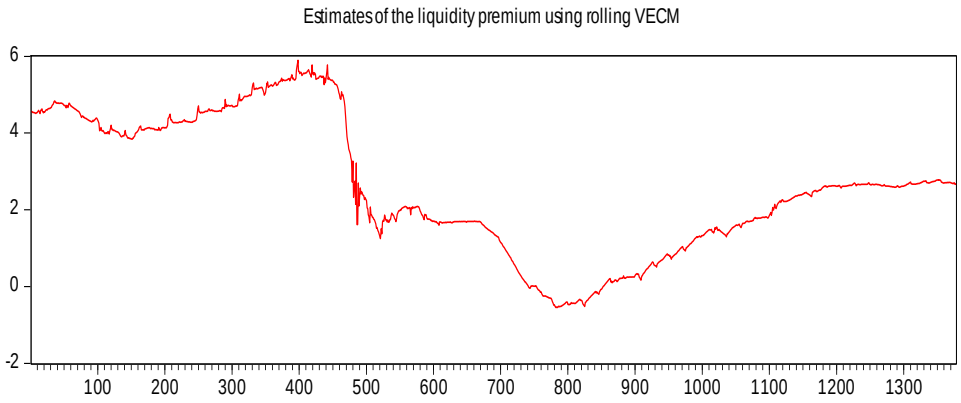

Figure 5: The liquidity premium estimated by a rolling VECM

Chapter 6

CONCLUSIONS

It can be concluded that the expectations hypothesis is valid for the short end of Romanian yield curve in the post-EU accession period, as the implications of the EH for the behavior of the interest rates not rejected. The liquidity premium is constant and the overnight rate and the 12 month interest rate are integrated with the vector (1:-1). The validation of the hypothesis is also associated with an overall decrease of the interest rates on the Romanian interbank market in the post EU-accession period. For the period 2003-2012 and the pre-EU accession period 2003-2006 the expectations hypothesis is rejected. Despite the apparently minor differences of the cointegrating vector obtained in the unrestricted regression from the one implied by the EH, when shorter subsamples are examined, the significant and frequent departures from the EH are observed in the periods when the hypothesis is rejected as the coefficients of the vector exhibit large departures from (1;-1) and the liquidity premium is fluctuating.

Thus, the behavior of the Romanian term structure of interbank money market short term rates is in line with the predictions of the expectations hypothesis in the period 2007-2012. As initially expected, the liquidity premium stabilized in the post-accession period probably due to the increase in investors' confidence. The term premium of the 12 month rate over the overnight rate is relatively constant at approximately 2.6%. An obvious implication is that the National Bank of Romania can impact the whole term structure at least up to 12 month interest rate indirectly through open market operations with instruments of shorter maturities, as the rates are cointegrated and move together.

Another implication of the EH for the Romanian interbank market is that the hypothesis reveals how actual and expected interest rates are determined in the short end of Romanian term structure of interest rates.Thus, the expectations of market participants of future overnight rates may be extracted from the term structure, given that under the EH the long term rate is an average of the expected future short term rates plus a constant liquidity premium. Also, assuming that the expectations are unbiased, the shape of the term structure predicts future changes in the short term rate. Namely, if the difference of the 12 month and overnight rates is larger than the liquidity premium, the short term rate can be expected to increase.

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