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DP/99/2015

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October 2015

ISBN 978-954-8579-71-1 (print)
ISBN 978-954-8579-72-8 (pdf)

Publishing, printing and binding: Publication Division of the BNB.

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Summary: This scientific paper analyses the factors affecting the interest rate spreads of commercial banks in Bulgaria. The Engle–Granger two-step method (1987) and the bounds testing approach of Pesaran *et al*. (1999, 2001) are applied. The main findings of the paper are that the interest rate spreads dynamics in Bulgaria in the period of Q1.2004 – Q3.2014 was under the long-term influence of factors such as: economic activity, market concentration, foreign ownership, external liabilities, profit margins, loan to asset ratio, loan to deposit ratio, house prices, inflation, interbank lending rates and stock prices. The short-term determinants of the interest rate spreads include: loan to deposit ratio, foreign ownership, unemployment and market concentration. The global financial crisis and its projection on the Bulgarian economy and the Corporate Commercial Bank's insolvency are among the developments increasing interest rate spreads.

Key words: interest margin, bank inefficiency, co-integration, dynamic models, ARDL
JEL classification: C32, E43, G21

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Introduction

Interest rate spreads have traditionally been a major economic concept for bank centric financial systems, hence attracting analysts' attention. This subject has quite practical dimensions for the Bulgarian economy and the banking system respectively, with net interest income comprising an average of above 70% of net banking income over the last decade, while the related net commissions and fees income add another 21%, and investments' net income has only a minor prominence. In the last decade, the Bulgarian banking system has grown dramatically in size and economic significance, being the main source of economic agents' external debt financing (with domestic credit to GDP ratio hovering between 63 and 71% of GDP in the last five years) and supplying the widely recognized investment/saving opportunities.

Banks in Bulgaria operate under a traditional banking model, in which deposit-lending services to non-financial firms and households represent the core of their daily routines. Net interest income and net fee and commission income are the main sources of banks' income, while income from financial markets operations has a negligible share in the net revenue mix.

It is well known that the banking sector is prone to oligopolistic behavior due to economies of scale and due to the high entry barriers, regulations and supervision. In the Bulgarian banking system, the five biggest banks (by asset value) control over 50% of the market, having the potential to dictate banking service trends.

Over the last eight years, the interest rate spreads of non-financial companies in Bulgaria have been on average 101% higher than the mean values of other EU countries, while households' housing purchases interest rate spreads have been over 90% higher compared to the other EU countries. The divergence has widened in the last couple of years, and the interest rate spreads for Bulgarian non-financial companies and households' housing purchases equal 5.4 percentage points and 4.5 percentage points as of November 2014 respectively.[1] Countries with similar risk and development characteristics (CEE countries), even countries that have experienced a more severe slump in GDP, employment, or countries with severely deteriorated public finances (Greece, Portugal, Hungary, Latvia, *etc.*), which were supported by international financial institutions (IMF, World Bank,

[1] For more detailed information on interest rate spreads in the EU, see Tables 4 and 5 in the Appendices section of the paper.

etc.) in latest financial crisis, have much lower spreads between loans and deposits interest rates.

This study has been motivated by the fact that interest rate spreads in Bulgaria have been relatively high compared to other EU countries for a considerable time. The paper aims to econometrically justify aggregate level factors that affect interest rate spreads in Bulgaria in the short and long term.

Review of Related Literature

Net Interest Margin (NIM) is found to be the prevailing dependent variable in most of the research on the subject; however, some researchers perform an analysis on interest rate spreads.[2] Interest rate spread, derived as the difference between loan rates and deposit rates, is a good approximation for the net interest margin of emerging economies' banking systems, where the main banking activities are deposit-lending operations and interest rates on other types of bank assets and liabilities have a very limited effect on NIM.

The most existing papers on the topic investigate the interest margin determinants using bank level data, aiming to better parameterize the relationship by means of panel econometric techniques, segmenting the results for big and small banks and for the system as a whole.

The widely cited and acknowledged interest rate spreads model of Ho and Saunders (1981) is built upon the assumption that macroeconomic factors are incorporated into the microeconomic variables included into the model. By means of a cross-sectional analysis on US individual commercial banks, the authors infer that the pure spread (the constant value in their regression) and non-interest expenses minus non-interest revenue to assets ratio seem to have the biggest and most positive impact on banks' net interest margin (*ibid.*). The model, which uses bank-specific variables, is prone to many limitations. Its approach implies that banks manage the markup above interest rates on deposits solely on their balance sheet indicators, ignoring the general national and international economic environment which is not yet reflected in *ad hoc* and interim financial statements.

[2] The net interest margin as a ratio between net interest revenues and interest-bearing assets is the dependent variable in the works of Gelos (2006), Claeys and Vander Vennet (2004), Trinugroho *et al.* (2012), Poghosyan (2012), Raharjo *et al.* (2014) and many others. Brock and Suarez (2000), Männasoo (2012), Mihailov (2005, 2014) and other researchers explain the variation of the interest rate spreads determinants.

Macroeconomic variables such as GDP and inflation are among the popular explanatory variables in recent papers. The change of the gross domestic product variable or a proxy of it leads to smaller lending margins (see Mihailov (2005), Gelos (2006), Liebeg and Schwaiger (2007), Gul *et al*. (2011), Chortareas *et al*. (2012) and Poghosyan (2012). Improving economic activity enhances banks' confidence in the economy and tends to stimulate lending at the expense of lower lending rates and lending spreads. However, in the results of Mihailov (2014), a positive relationship between the business climate and the lending spreads is found, despite the prevailing hypothesis that banks tend to decrease lending spreads as the economic conditions improve. The positive relationship can be explained with the higher/lower required returns associated with improving/deteriorating economic conjuncture.

The general price level tends to increase the value of the dependent variable, as found in the works of Mihailov (2005), Horovath (2009), Gul *et al*. (2011), Poghosyan (2012), Raharjo P *et al*. (2014). However, inflation has a negative impact on NIM in the work of Brock and Suarez (2000). Higher general price level leads to higher lending interest rates amid a lower marginal deposit rate increase, resulting in higher lending margins. When deflation forces prevail, deposit interest rates decline faster than interest rates on new and existing loans.

It can be assumed that a combination of bank-specific and general economic activity data better explains the variation in NIM and interest rate spreads. This statement is supported by the results of the most recent studies on the subject.

Operating expenses and a proxy of the indicator (personnel expenses, *etc*.) are among the variables widening the spread between loan and deposit rates (see Brock and Suarez (2000), Mihailov (2005), Gelos (2006), Liebeg and Schwaiger (2007), Fungáčová and Poghosyan (2009), Horovath (2009), Poghosyan (2012), Männasoo (2012), Trinugroho *et al*. (2012), Mihailov (2014), Raharjo *et al*. (2014), Ugur and Erkus (2014). Rising administrative and overall operating expenses motivate banks to compensate through higher net interest margins. Claeys and Vander Vennet (2004), however, found that operating costs decrease the net interest margin, contradicting the prevailing results and supporting the hypothesis that higher operating costs, especially higher personnel expenses, lead to lower NIM because of higher staff efficiency and lower asymmetric information side effects. The managerial efficiency diminishes the dependent variable, according to the paper of Chortareas *et al*. (2012).

Market concentration is frequently found to be a factor for the dynamics of NIM and its proxy interest rate spreads. NIM is in a positive association with market concentration according to the research findings of Demirgüç-Kunt and Huizinga (1999), Gelos (2006), Liebeg and Schwaiger (2007), Deans and Stewart (2012) and Poghosyan (2012). This dependency can be justified by an assumption that banks with a strong market presence widen the lending spread to increase their profitability. Banks in Turkey, however, seem to negatively manage their market share net interest margins (see Ugur and Erkus, 2014). In the scientific paper of Horovath (2009), market share has a negative effect on NIM as well. Authors claim that the tradeoff of gaining additional market share are reduced loan rates, hence a decline in the net interest income (*ibid*.). Market power, measured by the Lerner index, has a strong positive and statistically significant impact on NIM, according to the results of Trinugroho *et al*. (2012).

Net interest margin is positively affected by the foreign ownership of banks in emerging economies (see Demirgüç-Kunt and Huizinga (1999) and Ugur and Erkus (2014). Foreign parent banks require their subsidiaries to increase their NIM, thus increasing the speed of return on their investments. According to the findings of Männasoo (2012) and Trinugroho *et al*. (2012), there is a negative association between the two variables, *i.e.* foreign ownership increases the overall banking system's efficiency and leads to tighter lending spreads. However, state-owned banks are a factor for higher NIM, according to the scientific paper of Trinugroho *et al*. (2012).

Brock and Suarez (2000), using a panel model for Latin American countries, have found that non-performing loans lead to lower NIM, but in the model for Colombia bad loans are in a positive association with the dependent variable. The negative association is also revealed in the research of Fungáčová and Poghosyan (2009), Trinugroho *et al*. (2012) and Mihailov (2014). Poghosyan (2012) has found that a higher non-performing loan to assets ratio leads to higher NIM. It can be expected that aggravating loan quality would lead to higher lending rates; however, banks seem to narrow rates, mostly due to the faster decline of loan rates, eventually supporting borrowers' overall loan servicing capacity.

Capital adequacy (capital to assets and other capital ratios) leads to a higher dependent's value according to Claeys and Vander Vennet (2004), Gelos (2006), Fungáčová and Poghosyan (2009), Chortareas *et al*. (2012), Trinugroho *et al*. (2012), Raharjo P *et al*. (2014), Ugur and Erkus (2014). In contrast, Brock and Suarez (2000), Horovath (2009), Gul *et al*. (2011) and Poghosyan (2012) have found that capital adequacy reduces net interest margins. Both hypotheses have their grounds and reasoning, but may be valid in different stages of the business cycle. An upward trend in capital ratios leads to higher profits demand, for which net interest income is the main source. Moreover, banks tend to increase their capital position as a result of higher spreads between interest rates received on assets and paid on liabilities. Higher capital ratios may lead to lower lending rates and spreads, because banks have already increased their capital, preparing themselves for improved lending activity, thus being able to observe the ratio between capital and risk-weighted assets.

Liquid assets and a proxy of the indicator lead to smaller lending margins, as banks accumulate less liquid assets in exchange of higher lending activity, supported by lower lending rates and lending margins. In times of economic distress banks are active on the liabilities side in their demand for liquidity, *i.e.* banks narrow the lending spread and collect higher interest rates on deposits, as suggested in the works of Brock and Suarez (2000), Fungáčová and Poghosyan (2009) and Männasoo (2012), while the results of Poghosyan (2012) point to a positive association. Mihailov (2005) finds that reserves as a representation of liquid assets are in a negative correlation to interest rate spread values as well.

According to Horovath (2009), a risk proxy, such as the loan to assets ratio, is in a positive association with NIM in the Czech banking system. A similar dependency is also supported by the results in EU and CEE EU member countries in the work of Claeys and Vander Vennet (2004). Risk aversion (debt to equity ratio) leads to a higher interest margin in the study of Liebeg and Schwaiger (2007).

Many other parameters lead to changes of net interest margins. The change in loans leads to higher NIM (see Gul *et al.* 2011). The ratio of fees to interest earning assets also has a considerable positive effect on the interest rate spread, according to the study of Männasoo (2012). Using a bank sample for EU and CEE EU member countries, Claeys and Vander Vennet (2004) find that short-term interest rates are positively associated with NIM.

Profitability, measured through the return on assets ratio, is in a positive association with net interest margins (see Raharjo P *et al.*, 2014).

Williams and Rajaguru (2013) examine banks' net interest income in Australia as a decreasing function of the fees and commission income, with banks compensating the diminishing net interest income by raising fees and commissions.

According to the study of Demirgüç-Kunt and Huizinga (1999), bank assets to GDP ratio is in negative associations with the dependent variable.

Authors also find that indices of credit rights, law and order and corruption are positively related to interest margins in developing countries.

Data

Most of the scientific papers on the subject use a panel econometric technique, combining cross-sectional data from individual banks and macroeconomic variables. In this paper, a different approach has been applied. An aggregate bank-specific and general economic data is used to explain the variation of interest rate spreads. Aggregate data is not only more easily obtainable and less time-consuming to analyze and regress, but would be a better choice for a further study, in which different national economies are covered. The task is accomplished through standard time series regressions, *i.e.* using dynamic error correction models.

The interest rate spread has been calculated as the difference between the weighted average of interest rates on the loans and that on the deposits of non-financial companies and households. The approach used for calculating the interest rate spread is similar to the one used by the World Bank and ECB.[3] The data sources are the publicly available statistical databases of the Bulgarian National Bank and the European Central Bank.

All variables except LOG(YR) are seasonally adjusted using Census X-13 seasonal adjustment software. All variables except some interest rate indicators are in a natural logarithm form.

The analysis is performed with quarterly data, from the beginning of 2004 to the end of the third quarter of 2014. Each series set consists of 43 observations.

Table 1. Variables and Description

Variables	Description
RMFHBS	Interest rate spreads, outstanding amounts at the end of the period – weighted average of commercial banks' loan interest rates minus deposit interest rates (outstanding amounts at the end of the period), Source: BNB, Own calculations;

[3] Interest rate spreads, presented as lending margins in the ECB and WB datasets, are measured as the difference between MFIs' interest rates for new business loans to households and non-financial corporations and a weighted average rate of new business on deposits of households and non-financial corporations. For non-euro area countries, rates for loans and deposits in both euro and national currency are taken into account (see ESRB risk dashboard, 2014, and WB WDI database, 2014).

RMFHBV	Interest rate spreads, business volumes, *i.e.* new business (flows) – weighted average of commercial banks' loan interest rates minus deposit interest rates (new business on loans). Source: BNB, Own calculations;
BDLNS	A ratio between the restructured plus non-performing loans of non-financial companies and households overdue by 90 days or more divided by total loans of non-financial companies plus households. Source: BNB, Own calculations;
CAP	A ratio between commercial banks' common equity and assets. Source: BNB, Own calculations;
EXPTONII	Administrative expenses (personnel included) to net interest income ratio. Source: BNB, Own calculations;
EXTLIAB	External liabilities to assets ratio. Source: ECB, Own calculations;
FOWN	A ratio of foreign-owned local bank assets to total bank asset. Source: BNB, Own calculations;
MS5	Market share of the five biggest banks. Source: BNB, Own calculations;
HHI5	Herfindahl-Hirschman index of the assets of the five biggest banks. Source: BNB, Own calculations;
LNSTOASTS	Loans to non-financial companies and households to assets ratio. Source: ECB, BNB, Own calculations;
LNSTODPTS	Loans to non-financial companies and households to counterpart deposits. Source: ECB, BNB, Own calculations;
ROA	Net income to assets ratio. Source: BNB, Own calculations;
ROE	Net income to equity ratio. Source: BNB, Own calculations;
EONIA	A composite index of 1-day interbank lending interest rates. Source: ECB;
EURBR3M	A composite index of 3-month interbank lending interest rates. Source: ECB;
HPR	House prices index, deflated. Source: NSI, Own calculations;
SFX	SOFIX Bulgarian stock exchange index, deflated. Source: BSE, Own calculations;
UNMPL	Unemployment rate. Source: NSI;
YR	Gross domestic product in 2010 prices. Source: NSI;
PRH	Harmonized consumer price index. Source: NSI;
D1	Dummy variable for the start of the recession in Bulgaria, provoked by the last world financial crisis, starting from the beginning of Q1 2009;
D2	Dummy variable for Corporate Commercial Bank's failure, beginning in June 2014 (Q2 2014).

Methodology

From a methodological perspective, several steps are taken before structuring regression models deciphering the factors affecting interest rate spreads in Bulgaria. First, a correlation analysis is applied for identifying potential regressors and their impact on the dependent variable. Second, unit root tests are performed in levels and, if needed, in first differences. Third, co-integration tests, revealing long-term functional dependencies, are applied. Fourth, error correction models with added co-integrating vector (the error correction term) are built, possessing the ability to discover the factors that explain the short and long-term associations of regressors with the dependent variable. Fifth, results are tested for significance and then commented.

Depending of the order of integration, *i.e.* I(0) or I(1), a Engle and Granger (1987) two-step procedure or Pesaran *et al.* (1999, 2001) procedure can be used. The method of Pesaran *et al.* is more tolerate whether the variables are I(0) or I(1), and is also preferred due to the small size of the sample.

Correlation Matrix

For determining the probable strength of relationships between different pairs of dependent and independent variables, a standard correlation matrix has been used. It has been assumed that for an acceptable correlation coefficient, the p-value for accepting the null hypothesis should be less than 5%.

Correlation analysis is applied for identifying probable relationships between dependent variables and their explanatory variables with corresponding p-values below 5%. These initial and elemental relationships help the process of selecting regressors and researching their potential impact on the explained variable and their significance. Although these individual relationships are not indicative for the causation, the sign and the value of the individual coefficient and for its significance, being part of a regression based on multiple regressors, they are supposed to give cursory relation expectations. Correlation coefficients and their significance can be seen in the Table 2.

Correlation coefficients and their corresponding p-values suggest that interest rate spreads, measured through Ln(RMFHBS), are in a positive (possessing a correlation coefficient above 0.5) and significant correlation with EONIA, EURBR3M, Ln(HPR), Ln(ROA), Ln(ROE) and Ln(SFX). Interest rate spreads Ln(RMFHBV) correlate positively (with correlation coefficient exceeding 0.5) with Ln(EXPTONII).

Ln(RMFHBS) is in a negative correlation, with a coefficient below -0.5, with Ln(BDLNS), Ln(CAP), Ln(PRH) and Ln(UNMPL). Respectively, Ln(RMFHBV) is in a negative correlation of such magnitude with Ln(EXTLIAB), Ln(HHI5), Ln(LNSTOASTS), Ln(LNSTODPTS), Ln(MS5), Ln(PRH) and Ln(YR).

The value of correlation coefficients between Ln(HPR), Ln(UNMPL), Ln(FOWN) and both dependent variables are rather contradictory, *i.e.* each variable diverges in terms of the sign of the coefficient in a pair with Ln(RMFHBS) and Ln(RMFHBV), which is hard to be interpreted solely in terms of correlation.

While many correlation coefficients are statistically significant, their meaning is between -0.5 and 0.5. They are not ignored in the regression, but expected coefficient signs are challenged more.

Table 2. Correlation Matrix and p-values

VARIABLES	LN(RMFHBS)	LN(RMFHBV)	VARIABLES	LN(RMFHBS)	LN(RMFHBV)
LN(BDLNS)	**-0.68**	**-0.48**	Ln(ROA)	**0.79**	**0.46**
p-value	***0.00***	***0.00***	*p-value*	***0.00***	***0.00***
LN(CAP)	**-0.69**	**-0.42**	Ln(ROE)	**0.80**	**0.47**
p-value	***0.00***	***0.01***	*p-value*	***0.00***	***0.00***
LN(EXPTONII)	0.00	**0.82**	EONIA	**0.87**	0.27
p-value	*0.99*	***0.00***	*p-value*	***0.00***	*0.08*
LN(EXTLIAB)	0.01	**-0.69**	EURBR3M	**0.85**	0.15
p-value	*0.93*	***0.00***	*p-value*	***0.00***	*0.34*
LN(FOWN)	**0.42**	**-0.28**	LN(HPR)	**0.59**	**-0.29**
p-value	***0.00***	***0.07***	*p-value*	***0.00***	***0.06***
LN(MS5)	0.23	**-0.57**	LN(SFX)	**0.79**	**0.49**
p-value	*0.14*	***0.00***	*p-value*	***0.00***	***0.00***
LN(HHI5)	0.23	**-0.53**	LN(UNMPL)	**-0.52**	**0.38**
p-value	*0.13*	***0.00***	*p-value*	***0.00***	***0.01***
LN(LNSTOASTS)	**-0.32**	**-0.86**	LN(PRH)	**-0.58**	**-0.74**
p-value	***0.04***	***0.00***	*p-value*	***0.00***	***0.00***
LN(LNSTODPTS)	-0.21	**-0.83**	LN(YR)	**-0.13**	**-0.74**
p-value	*0.18*	***0.00***	*p-value*	***0.40***	***0.00***

Note: Numbers in bold mark the variables with p-values lower than 0.05.

Unit Root Tests

Results from Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) unit root tests reveal that all of the variables are stationary in first differences I(1) except Ln(LNSTOASTSECB), Ln(PRH), Ln (ROA) and Ln(BDLNS), which are level stationary under one of the three options (intercept, intercept and trend, no trend and intercept) and first difference stationary in the other two options. In some instances, ADF and PP point to slightly different results; nevertheless, as a whole, results from both type of unit root tests support each other.

For example, the ADF unit root test rejects the null hypothesis in first differences for the intercept option for Ln(CAP), while neither the level result, nor the two of the three options of the first differences ADF test reject the null. The PP test, however, strongly rejects the hypothesis of unit roots presence in the first differences for the same variable.

It can be summarized that variables don't have unit roots in their first differences; however, there are a few exceptions for level stationary variables under one of the three assumptions: intercept, intercept and trend, no trend and no intercept.

Error Correction Models

In this paper, a standard time series econometric modeling has been applied, since most of the level data failed to reject the null hypothesis of having unit root in levels. Error correction models using the two-step approach of Engle and Granger (1987) and the ARDL bounds testing approach of Pesaran and Shin (1999, 2001) have been applied.[4] The purpose of using both error correction methods is not only for the results to support each other, but also that some of the variables may have level stationary characteristics despite the fact that unit root tests point to an overall first difference data rejection of the null hypothesis. For the purpose of parameterizing level stationary, *i.e.* I(0) and first difference stationary data, *i.e.* I(1), the Pesaran *et al*. (1999, 2001) bounds testing approach is more suitable. However, a combination of I(0) and I(1) data may be integrated to lead to the integration of order I(1).[5]

Non-stationary time series require special methods for analysis. Dynamic models with error correction term may be the most appropriate in this case. Error correction models traditionally have the following form:

$$\Delta Y_t = \alpha + \sum_{m=1}^{n} \beta.\Delta Y_{t-m} + \sum_{m=0}^{n} \gamma.\Delta X_{it-m} + \delta.ECT_{t-1} + \zeta.Trend + \eta.Exogs + \varepsilon_{t,} \qquad (1)$$

$$ECT_{t-1} = \nu_{t-1} \Rightarrow Y_{t-1} = \alpha + \beta.X_{it-1} + \nu_{t-1} \qquad (2)$$

[4] Sheriff and Amoako (2014) use an aggregate data ARDL bounds testing technique on analyzing interest rate spreads in Ghana. English (2002) uses Engle and Granger two-step method on aggregate data for analyzing net interest margins and interest rates on assets and liabilities separately.

[5] See Engle and Granger (1987) and The Royal Swedish Academy of Sciences (2003).

Table 3. ADF and PP Unit Root Test Results (p-values)

	Augmented Dickey-Fuller test						Philip-Perron test					
	Levels			First differences			Levels			First differences		
Series	intercept	intercept and trend	no trend and no intercept	intercept	intercept and trend	no trend and no intercept	intercept	intercept and trend	no trend and no intercept	intercept	intercept and trend	no trend and no intercept
Ln(RMFHBS)	0.32	0.20	0.78	**0.00**	**0.00**	**0.00**	0.30	0.48	0.72	**0.00**	**0.00**	**0.00**
Ln(RMFHBV)	0.14	0.91	0.86	**0.00**	**0.00**	**0.00**	0.11	0.77	0.85	**0.00**	**0.00**	**0.00**
Ln(BDLNS)	0.94	0.45	**0.04**	0.09	0.28	**0.02**	0.89	0.46	0.12	**0.00**	**0.00**	**0.00**
Ln(CAP)	0.30	0.15	0.64	**0.00**	0.58	0.17	0.65	0.19	0.64	**0.00**	**0.00**	**0.00**
Ln(EXPTONII)	0.16	0.76	0.77	**0.00**	**0.00**	**0.00**	0.10	0.50	0.72	**0.00**	**0.00**	**0.00**
Ln(EXTLIAB)	0.41	0.35	0.71	**0.04**	**0.00**	**0.00**	0.12	0.35	0.43	**0.00**	**0.00**	**0.00**
Ln(FOWN)	0.53	0.66	0.56	**0.01**	**0.05**	**0.00**	0.53	0.65	0.56	**0.03**	0.22	**0.00**
Ln(MS5)	0.47	0.79	0.60	**0.00**	**0.00**	**0.00**	0.39	0.71	0.60	**0.00**	**0.00**	**0.00**
Ln(HHI5)	0.36	0.70	0.66	**0.00**	**0.00**	**0.00**	0.27	0.58	0.66	**0.00**	**0.00**	**0.00**
Ln(LNSTOASTS)	**0.00**	0.19	0.42	**0.00**	**0.00**	**0.00**	0.40	0.93	0.38	**0.00**	**0.00**	**0.00**
Ln(LNSTODPTS)	0.43	0.88	0.11	**0.03**	**0.05**	**0.00**	0.45	0.93	0.12	**0.04**	**0.05**	**0.00**
LOG(ROA)	0.62	0.64	0.88	**0.00**	**0.00**	**0.00**	0.29	**0.02**	0.77	**0.00**	**0.00**	**0.00**
LOG(ROE)	0.73	0.78	0.86	**0.00**	**0.00**	**0.00**	0.52	0.18	0.75	**0.00**	**0.00**	**0.00**
EONIA	0.49	0.24	0.16	**0.04**	0.14	**0.00**	0.73	0.61	0.24	**0.03**	0.11	**0.00**
EURBR3M	0.38	0.19	0.16	0.07	0.21	**0.01**	0.71	0.62	0.27	0.06	0.19	**0.01**
Ln(HPR)	0.20	0.23	0.55	0.19	0.62	**0.02**	0.34	0.17	0.76	0.16	0.54	**0.02**
Ln(SFX)	0.46	0.41	0.53	**0.00**	**0.02**	**0.00**	0.61	0.57	0.57	**0.00**	**0.02**	**0.00**
Ln(UNMPL)	0.52	0.56	0.60	**0.05**	0.13	**0.00**	0.54	0.66	0.66	**0.06**	0.13	**0.00**
Ln(PRH)	**0.01**	1.00	0.99	**0.01**	**0.00**	**0.00**	0.08	1.00	1.00	**0.00**	**0.00**	**0.00**
Ln(YR)	0.09	0.62	0.98	**0.00**	**0.00**	**0.00**	0.11	0.59	0.97	**0.00**	**0.00**	**0.00**

Note: The table presents the p-values for accepting the null hypothesis of presence of a unit root under each assumption. A 5% threshold is applied for rejecting the null. Bold values reject the null at 0.05 or lower.

Where: α – constant, $\Delta \mathbf{Y}_t$ – first differences of the dependent variable, $\Delta \mathbf{Y}_{t-m}$ – lagged first differences of the dependent variable, with the first lag being the smallest, $\Delta \mathbf{X}_{it-n}$ – lagged first differences of the i^{th} explanatory variable (with the zero lag being the smallest), $\mathbf{ECT}_{t-1}$ – the error-correction term (the coefficient of ECT should have a negative sign, representing the error correction mechanism) is the residual of the OLS regression of level variables, and represent the long-run associations, **Trend** – deterministic trend (if existing), **Exogs** – exogenous variables (dummy variable and other, if existing), ε_t – residual of the dynamic model, ν_{t-1} – white noise/the residual of the OLS regression in levels.

Under the Engle and Granger (1987) approach, the residual of the co-integrating equation (regressing levels of variables) revealed in equation (2) is tested for the presence of unit roots, using the Augmented Dickey-Fuller test on levels, but applying the more restrictive critical values provided by Davidson and MacKinnon (1993). Failing to accept the null hypothesis of ADF test validates the long-term relationship, *i.e.* a co-integrating vector exists, and a dynamic model like the one presented in equation (1) can be structured.

The ARDL dynamic models can be presented either in the form of an equation (1), or in the following functional schematic form:

$$\Delta Y_t = \alpha + \sum\nolimits_{m=1}^{n} \beta.\Delta Y_{t-m} + \sum\nolimits_{m=0}^{n} \gamma.\Delta X_{it-m} + Y_{t-1} - \alpha_y - \beta_y.X_{it-1} + \varepsilon_t \qquad (3)$$

Using the bounds testing procedure developed by Pesaran *et al*. (1999, 2001), a dynamic model with differenced and level data is constructed. Coefficients of level data are tested for whether they are equal to zero, using a standard Wald-test procedure. Testing for co-integration is performed using the asymptotic critical value bounds for the F-statistic presented in the papers of Pesaran *et al*. (1999, 2001).

For selecting the number of lags in each model under the ARDL bounds testing procedure, an EViews Add-in has been employed (see Yashar, 2014). Low values of Schwarz information criteria and Akaike information criteria and high F-statistic on the coefficients' Wald tests are the three main factors for selecting the lag length.

Results

Using both the co-integration and error correction approaches, nine different error correction models have been built and investigated in the analysis. Results of the two models with highest explanatory power have first been analyzed, *i.e.* model A and model B, followed by an analysis of the results of models C to I.

Models A and B best suit the Engle and Granger approach and the ARDL bounds testing procedure. Model B has the highest explanatory power in terms of R^2 adjusted, residual test results, lowest information criteria (Akaike and Schwarz info criteria) and T-stats of regressors' coefficients, while Model A better fits the ARDL bounds testing approach under these assumptions. Results from both models under both approaches seem to validate each other, which of course does not negate the results of models C to I, which yield valuable information. Models A and B would be the first to comment on in each of the subsections below, while findings from the rest of the models will be summarized at the end of the two subsections, *i.e.* the Engle and Granger two-step approach section and the ARDL bounds testing procedure sections respectively.

Co-integration Vectors

The same co-integrating vector is implemented in each model (*e.g.* A, B, C, I) under the Engle and Granger two-step method and the ARDL bounds testing procedures. All co-integration equations can be found at Table 6 in the Appendices section.

Models A and B

First, the co-integrating vectors of models A and B are discussed, followed by the analysts for the rest. Results reveal that factors that have a serious impact on interest rate spreads in Bulgaria are: external bank liabilities, non-performing loans, common equity, market concentration, interbank borrowing rates, house prices, inflation, and to a lesser extent, the stock market.

External liabilities in the case of Bulgaria are mostly due to foreign parent banks. The co-integrating vectors reveal that external bank indebtedness widens the interest rate spreads, and *vice versa*. Repayment of banks' external liabilities urges banks to accumulate buffers *via* increasing the lending margin. Parent banks also insist on higher returns on their receivables, thus making their subsidiaries widen the spread between lending and deposit rates.

The non-performing loan to gross loan ratio leads to higher interest rate spreads. Higher bad loans ratios stimulate the banks to accumulate buffers for covering loan write-downs and for supporting capital adequacy and liquidity.

The equity to assets ratio contributes to higher interest rate spread, *i.e.* a positive relationship exists. Higher capital requirements and buffers are financed through higher interest rate spreads and through other sources (hybrid debt-capital instruments issuance, common and preferred stock issuance, *etc.*), but deposit-lending activity is the core business of the Bulgarian banks.

In the long run, market share indicators are in a positive association with interest rate spreads, confirming the hypothesis that in less competitive markets banks naturally require higher interest rate spreads, aiming at higher returns on equity and assets. Market competition promotes lower lending spreads in the long run.[6]

Higher global interbank lending rates are a factor for higher interest rate spreads. Interbank lending rates are one of the main elements of bank financing sources. In times of economic distress, banks tend to become more risk-averse in lending to each other, *i.e.* interbank lending rates are considered as proxy for risk aversion, resulting in a positive change of lending rates. In favorable economic conditions, interest rates in the economy tend to increase, including interbank lending rates and banks demand higher returns, for which wider lending rates are an option.

Rising house prices lead to more expensive collaterals and boost banks' confidence, which translates into a higher willingness to borrow and lend, resulting in lower interest rate spreads.

Price levels have a negative impact on interest rate spreads. It can be assumed that higher inflation makes customers demand higher deposit interest rates. However, they cannot be fully transferred into higher lending rates, *i.e.* interest rate spreads decrease.

The Bulgarian stock exchange benchmark SOFIX has been included in the regression and reveals that stock prices have a positive effect on the value of interest rate spreads, despite the low coefficient. Rising stock prices signal that booming economic conditions are underway or are expected to come, making banks raise interest rate spreads to boost profitability.

Stock prices have a small effect on interest rate spreads, which however contradicts the effect of property prices. One would expect property prices and stock prices, depicting the wealth effect, to have at least a parallel impact on the dependent variable. Property prices have a bigger effect on the economy, because of the high-ownership rates, supported also

[6] Mihailov (2014) does not find any significant interrelation between lending spreads and market concentration in Bulgaria.

by the low market cap to GDP ratio and the low penetration of financial instrument investments in the country.

Models C to I

In model G, the administrative and personnel expense to net interest income ratio is in a positive association with dependent variable, as would be expected. Administrative inefficiency is compensated through wider interest rate spreads, supporting the results of the panel study on Bulgarian banks performed by Mihailov (2005, 2014). However, in Model C, the administrative and personnel expenses compared to the net interest income lead to lower interest rate spreads, contradicting the results in model G. The results in model C can be interpreted with the assumption that banks are inclined to expand lending at the expense of lowering interest rate spreads. This new lending requires the involvement of further resources (personnel, office premises, equipment, *etc*.). The long-term results for the administrative expense ratio are ambiguous.

The external liabilities in models C, D, G and H are in a negative association with interest rate spreads, contradicting the findings in model B. It can be assumed that the funds supplied mostly by parent banks lower bank's fund costs and increase reserves and liquidity, allowing banks to lower rates on the loans lent, following a strategy for loans' market share increase and/or for attracting better-quality borrowers with better conditions on loans. These long-term results seem to negate the results derived in model B. Often short-term results oppose long-term results, as can be seen in the dynamic models under both approaches, *i.e.* a single factor can be positively associated with the dependent variable in the short term and negatively in the long term.

Models C and H reveal that higher net income ratios (ROE and ROA) prompt banks to expand the spread between loan and deposit rates, demanding bigger returns on assets and equity, as net interest income is the pillar of Bulgarian banks' profitability. These findings are consistent with the results of Raharjo P *et al*. (2014).

Non-performing loans in models C to I negate the results of Model A by having negative coefficients in the long term. It would be expected that bad loans lead to higher lending margins for accumulating bad loan buffers. Negative coefficients may be appropriate under the hypothesis that in the long term banks try to attract high-quality loans through offering better loan conditions (lowering interest rates, for example). A similar negative relation is found to be viable in the panel study of Mihailov (2014) as well.

In the long term, when banks increase the loans *versus* the deposits of non-financial companies and households, they amplify their risk tolerance, thus requiring a smaller interest rate spread (see models E, F and I). The loan to deposit ratio may be considered a risk proxy, being in negative relationship with risk aversion. The lending spread is in positive relationship with risk aversion. These results are in contrast to the positive correlation between the interest margins and the loan to deposit ratio in the research of Trinugroho *et al*. (2012).

The loan to assets ratio leads to higher lending margins, signaling that banks are becoming more risk-averse with a higher weight of loans in their balances. The positive association is comparable to the interdependencies derived from Horovath (2009) and Claeys and Vander Vennet (2004).

Long-term results for foreign ownerships are inconclusive, with a positive coefficient for the parameter in model G and negative in H and I.

Bank concentrations ratios (Market share and HHI) in models E and I confirm the results of model A, leading to wider interest rate spreads, like in the findings of Demirgüç-Kunt and Huizinga (1999), Gelos (2006), Liebeg and Schwaiger (2007), Deans and Stewart (2012) and Poghosyan (2012).

Interbank borrowing rates in models D and F confirm the results derived in models A and B, resulting in interest rate spreads, yielding findings similar to those of Claeys and Vander Vennet (2004).

Lower unemployment rates in the country boosts banks' confidence, leading to lower lending-deposit rate differential (see models D, E and F). The general economic activity, measured through GDP, is a strong factor with a negative meaning for the dependent variable. Higher GDP translates in lower interest rate spreads (see models F to I), confirming the findings of Mihailov (2005), Gelos (2006), Liebeg and Schwaiger (2007), Gul *et al*. (2011), Chortareas *et al*. (2012) and Poghosyan (2012).

A long-term trend is found to be significant in models B, D and F.

Engle and Granger Two-step Approach

Models A and B

The error correction terms are statistically significant and have a highly negative impact on the model, representing the error correction mechanism, *i.e.* reducing the disequilibrium in the dynamic model with each subsequent quarter (since quarterly data is analyzed). Dynamic models structured under the Engle and Granger two-step approach can be found in the Appendices section in Table 7, while co-integrating vectors (ECT) are presented in Table 6 in the same section.

The interest rate spreads are in a positive and statistically significant relation to their lagged values.

It is common variables in the dynamic model that reveal short-term relations to have negative/positive coefficients and the opposite dependencies to develop in the long term.[7] Banks, as economic agents in general, have different behavior reasoning in the long and short term.

The first and second lags of the first differences of market share of biggest five banks by assets have a negative effect on regressand, while in the long term bigger market share results in larger spreads. It can be interpreted that in the short term banks are concerned with expanding their market share, which stimulates them to be more aggressive in terms of attracting deposits and new lending, thus maintaining or increasing their market share.

External bank liabilities, due mostly to parent banks, lead to larger interest rate spreads in the short term as well as in the long term, suggesting that banks through wider interest rate spreads secure returns in demand by foreign creditors by accumulating funds for their repayment.

Current changes of international interest rates on interbank loans have a positive effect on the dependent variable, and so do the third and fourth lags. The first lag of the regressor, however, has a diminishing effect on the dependent variable. In general, short-term results, presented in the dynamic models, confirm the co-integration findings. It can be summarized that interbank interest rate spreads can be considered as a risk proxy having a multiplying effect on the dependent variable.

House prices with a zero lag lead to wider interest rate spreads, while the first lag of the first differences has a negative effect on interest rate spreads. The coefficients of the house prices variable seem to negate each other with prevalence of the zero lag coefficient value, hence the long-term results should be considered concerning this regressor.

The recession dummy has a positive and statistically significant impact on interest rate spreads, and so does the dummy for Corporate Commercial Bank's turmoil.

The presented models pass the residual tests and have good explanatory power in terms of adjusted R^2 and F-stat. Testing for homoscedasticity is accomplished by using a Breusch-Pagan-Godfrey test and, if needed,

[7] See Pesaran *et al*. (1999, 2001).

White, ARCH and other tests are utilized. For accepting the null hypothesis of no serial correlation, a Breusch-Godfrey Serial Correlation LM Test is applied and, if needed, further investigation and confirmation is coupled with the correlogram of residuals, Q-stat probability, and a correlogram of squared residuals tests. A Jarque-Bera test is performed for normality of the distribution.

Models C to I

The error correction mechanism functions in models C to I as well, *i.e.* error correction terms have negative and statistically significant coefficients.

Interest rate spreads are in a positive association with their lagged first differences, confirming the results of models A and B.

Administrative and personnel expenses expressed as a ratio to net interest income lead to lower interest rate spreads in the short term, supported by the results of models C and I, with the first lag of Model C staying unconfirmed by other models and opposing the long-term results. It can be assumed that banks employ more resources in the short term, aiming to increase the size of their loan portfolios. Banks are in a position to expand lending at the expense of lowering interest rate spreads. New lendings require the involvement of new resources.

In model C, the return on assets ratio leads to smaller values for the dependent variable, in contrast to the long-term results. It can be assumed that lower profitability margins motivate banks to widen the lending spread, thus achieving better income results in the future and offsetting lower returns in the past. Higher return ratios, however, lead to lower interest rate spreads in the near term, with banks aiming to expand credit and deposit activity at the expense of lower lending margins, probably targeting bigger market share.

In the short term, foreign ownership leads to higher interest rate spreads. Banks are required by their foreign parent institution to achieve higher net and operating margins, thus being able to recover their investment according to their projections (see model H).

In contrast to the short-term results in model A, the dependent variable is in negative association with external liabilities (see models C, G and H). When banks acquire abundant funds by their foreign owners, they tighten the spread between interest rates on loans and deposits.

In the short term, the capital adequacy proxy leads to smaller interest rate spreads in its third lag and to a positive dependent value in its fourth lag, *i.e.* the results are inconclusive.

Unemployment in the short term leads to higher interest rate spreads. Deterioration in the labor market results in higher mark-ups on loans.

In dynamic models, the coefficients of first differences of GDP are inconclusive. The zero lag of the regressor has a negative effect on the regressand (see models D, F, G, H and I), while the third lag has a positive effect on interest rate spreads (see models G, H and I). It can be assumed that current GDP stimulates banks in requiring larger interest rate spreads, either because banks expect the situation to change for worse, *i.e.* being rational, or because banks require higher returns as economic conditions improve. However, the third lag of the regressor leads to a smaller value of the dependent, implying that GDP growth in the near past boosted banks' confidence and they increased lending activity at the expense of lowering interest rate spreads. A GDP decline leads to wider interest rate spreads, *i.e.* banks accumulate buffers, expecting balance sheet deterioration.

Growing consumer prices lead to smaller interest rate spreads, while their fourth lag values are in positive association with interest rate spreads (see model E). This contradiction can often be seen in dynamic error correction models when zero lag and other lags are employed, *i.e.* the same variables have positive/negative coefficients in the zero lag, while other lags' (1 to n) coefficients have negative/positive values. Banks behave differently not only in their long-term and short-term strategies, *e.g.* in the short term they may be differently motivated by the same factors.

The logic revealed in models A and B regarding the dummy variables also applies to models C, D, E and F.

Models C to I have a good explanatory power in terms of R^2 adjusted coefficients and residual stability; however, models A and B are preferred for their higher R^2 adjusted values and for their lower information criterion values.

ARDL Bounds Testing Procedure

Models A and B

The same co-integration equations have been employed under the ARDL bounds testing approach as in the Engle and Granger two-step models above, so the same reasoning applies.[8]

An EViews Add-in developed by Yashar (2014) has been employed for selecting the number of lags in each model under the ARDL bounds testing procedure. Low values of Schwarz information criteria and Akaike information criteria and high F-statistic of the Wald-test are the three main factors for selecting lag length. Dynamic models have the following lag structure:

- Model A: ARDL(3,3,3,3,2,1) [LOG(RMFHBS) = f(EONIA, LOG(BDLNS), LOG(HPR), LOG(MS5), LOG(SFX))],
- Model B: ARDL(5,0,1,3,4) [LOG(RMFHBS) = f(EONIA, LOG(EXTLIAB), LOG(CAP), LOG(PRH))].

The error correction mechanism is functioning in the ARDL dynamic models as well, having negative coefficients of lagged (one interval) level data of the dependent variable. All level data represent variables from the co-integrating equations and can be replaced with error correction terms. However, dynamic models will have slightly different short-term results if the first differences of co-integrated level variables are replaced by a single ECT formed by the same variables.

It was already stated that short-term findings frequently contrast long-term results, as cited in the co-integrating equations. A given variable can have a negative effect on the dependent variable in the long term and lead to an increase in the short term.

Dynamic models demonstrate that interest rate spreads are in a positive and very significant relationship with their lags.

By contrast, when compared with the long-term findings, market concentration is in a negative association with interest rate spreads in the short term, confirming the short-term findings of the Engle and Granger two-step dynamic model.

External liabilities lead to smaller interest rate spreads in the short term, contradicting the short-term results of the Engle and Granger two-step model B. Model B has a bigger explanatory power under the EG two-step

[8] Dynamic models under the ARDL bounds testing approach can be found in the Appendices section in Table 8, while co-integrating vectors (ECT) are presented in Table 6 in the same section.

approach and is supposed to have a bigger weight in weighing these contradictory findings.

As it can be expected, non-performing and restructured loans lead to a bigger dependent variable, *i.e.* banks acquire buffers in the short term for overcoming loan losses and to maintain sufficient liquid and capital buffers. The short-term and long-term findings coincide.

In the short term the capital adequacy proxy is in a strong positive association with interest rate spreads, supporting the long-term results. Capital buffer accumulation requires banks to widen the interest rate spreads, as net interest income is the main source of income and self-financing for local banks.

Interbank lending rates lead to smaller interest rate spreads in the short term, negating the positive coefficients for the zero, third and fourth lags in the two-step dynamic model under the Engle and Granger two-step approach. If lower interbank lending rates lead to higher interest rate spreads, it can be assumed that banks lower interest rates on deposits at a faster rate, being able to take advantage of interbank funds availability and of sources of income anchored to their rates.

The first lagged house price variable leads to lower interest rate spreads, while the third lag coefficient has a positive value, making implications inconclusive.

In the short term, the harmonized price index is in strong negative association with the regressand, with lags 3 and 4 being statistically significant and having negative coefficients.

Model A has bigger explanatory power under the ARDL bounds testing approach when compared to the Engle and Granger two-step approach in terms of the dynamic model's ability to explain the variation of the dependent variable (R^2 adjusted). The residual of the model has passed the serial correlation, heteroscedasticity and normality tests. However, model B suits examination under the Engle and Granger two-step approach better than model A.

Model A and model B findings validate each other to a bigger extent through confirmation under both types of co-integration techniques.

Models C to I

Models C to I have the following lag structure, as suggested by the EViews Add-in developed by Yashar (2014):[9]

- Model C: ARDL(3,5,2,4) [LOG(RMFHBS) = f(LOG(EXTLIAB), LOG(EXPTONII), LOG(ROA))]
- Model D: ARDL(3,2,3,3,3,4) [LOG(RMFHBV) = f(LOG(BDLNS), EURBR3M, LOG(EXTLIAB), LOG(UNMPL), LOG(YR))]
- Model E: ARDL(1,3,1,3,4,3) [LOG(RMFHBV) = f(LOG(BDLNS), LOG(UNMPL), LOG(YR), LOG(HHI5), LOG(LNSTODPTS))]
- Model F: ARDL(3,3,4,3,4,1,1) [LOG(RMFHBV) = f(LOG(BDLNS), EONIA, LOG(UNMPL), LOG(YR), LOG(LNSTOASTS), LOG(LNSTODPTS))] is transformed into ARDL(0,2,4,1(LAG 3),2(LAG1 AND LAG4),0,0) PASSING THE RESIDUAL TESTS,
- Model G: ARDL(3,1,4,4,4) [LOG(RMFHBV) = f(LOG(EXTLIAB), LOG(FOWN), LOG(YR), LOG(EXPTONII))]
- Model H: ARDL(1,1,3,2,4) [LOG(RMFHBV) = f(LOG(EXTLIAB), LOG(YR), LOG(ROE), LOG(FOWN))]
- Model I: ARDL(1,3,3,3,2,4) [LOG(RMFHBV) = f(LOG(YR), LOG(BDLNS), LOG(LNSTODPTS), LOG(FOWN), LOG(HHI5))]

The error correction mechanism functions well in the ARDL dynamic models with the coefficient of lagged (one interval) level variables being negative.

A positive association between the dependent variable and its lagged values in the dynamic model is revealed, confirming the findings of models A and B.

The expense to net interest income ratio leads to larger interest rate spreads in the long term and to smaller interest rate spreads in the short term in model C, while in model G, the opposite dependencies are revealed, *i.e.* the expense to net interest income ratio has a positive coefficient in the co-integrating equation and a negative coefficient in the dynamic model. Short-term results of model C are also corresponding to the main findings of Mihailov (2005, 2014). Model G results, however, are in line with Claeys and Vander Vennet (2004).

[9] All dynamic models under the ARDL bounds testing approach can be found in Table 8 in the Appendices section.

The return on assets ratio is in a positive relation with interest rate spreads in model C, while at 9% significance level the return on equity leads to larger dependent's values in model H. It can be assumed that in the near term banks decrease margins as profitability improves (in terms of return on assets ratio). Banks become more confident and more willing to lend, which results in lower lending rates and spreads.

Market concentration is in a negative association with interest rate spreads in the short term. Market share and HHI have been assigned negative coefficients in the dynamic models (models A, E and I). In a pursuit to increase market share, banks boost lending, thus decreasing the spread between loan and deposit rates.

In the short term, external liabilities' coefficients have opposing values in models B, C and D. While in models C and D, a short-term positive association exists, in model B, external liabilities lead to smaller interest rate spreads.

The non-performing loans parameter has a controversial impact on the dependent variable, having a negative coefficient in the short term in models E and I, and a positive coefficient in models A, D and F. Non-performing loans have a positive long-term effect on interest rate spreads in model A, while in models D, E, F and I, there is a negative association. While in models D and F the negative and positive signs are reversed between short-term and long-term dimension, models A, E and I don't share this feature.

The dynamic models reveal that in the short term, the loan to deposit ratio, employed as a risk proxy, has a significant positive effect on interest rate spreads, but a negative one in the long term.

In the short term, foreign ownership leads to higher interest rate spreads. Banks are required by their parent company to achieve higher net and operating margins, so that the parent organizations can recover investments as *per* projections. Co-integrating relations, however, reveal that foreign ownership leads to smaller interest rate spreads in models H and I and to higher interest rate spreads in model G.

Interbank lending rates have a contradicting effect on the regressand in the short term. The EONIA variable has a negative effect on the dependent in model A and leads to higher interest rate spreads in model F, while EURBR3M leads to higher interest rate spreads.

Unemployment leads to lower interest rate spreads in the short term. Banks reduce interest rate spreads, aiming to improve the quality of their loan portfolio through attracting new borrowers and easing conditions to existing ones.

The change in GDP has an ambiguous impact on the dependent variable. In models D, F (lag 4), G and H, GDP is in a positive association with interest rate spreads, while the change of GDP leads to lower interest rate spreads in models E, F(lag 1) and I. However, the long-term results are persistent.

All presented models pass the serial correlation, heteroscedasticity and normality residual tests. Their ability to explain more than half of the variation in the dependent variable and the overall confirmation of results from the Engle and Granger two-step approach boost confidence in the results, despite some short-term results' divergence.

Model F follows a different lag structure from that suggested by the EViews Add-in developed by Yashar (2014). Instead of being an ARDL(3,3,4,3,4,1,1), it is an ARDL(0,2,4,3(lag 3 only),2(lag 1 and 4),0,0) for being in shape to overcome serial correlation issues.

Summary and Conclusions

Because of mixed economic, bank-specific and local factors, interest rate spreads in Bulgaria have been on average above the mean EU member states values for a considerable period. Bulgarian banks motivate their interest rate spreads by different factors in the short and in the long term, the biggest impact on interest rate spreads being from regressors like: economic activity, market concentration, foreign ownership, external liabilities, profitability, risk aversion, structural changes due global financial crisis and induced by local banking system shocks.

Sector competitiveness is important to interest rate spreads. Competition in the sector promotes lower interest rate spreads in the long term; however, in the short term, a less competitive bank sector promotes lower interest rate spreads, probably due to attempts at increasing market shares.

General economic activity has a strong inverted association with interest rate spreads. In periods of economic improvement, banks tend to diminish the interest rate spreads, and in time of economic deterioration, the opposite development is expected. Higher GDP, house prices, consumer prices and lower unemployment all lead to smaller interest rate spreads in the long term. In the short term, unemployment is distinctive to the dynamics in the spread between loan and deposit rates and has a positive impact on the dependent variable.

Banks act pro-cyclically in an economic sense, which is also confirmed by the negative dependency of interest rate spreads on the risk proxy variable loan to deposit ratio in the long term. However, in the short term, banks have a reverse response to the risk proxy variable of the loan to deposit ratio, revealing higher risk aversion.

External financing for banks, provided mostly by their foreign parent companies, usually leads to lower interest rate spreads in the long run. Bank privatization not only leads to transfer of know-how, but also to an increase in FDIs, especially the part provided by the bank's headquarters to Bulgarian subsidiaries, resulting in a lower interest rate spread in the long term. In the short term, however, foreign ownership stimulates larger interest rate spreads, as banks are required to achieve bigger returns on their assets and equity through a larger difference between the interest earned on loans and paid to deposits.

The accumulation of capital buffers, *i.e.* the increase in the capital adequacy ratio and net income margins, lead to an increase in the interest rate spreads in the long run. In the long term, higher loan to assets ratio also stimulates banks to demand higher interest rate spreads for achieving higher capital ratios due to the denominator growth (*i.e.* the risk-adjusted assets).

It can be assumed that banks widen interest rate spreads to absorb economic and financial shocks. Results under both econometric methods suggest that two structural changes events, namely global and local financial and economic shocks, play a key role in the interest rate spreads dynamics in Bulgaria in the analyzed time period. Dummy variables for the immediate effects of the last global financial crisis, with a severe impact in the first quarter of 2009 and Corporate Commercial Bank's crisis in the second quarter of 2014, have widened interest rate spreads.

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Table 4. Non-financial Companies' Lending Margins

	2007	2008	2009	2010	2011	2012	2013	Nov. 2014
BG	4.3	2.7	2.2	4.1	4.4	3.3	4.6	5.4
PT	1.8	2.6	2.6	2.1	3.3	4.0	3.5	3.6
IE	2.3	2.0	1.3	1.6	1.6	2.0	2.8	3.5
GR	1.7	0.5	2.0	1.7	2.2	1.6	2.1	3.4
RO	3.4	1.6	2.8	2.0	2.7	3.1	3.5	3.3
SI	1.9	2.0	3.1	3.2	2.8	2.7	3.1	3.1
CY	2.0	0.9	1.9	2.6	2.7	2.4	3.4	2.9
LV	3.0	3.2	1.5	3.0	3.3	2.6	3.9	2.7
HR					3.8	2.8	2.7	2.6
LT	1.7	1.5	1.2	3.1	3.1	2.8	2.8	2.5
ES	1.2	0.8	0.8	0.6	1.3	0.8	1.9	2.5
MT	1.8	2.2	2.5	2.9	1.6	2.1	1.1	2.3
HU	1.6	0.2	2.0	2.0	2.3	1.5	1.9	2.3
EE	2.6	2.2	2.9	3.1	3.0	2.8	2.8	2.0
NL	0.9	0.9	1.8	2.0	1.9	1.9	1.9	1.7
PL	2.9	2.1	3.1	2.7	2.0	2.1	1.9	1.6
CZ	2.0	2.5	2.7	2.8	2.2	2.0	2.0	1.6
DE	1.4	1.6	2.1	2.2	2.0	1.7	1.8	1.5
BE	1.3	1.6	1.5	1.6	1.7	1.4	1.6	1.5
IT	1.3	1.5	1.3	1.5	1.3	1.3	1.7	1.4
SK	0.0	2.7	1.9	2.3	2.1	1.6	1.8	1.3
FI	0.8	1.2	1.5	1.6	1.6	1.5	1.8	1.3
SE	0.7	0.6	1.2	0.7	0.8	1.0	1.2	1.2
LU	1.2	1.6	1.6	1.8	2.0	1.7	1.6	1.1
AT	0.7	1.2	0.9	1.0	0.9	1.1	1.2	1.1
FR	0.9	1.5	1.4	1.2	1.2	1.1	1.3	1.1
DK	1.0	1.0	1.5	1.9	1.7	1.9	1.2	0.9
min	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
max	**4.3**	**3.2**	**3.1**	**4.1**	**4.4**	**4.0**	**4.6**	**5.4**
mean	**1.6**	**1.6**	**1.8**	**2.0**	**2.1**	**1.9**	**2.2**	**2.1**
median	**1.6**	**1.6**	**1.8**	**2.0**	**2.0**	**1.9**	**1.9**	**1.9**
BG above average	**169%**	**73%**	**17%**	**101%**	**110%**	**67%**	**111%**	**161%**

Note: BG – Bulgaria, PT – Portugal, IE – Ireland, GR – Greece, RO – Romania, SI – Slovenia, CY – Cyprus, LV – Latvia, HR – Croatia, LT – Lithuania, ES – Spain, MT – Malta, HU – Hungary, EE – Estonia, NL – Netherlands, PL – Poland, CZ – Czech Republic, DE – Germany, BE – Belgium, IT – Italy, SK – Slovakia, FI – Finland, SE – Sweden, LU – Luxemburg, AT – Austria, FR – France, DK – Denmark.

Source: ECB, Own calculations.

Table 5. Households Housing Purchases Lending Margins

	2007	2008	2009	2010	2011	2012	2013	Nov. 2014
HU	3.9	-0.1	3.8	4.5	4.8	5.1	5.5	4.8
BG	3.7	2.6	2.9	3.2	3.5	3.2	4.1	4.5
HR					2.5	2.3	2.8	3.4
RO	0.7	-5.4	-1.9	0.2	0.6	0.3	2.8	3.3
IE	1.1	1.3	1.4	1.6	0.7	2.4	2.7	3.3
LV	2.2	3.0	1.7	2.4	2.8	2.9	2.7	3.0
NL	0.9	2.2	4.2	3.4	3.4	3.6	3.1	2.8
PL	2.7	2.8	3.7	3.0	2.2	2.6	2.8	2.7
DK	1.5	1.7	2.3	2.7	1.7	2.2	1.9	2.7
BE	0.9	2.5	3.2	3.1	3.0	3.0	3.1	2.6
CZ	2.1	3.3	4.7	4.0	3.3	2.9	3.0	2.3
GB	0.1	2.4	3.2	2.9	2.2	2.9	2.4	2.3
ES	1.0	1.8	0.6	0.2	1.1	0.3	1.6	2.1
SI	2.4	2.3	1.5	1.4	1.5	0.5	1.7	2.1
SK	0.0	4.3	4.4	3.7	3.4	3.3	3.2	2.1
PT	0.8	1.2	0.8	0.0	1.1	1.7	1.7	2.0
DE	1.0	2.0	3.3	2.8	2.3	2.3	2.4	1.9
LU	0.8	1.8	1.6	1.6	1.6	2.0	1.8	1.8
IT	1.5	2.0	2.0	1.7	1.2	1.4	1.7	1.8
FR	0.6	2.2	2.8	2.0	1.9	2.2	2.1	1.7
EE	1.9	0.7	2.4	2.1	2.1	2.2	2.2	1.7
CY	1.2	0.8	0.3	1.0	1.4	0.7	2.4	1.6
AT	0.8	2.1	1.7	1.4	1.2	1.7	1.6	1.6
LT	0.9	-0.3	0.7	2.6	2.3	1.7	1.8	1.5
SE	0.9	1.2	1.2	1.4	1.3	1.2	1.1	1.3
MT	1.3	1.1	1.6	1.8	0.8	1.3	0.6	1.1
GR	0.0	0.2	1.7	0.2	-0.4	-1.6	0.0	0.9
FI	0.7	1.2	1.2	1.2	1.2	1.2	1.3	0.7
min	**0.0**	**-5.4**	**-1.9**	**0.0**	**-0.4**	**-1.6**	**0.0**	**0.7**
max	**3.9**	**4.3**	**4.7**	**4.5**	**4.8**	**5.1**	**5.5**	**4.8**
mean	**1.3**	**1.5**	**2.1**	**2.1**	**1.9**	**2.0**	**2.3**	**2.3**
median	**1.0**	**1.8**	**1.7**	**2.0**	**1.8**	**2.2**	**2.3**	**2.1**
BG above average	**202%**	**74%**	**38%**	**60%**	**88%**	**65%**	**83%**	**104%**

Note: BG – Bulgaria, PT – Portugal, IE – Ireland, GR – Greece, RO – Romania, SI – Slovenia, CY – Cyprus, LV – Latvia, HR – Croatia, LT – Lithuania, ES – Spain, MT – Malta, HU – Hungary, EE – Estonia, NL – Netherlands, PL – Poland, CZ – Czech Republic, GB – Great Britain, DE – Germany, BE – Belgium, IT – Italy, SK – Slovakia, FI – Finland, SE – Sweden, LU – Luxemburg, AT – Austria, FR – France, DK – Denmark.

Source: ECB, Own calculations.

Table 6. Co-integrating Equations

	MODEL A		MODEL B		MODEL C		MODEL D		MODEL E		MODEL F		MODEL G		MODEL H		MODEL I	
DEPENDENT VARIABLE	LOG(RMFHBS)		LOG(RMFHBV)		LOG(RMFHBS)		LOG(RMFHBS)		LOG(RMFHBV)		LOG(RMFHBV)		LOG(RMFHBV)		LOG(RMFHBV)		LOG(RMFHBV)	
EXPLANATORY VARIABLES	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
CONSTANT	-0.99	**0.09**	7.97	**0.00**	-2.30	**0.00**	17.30	**0.02**			24.77	**0.00**			10.69	**0.00**		
LOG(EXPTONII)					-0.47	**0.00**							1.17	**0.00**				
LOG(EXTLIAB)			0.19	**0.00**	-0.17	**0.01**	-0.29	**0.01**					-0.54	**0.00**	-0.44	**0.00**		
LOG(ROE)															0.16	**0.00**		
LOG(ROA)					0.19	**0.00**												
LOG(BDLNS)	0.03	**0.02**					-0.22	**0.00**	-0.13	**0.00**	-0.16	**0.02**					-0.07	**0.01**
LOG(LNSTODPTS)									-1.05	**0.00**	-1.42	**0.04**					-1.44	**0.00**
LOG(LNSTOASTS)											1.52	**0.09**						
LOG(CAP)			1.05	**0.00**														
LOG(FOWN)													1.50	**0.01**	-1.05	**0.09**	-1.35	**0.02**
LOG(MS5)	0.66	**0.00**																
LOG(HHI5)									0.34	**0.11**							0.64	**0.01**
EURBR3M							10.01	**0.00**										
EONIA	9.35	**0.00**	13.18	**0.00**							11.85	**0.00**						
LOG(UNMPL)							0.59	**0.00**	0.41	**0.00**	0.45	**0.02**						
LOG(YR)							-2.16	**0.01**	-0.47	**0.00**	-2.82	**0.00**	-0.32	**0.00**	-1.49	**0.00**	-0.79	**0.00**
LOG(HPR_R1)	-0.29	**0.00**																
LOG(PRH)			-1.87	**0.00**														
LOG(SFX_R)	0.06	**0.01**																
TREND			0.02	**0.00**			0.02	**0.00**			0.02	**0.01**						

Note: P-values below or equal to 10% (p-values ≤ 0.10) are in bold.

Table 7. Engle and Granger Dynamic Models

	MODEL A		MODEL B		MODEL C		MODEL D		MODEL E		MODEL F		MODEL G		MODEL H		MODEL I	
DEPENDENT VARIABLE	ΔLOG(RMFHBS)		ΔLOG(RMFHBS)		ΔLOG(RMFHBS)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)	
EXPLANATORY VARIABLES	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
CONSTANT			0.09	**0.00**					-0.05	**0.03**			-0.09	**0.02**				
ECT(-1)	-1.14	**0.00**	-2.56	**0.00**	-0.65	**0.00**	-1.05	**0.00**	-0.96	**0.00**	-1.19	**0.00**	-0.66	**0.00**	-0.67	**0.00**	-0.78	**0.00**
Δ(log(RMFHBS(-1)))	0.51	**0.00**			0.59	**0.00**			1.58	**0.00**								
Δ(log(RMFHBS(-2)))	0.39	**0.00**			0.44	**0.00**			0.32	**0.03**								
Δ(log(RMFHBV(-2)))															0.27	**0.04**	0.24	**0.06**
Δ(log(RMFHBV(-3)))															0.27	**0.04**	0.29	**0.03**
Δ(log(EXPTONII(-1)))					0.53	**0.00**							-1.02	**0.00**				
Δ(log(EXPTONII(-2)))					0.21	0.13							-0.92	**0.00**				
Δ(log(EXPTONII(-3)))					-0.36	**0.01**							-0.56	**0.03**				
Δ(log(ROA(-1)))					-0.08	**0.02**												
Δ(log(MS5(-1)))	-0.63	**0.02**																
Δ(log(MS5(-2)))	-0.44	**0.05**																
Δ(log(EXTLIAB))			0.48	**0.00**	-1.47	**0.00**							-0.90	**0.00**	-0.89	**0.00**		
Δ(log(EXTLIAB(-1)))			0.43	**0.00**														
Δ(log(EXTLIAB(-2)))			0.50	**0.00**														
Δ(log(BDLNS(-2)))									-0.20	**0.05**	-0.17	**0.08**						
Δ(log(CAP(-3)))									0.46	**0.01**								
Δ(log(CAP(-4)))									-0.92	**0.00**								
Δ(log(LNSTOASTS))											0.81	0.13						

Δ(log(FOWN(-1)))															2.48	**0.01**		
Δ(EONIA)			15.28	**0.00**														
Δ(EONIA(-1))	-6.44	**0.03**	-7.75	**0.02**														
Δ(EONIA(-3))			3.52	**0.05**														
Δ(EONIA(-4))			3.75	**0.03**														
Δ(log(UNMPL))							0.46	**0.06**										
Δ(log(UNMPL(-2)))											0.87	**0.00**						
Δ(log(YR))							-2.01	**0.01**			-1.83	**0.00**	-2.36	**0.00**	-2.72	**0.00**	-1.79	**0.01**
Δ(log(YR(-3)))													2.73	**0.00**	2.39	**0.00**	1.88	**0.01**
Δ(log(HPR_R1))	1.12	**0.00**																
Δ(log(HPR_R1(-1)))	-0.55	**0.02**																
Δ(log(PRH))									-3.23	**0.00**								
Δ(log(PRH(-4)))									1.33	**0.04**								
trend			-0.01	**0.00**									0.00	**0.10**				
D1	0.05	**0.06**	0.07	**0.01**	0.04	0.14	0.11	**0.07**			0.13	**0.03**						
D2			0.28	**0.00**					0.08	**0.01**								
R^2 adj.	0.69		0.79		0.53		0.56		0.51		0.62		0.59		0.57		0.55	
F-Stat	10.45		9.09		6.21		11.35		14.59		11.46		7.78		8.00		8.79	
Akaike info criterion	-3.81		-4.37		-3.45		-2.08		-1.96		-2.16		-2.00		-1.98		-1.98	
Schwarz criterion	-3.43		-3.60		-3.11		-1.87		-1.79		-1.91		-1.62		-1.69		-1.72	
DW stat	1.84		1.97		1.93		2.22		2.26		2.03		2.40		1.84		2.26	
Residual tests	H0 probability		H0 probability		H0 probability		H0 probability		H0 probability		H0 probability		H0 probability		H0 probability		H0 probability	

Ser. Corr. Test (type)	23% (Breusch-Godfrey Serial Correlation LM Test- 3 lags)	69% (Breusch-Godfrey Serial Correlation LM Test- 6 lags)	OK (Correlogram of residuals and Correlogram of squared residu-als)	63% (4 lags)	18% (Breusch-Godfrey Serial Correlation LM Test- 4 lags)	32% (Breusch-Godfrey Serial Correlation LM Test- 4 lags)	OK (Correlogram of squared residuals)	66% (Breusch-Godfrey Serial Correlation LM Test- 6 lags)	61%(Breusch-Godfrey Serial Correlation LM Test- 6 lags)
Heteroscedasticity Test (type)	37% (ARCH-4 lags)	32% (Breusch-Pagan-Godfrey)	58% (Breusch-Pagan-Godfrey)	80% (ARCH-4 lags)	27% (Breusch-Pagan-Godfrey)	42% (Breusch-Pagan-Godfrey)	89% (Breusch-Pagan-Godfrey)	93% (Breusch-Pagan-Godfrey)	72% (Breusch-Pagan-Godfrey)
Jarque-Bera Test	47%	34%	57%	69%	23%	48%	88%	94%	97%

Note: P-values below or equal to 10% (p-values ≤ 0.10) are in bold.

Table 8. ARDL Dynamic Models

	MODEL A		MODEL B		MODEL C		MODEL D		MODEL E		MODEL F		MODEL G		MODEL H		MODEL I	
DEPENDENT VARIABLE	ΔLOG(RMFHBS)		ΔLOG(RMFHBS)		ΔLOG(RMFHBS)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)		ΔLOG(RMFHBV)	
EXPLANATORY VARIABLES	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
CONSTANT	-0.88	0.45	-9.69	**0.00**	-4.43	**0.00**			-13.91	0.27	-14.83	**0.04**	10.72	**0.07**	11.34	**0.02**	-12.45	0.31
LOG(RMFHBS(-1))	-1.50	**0.00**	-1.67	**0.00**	-1.46	**0.00**												
LOG(RMFHBV(-1))							-1.59	**0.00**	-2.17	**0.00**	-1.43	**0.00**	-1.21	**0.00**	-0.73	**0.00**	-2.12	**0.00**
LOG(BDLNS(-1))	0.12	**0.00**					-0.25	**0.00**	0.40	**0.03**	-0.53	**0.00**					0.21	**0.01**
LOG(CAP(-1))			-1.04	**0.02**														
LOG(EXTLIAB(-1))			0.18	**0.01**	-0.51	**0.00**	-0.06	0.83					0.14	0.60	0.22	0.40		
LOG(LNSTODPTS(-1))									-10.09	**0.00**	-2.52	**0.01**					-7.78	**0.00**
LOG(LNSTOASTS(-1))											3.05	**0.01**						
LOG(EXPTONII(-1))					-1.27	**0.00**							0.10	0.88				
LOG(ROE(-1))															-0.07	0.27		

LOG(ROA(-1))					0.22	**0.01**												
LOG(FOWN(-1))													-3.59	**0.01**	-1.97	**0.08**	1.28	0.26
LOG(MS5(-1))	1.03	**0.06**																
LOG(HHI5(-1))									7.18	**0.00**							5.34	**0.00**
EURBR3M(-1)							-25.80	**0.00**										
EONIA(-1)	15.16	**0.02**	11.31	**0.01**							-32.28	**0.00**						
LOG(HPR_R1(-1))	-0.66	**0.03**																
LOG(UNMPL(-1))							0.07	0.81	-0.84	0.15	0.18	0.44						
LOG(YR(-1))							-0.52	**0.00**	-4.06	**0.01**	1.21	**0.11**	-1.58	**0.02**	-1.46	**0.01**	-2.79	**0.00**
LOG(SFX_R(-1))	0.27	**0.00**																
LOG(PRH(-1))			0.58	**0.00**														
Δ(log(RMFHBS(-1)))	0.68	**0.11**	0.87	**0.02**	1.23	**0.00**			0.19	0.32								
Δ(log(RMFHBS(-2)))	0.56	**0.08**	0.44	**0.07**	0.93	**0.00**												
Δ(log(RMFHBS(-3)))	0.42	**0.01**	0.22	0.15	0.57	**0.00**												
Δ(log(RMFHBS(-4)))			0.25	0.12														
Δ(log(RMFHBS(-5)))			0.48	**0.01**														
Δ(log(RMFHBV(-1)))							0.51	**0.10**					-0.04	0.86	-0.14	0.51	0.27	0.17
Δ(log(RMFHBV(-2)))							0.43	**0.07**					0.36	**0.07**				
Δ(log(RMFHBV(-3)))							0.45	**0.02**					0.31	**0.06**				
Δ(log(EXPTONII(-1)))					1.24	**0.00**							-0.86	0.15				
Δ(log(EXPTONII(-2)))					0.82	**0.00**							-1.03	**0.07**				
Δ(log(EXPTONII(-3)))													-1.31	**0.01**				
Δ(log(EXPTONII(-4)))													-0.73	**0.03**				
Δ(log(ROA(-1)))					-0.22	**0.00**												
Δ(log(ROA(-2)))					-0.18	**0.00**												

Δ(log(ROA(-3)))					-0.12	**0.03**												
Δ(log(ROA(-4)))					-0.06	**0.10**												
Δ(log(ROE(-1)))															0.11	0.15		
Δ(log(ROE(-2)))															0.11	0.09		
Δ(log(MS5(-1)))	-1.07	**0.07**																
Δ(log(MS5(-2)))	-0.89	**0.01**																
Δ(log(MS5(-3)))																		
Δ(log(MS5(-4)))																		
Δ(log(HHI5(-1)))									-7.18	**0.00**							-5.26	**0.00**
Δ(log(HHI5(-2)))									-6.16	**0.00**							-4.40	**0.00**
Δ(log(HHI5(-3)))									-3.75	**0.00**							-2.60	**0.00**
Δ(log(HHI5(-4)))									-1.63	**0.01**							-1.07	**0.08**
Δ(log(EXTLIAB(-1)))			-0.07	0.74	0.33	**0.06**	0.40	0.29					-0.53	0.30	0.13	0.80		
Δ(log(EXTLIAB(-2)))			-0.73	**0.00**	0.15	0.34	0.42	**0.06**										
Δ(log(EXTLIAB(-3)))			-0.48	**0.00**	0.24	**0.04**	0.38	**0.03**										
Δ(log(EXTLIAB(-4)))					0.39	**0.01**												
Δ(log(EXTLIAB(-5)))					0.25	**0.02**												
Δ(log(BDLNS(-1)))	-0.03	0.59					0.30	**0.02**	-0.39	**0.10**	0.40	**0.00**					-0.09	0.51
Δ(log(BDLNS(-2)))	0.22	**0.00**					0.27	**0.04**	-0.53	**0.01**	0.14	0.21					-0.35	**0.03**
Δ(log(BDLNS(-3)))	0.13	**0.07**							-0.35	**0.03**							-0.36	**0.05**
Δ(log(CAP(-1)))			1.87	**0.00**														
Δ(log(LNSTODPTS(-1)))									5.03	**0.00**							4.51	**0.00**
Δ(log(LNSTODPTS(-2)))									3.74	**0.00**							2.78	**0.01**
Δ(log(LNSTODPTS(-3)))									2.59	**0.02**							2.44	**0.04**
Δ(log(FOWN(-1)))													3.46	**0.03**	3.40	**0.03**	0.37	0.80

Δ(log(FOWN(-2)))													2.84	**0.09**	0.68	0.59	-1.41	0.22
Δ(log(FOWN(-3)))													-0.07	0.96	1.34	0.28		
Δ(log(FOWN(-4)))													4.72	**0.01**	3.08	**0.02**		
Δ(EONIA(-1))	-12.24	**0.01**	-0.37	0.93							38.23	**0.00**						
Δ(EONIA(-2))	-8.69	**0.02**									21.56	**0.00**						
Δ(EONIA(-3))	-4.81	**0.09**									17.90	**0.00**						
Δ(EONIA(-4))											22.82	**0.00**						
Δ(EURBR3M(-1))							19.78	**0.00**										
Δ(EURBR3M(-2))							3.50	0.54										
Δ(EURBR3M(-3))							18.18	**0.01**										
Δ(log(UNMPL(-1)))							-0.80	0.14	1.29	0.11								
Δ(log(UNMPL(-2)))							-1.06	**0.05**										
Δ(log(UNMPL(-3)))							-1.74	**0.01**			-0.96	**0.01**						
Δ(log(YR(-1)))							1.74	0.15	0.79	0.51	-2.41	**0.00**	0.95	0.46	2.42	**0.05**	-0.51	0.58
Δ(log(YR(-2)))							1.75	0.11	-2.04	**0.03**			1.31	0.22	1.72	**0.10**	-2.34	**0.04**
Δ(log(YR(-3)))							2.36	**0.05**	-2.14	**0.03**			2.89	**0.01**	2.38	**0.02**	-2.10	**0.05**
Δ(log(YR(-4)))							2.14	**0.02**			1.90	**0.02**	2.31	**0.04**				
Δ(log(HPR_R1(-1)))	-0.83	**0.03**																
Δ(log(HPR_R1(-2)))	0.55	0.14																
Δ(log(HPR_R1(-3)))	0.95	**0.00**																
Δ(log(SFX_R(-1)))	-0.03	0.43																
Δ(log(PRH(-1)))			-0.19	0.82														
Δ(log(PRH(-2)))			-0.75	0.39														
Δ(log(PRH(-3)))			-2.50	**0.01**														
Δ(log(PRH(-4)))			-2.99	**0.00**														

R^2 adj.	0.86	0.62	0.65	0.81	0.69	0.76	0.57	0.48	0.67
Akaike info criterion	-4.56	-3.80	-3.88	-2.69	-2.18	-2.43	-1.84	-1.64	-2.11
Schwarz criterion	-3.62	-2.93	-2.96	-1.66	-1.23	-1.70	-0.89	-0.86	-1.12
DW stat	2.04	2.71	1.86	2.44	2.08	2.44	2.24	2.27	1.95
Residual tests	H0 Probability	H0 Probability	H0 Probability	H0 Probability	H0 Probability	H0 Probability	H0 Probability	H0 Probability	H0 Probability
Ser. Corr. Test (type)	34% (Breusch-Godfrey Serial Correlation LM Test- 8 lags)	25% (Breusch-Godfrey Serial Correlation LM Test- 9 lags) OK (Correlogram of squared residuals)	OK (Correlogram of residuals and Correlogram of squared residuals)	24% (Breusch-Godfrey Serial Correlation LM Test- 6 lags)	18% (Breusch-Godfrey Serial Correlation LM Test- 4 lags)	OK (Correlogram of squared residuals)	34% (Breusch-Godfrey Serial Correlation LM Test- 6 lags)	31% (Breusch-Godfrey Serial Correlation LM Test- 6 lags)	26%(Breusch-Godfrey Serial Correlation LM Test- 6 lags)
Heteroscedasticity Test (type)	27% (Breusch-Pagan-Godfrey)	73% (Breusch-Pagan-Godfrey)	95% (Breusch-Pagan-Godfrey)	36% (Breusch-Pagan-Godfrey)	82% (Breusch-Pagan-Godfrey)	57% (Breusch-Pagan-Godfrey)	82% (Breusch-Pagan-Godfrey)	23% (Breusch-Pagan-Godfrey)	40% (Breusch-Pagan-Godfrey)
Jarque-Bera Test	64%	95%	85%	88%	23%	27%	34%	48%	67%

Note: P-values below or equal to 10% (p-values ≤ 0.10) are in bold.

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