

IMPACT OF SOVEREIGN CREDIT RISK ON THE LITHUANIAN INTEREST RATE ON LOANS

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Abstract. *The paper deals with banks' interest rates on loans for non-financial corporations and households in Lithuania. It focuses on the influence of the sovereign credit risk on interest rates for loans. The paper presents an analysis of long-run and short-run relationship between interest rates on loans and the financial market indicators EURIBOR and CDS spread. The application of the cointegration technique has revealed that a change in the CDS spread by 100 basis points has an impact on changes in interest rates on loans by 42 basis points in the long run. No evident relationship between CDS spread and interest rates on loans in a short run has been detected. This shows that market conditions do not play a pivotal role for the banks in setting the interest rates on loans in a short run. Some communalities in interest rates on loans in the Baltic states have been established. The main finding is that the sovereign credit risk of Lithuania, expressed as a CDS spread, has a substantial impact on interest rates in the retail credit market of Lithuania in a long run.*

Key words: *CDS, spread, credit risk, retail market, loans*

1. Introduction

A country's macroeconomic climate is determined by a number of internal political and economic decisions as well as by the external environment. Currently, the role of external factors is growing. Globalization of the world economy has a huge impact on a country's wealth, particularly where the country's economy is open (see Urbšienė, 2013). Having a small and open economy, Lithuania enjoys the benefits of globalization and at the same time faces challenges of the world economy disturbances. A spill-over effect of the financial crisis of 2008 has had a huge impact on the Lithuanian economy. As a consequence of the crisis, the real GDP growth rate dropped to minus 14.8 percent in 2009, despite the fact that the year 2008 was rather efficient for the Lithuanian economy,

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and the real GDP growth rate was 2.9 percent¹. The financial crisis of 2008 has had a reflection in almost all the indices and parameters of financial markets. Sovereign credit risk indices were among the first market indicators of the crisis.

A proper understanding of the impact of sovereign credit risk on interest rates on loans is of great significance for the country where the volatility of credit risk is high. The credit risk indicators, such as Credit Default Swaps (CDS) spreads or Eurobonds risk premiums, together with a risk-free interest rate are the factors determining interest rates for the sovereign debt and at the same time foreign and local borrowing cost of the country. Volatility in government bond yields can have significant macroeconomic consequences. A rise in sovereign yields tends to be accompanied by an increase in interest rates in the rest of the economy, affecting both investment and consumption decisions (Caceres et al., 2011)

Interest rates of the government securities serve as a benchmark for the retail market (see, e.g., Cifarelli and Paladino, 2014). Being one of the major parameters determining the government borrowing cost, the sovereign credit risk is reflected in the retail market. It is worth noting that many researchers agree that sovereign risk in fact is not sovereign and the major part of credit risk is linked to global factors (Longstaff et al., 2011). Nevertheless, in most cases it determines the level of government borrowing cost and at the same time the interest on loans in the country.

We chose the CDS spread as a measure of the sovereign credit risk. The CDS spreads have an advantage over the credit ratings because they are market-based variables and can be considered as an interval variables, whereas credit ratings are a categorical variable. We investigate the period of 67 months, and during this period the Moody's rating of Lithuania changed just 5 times, while CDS spreads react immediately and their value changes daily. Therefore, the variability of CDS over time is more flexible and better adjustable to the changing market conditions.

The aim of the paper is to determine the impact of the Lithuanian sovereign risk on the retail borrowing cost from financial institutions in the country. The analysis of interest rates on loans of non-financial institutions and households in Lithuania and its relationship with sovereign credit risk is performed. The authors of the paper use CDS spreads as a measure of sovereign credit risk and the EURIBOR as an indicator of an interbank interest rate, as well as the harmonized Monetary and Finance Institutions (MFI) statistics for interest rates on loans.

A number of authors have investigated the monetary transmission mechanism in the euro area. Considering changes in the monetary policy rate, they analysed its propagation on interest rates for loans (see, e.g., Cifarelli and Paladino, 2014, Belke et al., 2013). This

¹ <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tec00115>
Extracted on 22 08 2014.

issue is called the pass-through phenomenon, and it has an important role in setting the monetary policy in the euro area. This paper is intended for a deeper analysis. Considering the CDS spread as a measure of the credit risk of a country, its influence on interest rates for loans in Lithuania is analysed. More precisely, the behaviour of bank interest rates on loans with respect to the interbank lending rate EURIBOR and the Lithuanian CDS spread is investigated. A cointegration technique is applied for determining the long-run relationship. The short-term relationship is investigated by analysing monthly changes of the variables.

The rest of the paper is structured as follows. Section 2 presents a literature overview focusing on CDS as an indicator of credit risk. Section 3 provides the description of the data used in the paper. Section 4 reveals the commonality in retail markets of the Baltic states. Section 5 describes long-run and short-run relationship models among the explored variables. Section 6 presents the conclusion.

2. Literature overview

There are several ways to measure the sovereign credit risk. Credit agencies look very closely at the economic fundamentals and political developments in a country and assign ratings for the sovereign debt. Actually, the ratings reflect the probability of default of the debt repayment. Despite the very considerable experience of credit rating institutions, a lot of criticism is addressed to them. Eijffinger (2012) claimed that the rating agencies were lagging behind markets in their judgments. Nevertheless, an analysis of Antonio et al. (2012) established significant responses of government bond yield spreads to changes in rating notations and outlook.

The volatility of the market stresses the need to use a market-based measure for the borrowing cost. A common measure for the country's borrowing cost in the international market is a sovereign bond yield spread which is defined as a difference between the yield of the country's debt securities and the yield of the AAA rated sovereign bonds. Currently, the interest rate swap is used as an indicator of a risk-free rate substituting the yield of high quality securities in defining a bond yield spread. The advantages of the interest rate swap are that it is highly liquid, carries a relatively little counterparty risk, and provides explicit quotes for the 3, 5, 7 and 10-year maturities (see Beber et al., 2009). The sovereign bond yield spread is one of the measures for a credit risk of the country.

CDS spread is an alternative measure for sovereign credit risk. According to the Statistics of BIS², the total outstanding notional amount of sovereign CDS at the end of June 2013 was 3.4 trillion USD dollars, which is approximately equal to 6% of the sovereign debt. As a measure of credit risk, CDS spreads imply the probability of the

² Available at Internet https://www.bis.org/publ/otc_hy1311.pdf

default of the sovereign combined with a recovery ratio in case of the default. One of the advantages of CDS spreads over bond yield spreads is that they explicitly express the risk and there is no influence from a risk-free yield curve which can be built using some models (Ericsson et al., 2009). Being a market indicator, CDS spreads incorporate some market “noise” which is not directly related to the credit risk. It consists of the liquidity of the market, the positions of traders, and of similar factors. Badaoui et al. (2013) argue that the liquidity risk can have a substantial impact on the level of CDS spreads. They developed a method to decompose the CDS spreads into the default risk and liquidity risk components.

The fact that the credit risk can be measured by CDS spreads and yield spreads implies an interest in analysing these two variables together. A number of papers are devoted to the analysis of the leading role of two variables: CDS spreads and the bond yields of the same entity. As indicated by Blanco et al. (2005) and Zhu (2006), the CDS market surpasses the bond market in price discovery for corporate entities. Forte and Pena (2009) applied the Vector Error Correction Model (VECM) to find out the leading indicator among three variables: stock price volatility, bond spreads, and CDS spreads. They have established that the prices of stocks react faster to changes in the credit risk profile than those of CDS and bonds. Their modelling shows that CDS play the leading role with respect to bonds. Norden et al. (2009) has proved that the CDS market is more sensitive to changes of the risk profile of the entity than the bond market, and this effect is stronger for the US than for the European corporates.

There are a number of papers (IMF, 2013, Fontana and Scheicher, 2010) describing the co-movement of sovereign CDS and bond spreads. It is commonly agreed by the authors that the co-integration relationship of the variables holds reasonably well. The IMF (2013) has performed a comprehensive lead-lag analysis of CDS and bond spreads and made a conclusion that both indicators can be leading depending on the market conditions. According to IMF (2013), CDS prices moved faster in advanced economies during the crisis period, and the leadership of CDS spreads against bond spreads is different for advanced and developing economies. Gyntelberg et al. (2013) analysed the co-movement of CDS and bonds spreads of the euro area countries during an intraday trading. They established that the CDS market dominated over the bond market in terms of price discovery in the vast majority of cases they examined. A lead-lag analysis for various euro area countries was carried out by many authors. The French CDS analysis was presented by Coudert and Gex (2010), the Italian case was described by Carboni (2011).

CDS spreads for individual CEE countries have been analysed by a number of authors. Some researchers carried out a lead-lag analysis of CDS spreads and bond yield spreads. Varga (2009) studied the development of the CDS-bond basis spread in Hungary

from February 2005 to June 2008 in order to compare the results of the Hungarian CDS market analysis in an international context³ covering the Baltic countries. He concluded that there was no clear leader in this market. Noteworthy, Varga analysed the markets before the crisis. A lead-lag analysis for CDS of the Czech Republic was performed by Komarkova et al. (2013) who found that the movements in the Czech sovereign CDS market preceded the movements in the sovereign yield spread during the global crisis. A lead-lag analysis of the Lithuanian CDS and bond market during and after the crisis was made by Kregzde and Murauskas (2014). They have found that in the majority of cases the CDS market dominates over the bond market.

The amount of literature on the impact of credit risk on the macroeconomics of sovereigns increased after the sovereign debt crisis. Several authors analysed the euro area countries. Neri and Ropele (2013) investigated the impact of the sovereign debt crisis on a number of macroeconomic variables pertaining not only to the euro area as a whole but also to individual countries. They found that sovereign tensions had led to an increase in the cost of new loans and contraction in credit. The implication of the sovereign risk channel was explored by Corsetti et al. (2013). They studied how sovereign default risk raised the funding cost in the private sector. It is worth noting that a completely different mathematical approach was used for the studies mentioned above. Neri and Ropele (2013) based their empirical analysis on the Factor Augmented Vector Autoregressive (FAVAR) model with the Bayesian methods, while Corsetti et al. (2013) designed their model on the basis of the New Keynesian baseline theory. Despite the different approaches, the conclusions show that private borrowing is affected by sovereign risk or sovereign tensions. Some studies were related to the impact of corporate credit spreads on business cycles. Gilchrist and Zakrajek (2012) reported that credit market spreads had a significant impact on business cycles in the U.S.

Another group of papers deals with a monetary policy of the European Monetary Union. From the monetary policy point of view, it is important to investigate the interest rate pass-through from the money market to various loan rates. Belke et al. (2013) analysed a long-run relationship and a short-run dynamics between the EONIA and credit categories with different maturities. A monetary transmission mechanism for eight euro zone countries was investigated by Cifarelli and Paladino (2014). Their research dealt with the relationship between EURIBOR and a long-run interest rate on loans to non-financial corporations. They have found that for some countries the spread between domestic and German long-term bond interest rate plays a significant role in changes of the bank's cost of funding.

³ Varga (2009) analysed Brasil, Bulgaria, the Czech Republic, the Republic of South Africa, Estonia, Croatia, Poland, Latvia, Lithuania, Russia, Romania, and the Slovak Republic.

3. Data

The interest rate is the main measure for the cost of borrowing; therefore, it attracts a great interest from regulators. Starting from January 2003, the euro area countries report harmonised interest rate statistics of Monetary and Financial Institutions to the ECB. Lithuania started collecting data on interest rates from October 2004.

Moreover, two basic categories of interest rate indicators were used in our paper: for households and for non-financial corporations. We did not investigate interest rates on long-term and short-term loans individually. Hence, we used consolidated data which were a weighted average of long-term and short-term interest data. Our analysis was focused on the loans denominated in euros. The reason behind this choice was a domination of euro loans in the Lithuanian market. For example, in January 2014, new loans for non-financial corporations amounted to 41.3 million euros (loans issued in litas) and to 115.4 million euros (loans issued in euros)⁴. Our analysis was focused on the period from September 2008 to March 2014. We chose data starting from September 2008 because from this date the Lithuanian CDS market has become liquid and the data on CDS spreads have been reliable (see Kregzde and Murauskas, 2014). An analysis of interest rates on loans and CDS spreads was performed with respect to the period mentioned above. We used monthly data of new loans.

When analysing loans to households, we limited our scope of analysis to mortgage loans⁵. This was due to two reasons. Firstly, a monthly average amount of new mortgage loans was approximately 8.2 times higher than that of consumer credits. Secondly, the volatility of interest rates on consumer credits was very high. In 2013, the ECB claimed that consumer credits and loans for other purposes were less relevant for macroeconomic projections. Gambacorta (2005) showed that the interest rate on short lending reacted to monetary shocks less and was based mostly on the demand side. The volatility of interest rates on consumer credits in Lithuania is presented in Fig. 1.

Moreover, there is a problem with the data on the interest rate for loans to non-financial corporations. The small volume of the financial market creates a high volatility of the interest rate series. Financing of government projects increases the volatility of interest rates as well, because they are fairly high, and the fact that they have the government's guarantee push the monthly average of the interest rate down in case such a loan is granted. The average monthly amount of new loans to non-financial corporations in Lithuania makes 275 million euros. In case the government borrows, for example, 140 million at a lower interest rate, this has an impact on statistics with a

⁴ Bank of Lithuania. Available at http://www.lbank.lt/stat_pub/statbrowser.aspx?group=8279&lang=lt. Retrieved on 04 01 2004 .

⁵ The ECB use the term "loans for house purchase" instead of "mortgage loans" in harmonized Monetary and Finance Institutions statistics. Available at internet <https://www.ecb.europa.eu/press/pdf/mfi-mir-presentation-keuning.pdf>

weight approximately equal to 0.3. For this reason, the ECB⁶ uses a 24-month average approach which has the effect of smoothening the data series. The aim of the study was to establish the relationship of the interest rates on loans and other market indicators; therefore, the smoothening of data was declined.

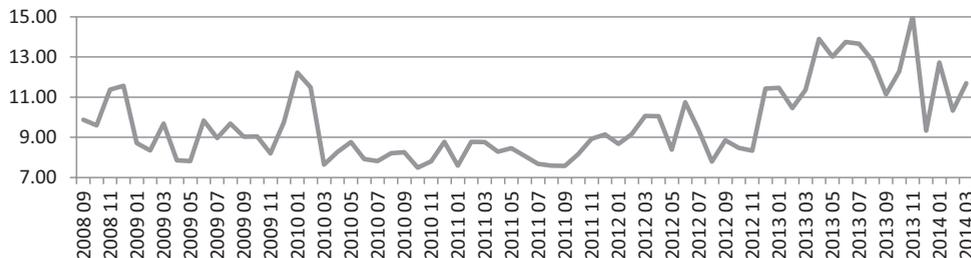


FIG 1. Weighted average of interest rates on consumer credits of all maturities in percent

Source: authors' calculation using data from the Bank of Lithuania.

A monthly interest rate of the 6-month interbank lending rate EURIBOR and the Lithuanian sovereign 5-year CDS data were used for this study. The descriptive statistics are presented in Table 1. As expected in such an unstable time period, all the variables are positively skewed with a moderately high kurtosis. The Jarque–Bera statistics significantly reject the assumption of a normal distribution for all variables indicating a non-normality of their unconditional distributions.

4. Interest rates on loans in the Baltic states

This section provides a comparison of interest rates on loans in the Baltic states. Figure 2 presents interest rates for non-financial institution in the Baltic states.

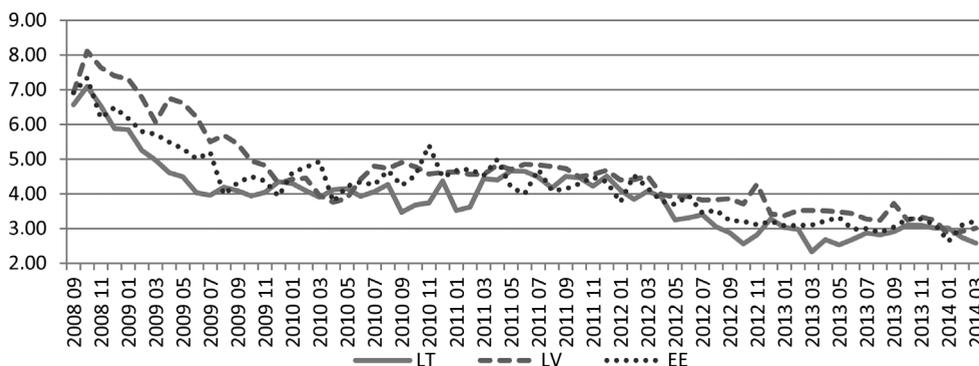


FIG. 2. A weighted average of interest rates for non-financial corporations of all maturities in the Baltic states (in percentage)

Source: Bank of Lithuania, Bank of Latvia, Bank of Estonia.

⁶ Available on Internet <https://www.ecb.europa.eu/stats/money/interest/comp/html/index.en.html>

Some commonalities on interest rates in the Baltic states are observed. The averages of interest rates on loans for non-financial corporations in Lithuania, Latvia, and Estonia are 3.92%, 4.59% and 4.24%, respectively. The standard deviations of interest rates for Lithuania, Latvia, and Estonia are 0.98%, 1.19%, and 1.02%, respectively. This shows that the statistical characteristics of interest rates of the Baltic states are very similar. During the period under consideration, Lithuanian non-financial corporations enjoyed the lowest average interest rate and the lowest standard deviation. The average of month-to-month changes of interest rates is equal to 0.06% for all the three states. As said before, the small volumes of financial markets for loans to non-financial corporations create a great volatility of interest rate changes. As a consequence, the pairwise correlations among changes of interest rates for non-financial corporations in the Baltic states are weak and insignificant (see Table 2).

Some troubles arise when comparing interest rates among the Baltic states on mortgage lending. The Estonian statistics provides interest rates for mortgage loans, whereas Latvian statistics gives an annual percentage rate of charge which comprises an interest rate component and other related charges. The Lithuanian statistics provides both indicators. According to our calculations, the difference of the annual percentage rate of charge and the interest rate in the case of Lithuania is equal to 0.15 on the average. In order to get comparable figures, we used the interest rate as the main indicator. In the case of Latvia, we used the Latvian statistical figure of annual percentage rate of charge and subtracted it by 0.15. The mortgage interest rates are presented in Fig. 3.

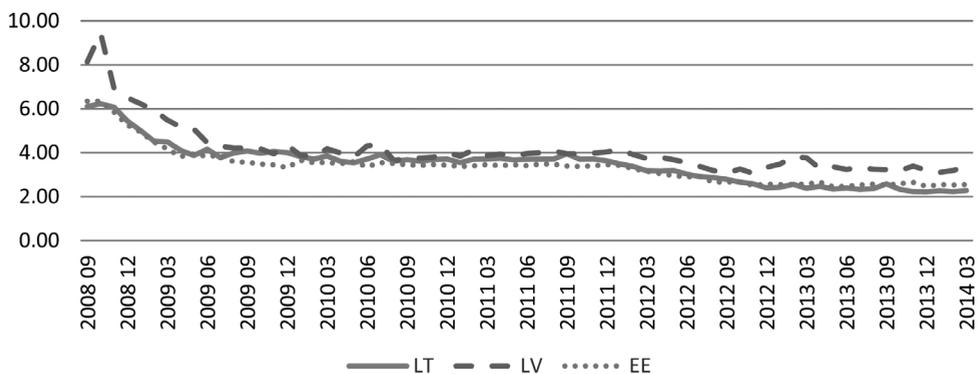


FIG. 3. A weighted average of interest rates for mortgage loans of all maturities in the Baltic states in percentage

Sources: Bank of Lithuania, Bank of Latvia, Bank of Estonia.

The averages of interest rates on mortgage loans in Lithuania, Latvia, and Estonia are 3.49%, 4.12%, and 3.38%, respectively. Standard deviations of interest rates for Lithuania, Latvia, and Estonia are 0.92%, 1.14%, and 0.839%, respectively. The level and volatility of interest rate in Latvia is the highest, but the difference is moderate.

The relationship of interest rate changes for mortgage, as expressed in terms of pairwise correlation coefficients, is presented in Table 3. The calculations show significant positive correlations of interest rate changes in the Baltic states. Note that Kregzde and Murauskas (2014) have established a very high correlation among the CDS of the Baltic states. It is important that foreign investors dominate in the Baltic banking system. Data from the banking associations of the Baltic states⁷ show that two Swedish banks – SEB and Swedbank – have the shares of 56 percent of the Lithuanian (September 2013), 61 percent of the Estonian (December 2013), and 32 percent of the Latvian (December 2013) banking sectors. It is not surprising that foreign owners run a similar policy with respect to setting interest rates on loans in all the Baltic states.

In the middle of 2010, a decision to invite Estonia to the euro zone was taken. Decisions of the EU institutions concerning Latvia's and Lithuania's joining the euro zone were made in the middle of 2013 and of 2014, respectively. We did not find any significant structural changes in the interest rates for loans in Estonia, Latvia and Lithuania during the mentioned periods. When analysing the accession of Greece to the EMU in 2001, Chionis and Leon (2006) established some structural changes in the interest rates on loans. The difference between Greece and the Baltic states can be explained by a fixed exchange rate regime in the Baltic states before their accession to the EMU.

5. Determinants of interest rates on loans

In this section, we try to provide answers to the question as to whether the EURIBOR and CDS spreads affect the interest rate on loans offered by banks. Figure 4 presents the EURIBOR and CDS spread and banks' interest rates for non-financial corporations and for mortgage.

We perform an estimation of a correlation among the changes of the variables. The estimates of the pairwise correlation are presented in Table 4. We see no evident correlation among changes of the interest rate on loans offered by banks with CDS spreads. This can be explained by the policy of banks in setting interest rates on loans. Banks adjust their interest rates on loans by taking into account the mismatching maturity of assets and liabilities as well as other individual factors, and market conditions can be not a pivotal factor in a short- run.

⁷ Association of Lithuanian Banks. Available in the Internet: http://www.lba.lt/go.php/eng/Main_Indicators_of_Banks/360

Association of Commercial Banks of Latvia. Available in the internet: http://www.bankasoc.lv/en/statistics/banks/Banku_statistika_www_12_2013_ENG_eiro_ok.pdf

Estonian Banking Association. Available the internet <http://www.pangaliit.ee/en/banking-information>

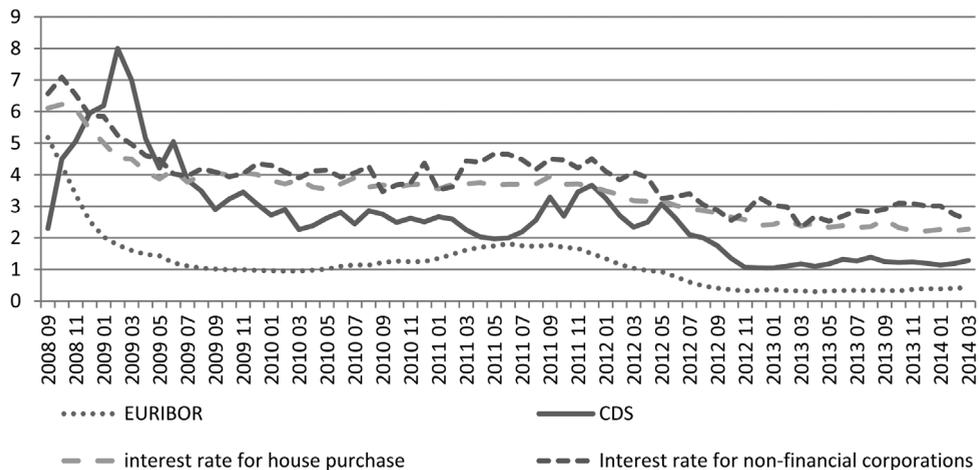


FIG. 4. EURIBOR, Lithuanian CDS spreads and a weighted average of interest rates of all maturities for non-financial corporations and mortgage in Lithuania in percentage

Source: Bank of Lithuania, Bloomberg.

Our next step is to estimate a long-run and a short-run relationship among the variables. For this reason, first at all we test the stationarity of the variables by performing the Augmented Dickey–Fuller (ADF) unit-root test. Table 5 provides the results of the unit root tests. All the variables have unit roots at a 5% significance level. In addition, the results reveal that the CDS spread changes, EURIBOR changes and changes in interest rates on mortgage loans are stationary variables during the analysed period.

Further, we analyse a relationship among the interest rates of mortgage loans, CDS and EURIBOR. A long-run relationship is described by the following equation:

$$brh_t = \beta_0 + \beta_1 CDS_t + \beta_2 EURIBOR_t + \varepsilon_t \quad (1)$$

where brh_t is the banks' interest rate on loans for mortgage, CDS_t is the CDS spread, and $EURIBOR_t$ is the 6-month EURIBOR rate at time t . These variables, entering the equation (1) are non-stationary and cointegrated, and the equation measures a long-run relationship among the variables. ε_t is $I(0)$. It is assumed that $\beta_1 > 0$ and $\beta_2 > 0$.

A short-run dynamics around a long-run equilibrium can be modelled by using the following error correction relationship:

$$\Delta brh_t = \sum_{i=1}^n \alpha_i \Delta brh_{t-i} + \sum_{i=1}^n \gamma_i \Delta CDS_{t-i} + \sum_{i=1}^n \mu_i \Delta EURIBOR_{t-i} + \alpha \varepsilon_{t-1} + \vartheta_t$$

where ε_{t-1} is the lagged residual of the cointegration relationship (1), the coefficients α_i , γ_i , μ_i , $i = 1, \dots, n$ quantify a short-run relationship dynamics, and α is the error correction term which measures the speed of adjustment of interest rates to the long-run equilibrium; ϑ_t is the normal i.i.d. shocks.

Firstly, we apply the Johansen (1995) cointegration trace test. The Johansen trace statistics detect the presence of cointegration among the interest rates on mortgage loans, CDS spread, and EURIBOR (see Table 6). After determining the cointegrating rank and the optimal lag structure, the model is estimated by using the Two Stage procedure (S2S) (see Lütkepohl and Krätzig (2004, Chapter 3)). The results of the analysis are shown in Tables 7 and 8. The cointegration equation can be rewritten as follows:

$$brh_t = 1.693 + 0.432 CDS_t + 0.720 EURIBOR_t.$$

The coefficients of CDS_t and $EURIBOR_t$ are both significant at the 0.1% level. A number of authors have found that interest rates on loans are cointegrated with EURIBOR in the euro zone countries (see, e.g., Cifarelli and Palandino, 2014). Our calculations have revealed that in the Lithuanian case the cointegration holds not only for EURIBOR, but for CDS spreads as well.

Based on the error correction model results, we can thus conclude that when the brh is out of equilibrium at time $t-1$, the adjustment process will push the brh towards the equilibrium at time t with the speed of adjustment -0.051 (see Table 8), but the error correction term is insignificant. The fact that the banks' interest rates on loans do not react immediately and the reaction is not symmetric (the reaction is fast when the external conditions are worsening, and slow when the conditions are improving) has been established by the Belke et al. (2013) and other authors for some countries in the euro zone.

In order to confirm whether the model presents valid results, we have chosen the Portmanteau test for residual autocorrelations, the ARCH LM conditional heteroscedasticity test, and the Jarque–Bera test. Table 9 presents summarized results of the three specification tests which have been performed to confirm the validity of the estimated model. The residuals have been found to be heteroscedastic. On the heteroscedasticity, the problem is the efficiency, although our estimates will remain asymptotically unbiased. In general, the results of the three conducted tests confirm that the model is correctly specified.

Our study has revealed the presence of a long-run cointegration between banks' interest rates and CDS spreads. We did not establish any clear dependence between banks' interest rates and CDS spreads in a short run. The results are in line with the findings of Belke et al. (2013) for the euro zone countries. They demonstrate that changes of external conditions are not immediately reflected on interest rates for loans. The policy of banks in setting interest rates plays an important role. There are several reasons for banks not to react immediately to changes of market conditions. First of all, this depends on the maturity mismatch of banks' loan and the deposit portfolio. The more long-term loans are covered by long-term deposits, the less pressure banks feel to adjust their lending rates, given that their liabilities are less sensitive to market rates (Weth, 2002). Another reason is long-term relationships of banks with their customers, which initiate banks to smooth interest rate changes.

6. Conclusions

External financial market indicators have a substantial impact on interest rates on loans in Lithuania. A correlation of interest rates on loans with EURIBOR and CDS spreads is very high. We established a long-run relationship between interest rates on mortgage loans with EURIBOR and CDS spreads. Seemingly, EURIBOR and CDS spreads are the main drives for banks when setting interest rates on loans. The interest rate on mortgage loans changes by 72 basis points when EURIBOR changes by 100 basis points, whereas the interest rate changes by 42 basis points when CDS spread changes by 100 basis points. In most cases, banks' interest rates on loans are explicitly related to EURIBOR, because they are determined according to the following formula:

$$\text{interest rate} = \text{EURIBOR} + \text{banks' margin}.$$

The Lithuanian CDS spread is not explicitly included in the formula above. Our analysis shows that the banks' margin is affected by the Lithuanian sovereign CDS spread in a long run. Therefore, CDS spread determines the interest rate on loans in an implicit way.

We did not detect any short-run relationship between loans and CDS spreads as well as EURIBOR. This can be explained by the policy of banks in setting interest rates on loans. Banks adjust their interest rates on loans by taking into account the mismatching maturity of assets and liabilities as well as other individual factors, and the market conditions can be not a pivotal factor in a short run.

The Baltic states have a strong commonality. We observe a very strong correlation of interest rates on loans for households and for non-financial corporations in the Baltic states. This can be explained by a high correlation of CDS spreads of these states. Another important reason for the commonality of interest rates on loans is the fact that the major part of the banking system of the Baltic states is owned by the same foreign investors, and they run an adequate credit policy in each of the country. We did not find any impact of the timing of euro introduction on the interest rates for loans. Despite the fact that the timing of the euro introduction was different in each of the Baltic states, we did not establish any structural changes in interest rates on loans in the Baltic states as a result of the accession to the EMU.

Our main finding is that the Lithuanian sovereign credit risk indicator – CDS spread – has a strong impact on banks in setting interest rates on loans in a long run.

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APPENDIX

TABLE 1. Descriptive statistics for the period of September 2008 – March 2014

Variable	Mean	Median	Std. Dev	Skewness	Kurtosis	JB
CDS	2.69	2.51	1.47	1.48	2.62	38.5206 (<0.001)
EURIBOR	1.17	1.04	0.88	2.29	7.68	193.78 (<0.001)
brh	3.49	3.67	0.93	0.88	1.33	11.8346 (0.0027)
brc	3.92	3.96	0.99	0.98	1.45	14.9496 (0.0006)
Δ CDS	-0.02	-0.02	0.59	0.70	4.45	49.75 (<0.001)
Δ EURIBOR	-0.07	-0.02	0.20	-3.05	9.94	326.04 (<0.001)
Δ brh	-0.06	-0.04	0.18	-0.72	1.07	7.7341 (0.0209)
Δ brc	-0.06	-0.05	0.18	-0.72	1.07	7.7341 (0.0209)

Note. Here, CDS is a CDS spread, brh is the banks interest rate on mortgage, and brc is the interest rate to non-financial corporates. We use Δ in front of the variables for the first-order difference of the variable. JB: Jarque–Bera normality test.

TABLE 2. Correlation coefficients of interest rate changes for non-financial corporations

	LT	LV	EE
LT	1.000	0.142	-0,053
LV		1.000	0.145
EE			1.000

TABLE 3. Correlation coefficients of interest rate changes on mortgage loans

	LT	LV	EE
LT	1.000	0.288*	0.348**
LV		1.000	0.385**
EE			1.000

Note: * significant at 5% level;** significant at 1% level.

TABLE 4. Correlation coefficients of the changes of external indicators EURIBOR, CDS and interest rates on mortgage loans and loans for non-financial corporations

	Δ EURIBOR	Δ CDS	Δ brh	Δ brc
Δ EURIBOR	1.000	-0.402**	0.360**	0.182
Δ CDS		1.000	0.090	-0.073
Δ brh			1.000	0.386**
Δ brc				1.000

Note: ** significant at 1% level.

TABLE 5. ADF unit root test

Variable	t-stat	p-value	5% critical value
<i>CDS</i>	-1.489	0.534	-3.41
<i>EURIBOR</i>	-2.606	0.097	-2.86
<i>brh</i>	-3.273	0,081	-3.41
Δ <i>CDS</i>	-7.982	<0.001	-2.86
Δ <i>EURIBOR</i>	-4.770	<0.001	-2.86
Δ <i>brh</i>	-7.828	<0.001	-2.86

Note: For ADF test, the order of lags was chosen by the Schwarz Information Criteria.

TABLE 6. Johansen Cointegration Trace Test statistics

List of variables in cointegration vector	Hypothesized N of cointegration relations	Trace statistics	Probability of rejection of the null hypothesis	5% critical value	N of lags in VAR	Deterministic trend assumption
<i>brh</i>	None	50.2	0.0004	35.07	2	Restricted constant
<i>CDS</i>	At most 1	14.65	0.2527	20.16		
<i>EURIBOR</i>	At most 2	2.07	0.7607	9.14		

TABLE 7. Cointegration equation estimates

$$brh_t - \beta_0 - \beta_1 CDS_t - \beta_2 eurib_t = \varepsilon_t$$

	β_0	β_1	β_2
<i>brh_t</i>	1.693* [8.742]	0.432 * [5.591]	0.720* [4.227]

Notes: t values are in parentheses; * significant at the 0.1% level.

TABLE 8. Short-run dynamics estimates

$$\Delta brh_t = \alpha_1 \Delta brh_{t-1} + \gamma_1 \Delta CDS_{t-1} + \mu_1 EURIBOR_{t-i} + \alpha \varepsilon_{t-1} + \vartheta_t$$

	α_1	γ_1	μ_1	α
Δbrh_t	-0.333** [-3.053]	0.059* [1.857]	0.677** [5.687]	-0.051 [-0.809]

Notes: *t* values are in parentheses; * significant at 10% level;** significant at 0.5% level.

TABLE 9. The portmanteau residual autocorrelation test, ARCH LM conditional heteroscedasticity test, and the Jarque–Bera test results

Test	Portmanteu test (5 lags)	ARCH LM test	Jarque–Bera
Explanation	No autocorrelation	No heteroscedasticity	Normality test
Statistics (p-value)	37.630 (0.266)	14.404 (0.014)	2.525 (0.283)