EUROSÜSTEEM

Determinants of Bank Interest Spread in Estonia

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Kadri Männasoo *

Abstract

The recent global financial turmoil increased bank interest spreads in Estonia to the highest levels recorded since the Russian crisis in 1998–1999. The pure spread concept and the two-step estimation approach of Ho and Saunders (1981) have been used to decompose the interest spreads in Estonia. The pure spread is mainly determined by risk aversion and the market structure of the banking sector, with money market interest volatility playing quite a modest role in the long-term equilibrium. The regulatory, efficiency and bank-portfolio effects share a roughly equal weight in the observed spread, whereas credit risk adds only a tiny portion to the mark-up. Strong liquidity and foreign capital permit lower spreads.

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Non-technical summary

The role of banks in intermediating funds from depositors to borrowers is of crucial value in facilitating economic development and growth. The rapid modernisation of the banking sector in Estonia has been one of the most important success factors in the transition process from the centrally planned system to an open market economy.

The bank charges a fee — the spread — for the provision of immediacy in offering loan and deposit service to its customers. This fee constitutes a cost to the non-financial sector and income for the banks. Affordable lending rates are a critical factor in enhancing credit access, but at the same time the interest spreads have to cover the banks' costs and risks arising from the funds intermediation process.

Bank spreads in Estonia decreased gradually following the rebound from the Russian crisis in 1999, reaching their lowest levels during the lending boom in 2005–2006. The eruption of the recent global financial turmoil has, however, raised the bank interest spreads back to the high levels recorded at the beginning of the last decade.

The strong impact of interest spreads on the economic environment is well substantiated and widely recognised, but there is still room for more research on the factors affecting the interest spreads. In light of this, the aim of the current research is to investigate what the main drivers are that determine interest spreads in Estonia.

Theoretical and empirical underpinning of the current study draws largely on the bank dealership model proposed by Ho and Saunders (1981) and augmented later by several authors.[1] Using the two-step estimation approach of Ho and Saunders (1981) the pure spread component determined by the volatility of money market interest rates, the banking sector aggregate level of risk aversion and market structure is extracted from the observed spread. The remaining part of the spread, consisting of market and regulatory imperfections and idiosyncratic bank factors, is also subject to detailed decomposition.

The econometric analysis employs the monthly and quarterly micro-data on the population of Estonian credit institutions from the Bank of Estonia financial statistics database for the period December 1998 to June 2011. Four types of loan portfolio are considered: mortgage loans, consumer credit loans, corporate short-term loans and corporate long-term loans. A panel on bank-portfolios is used for the estimation of the pure spread, with the bank and portfolio level effects being taken into account. After this an error correction

[1] Allen (1988), Angbazo (1997), Saunders and Schumacher (2000) and others.

model for the estimated pure spread time-series is run in order to decompose the determinants of the spread at sector level.

The results show that the estimated pure spread is mainly determined by the risk aversion and the market structure of the banking sector. Risk aversion proxied by the banking sector aggregate capital adequacy ratio implies that spreads are an important source for the build-up of cushioning for covering potential losses. The credit market proves to be very competitive in Estonia, suppressing the interest spreads. The interest rate volatility, though statistically significant, is relatively modest in spread composition. By imposing Euribor-linked long-term contracts the banks have largely passed the interest rate risk on to borrowers. The regulatory, efficiency and bank-portfolio effects share a roughly equal weight in the observed spread, whereas credit risk adds only a tiny portion to the mark-up. Strong liquidity and foreign capital have allowed some of the upward trend in spreads to be counteracted and alleviated.

The overall implication suggests that in spite of the improved efficiency, the competitive credit market and dominant foreign participation, the banks' spreads in Estonia remain vulnerable to global risks, which elevate banks' risk-aversion at times of high uncertainty.

Contents

1. Introduction

Estonia has been an exemplary transition country, demonstrating a remarkable transformation from a centrally planned economy to an independent country with modern institutions, a strong private sector and an open market. All that development has required a large amount of funds to be channelled into private sector investments and expenditures. One of the success factors in Estonia gaining the confidence of foreign and domestic investors has been the rapidly modernised banking sector. A major share of private savings are deposited in banks, and these can be used to meet the demand of borrowers for credit.

Lower interest spreads facilitate the access of entrepreneurs and households to credit and enhance economic growth. In Estonia, as in other emerging markets in Central and Eastern Europe, the share of foreign direct investments has been very high, and it has meant that a large share of companies in foreign ownership have direct access to parent company financing. In order for comparable financing conditions to be granted to local companies, the bank spreads need to converge with the spreads in the home markets of investor countries. At the same time household borrowing supporting domestic demand and consumer spending is critical for the development of the service sector. Nevertheless, the interest spreads have to remain adequate to cover the banks' costs and risks arising from the funds intermediation process. Margins allow a buffer to be built-up against losses incurred at times of adverse macroeconomic circumstances or idiosyncratic shocks (Saunders and Schumacher (2000)).

The interest spreads in Estonia were declining strongly following the rebound from the Russian crisis in 1999 until the middle of 2007 (see Figure 2 in section 5).[2] The trend was reversed by the eruption of the global financial crisis. Bank interest spreads surged in 2008, peaking in 2009 at 6–7%, the highest rates recorded since 1999.

Comparing the interest spreads over the 6-month Euribor rate in Europe (see Figure 1) shows that 2008–2011 the Estonian corporate credit and consumer credit spreads have exceeded the European Monetary Union (EMU) aggregate. However, the interest spread on new mortgage loans is remarkably low, falling below the EMU average.

Though the strong impact of interest spreads on the economic environment has not been neglected, there is still room for more research on the factors affecting the interest spreads. The aim of the current research is to investigate

[2]The decline in interest spreads has been coupled with a decrease in other credit constraints such as easier loan application procedures, lower down-payment requirements etc.

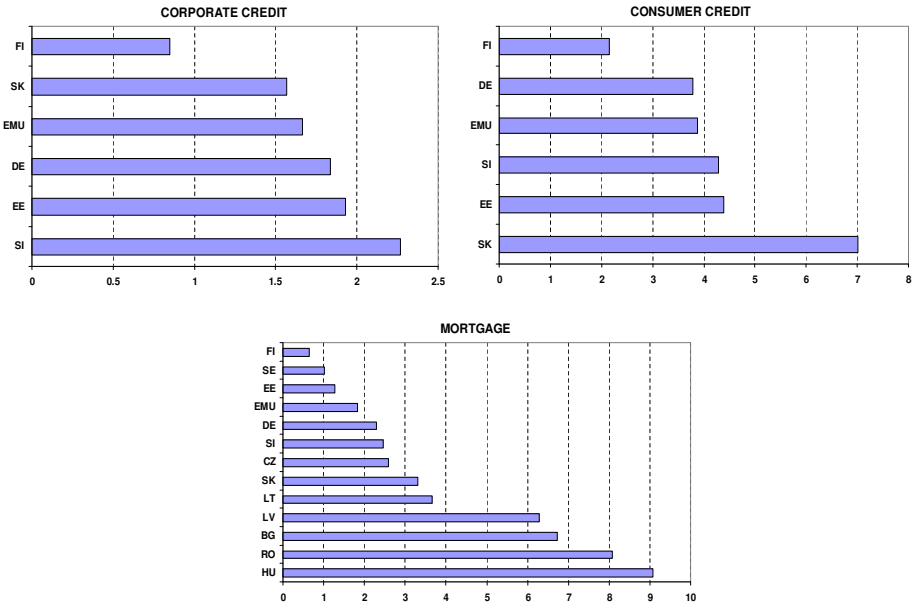

Figure 1: New lending spreads over Euribor 6-month rate: January 2008–April 2011.

Source: European Central Bank
Note: Interest rates in national currencies. Changing composition of the European Monetary Union (EMU): Slovenia joined the EMU in January 2007, Slovakia in January 2009 and Estonia in January 2011.

what the main drivers are that determine interest spreads in Estonia and how consistent the Estonian evidence is with the theoretical arguments proposed in the literature (Ho and Saunders (1981)) or with the empirical results from previous research. This study draws largely on the bank dealership model proposed by Ho and Saunders (1981) and augmented by several authors in their theoretical and empirical contributions (Allen (1988), Angbazo (1997), Saunders and Schumacher (2000) and others). Using the two-step estimation approach of Ho and Saunders (1981) the pure spread component determined by the volatility of money market interests, the banking sector's aggregate level of risk aversion and the market structure is extracted from the observed spread. The remaining part of the spread, consisting of market and regulatory imperfections and idiosyncratic bank factors, is also subject to a detailed decomposition.

The paper is structured as follows: sections 2 and 3 give an overview of the

literature, firstly introducing the theoretical concepts of interest spread models and secondly surveying the empirical evidence on the measurement of interest spreads. The fourth section envisages the empirical model. Section 5 describes the data and section 6 explains the estimation methodology. Section 7 provides empirical results and section 8 concludes.

2. Interest spread model

The best-known theoretical contribution to explaining the determinants of interest spreads is provided by Ho and Saunders (1981). By integrating the hedging and expected utility of wealth (profit) approaches they build up a model where the bank is viewed as a risk-averse dealer seeking to match the maturities of loans and deposits in order to avoid the interest rate fluctuation risk which arises if positions are either too short or too long. The bank's objective function is to maximise the expected utility of shareholders' wealth. The arrival of loan requests and deposit supplies is random and exogenous to the bank. The only possible way for the bank to influence the balance between the supply of deposits and demand for loans is to impose a fee over the expected risk-free interest rate r, which decreases the rate R_D paid on deposits by a and increases the rate R_L required for loans by b. The sum of these fees $a + b$ constitutes the interest rate spread required by the bank for it to provide immediacy in its deposit and loan service.

$$R_L = r + b$$
$$R_D = r - a$$

A single period planning horizon is assumed, where the deposit and loan rates remain fixed after being set by the bank at the beginning of the decision period. Only a single transaction with a loan and a deposit of equal size is assumed to take place within the observed period.

The pure interest spread model contains a number of reservations neglecting the "imperfections" related with the regulatory restrictions, such as capital adequacy, required reserves or deposit insurance which have an effective impact on observed interest margins. Neither is any account taken of the presence of credit risk nor for the costs accrued in the funds intermediation process between depositors and borrowers. Maudos and Fernandez de Guevara (2004) addressed these limitations and extended the model by introducing the average operating costs term, a credit risk component and covariance between the interest rate risk and credit risk.

Finally, the Ho and Saunders (1981) model considers loans and deposits to be homogeneous, implying a single product bank. Allen (1988) augmented

the framework of the model by introducing the multi-product solution. Her augmented model demonstrates that the interest spread may be reduced by the benefits of product diversification, enabling the bank to optimize the relative interest spread across products.

Departing from the assumptions above, Ho and Saunders (1981) maximise the bank's expected utility of wealth by first using a Taylor expansion, then applying symmetric and linear deposit supply and loan demand functions and finally solving for first order conditions in the fees imposed on deposits and loans separately. As a result of these computations the pure interest spread $s = a + b$ is determined by the following four factors: (1) the degree of bank market power $\frac{\alpha}{\beta}$, expressed in relatively inelastic loan demand and deposit supply functions; (2) bank risk aversion, *R*; (3) interest rate volatility, σ_I^2 and finally (4) transaction size, *Q*.

So that spread is defined as:

$s = R_L - R_D = a + b = \frac{\alpha}{\beta} + \frac{1}{2} R \sigma_I^2 Q$

All the model terms increase the interest spread. The stronger the monopoly power of the bank, the more risk averse it is, the larger the transaction and the more volatile the interest rates, the higher the spread charged by the bank is.

The main conclusion from the Ho and Saunders (1981) dealership model is that the interest spread is an intrinsic part of banks' risk buffer, covering the risks and costs incurred in providing the intermediation service. It is the bank's fee for the provision of immediacy in loans and deposits.

Kit (1997) applies an alternative approach based on a firm-theoretical model and arrives at very similar conclusions to the baseline and augmented versions of the dealership model. Kit (1997)'s findings confirm that the optimal bank interest margin has a positive relation with the banks' market power, with the operating costs, with the degree of interest rate risk and with the degree of credit risk.[3].

3. Measurement of the interest rate spread

A major share of empirical research on determinants of bank interest spreads employs the Ho and Saunders (1981) dealership model as a cornerstone, extended by other factors that influence the bank interest spread. Ho and Saunders (1981) themselves have also challenged their own theoretical model by

[3]The impact of the interbank market rate on the interest margin depends on the bank's net position in the interbank market, whereas the bank's equity capital is inversely related to the spread when the interest rate risk is not significant.

empirical testing. Employing the quarterly income and balance-sheet data for 53 major US banks from 1976-IV to 1979-IV, Ho and Saunders (1981) demonstrate that the pure interest spread can be measured by applying a two-step estimation procedure. At first the observed interest margin (a proxy for the interest spread) is regressed on a number of bank-specific variables capturing the "market and institutional imperfections". Among these variables are the measures of implicit interest on deposits, the opportunity cost of holding reserves and the default risk on loans. All other effects that are incidental to the pure interest spread are contained in the residual variable, while the intercept of the first regression constitutes the pure interest margin or spread. The pure interest spread is the fundamental determinant of the observed spread, and it is time-variant and equal across the banks. In the second stage, the pure interest margin derived from the first equation is regressed on variables suggested by the baseline model, starting first of all with interest rate volatility. The results from this test confirmed that interest rate risk is indeed positively and significantly correlated with the pure interest margin.

Claeys and Vander Vennet (2008) study the interest margins in the transition economies of Central and Eastern Europe and compare the results with those of banks in Western Europe. Claeys and Vander Vennet (2008) employ a single-step panel regression estimation procedure that includes both the bank-specific variables and country-specific macroeconomic indicators in their empirical model. The findings imply that, as they are for Western banks, the interest margins in the CEE region are reduced by improved operational efficiency, and that the entry of foreign banks has increased competition in the banking sector of those CEE countries which joined the EU in 2004[4]. The risk-based pricing approach is evident in CEE banking markets with limited state-ownership. In a similar vein Drakos (2003) finds evidence for declining interest margins over the course of the transition process in eleven formerly centrally planned economies[5]. His results confirm the conclusions drawn by Claeys and Vander Vennet (2008) suggesting that foreign banks have contributed to the efficiency of the banking sectors in the CEE countries.

Poghosyan (2010), however, challenges the conclusions on foreign bank entry as a significant determinant of the interest rate margin in CEE countries[6]. He claims that in the absence of a consistent theoretical and empirical

[4]A negative relationship between the number of foreign banks and the net interest margin was found for the sample of countries including the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. Conversely a positive relation emerged in a sample consisting of banks from Bulgaria, Croatia, Romania, Russia and Ukraine.

[5]Belarus, Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Ukraine.

[6]Poghosyan (2010)'s empirical analysis covers 11 CEE countries: Bulgaria, the Czech Republic, Estonia, Croatia, Hungary, Lithuania, Poland, Romania, Slovenia and Slovakia.

framework for estimating the impact of foreign ownership on bank net interest margins, the empirical evidence remains mixed as it is dependent on the researcher's choice of the variables used in the model. Departing from the modified dealership model of Maudos and Fernandez de Guevara (2004), no firm evidence for the impact of foreign ownership[7] on the bank interest margin has been found. Poghosyan (2010) argues that foreign entry has no impact of its own on interest margins, but might reduce the interest margin via the main determinants as suggested by the augmented dealership model including an improvement in the competitive environment, a decrease in market and credit risk and increased bank efficiency.

Saunders and Schumacher (2000) investigate the determinants of bank net interest margins in a sample of six selected European countries [8] and the US. Applying the two-step regression procedure suggested by Ho and Saunders (1981) they find support for the dealership model, demonstrating that the effect of interest rate volatility on the interest margin was significant and positive. The impact of regulatory restrictions — the minimum capital and liquid reserves requirements and implicit interest rates — proved to be highly relevant determinants in widening the observed interest margin.

Industry level evidence on bank interest margins in 14 OECD countries is provided by Hawtrey and Liang (2008). Treating each country's banking sector as a single representative firm they find that market power, operating costs, risk aversion, volatility of the interest rate, credit risk, opportunity cost and implicit interest rates on deposits all have a positive impact on banks' interest margins.

The fall of bank interest margins in Europe over the last decade[9] drew the attention of Maudos and Fernandez de Guevara (2004), whose analysis documents the fact that the effect of market concentration on intermediation costs has been countered by other factors. The reduction of interest rate risk, credit risk and operating costs for banks have led to narrower margins.

Hanweck and Ryu (2005) show the dissimilarities in how interest rate shocks, term-structure-shocks and credit-shocks are transmitted into the interest margin across US banks with different product-line specialisations.[10]

[7]Both the direct (dummy variables for Greenfield and acquired foreign banks) and the indirect (foreign bank market share) foreign bank participation effects on interest rate margin have been controlled for, with no significant result in either case.

[8]Germany, Spain, France, Great Britain, Italy and Switzerland.

[9]The study considers the principal European banking sectors in Germany, France, the United Kingdom, Italy and Spain.

[10]The study covers international banks, agricultural banks, credit card banks, commercial and industrial loan specialists, commercial real estate specialists, commercial loan specialists, mortgage specialists, consumer loan specialists, and nonspecialist banks.

The study suggests that larger and more diversified banks are less sensitive to interest-rate and term-structure shocks, but remain vulnerable to credit risk.[11]

4. Empirical model

The current study employs the two-step procedure proposed by Ho and Saunders (1981) decomposing the observed interest spread into the pure spread and the residual, which reflects the market and regulatory imperfections as well as the bank-driven costs and business model determinants. At first the observed spread is regressed on a number of factors which make the spread fluctuate across the banks and loan portfolios, or the residual spread. The intercept term of this regression constitutes the pure spread.

$$Observed\ Spread = Pure\ Spread + Residual\ Spread$$

The pure spread in turn is determined by time-variant macroeconomic factors that influence the spread of all banks in the same manner.

$$Pure\ Spread = F(MS, V, RA)$$

$$\begin{array}{lcl} MS & = & market\ structure\ measured\ by\ intercept\ term \\ V & = & interest\ rate\ volatility\ risk, monthly\ st.dev\ of\ 6\ month\ EURIBOR \\ RA & = & Risk\ aversion\ measured\ by\ sector\ capital\ adequacy\ ratio \end{array}$$

The pure spread captures the main components suggested by the Ho and Saunders (1981) model including the market structure, the risk aversion proxied by the sector capital adequacy ratio and the variance in interest rates.[12] The institutional and structural changes in the environment[13] have been controlled for by including either the year fixed effects or the logarithmic time trend. The assumption of relatively low time-variability in market structure, captured by yearly dummies, may not be overly restrictive since there have been no major changes among the main players since the end of 1998. The four largest banks covered about 90% of sector's total assets from 1998 up to 2006, and after that their share has gradually decreased, but remained at the high level of 80% in 2011.[14]

[11] The credit risk has been proxied by the change in the loans to earning assets ratio and by the change in the non-performing loans ratio. A similar conclusion is reached by Angbazo (1997) in his study on US banks over the period 1989–1993.

[12] Maudos and Fernandez de Guevara (2004) suggest capital held in excess of regulatory capital in the capital buffer as an adequate measure of risk aversion. Since the minimum requirement of capital adequacy in Estonia was 10% over the whole observation period, there was no need to substract the required level from the actual level of capital adequacy.

[13] Estonia experienced a significant improvement in foreign confidence and financial stability over the observation period, marked by events such as joining the European Union in May 2004 and the European Monetary union in 2011 amongst others.

[14] Since the end of 2006 a number of small banks have entered the market. This has gradu-

The remaining part of the spread is given by:

$$Residual\ Spread = F(E, LQ, CR, MQ, FS, DG, FO, A, P, B)$$

E = *inverse efficiency measured by the operating expenses to total assets ratio*
LQ = *liquidity measured by the liquid assets to total liabilities ratio*
CR = *credit risk measured by the ratio of loans past due over 60 days to total loans*
MQ = *management quality measured by the ratio of demand deposits to total liabilities*
FS = *share of fees from interest earning assets*
DG = *share of deposit guarantee payment costs from total deposits*
FO = *share of foreign owned capital in the bank*
A = $non-affiliation\ dummy:\ 1\ if\ not\ a\ foreign\ affiliate,\ 0\ otherwise$
P = *loan portfolio dummies*
B = *bank dummies*

The bank-specific factors affecting the spread can be broadly divided into categories that can be called: efficiency and management, regulatory aspects, market imperfections and other bank-portfolio-specific aspects.

The inverse efficiency of the bank is reflected in the operating costs to assets ratio (E). The share of fees from interest earning assets (FS) is an implicit measure of costs, since the banks charge fees to cover the fixed costs of the service. Well-managed banks with strong franchise value are generally able to widen the spread (Poghosyan (2010), Hawtrey and Liang (2008) and Angbazo (1997)). The management quality (MQ) is proxied with the share of demand deposits in total liabilities since higher share of low cost demand deposits and a larger base of loyal customers is often a reflection of strong management.[15]

The share of deposit guarantee payments is a regulatory cost which might easily be passed on to the spread. The foreign affiliates enjoy the lower capital requirement of their parent bank's home country, so the affiliation dummy reflects the difference in regulatory costs relative to those of domestic banks.

The market imperfections mean that banks are subject to credit and liquidity risk. The credit risk is measured by the loans due ratio. The liquid assets to liabilities ratio captures the effects of liquidity on the interest spread. On the one hand the buffer of liquid assets[16] mitigates the liquidity risk, but on the other hand holding low-yield reserves incur opportunity costs.

There are a number of bank-portfolio causes which have an effect on the spread. Collateralised loans such as mortgages, have a lower default risk than do consumer credits. Corporate loans on the other hand are subject to business risk including risks related with legal and cross-border issues. The term-structure of bank assets and liabilities determines the bank's vulnerability to

ally lowered the banking sector's Herfindahl index from 40% in 1998–2006 to 30% in 2008–2011.

[15]During the credit boom 2005–2007 the foreign-owned banks had easy access to cheap parent bank funding, which decreased the importance of domestic deposits as a source of liquidity.

[16]Liquid assets consist of reserves held in central bank and liquid securities.

the interest rate risk. Hence the portfolio structure and bank-specific factors have a considerable effect upon the spreads.

The empirical model applies two spread definitions: firstly, the loan-deposit spread, calculated as the difference between the loan and deposit spread; and secondly, the loan-Euribor spread calculated as the difference between the loan rate and Euribor 6-month rate. Since the Euribor rate is beyond the control of the Estonian banks, the only source for widening or shrinking the spread is the domestic lending rate. The baseline model of Ho and Saunders (1981) still holds as long as the lending rates and hence the spread over Euribor are affected by the market structure, interest rate volatility and risk aversion.

5. Data description

The analysis draws on the monthly and quarterly micro-data on Estonian credit institutions from the Bank of Estonia financial statistics database. The Euribor 6-month interest rate data are from the European Central Bank statistics.

As in Kattai (2010), the analysis includes four major credit insitutions, Swedbank, SEB, Danske Bank and Nordea, which cover about 90% of the market[17], while the small banks sharing the remaining 10% of the sector total assets are considered in a single group. The dataset corresponds to the population of Estonian banks.

Four types of loans portfolio are considered: mortgage loans, consumer credit loans, corporate short-term loans and corporate long term loans. The observation period ranges from December 1998 up to June 2011. The ratios for quarterly profit and loss statement data are interpolated into the monthly series using the natural cubic spline method.

The spread is calculated for new lending, which captures the dynamics and structure of the spread more rapidly than loan stock data. Two types of loan spread are considered in the analysis, firstly the lending spread over the deposit rate and secondly the loan spread over the Euribor 6-month rate. The deposit data refer to new private sector deposits, except for demand deposits. The loan and deposit interest rates are weighted by transaction size. The analysis started off with a panel T = 151 and N = 4 x 5 totalling 3006 observations. Of these, 135 observations, or 4.5% of total sample, have been left out due to abnormally high spreads with values of over 30%, or higher than 3 standard deviations from the sample mean. There were 14 bank-portfolio-month observations missing, and so the final analysis contains 2871 observations.

[17]Market size is measured by banks' total assets.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	N
Spread w.r.t. Euribor 6 months	5.742	4.462	2871
Spread w.r.t Deposits	5.88	4.241	2871
E	0.606	0.346	2871
LQ	13.6	6.702	2871
CR	5.572	10.041	2871
MQ	29.213	9.343	2871
FO	76.584	33.35	2871
A	0.281	0.422	2871
FS	0.225	0.117	2871
DG	0.016	0.016	2871
PURE SPREAD DETERMINANTS			
Pure Spread w.r.t Euribor 6 months	1.679	1.398	150
Pure Spread w.r.t Deposits	3.286	0.872	150
EURIBOR6MSD	0.093	0.114	150
RA	16.13	3.359	150

Source: authors' calculations on Bank of Estonia financial statistics and European Central Bank statistics on Euribor rates.
Note: Variables given in percentages, except A: 1 if affiliate, 0 otherwise.

The time-series data for decomposing the estimated pure spread measure consists of 150 monthly observations (January 1999–June 2011) of the banking sector's aggregate capital adequacy ratio and the 6-month Euribor volatility variable.[18]

The lending spreads for the Euribor 6-month rate and the private sector deposit rate average 5.7% and 5.9% respectively (see Table 1) and also show similar dynamics over time (see Figure 2). The loan-deposit spread is most of the time higher than the loan-Euribor spread suggesting that the domestic deposit rates have normally been lower that the Eurozone money market lending rates.[19] However this pattern has reversed in financial distress episodes,[20] since the liquidity injections in Eurozone have dropped the Euribor below the domestic deposit rate.

In general the spreads decreased gradually from their two-digit levels at the beginning of 1999 down to 2–3% by the end of 2006. This trend was reversed in 2007 when spreads started to pick up, followed by a spike in 2008 triggered by the global financial crisis. Over the most recent period, 2009–2011, the spreads have achieved their highest levels since 2001, averaging 4–6%.

[18]The daily data on the 6-month Euribor rate are used to compile the monthly volatility measured by standard deviation.

[19]On average the loan-deposit spread exceeds the lending spread for Euribor by 0.5%.

[20]The Russian crisis in 1998–1999. The Iraq war, global tensions and economic stagnation from the end of 2002 up to the beginning of 2003. The global financial crisis of 2008–2009.

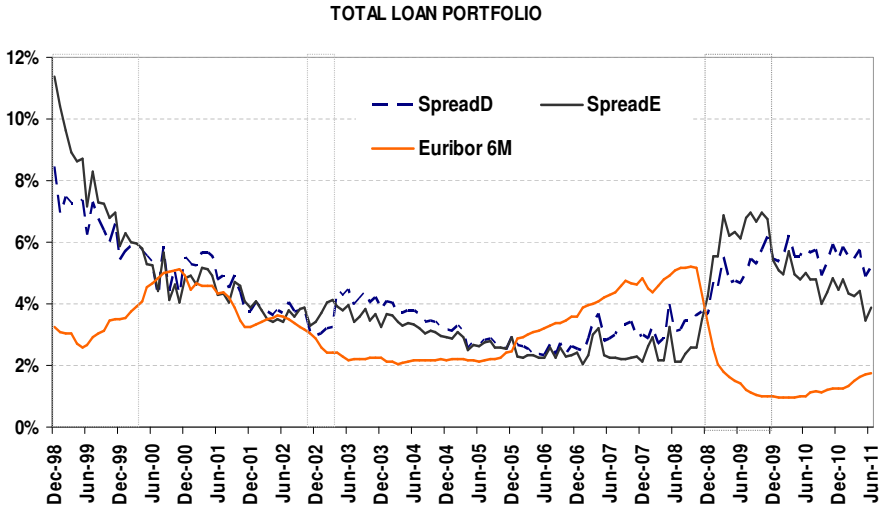

Figure 2: Loan spreads December 1998–June 2011

Source: author's calculations on Bank of Estonia financial statistics.

The dynamics in the spreads has been relatively heterogeneous across the loan portfolios (see Figure 3). Although all the portfolios were hurt by the crisis, the clearest hike can be observed in the consumer credit portfolio. The spreads in the consumer credit portfolio have been growing since the beginning of 2001, which reflects the changes in the portfolio structure over a longer period of time.[21]

6. Methodology

A two-step approach is applied in order to decompose the observed interest spread into pure spread and the spread containing market imperfections, regulatory effects and bank-idiosyncratic effects.[22] In the first stage the model is

[21] Improved access to credit and eased credit conditions have boosted the riskiness of the consumer credit portfolio.

[22] The seasonality of the observed and pure spread series has been diagnosed by using the Eurostat Demetra+ software, which contains the non-parametric Friedman and Kruskall-

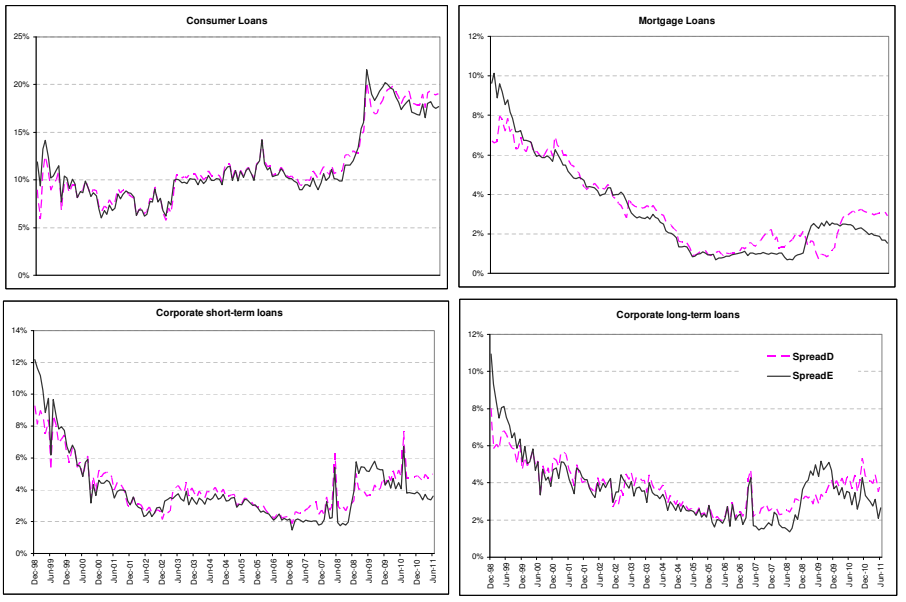

Figure 3: Loan spreads December 1998–June 2011

Source: author's calculations on Bank of Estonia financial statistics.

run on time-series-cross-section (TSCS) data [23] with 5 x 4 bank-portfolio units and 151 months (see the data section). The monthly fixed effects included in the panel estimation serve as a measure of the time-variant pure spread, which is equal across the banks and the loan portfolios.

The TSCS data pose a number of challenges in econometric terms as they are frequently subject to serially correlated, heteroschedastic or contemporaneously correlated errors. Beck and Katz (1995) propose the OLS estimation procedure with panel corrected standard errors (PCSE), which allows for the correct computation of confidence intervals and statistical tests. Chen, Lin, and Reed (2006) have shown that the benefits of PCSE are offset by a substantial loss in estimator efficiency. One further restriction of PCSE is that any serial correlation in errors must be eliminated, otherwise the estimators will be inconsistent (Beck and Katz (1995), Podesta (2000)). The TSCS model might

Wallis seasonality tests. The presence of seasonality was rejected in all cases. This means the model specifications do not account for the seasonality, since the spreads series do not exhibit seasonal patterns.

[23] Sometimes also referred to as multiple time series.

be mis-specified if the dependent variable is not homogeneous in its levels across units, time-periods or both. Ignoring these cross-sectional and temporal effects leads to inflated errors for autocorrelation and heteroschedasticity[24]. Unit and time effects[25] have been added to control for the heterogeneous level effect. Conclusively Chen, Lin, and Reed (2006) advise applying the PCSE estimation for hypothesis testing and GLS for accurate estimation of cofficients.

Since the dataset used for estimating the pure spread contains a population of Estonian banks and the panel-data model is subject to serial correlation according to the Wooldridge (2002, 2010) test, the current analysis opts for the GLS estimation approach.

A number of unit root tests for panels[26] have been used to control for the stationarity of the interest spread variables. The null hypothesis of the presence of non-stationarity was strongly rejected by the majority of tests on both spread variables, the loan-deposit spread and the loan-Euribor spread.

The first step equation is given as follows:

$$Observed\ Spread_{ijt} = \beta_0 + D_t + B_i + P_j + \beta_1 X_{ijt} + \epsilon_{ijt}$$
$$Pure\ Spread_t = \beta_0 + D_t$$

where the sum of the intercept term β_0 and the period dummy variables D_t give the sector level pure spread variable. B_i and P_j denote the bank and portfolio fixed effects. X_{ijt} stands for the number of bank-level or bank-portfolio level explanatory variables and ϵ_{ijt} is the error term.

In the second step the time series of the pure spread derived from the first stage were regressed on the daily volatility of the Euribor 6-month rates and the banking sector aggregate capital adequacy ratio. The transition process is taken into account by the introduction of a logarithmic time trend (Drakos (2003)), or alternatively the year dummies were added to the right-hand side of the equation.

All time series were controlled for the unit root using the Dickey-Fuller and Phillips-Perron unit root tests. Non-stationarity was not rejected for the capital adequacy variable, but the non-stationarity of regression residuals was rejected at the 1% critical value. An error correction model was estimated for both the Euribor 6-month and deposit pure spread series.

$$\Delta Y = \alpha + \beta_0 \Delta X_t - \beta_1 (Y_{t-1} - \beta_2 X_{t-1}) + \epsilon$$

β_0 estimates the short term effect of an increase in X on ΔY. $\beta_1, -1 <$

[24] Podesta (2000).

[25] Bank, portfolio and period fixed effects.

[26] 14 missing values have been linearly interpolated in order to achieve the balanced panel. Levin-Lin-Chu, Harris-Tzavalis, Im-Pesaran-Shin tests for balanced panels and the Fisher unit root test for unbalanced panels were used to controll for the stationarity of variables.

$\beta_1 < 0$ denotes the speed of the return to equilibrium after a deviation. β_2 estimates the long term effect that a one-unit increase in X has on ΔY.

In order to decompose the level of interest spread we have to derive the long-run equilibrium relationship between X and Y. The long-run multipliers are calculated as follows (Banerjee, Dolado, Galbraith, and Hendry (1993):

$$Y = k_0 + k_1 X$$
$$where\ k_0 = \frac{\alpha}{\beta_1}\ and\ k_1 = \frac{\beta_2}{\beta_1}$$

The importance of the interest spread determinants has been investigated using the coefficients of the equilibrium equation and annual average values of explanatory variables in order to show the dynamics and composition of the interest spreads year by year.

7. Results

The estimated pure spread dynamics follows a broadly similar line with the observed interest spreads and are correlated to the degree of 87% with the loan-Euribor spread and 69% for the loan-deposit spread (see Figure 4). As can be seen from the error correction model (see Table 3 in Appendix) the lending spread over Euribor is more sensitive to the Euribor volatility as well as to market competition. Fierce competition in the credit market becomes evident in a negative market structure coefficient and in a lower pure spread relative to the deposit spread.[27] The strongest pressure on loan rates can be observed at the end of the loan boom in 2006–2007, when the rates became substantially suppressed.

Interest rate volatility has a relatively small nominal effect on both spreads. This evidence can be explained by the fact that a large share of the Estonian banks' loan portfolio has a flexible-Euribor pegged loan rate which is reviewed every six months. Even so it is noticeable that the interest rate volatility in the composition of the spread has gained weight at times when there is an upward trend in the average Euribor rate. The major determinant of the pure spread is the risk aversion of the banking sector, which has significantly widened the spreads since the eruption of the global financial crisis in late 2007.

The analysis has also revealed a few factors that narrow the observed spread. Firstly, a higher share of foreign ownership in bank capital leads to a cut in spreads (see Table 2 and Figure 5). Equally, the strong liquidity position enables the banks to offer more favourable rates to their customers. During times

[27] The negative coefficients for market structure have earlier been reported by Saunders and Schumacher (2000) for the banking sectors in France and the UK, which appeared to be more competitive than Germany, Spain, Italy, Switzerland or the USA.

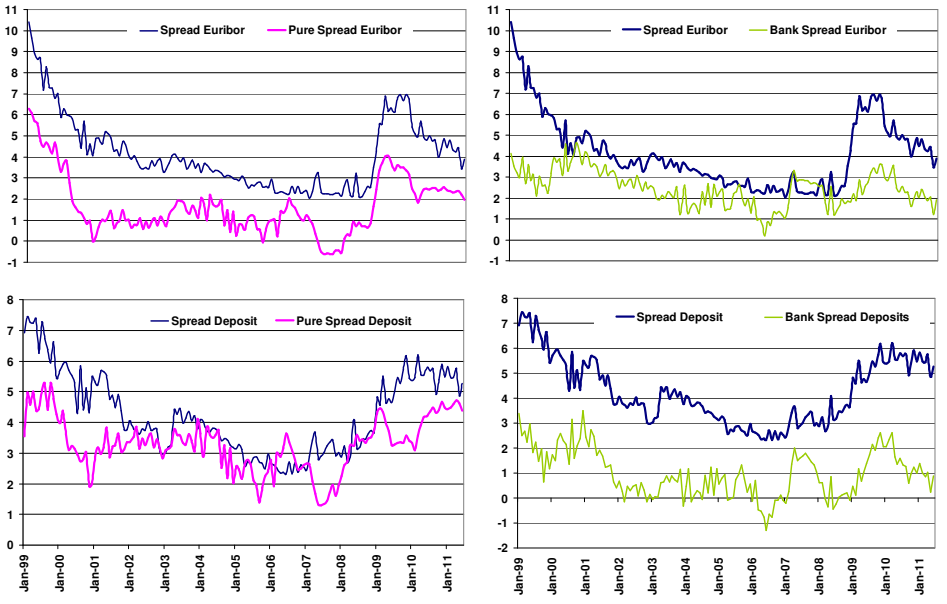

Figure 4: Decomposed spread dynamics: January 1999–June 2011

Source: author's calculations on Bank of Estonia financial statistics.

of financial market turmoil in particular, the banks with higher liquidity buffers have been able to exert more control over the upward trend in spreads. This evidence is more obvious for the loan-deposit spread, since the banks with adequate liquidity positions have been able to maintain low-cost funding due to their sound deposits base and good reputation.

The credit risk share in spread composition is surprisingly low, although it is positive and significant in statistical terms. Seemingly the banks are managing a major part of their risk exposure by increasing capital buffers and are doing so much less by relying on risk-based-pricing systems. The impact of management quality upon spread is positive, but it has to be interpreted with pre-caution as the significance of the variable fell slightly below 10% statistical significance. One reason behind the weak significance is that the loan-deposit spread does not account for the rate of demand deposits, but only for term and savings deposits.

In general the decomposition into determinants implied by the model provides a better explanation for the loan-Euribor spread than for the loan-deposit spread. The costs and risk incurred by the bank are rather an intrinsic part of

Table 2: I-Step: GLS panel estimation, December 1998–June 2011

Observed spread w.r.t	Deposit rate	Euribor 6M
Inverse efficiency	0.8062*	1.3270***
	(0.4653)	(0.4473)
Liquidity	–0.0366***	–0.0217*
	(0.0133)	(0.0130)
Credit risk	0.0092*	0.0106**
	(0.0054)	(0.0052)
Management quality	0.0168	0.0153
	(0.0109)	(0.0106)
Foreign ownership in capital	–0.0182***	–0.0147**
	(0.0067)	(0.0063)
Net fees to assets	4.2872***	4.8534***
	(0.8468)	(0.8337)
Deposit quarantee costs	11.9379	20.1292**
	(8.9595)	(8.7880)
Not foreign affiliate	1.1637**	1.2629**
	(0.5930)	(0.5540)
Consumer credit	4.4576***	4.4843***
	(0.7096)	(0.7312)
Corporate long	0.4049	0.5723
	(0.5139)	(0.5526)
Corporate short	0.5187	0.6584
	(0.4958)	(0.5295)
Bank dummies	YES	YES
Pure spread dummies	YES	YES
Wald Chi2	650.35	933.69
No of obs.	2871	2871

Source: author's calculations on Bank of Estonia financial statistics.
*Note: Standard errors adjusted for panel-specific AR1 autocorrelation structure. ***, **, * indicate statistical significance at the 1%, 5% and 10% levels respectively.*

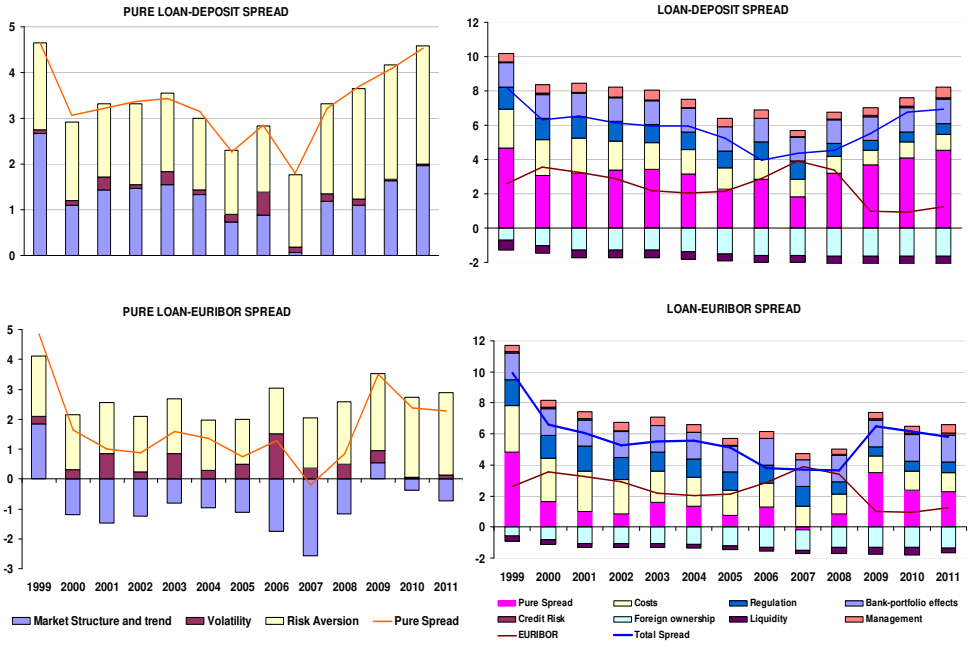

Figure 5: Decomposed spread structure: January 1999-June 2011, year averages

Source: author's calculations on Bank of Estonia financial statistics.

the lending rate, whereas the deposit rate is more dependent on access and the costs of liquidity.

In the light of the global financial crisis, the pure spread equations have also been run for the period 2007–2011, in order to control for whether the effects work in the same direction. The long term coefficients for risk aversion and interest volatility have retained the expected signs and are highly statistically significant. The market structure term has become more negative, reflecting the increased competition over recent years. The interest rate volatility coefficients became substantially larger relative to their value over the total period. Risk-aversion has also gained a greater role in explaining the long-term equilibrium of the spread. In general the results confirmed that the model for the crisis period provided coefficients along the expected lines, revealing heightened competition in the banking market in the years 2007–2011 despite higher sensitivity to risks and volatilities.

8. Summary

In the aftermath of the global financial crisis the bank interest spreads in Estonia have reached their highest levels for a decade. The current research aims to explain the determinants of the interest spreads in order to cast light on the reasons behind the sudden surge in the bankers' mark-up.

Employing the Ho and Saunders (1981) pure interest spread concept and the two-step estimation procedure, the interest spreads have been decomposed into sector- and bank-level determinants. It follows that the model provides a better explanation for the loan-Euribor spread than for the loan-deposit spread. The costs and risks incurred by the bank are an intrinsic part of the lending rate, whereas the deposit rate is more dependent on access and the costs of liquidity on money markets.

The evidence proves that the credit market in Estonia is very competitive. The strongest pressure on loan rates can be observed at the end of the lending boom in 2006–2007, when the rates became substantially suppressed. There has however been some room for banks to exert their market power in the deposit market.

The risk-aversion of the sector is one of the main triggers behind the widening spreads, and even more so since the eruption of the recent global financial crisis. The banks keep holding strong capital positions over their risk exposures.

The interest rate volatility, though statistically significant, has a relatively modest share in the spread composition. The banks have largely transferred the interest rate risk to borrowers by imposing flexible Euribor-linked rate contracts.

The bank-specific spread is composed of the regulatory, efficiency and bank portfolio effects, each of which has a roughly equal weight in the observed spread, while credit risk adds only a tiny portion to the mark-up. Strong liquidity and foreign capital have enabled the banks to counteract and alleviate some of the upward trend in the spreads.

The overall implication suggests that in spite of the improved efficiency, the competitive market and dominant foreign participation, the banks' spreads in Estonia remain vulnerable to global risks, being increased by the heightened risk-aversion of banks at times of high uncertainty.

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9. Appendixes

Table 3: II-Step: Error Correction Model, January 1999–June 2011

Pure Spread w.r.t	Deposit rate		Euribor 6 months	
	1999-2011	2007-2011	1999-2011	2007-2011
dVolatility	0.8243***	0.6049	1.0295***	2.1475***
	(0.2171)	(0.3975)	(0.3822)	(0.5750)
dRisk-aversion	0.0589**	0.0761***	0.0619*	0.1051***
	(0.0295)	(0.0225)	(0.0329)	(0.0354)
Adjustment	–0.3173***	–0.1593***	–0.1507***	–0.1275***
	(0.0626)	(0.0589)	(0.0336)	(0.0423)
LVolatility	1.1201***	1.5625***	1.3881***	3.7090***
	(0.3561)	(0.4829)	(0.4425)	(0.3260)
LRisk-aversion	0.0775***	0.0513**	0.0563***	0.0646***
	(0.0196)	(0.0204)	(0.0175)	(0.0161)
LnTrend	–0.1540*		–0.0960*	
	(0.0781)		(0.0560)	
Market structure	0.3155	-0.5138**	–0.4191**	–1.2146***
	(0.2808)	(0.2510)	(0.1977)	(0.2465)
F	9.69	5.05	6.11	34.62
No of obs.	150	54	150	54
R square	0.21	0.26	0.19	0.63
R square adj	0.18	0.19	0.16	0.59

LONG-RUN EQUILIBRIUM 1999-2011:

$$Spread_{Deposits} = 0.99 - 0.49LnT + 3.53V + 0.24RA$$

$$Spread_{Euribor} = -2.78 - 0.64LnT + 9.21V + 0.37RA$$

LONG-RUN EQUILIBRIUM 2007-2011:

$$Spread_{Deposits} = -3.23 + 9.81V + 0.32RA$$

$$Spread_{Euribor} = -9.52 + 29.09V + 0.51RA$$

Source: author's calculations on Bank of Estonia financial statistics.
*Note: Robust standard errors in parentheses. ***, **, * indicate statistical significance at the levels of 1%, 5% and 10% respectively.*

Table 4: II-Step: ECM with period effects, January 1999-June 2011

Pure Spread w.r.t	Deposit rate		Euribor 6 months	
	annual effects	3-year effects	annual effects	3-year effects
dVolatility	0.5436**	0.9390***	0.9732**	1.1325***
	(0.2561)	(0.2307)	(0.4661)	(0.4106)
dRisk-aversion	0.0577	0.0791**	0.0463	0.0737**
	(0.0424)	(0.0342)	(0.0426)	(0.0358)
Adjustment	–0.4980***	–0.3854***	–0.2677***	–0.2221***
	(0.0852)	(0.0656)	(0.0808)	(0.0551)
LVolatility	0.8921**	1.4555***	1.4121***	1.6692***
	(0.3745)	(0.3294)	(0.5276)	(0.4391)
LRisk-aversion	0.0564	0.1064***	0.0324	0.0604**
	(0.0480)	(0.0281)	(0.0488)	(0.0244)
2000	–0.7838***		–0.8133**	
	(0.2609)		(0.3654)	
2001	–0.6128**		–0.8880**	
	(0.2641)		(0.3686)	
2002	–0.5941**		–0.8296**	
	(0.2318)		(0.3711)	
2003	–0.5573**		–0.7097**	
	(0.2406)		(0.3284)	
2004	–0.6624**		–0.7551**	
	(0.2922)		(0.3586)	
2005	–0.9629***		–0.7922**	
	(0.3178)		(0.3982)	
2006	–0.8895***		–0.9678***	
	(0.2861)		(0.3527)	
2007	–1.2936***		–1.1826***	
	(0.3220)		(0.4313)	
2008	–0.7401***		–0.8059*	
	(0.2603)		(0.4136)	
2009	–0.7790**		–0.3493	
	(0.3758)		(0.3180)	
2010	–0.5110		–0.5962	
	(0.3681)		(0.4201)	
2011	–0.3522		–0.6928	
	(0.3509)		(0.4366)	
2000–2002		–0.4360**		–0.6275**
		(0.2162)		(0.2809)
2003–2005		–0.4169*		–0.5054*
		(0.2270)		(0.2751)
2006–2008		–0.6977***		–0.7556**
		(0.2386)		(0.3000)
2009–2011		–0.7647***		–0.5570**
		(0.2755)		(0.2318)
constant	1.3283*	–0.0599	0.4958	–0.2150
	(0.7660)	(0.4034)	(0.8177)	(0.4854)
F	5.23	6.76	2.90	4.14
No of obs.	150	150	150	150
R square	0.32	0.25	0.27	0.24
R square adj	0.23	0.20	0.18	0.19

Source: author's calculations on Bank of Estonia financial statistics.
*Note: Robust standard errors in parentheses. ***, **, * indicate statistical significance at the levels of 1%, 5% and 10% respectively.*

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