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INTEREST RATE SPREADS IN THE BALTICS AND THE REST OF THE EURO AREA: UNDERSTANDING THE FACTORS BEHIND THE DIFFERENCES

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Interest Rate Spreads in the Baltics and the Rest of the Euro Area: Understanding the Factors behind the Differences

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Abstract

This paper analyzes the determinants of interest rate spreads during the period 2014–2020 in the euro area, with a focus on the Baltic countries. Against the background of accommodative monetary policy, interest rates on loans in the euro area have declined markedly, except in a few countries. In Latvia, Lithuania and Estonia, interest rates on new loans to non-financial corporations in 2020 were about the same as in 2014, and at the same time they were among the highest in the euro area. In this study, we apply the Ho and Saunders (1981) theoretical framework to identify explanatory factors of spreads and use the obtained econometric estimates to calculate the so-called pure spread by subtracting the influence of the bank funding structure and other bank-specific factors from the interest rate spread. Our study shows that even after accounting for the conventional determinants of interest rate spread, differences in the pure spread between euro area countries, especially between the Baltic countries and the rest of the euro area, persist. In part, these differences can be explained by varying degrees of financial sector market concentration. However, the bulk of the gap in spreads remains unexplained. The findings of this paper suggest that properly designed policy measures are needed to reduce spreads in the Baltic countries and lessen the fragmentation in the euro area. This would allow for more effective monetary policy transmission and stimulate lending and post-Covid economic recovery in the Baltics.

Keywords: interest rate spread, interest rate on loans, market concentration

JEL Codes: G21, L11, E43, E52

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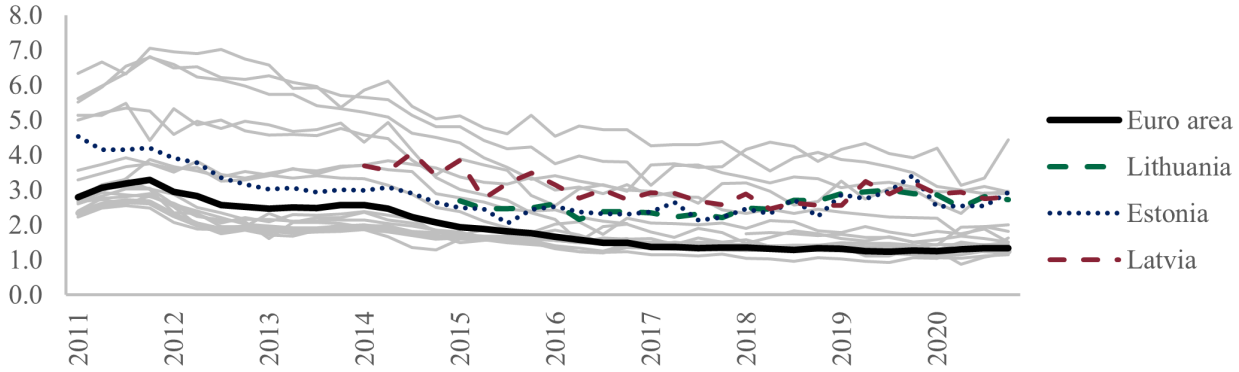
1 Introduction

The financial sector has traditionally played an important role in the economy, linking the investment needs of borrowers and the stock of savings accrued by lenders. Banks also play an essential role in the transmission of monetary policy measures to households and nonfinancial corporations (NFCs). Since the outbreak of the great recession the euro area economy has received strong support from the accommodative monetary policy of the Eurosystem. Short-term interest rates set by the European Central Bank (ECB) had been at an all-time low for several years before turning negative in 2014. The monetary accommodation was strengthened by a new set of instruments that has been added to the monetary policy toolkit. Liquidity providing operations (e.g. TLTRO) have lowered the financing costs of the banking sector and directly stimulated lending to the real economy. Furthermore, other instruments, such as asset purchases and forward guidance, supported the economy through a number of transmission channels, including through the banking sector.

Accommodative monetary policy has been accompanied by a decline in money market interest rates, which are often used by financial intermediaries as a benchmark in setting the price of loans to the corporate sector and households. This led to a noticeable decrease in interest rates on loans in the euro area. In 2020, interest rates on new loans to NFCs were on average about half as high as in 2014 (see Figure 1). The downward trend in lending rates was observed in the majority of euro area countries, and it continued until the onset of the Covid-19 pandemic.

Figure 1: Interest rates on new loans to NFCs in the euro area, %



Source: IMIR.

However, the downward trend in interest rates was not the same everywhere in the euro area. The Baltic states (Latvia, Lithuania and Estonia) were among the few euro area countries where

the decline in interest rates on new loans was relatively subdued. In fact, after a gradual decline that lasted until 2017, interest rates on new loans to NFCs in all three Baltic countries slightly increased — a phenomenon not observed in most of the other euro area economies (at least until the onset of the Covid-19 pandemic). As a result, in the Baltic countries interest rates on new loans to NFCs in 2020 were about the same as they were in 2014, and at the same time they were among the highest in the euro area. Similarly, the spreads between interest rates on new loans to NFCs and interest rates on deposits charged by banks in the Baltics have been among the highest in the euro area. Thus, the Baltic banking system has demonstrated exceptionally high interest rate spreads. In 2020, the average spread in the Baltic countries was approximately 2.7 percentage points, whereas in the euro area it stood close to 1.3 percentage points.

Noticeable differences in interest rate spreads within a monetary union could be a sign of financial sector fragmentation, which in turn might raise some concerns about the effectiveness of monetary policy transmission in the euro area. However, there are other possible explanations of the relatively high level of spreads, such as higher credit risk of loan portfolios which may arise for various reasons, for example, due to the structural features of the Baltic economies or the increased risk appetite of the Baltic banks.[1]

The main objective of this paper is to explore the extent to which the spreads recorded by banks in the Baltics can be explained by conventional factors and how they compare to the rest of the euro area once these factors are controlled for. Simply put, in this study we investigate whether the high lending rates charged by banks in Latvia, Lithuania and Estonia are justified from the theoretical and empirical standpoints. For that purpose, we use the widely recognized Ho and Saunders (1981) theoretical framework, further extended by the empirical literature, to uncover the effect of bank margin determinants. Following Aydemir and Guloglu (2017) in this study, we analyze interest rate spread as a proxy for bank margin. More specifically, we use the difference between the average interest rate on new loans to NFCs and the average interest rate applied to all new deposits. Our proxy for bank margin reacts quickly to various kinds of changes and shocks, including those related to the bank-specific indicators as well as the application of non-standard monetary policy measures.

We follow most of the literature and employ the single-stage panel regression approach to investigate the main determinants of interest rate spreads recorded by individual banks in the euro

[1]Differences in interest rates on new loans could be related to different responses to negative interest rate environment. It has previously been shown that negative interest rates induced some banks to take on more risk (Heider et al. 2019).

area over the period between 2014 and 2020. In the baseline econometric specification, we regress bank-specific interest rate spreads on factors reflecting bank funding structure, bank-specific imperfection indicators (such as those that proxy for the credit risk or liquidity risk) and country-level indicators (e.g. market structure and macroeconomic conditions). Moreover, we account for bank and time fixed effects. We check the robustness of our estimates to the introduction of country-time dummies (that replaces country-specific indicators but allows accounting for any country-time specific shocks) and to employing the weighted least squares (WLS) estimation approach instead of the OLS.

This procedure yields the coefficient estimates that largely confirm the previous literature. We use these estimates to calculate the so-called pure spread by subtracting the impact of the bank funding structure and bank-specific factors from the interest rate spread. These calculations show that even after cleaning the interest rate spread from bank specific factors, the differences in the pure spread persist. These differences are partly attributable to a different market structure in the euro area countries, as a concentration indicator (Herfindahl-Hirschman index) is found to be one of the most influential factors affecting spreads. However, the bulk of the differences remains unexplained.

Our contribution to the previous literature is mostly of the empirical nature. We do not introduce a new explanatory variable or expand the geography of the analysis. Instead, we examine whether the inclusion of traditional determinants of bank margin in the euro area is sufficient to explain the exceptionally high spreads currently observed in one part of the monetary union, namely the Baltic countries. It appears that the inclusion of traditional determinants is not sufficient. All in all, this calls for further investigation and policy measures that would lessen financial sector fragmentation in the euro area and facilitate transmission of accommodative monetary policy to all parts of the monetary union.

The rest of the paper is structured as follows. Section 2 provides the overview of the most commonly used determinants of bank margin and summarizes evidence from the related literature. Section 3 lays down the methodology and data employed in the paper and provides the main stylized facts on the distribution of spreads in the euro area. Section 4 presents the estimation results and calculates the pure spread. Section 5 discusses the obtained results and provides possible explanations of the estimated gap in pure spreads. Finally, Section 6 concludes.

2 Literature review

2.1 Determinants of bank margins

The starting point for analyzing the determinants of interest rate spreads is the microeconomic dealership model of bank margin[2] suggested in the seminal paper by Ho and Saunders (1981). It has been later extended by numerous other studies and applied to different countries and regions. The dealership model is based on the assumption that the representative bank is a risk-averse dynamic dealer, which faces a high degree of uncertainty and sets interest rates on deposits and loans, accounting for the fact that deposits inflow at a different point in time from a credit demand. In Ho and Saunders (1981) the pure bank margin varies across countries and periods depending on two main factors: the degree of competition in the bank market and the volatility in money market interest rates. Thus, if the bank can exercise a monopoly power (by facing a relatively inelastic demand for loans and supply of deposits) it sets a higher margin.

Stemming from the pioneering study by Ho and Saunders (1981), two types of empirical approaches have been used in the literature to uncover the effect of bank margin determinants. The original *two-step approach*, as applied by, among others, Saunders and Schumacher (2000) and Brock and Rojas-Suarez (2000) is composed of two stages. In the first stage, the observed bank margins are cleared of bank specific factors before the dealership model can be applied and the effect of theoretical determinants (such as market structure) can be estimated. *Pure margins* are disentangled by regressing bank margin (usually defined as the ratio of net interest income to bank's assets) on several bank-specific imperfection factors using cross-sectional regressions of individual banks for each country and each time period. The obtained regression constant can be viewed as the estimate of the pure margin, which is supposed to be equal across all banks in any country at any point in time but may vary across countries and time (Saunders and Schumacher 2000). Bank margins depend on the number of bank-specific imperfection determinants, such as credit risk, liquidity risk, opportunity cost of holding reserves at the central bank and other factors. These factors alongside the most widely used proxy variables are summarized in Table 1. For example, the ratio of non-performing loans (NPLs) has been popular to proxy for the credit risk. However, in cases when the data on NPLs are not available, the loan-to-asset ratio is included as banks that specialize

[2]Bank margin is usually measured as the ratio of the difference between interest earned and paid to bank assets. In this paper we use the difference in lending rates (to NFCs) and deposit rates as the proxy for bank margin for the reasons explained in the text.

in issuing loans are subject to greater credit risks (Maudos and Fernandez de Guevara 2004).

Table 1: Determinants of bank margin

Determinants of bank margin	The effect on bank margin (+/−)	Proxy variables (Examples of studies where used)
Credit risk	Higher uncertainty about the expected return on granted loans induces banks to charge higher bank margin (+)	NPLs/total loans (Brock and Rojas-Suarez 2000; Martinez Peria and Mody 2004; Yuksel and Zengin 2017); Loans/total assets (Maudos and Fernandez de Guevara 2004; Liebeg and Schwaiger 2007; Cruz-García et al. 2019); Total loan loss provision/total loans (López-Espinosa et al. 2011; Dumicic and Rizdak 2013)
Degree of risk aversion	More risk-averse banks charge higher margin (+)	Core capital/total assets (Angbazo 1997); Equity/total assets (in most of studies); (Bank capital + reserves)/total assets (Martinez Peria and Mody 2004; Carbo-Valverde and Rodríguez-Fernández 2007)
Operating costs/management quality	Higher operating costs imply higher bank margin to offset those costs (+)	Operating cost/income (Carbo-Valverde and Rodríguez-Fernández 2007; Maudos and Fernandez de Guevara 2004); Payroll and other operating expenses/total assets (Martinez Peria and Mody 2004; Cruz-García et al. 2019); Administrative and other operating costs/performing loans (Brock and Rojas-Suarez 2000)
Liquidity risk/opportunity costs	Availability of liquid assets reduces liquidity risk and lowers liquidity premium and bank margin (−); Bigger reserve volumes imply higher opportunity costs and hence bank margin to compensate those costs (+)	Liquid assets/total liabilities (Angbazo 1997; Carbo-Valverde and Rodríguez-Fernández 2007); (Cash + deposts at CB)/total assets (Martinez Peria and Mody 2004; Yuksel and Zengin 2017); Non-interest bearing reserves/total assets (Maudos and Fernandez de Guevara 2004; Saunders and Schumacher 2000; Cruz-García et al. 2019)
Size of bank operations	Greater operations are associated with larger losses that are translated into higher bank margin (+)	Volume of loans (Maudos and Fernandez de Guevara 2004; Liebeg and Schwaiger 2007; López-Espinosa et al. 2011; Cruz-García et al. 2019)

Source: based on studies listed in the table.

In the second stage, the theoretical determinants (such as macroeconomic factors, market structure and interest rate volatility) of pure margins are analyzed in a country/year panel framework. Most commonly used determinants and their proxy variables are listed in Table 2. In the earlier studies (such as Saunders and Schumacher 2000), the constant term of the second step (i.e. the part that cannot be explained by bank-specific characteristics, interest rate volatility or macroeconomic

variables) was supposed to explain the effect of market structure. However, in most other papers, the Herfindahl-Hirschman index (HHI), the Lerner index or the concentration ratio were used to measure the degree of competition in the banking sector.

Table 2: Determinants of pure margins

Determinants of pure margins	The effect on pure margins (+/–)	Proxy variables (Examples of studies where used)
Macroeconomic factors	More favourable macroeconomic environment implies a smaller margin (–)	Inflation (Brock and Rojas-Suarez 2000; Martinez Peria and Mody 2004; López-Espinosa et al. 2011); GDP growth rate (Liebeg and Schwaiger 2007; Brock and Rojas-Suarez 2000; Yuksel and Zengin 2017; Cruz-García et al. 2019); Real GDP (Carbo-Valverde and Rodríguez-Fernández 2007; Claeys and Vander Vennet 2008); GDP per capita (Liebeg and Schwaiger 2007); Exchange rate (Yuksel and Zengin 2017); Public debt (Dumicic and Rizdak 2013); Unemployment (López-Espinosa et al. 2011; Yuksel and Zengin 2017)
Risk-free interest rate volatility	Interest rate volatility drives bank margin (+)	Real interest rate (Martinez Peria and Mody 2004; Claeys and Vander Vennet 2008); Interest rate volatility (Brock and Rojas-Suarez 2000; Saunders and Schumacher 2000; Liebeg and Schwaiger 2007; Cruz-García et al. 2019)
Bank market structure	Banks may charge a higher margin in more concentrated markets (+)	HHI (Martinez Peria and Mody 2004; Maudos and Fernandez de Guevara 2004; Carbo-Valverde and Rodríguez-Fernández 2007); Lerner index (Maudos and Fernandez de Guevara 2004; Cruz-García et al. 2019); Share of assets (loans) by 3 -5 largest banks (Claeys and Vander Vennet 2008; Martinez Peria and Mody 2004; Liebeg and Schwaiger 2007); Number of foreign banks (Martinez Peria and Mody 2004; Claeys and Vander Vennet 2008); Asset share of state owned banks (Claeys and Vander Vennet 2008)

Source: based on studies listed in the table.

The two-step approach is preferable when a large cross-section of banks is available for each country, so that there is a sufficiently large number of observations for the first-stage analysis. However, in many cases the number of banks is rather small and does not allow for estimating the pure margin in a separate cross-section regression. Therefore, a number of studies, Angbazo (1997), Maudos and Fernandez de Guevara (2004), Carbo-Valverde and Rodríguez-Fernández (2007), Dietrich and Wanzenried (2011) among others, saw a solution to the short series problem in the one-step

approach, where determinants of pure margin, bank-specific factors and bank/country/time dummies are included in a single reduced form panel regression that is estimated using the fixed effect (FE) or GMM approach.

2.2 Main findings in the previous literature

The original model by Ho and Saunders (1981) has been subsequently expanded with additional explanatory factors of bank margin. In fact, over the period of 40 years since their paper was published, there have been numerous modifications of the original model depending on the popular interest at the time and the group of countries under consideration. For the sake of brevity, we mention only a few of these extensions.

Thus, Angbazo (1997) added the risk of default and its interaction with interest rate risk. Maudos and Fernandez de Guevara (2004) incorporated operating costs and used the direct measures of market power. Carbo-Valverde and Rodríguez-Fernández (2007) broadened the definition of bank margin beyond the interest rate margin to account for banks' non-traditional activities. Entrop et al. (2015) incorporated costs of maturity transformation. Cruz-García and Fernández de Guevara (2020) extended the model to incorporate capital requirements and the deposit insurance premium. Finally, and more closely related to the focus of our study, Cruz-García et al. (2019) looked at the impact of expansionary (both standard and non-standard) monetary policy measures, adopted to address the consequences of the great recession.

Many studies applied the Ho and Saunders (1981) framework to study bank margins in a different geographical setting (individual countries and country groups). Maudos and Fernandez de Guevara (2004), Carbo-Valverde and Rodríguez-Fernández (2007) examined interest margins of banks in largest European countries. Brock and Rojas-Suarez (2000) studied determinants of margins in seven Latin American countries in the context of financial sector liberalization of the 1990s. Doliente (2005) explored margins in Southeast Asian countries (Thailand, the Philippines, Indonesia and Malaysia), Islam and Nishiyama (2016) – in South Asian countries (Bangladesh, Nepal, India and Pakistan), Birchwood et al. (2017) – Central American and Caribbean countries, Tennant and Folawewo (2009) – 33 low- and middle- income countries. This list is far from being exhaustive and potentially is very long. It does not merely comprise country groups, but also several individual countries. Thus, Williams (2007) analyzed the determinants of margins in Australia, Zhou and Wong (2008) – in China, Maudos and Solís (2009) – in Mexico, Hanafi et al. (2013) – in Indonesia,

Aydemir and Guloglu (2017) – in Turkey, Khan and Jalil (2020) – in Pakistan and Fungáčová and Poghosyan (2011) – in Russia.

Of special interest for our study are papers that used data on commercial banks of the Baltic countries, first as part of the sample of Central and Eastern European (CEE) countries (Claeys and Vander Vennet 2008, Liebeg and Schwaiger 2007, Dumicic and Rizdak 2013), and later, after joining the euro area, in the sample of euro area or OECD countries. The former set of studies aimed to explain the declining path of bank margins in CEE countries before the outset of the financial crisis. For example, Claeys and Vander Vennet (2008) showed that margins in CEE countries narrowed sharply due to higher operational efficiency and the entry of foreign banks, irrespective of the fact that the latter acquired a relatively large share of the market. In the most recent papers, data of the Baltic states were employed in the broad panel of 32 OECD countries in Cruz-García et al. (2019) and Cruz-García and Fernández de Guevara (2020); and euro area countries in Angori et al. (2019). The latter presented a set of novel findings of the effect of traditional determinants of banking sector profitability (interest margin) in the aftermath of the financial crisis in the euro area. In addition to the traditional determinants, they accounted for country institutional settings and regulatory structures and showed, for example, that interest margin remained lower in countries with less stringent capital requirements and stronger supervisory power.

To sum up, the analysis of bank margin has mainly focused on the influence of various factors in different regions and countries. To contribute to the previous literature, we do not plan to introduce any new explanatory variables or to expand the geography of the analysis. Instead, we examine whether the inclusion of traditional determinants of bank margin in the euro area is sufficient to explain the exceptionally high spreads currently observed in one part of the monetary union, namely the Baltic countries.

3 Empirical approach: econometric specification, data sources and stylized facts

3.1 Econometric approach

In this paper, we follow the single-step approach and explain interest rate spreads in the euro area using the variables suggested by Ho and Saunders (1981) theoretical framework as well as several other bank-specific and country-specific factors added by further literature. We estimate

the parameters of the following panel regression:

$$IS_{bct} = \alpha \cdot FS_{bct} + \beta \cdot R_{bct} + \gamma \cdot M_{ct} + \mu_b + \mu_t + \epsilon_{bct} \tag{1}$$

where IS_{bct} is bank margin of bank b in country c at time t. Most of the papers employ net interest margin variables (such as the ratio of the difference between interest received and interest paid to total assets) as the dependent variable. We follow Aydemir and Guloglu (2017) that defines the bank margin directly by using the difference between loan and deposit rates, i.e. the interest rate spread. More specifically, we use the spread between the average interest rate on new loans to NFCs and the average interest rate applied to all new deposits of bank b in country c at period t. Our approach has the advantage of responding more quickly to changing environment and thus better fits the focus of this study, which emphasizes the developments in pure margin over a relatively short period of time.

FS_{bct} denotes bank-specific variables that account for the structure of bank liabilities as individual banks may rely on different business models and different sources of financing for their lending activities. R_{bct} represents bank-specific imperfection indicators, such as those that proxy for the credit risk and liquidity risk. M_{ct} are country-specific theoretical determinants of the pure spread, such as market concentration and macroeconomic indicators. The latter capture the macroeconomic environment in which a bank operates. Table A1 summarizes the variables used in the estimation. The equation includes bank and year fixed effects (μ_b and μ_t respectively) and allow for unobserved residual effect ϵ_{bct} that is identically and independently distributed. The estimations are performed using the fixed effect (FE) approach in the baseline and using the WLS estimator in the robustness section. To reduce the concerns of possible reverse causality, bank-specific variables that are grouped into FS_{bct} and R_{bct} enter the equation with one period lag (see e.g. Martinez Peria and Mody 2004). The use of lagged variables cannot solve the problem of reverse causality in the fixed effects regression due to well-known correlation of within-transformed lagged variables with the error term. However, this reduces the above-mentioned correlation especially when T is relatively large (23 in our case).

As explained above, we include several variables that account for the structure of a bank's liabilities, which in turn may affect costs of funds. For example, a bank may issue bonds whereby interest payments affect loan rates but are not reflected in deposit rates with a corresponding effect

on the interest rate spread. To this end, we include the share of bonds issued in total liabilities. On the one hand, investors demand higher interest rates on bonds if the perceived risk of the borrower is higher. Such a risky borrower, which to a large extent relies on bond issuance to raise funds, is more likely to exhibit higher interest rate spreads. On the other hand, for financially sound banks bond financing in the negative interest rate environment might actually prove to be a cheaper source of financing compared to deposits. To take this into account, we interact the bonds variable with the country's credit default swap (CDS) to control for difference in premiums paid by banks located in different countries. Likewise, we account for bank heterogeneity by interacting bonds variable with the capital-to-assets ratio. Gaining access to funds under non-standard monetary policy programmes, such as targeted longer-term refinancing operations (TLTRO) and/or asset purchase programmes (APP), also can affect lending rates and hence interest rate spreads. We lack bank-level data on participation in liquidity providing operations and asset purchases therefore we exploit the information available from the balance sheets. First, we introduce the share of liabilities to the central bank and its interactions with the availability of TLTROs to account for the effect of TLTROs on funding costs. Second, we measure the exposure to the APP by the share of government securities holdings in total assets and interact it with the dummy variables accounting for the deployment of the public sector purchase programmes (PSPP) and the pandemic emergency purchase programmes (PEPP). Finally, a bank can also borrow from other banks that we account for by including the share of liabilities to other credit institutions and its interactions with a few risk indicators mentioned above. To sum up, deposits have traditionally been cheaper than borrowed funds, hence a bank that relies on the latter to a larger extent is expected to charge higher interest on issued loans. However, since the deployment of non-standard measures of monetary policy by the Eurosystem, market financing and central bank programmes may actually reduce the costs of funds and lower the spreads.

We include several bank-specific variables that have been shown in the previous literature to explain bank margin.[3] The capital-to-assets ratio is expected to exert a positive effect on spreads mostly because a higher capital proportion is a signal of a bank's stronger creditworthiness. This in turn enables banks attract deposits at a lower interest rate.[4] We include total bank liquidity that can have both a negative and a positive effect. On the one hand, extra liquidity that is held

[3]We bear in mind that, in contrast to most of the previous studies, we employ interest rate spread as the dependent variable.

[4]However, this relationship might have become somewhat weaker in the low interest rate environment.

by banks represents foregone revenue which requires higher lending rates as the compensation, on the other hand, it signals a bank's stability should a shock arrive. We try to take various aspects of credit risk into account by including several factors. First, we use the loan-to-asset ratio. Banks that specialize in the provision of loans are supposed to be more exposed to risks (as loans are considered the most risky asset type, see Claeys and Vander Vennet 2008; and such banks are also more likely to attract borrowers with a higher risk profile) and may charge higher lending rates to compensate for the smaller share of less risky activities. On the other hand, specialized banks may be able to reap the benefits from a better understanding of how the credit market works in a particular country as well as from having long-term relationships with clients, which allows them to pass some of these benefits to borrowers in the form of lower spreads. The effect of this variable cannot be determined on a priori grounds since it does not simply reflect the risk factor. Therefore, we introduce a few more specific risk indicators. For example, we consider short-term loans and smaller loans to be riskier types of credits, hence we introduce their shares in total loans in the estimation. Ideally, to fully assess the impact of credit risk, we should also employ the proportion of problem or NPLs, alongside the loss given default.[5] However, the dataset at hand does not offer bank-specific data on the proportion of NPLs. Nevertheless, we incorporate country-specific NPLs of NFCs and their interactions with the country-specific recovery rate from resolving insolvency.[6] We believe that by including all these measures we can adequately cover as many aspects of credit risk as possible using the available data.

Bank behaviour is driven by market structure, which has traditionally been regarded as key determinant of pure margin. In this study, we employ the widely used HHI of bank loan concentration as well as its interaction with the country-specific amount of loans to NFCs to account for the possibility that concentration effect differs on small and large markets due to possible economies of scale. Finally, we control for macroeconomic conditions by including inflation and GDP growth rate. When these conditions are favourable, banks are expected to provide loans on more advantageous terms.

[5]The share of an asset that is lost if a borrower defaults.

[6]Note that the recovery rate from resolving insolvency is inverse to the loss given default, therefore we also include the share of NPLs in the regression.

3.2 Data sample and stylized facts

We use a sample of 269 banks from 19 euro area countries, which account for 83.6% of loans to domestic NFCs in the euro area in 2020. Quarterly data over the period from the fourth quarter of 2014 to the fourth quarter of 2020 have been employed.[7,8] The use of higher-frequency quarterly data is the advantage of this study (which contrasts most of the previous studies) as it allows to properly capture the short-term responses of interest rate spreads. Almost all data (apart from macroeconomic indicators) are obtained from the ESCB SDW database that contains the following datasets: IMIR (individual MFI interest rates), IBSI (individual balance sheet items), CBD2 (consolidated banking data), BSI (balance sheet items) and SSI (banking structural statistic indicators). These datasets use unconsolidated financial statements. Data on inflation and GDP growth are taken from Eurostat, while the data on recovery rate – from Doing Business of the World Bank. The final sample used in the estimation is the unbalanced panel of 5447 observations, corresponding to the number of banks varying from 233 in 2014 to 213 in 2020. The largest number of observations is represented by banks in Germany (59) and Italy (34). The database contains information on 19 banks from the Baltic states (7 for Latvia, 6 for Lithuania and 6 for Estonia).

Table A2 in Appendix reports summary statistics of the variables used in the estimation. On average, over the period observed, interest rate spreads in the euro area were about 1.9%, while banks of the Baltic states recorded higher spreads, i.e. approximately 2.9%. Differences are not merely noticeable when looking at the mean or median levels: banks whose interest rate spreads are at the bottom 25th percentile in the Baltics are roughly at the top 25th percentile in the distribution of spreads across the euro area. This effectively means that banks in the Baltic states have one of the highest spreads in the monetary union. This observation becomes even more evident when examining in more detail the lending rates charged by individual banks to NFCs in the Baltic countries[9] compared to other banks in the euro area.

After monetary policy interest rates turned negative in 2014, the distribution of interest rates on new loans to NFCs in the euro area gradually shifted to the left (see Figure 2). In 2020, the median lending rate in the euro area was significantly lower than in 2014 (1.44 and 2.41, respectively).[10] In

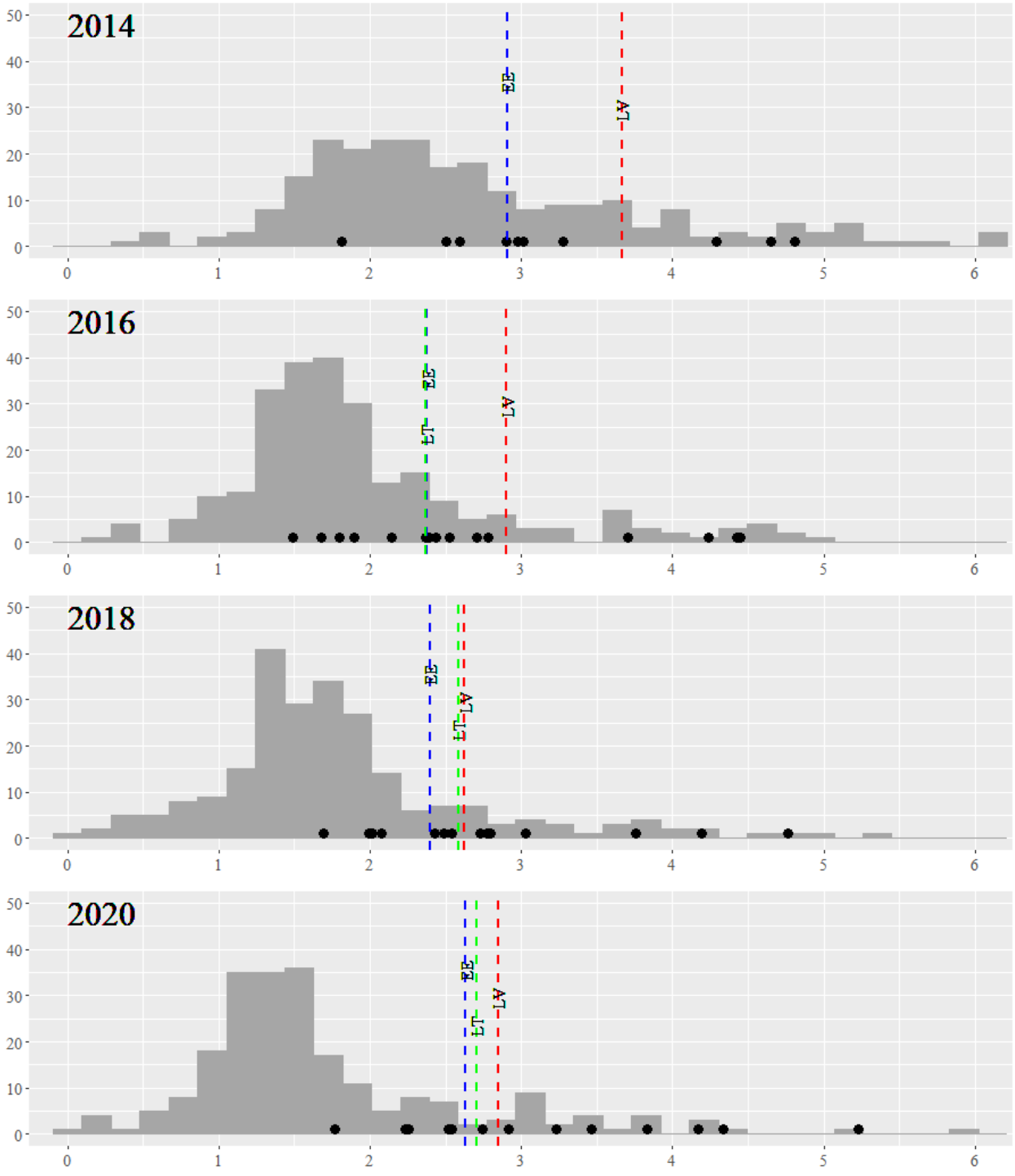
[7] Data on NPLs to NFCs are available only from the fourth quarter of 2014.

[8] Note that the data on HHI is available only until 2019. We assume that in 2020 the level of market concentration was the same as in 2019. Similarly, we assume that the country-specific share of NPLs to NFCs in the fourth quarter of 2020 was the same as in the third quarter of 2020.

[9] Banks are not identified in the text due to data confidentiality.

[10] The null hypothesis on the equality of the interest rate on new loans to NFCs in 2014 and 2020 was clearly rejected (t-test: t=10.497, p=0.000; KS-test: D=0.530, p=0.000).

Figure 2: Distribution of the average interest rate on new loans to NFCs in the euro area banks

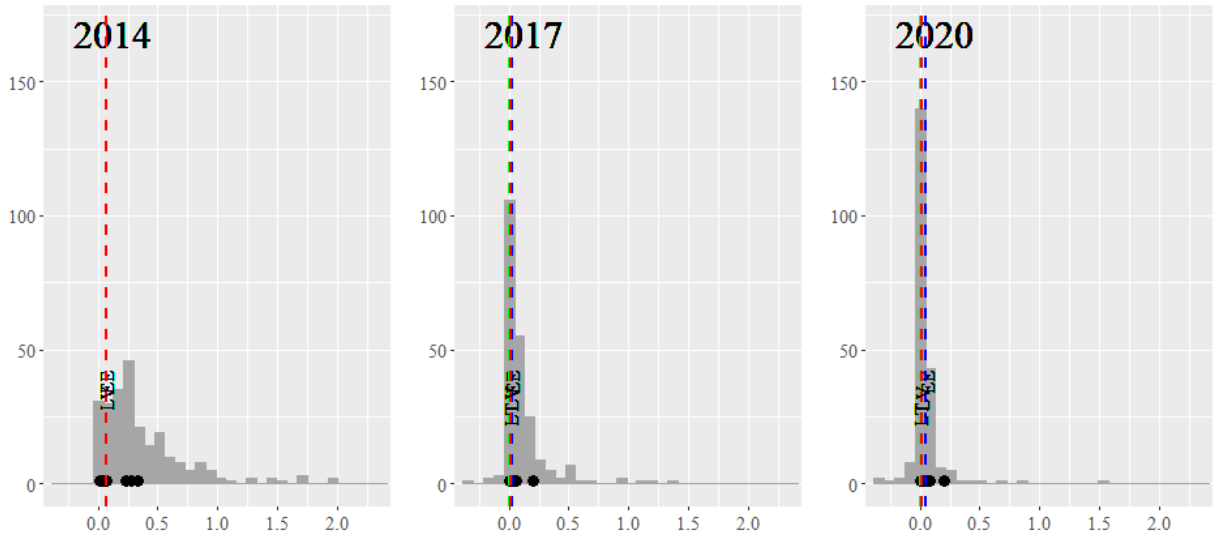


Notes. The black dots show the average interest rate on new loans to NFCs for individual banks in Estonia, Latvia and Lithuania. The vertical dotted lines denote the country-level average interest rate on new loans to NFCs in the Baltic countries.
Source: IMIR.

addition, the dispersion of rates between banks in the euro area has narrowed. However, looking at the dynamics of lending rates charged by banks in the Baltic countries, one can easily notice that the changes were more restrained. As a result, in 2020, nearly all large lenders in Estonia, Latvia and Lithuania were in the top deciles of the loan interest rate distribution (all but one were in the 9th and 10th deciles).

The deviation of lending rates of the Baltic banks from the rest of the euro area was not caused by differences in the deposit rates, which are at a record low. In addition, the differences between them have narrowed markedly. In 2020, the average interest rate on new deposits was close to zero in almost all banks (Figure 3).

Figure 3: Distribution of the average interest rate on new deposits in the euro area banks



Notes. The black dots show the average interest rate on new deposits for individual banks in Estonia, Latvia and Lithuania. The vertical dotted lines denote the country-level average interest rate on new deposits in the Baltic countries.
Source: IMIR.

Although deposits are only one source of funding, they represent a significant share of bank liabilities in the euro area and especially in the Baltic countries. While bonds issued by banks represent on average only 1% of total liabilities in the Baltic states, this share reaches 10% in the euro area as a whole (see Table A2). Similarly, borrowing from other banks represents 4% in the Baltics compared to 16% in the euro area. Deposits were traditionally considered a cheaper source of funding, but since the introduction of negative interest rates it may no longer be the case.[11] This might partly explain higher spreads recorded by banks in the Baltic countries. Also, the mean levels

[11]The deposit rates are considered to be bound by a zero lower bound, at least in the case of household deposits.

of most of the other explanatory variables used in the study seem to at least some extent justify the higher spreads in the Baltics. For example, liquidity measure, loan-to-assets and capital-to-assets ratios (whose impact on spreads is considered positive) exhibit higher values in the Baltics. Likewise, the Baltic banking sector is more concentrated. Regarding the share of problem loans, although euro area exhibits on average a higher share of NPLs, their recovery rate from resolving insolvency is somewhat greater. However, banks in the Baltics display a smaller share of small (and therefore riskier) loans. Ultimately, it is an empirical question whether the included factors can fully or at least to some reasonably high level explain the difference in the spreads between the Baltics and the rest of the euro area.

4 Estimation results

Table 3 presents three sets of the estimation results. First, we report the results of the baseline estimation of (1) which includes bank and time fixed effects. Second, we include country-time fixed effects to control for any country-specific determinants of interest rate spreads. Such unobserved determinants in the case of the Baltic countries could, for example, be related to repercussions from geopolitical tensions or measures introduced by Latvian authorities, following the critical assessment of Latvian banks by Moneyval[12], to tackle money laundering. Finally, we account for the fact that there is considerable heterogeneity with respect to the volume of loans issued by banks in the euro area and estimate (1) using the WLS procedure.

Table 3: Determinants of interest rate spread in the euro area

Variable	Baseline	Country-time FE	WLS
Funding structure (FS_{bct})			
Demand deposits	0.034	0.061	-0.225***
	(0.089)	(0.090)	(0.065)
Individual deposits	0.156	0.127	-0.087
	(0.108)	(0.108)	(0.067)
Bonds	-0.625	-0.307	-0.092
	(0.407)	(0.413)	(0.344)
Bonds*CDS	0.012***	0.004	0.011***
	(0.003)	(0.003)	(0.002)
Bonds*Capital-to-assets	0.735	1.812	-3.108
	(2.958)	(3.006)	(2.830)
Liabilities to MFIs	0.395**	0.543***	0.543***
	(0.178)	(0.181)	(0.160)
Liabilities to MFIs*CDS	0.000	0.002***	0.000
	(0.000)	(0.001)	(0.000)
Liabilities to MFIs*Capital-to-assets	-2.659	-7.586***	-3.706**

[12]Council of Europe's Committee of Experts on the Evaluation of Anti-Money Laundering and the Financing of Terrorism.

	(1.645)	(1.688)	(1.447)
Liabilities to CBs	1.991***	1.730***	4.008***
	(0.455)	(0.523)	(0.401)
Liabilities to CBs*TLTRO II	-1.568***	-1.203**	-4.611***
	(0.384)	(0.509)	(0.337)
Liabilities to CBs*TLTRO III	0.119	0.566	1.747***
	(0.386)	(0.454)	(0.247)
Government bonds	0.574	0.554	-0.535
	(0.404)	(0.447)	(0.418)
Government bonds*APP	-1.644***	-0.948**	-0.955***
	(0.336)	(0.387)	(0.343)
Government bonds*PEPP	-0.402	-0.243	-0.744**
	(0.384)	(0.441)	(0.341)
Bank-specific imperfection factors (R_{bct})			
Loans to assets	0.122	0.259	0.766***
	(0.245)	(0.248)	(0.226)
Total assets	0.139***	0.107***	0.200***
	(0.039)	(0.039)	(0.035)
Capital to assets	-0.653	-0.300	3.575***
	(0.442)	(0.471)	(0.545)
Liquidity	-0.045	-0.057	-0.138
	(0.097)	(0.103)	(0.084)
Short-term loans	-0.082	-0.091	-0.163***
	(0.054)	(0.056)	(0.057)
Small loans	0.234***	0.273***	0.466***
	(0.056)	(0.061)	(0.056)
Non-performing loans#	0.044***	-	0.039***
	(0.004)	-	0.008
Non-performing loans*recovery rate#	0.000***	-	0.000***
	(0.000)	-	(0.000)
Country-specific factors (M_{ct})			
Total loans	0.316***	-	0.335***
	(0.091)	-	(0.075)
Market concentration	11.657***	-	17.821***
	(3.353)	-	(4.532)
Market concentration*Loans	-1.243***	-	-1.775***
	(0.340)	-	(0.379)
Inflation	0.738	-	5.015***
	(0.909)	-	(0.945)
GDP growth	0.068	-	0.986***
	(0.301)	-	(0.246)
Bank fixed effect	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Country-time fixed effect	No	Yes	No
R^2	0.824	0.849	0.783
Observations	5412	5424	5412

Note. The dependent variable is the net interest spread. Standard errors are given in brackets. (*), (**), (***) indicate statistical significance levels of 10, 5 and 1 percent respectively. # data on the share of NPLs and the rate of recovery in the database we use are only available on a country level.

Regarding the results of the baseline specification, the signs of the estimated parameters, particularly when their statistical significance is confirmed, are largely in line with our prior expectations. As for the bank funding structure, we confirm that non-standard monetary policy operations reduce the spreads (reflecting monetary policy pass-through to lending rates) and the positive effect of both the proportion of bonds in countries with higher CDS and the share of borrowed funds from other credit institutions. Turning to the effect of proxies for credit risk, the shares of small loans

and NPLs have a positive effect on the interest rate spread, although the size of the latter effect becomes smaller when a higher proportion of bad loans is recovered through the insolvency procedure. Previous literature has in fact been inconclusive regarding the impact of bad loans. While Angbazo (1997) provided an example of the positive effect of the difference between written off and recovered loans, Martinez Peria and Mody (2004) and Brock and Rojas-Suarez (2000) argued that the effect of bad loans in Latin American countries (in contrast to advanced economies) is ambiguous. Furthermore, Brock and Rojas-Suarez (2000) presented several arguments explaining the opposite signs obtained for different Latin American countries. The market structure, proxied by the HHI, has a predictable positive effect: more concentrated banking markets are associated with higher spreads (see Martinez Peria and Mody 2004, Claeys and Vander Vennet 2008). However, this effect is found smaller in countries with a large volume of loans to NFCs. Likewise, in accordance with expectations, the positive and highly significant coefficient for total assets implies that larger banks manage to reap the benefits of their position in the market by charging higher spreads (that contrasts Cruz-García and Fernández de Guevara 2020 who documented a negative effect).

The estimated impact of explanatory factors remains robust to the introduction of country-time fixed effects, whereas the use of WLS leads to slightly more important changes in the estimation of the parameters and their significance. For example, the effect of the capital-to-assets ratio changes its sign from negative (albeit insignificant) in the baseline to positive and becomes highly significant under the WLS estimation. This finding corroborates previous results, such as in Claeys and Vander Vennet (2008) who argue that capital serves as a signal of banks' creditworthiness. In addition, the estimated coefficient of the variable capturing the proportion of demand deposits in the structure of the bank's liabilities enters negative in the regression. Finally, the loan-to-asset ratio obtains a positive and statistically significant coefficient. Thus, weighting brings several signs in line with theoretical justifications, without significantly altering the overall results.

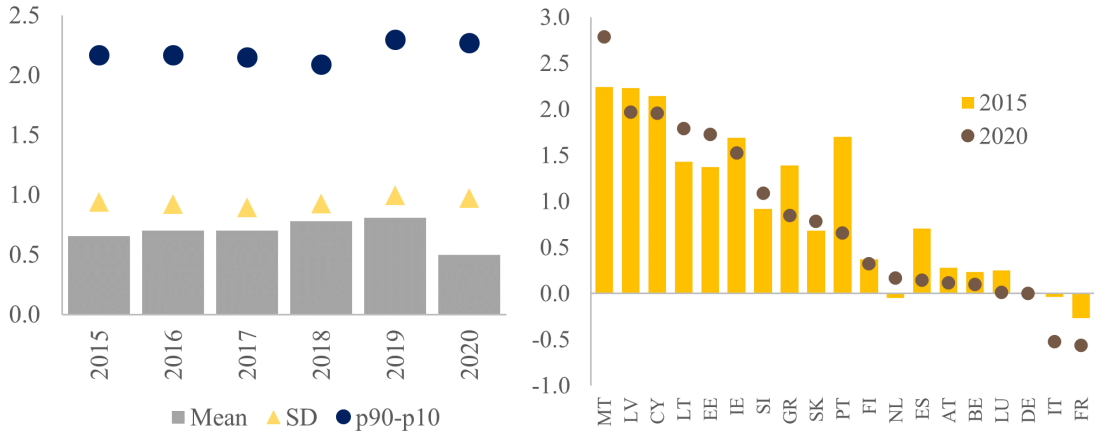
Next, we calculate the pure spread using the above estimated parameters (reported in Table 3) and subtracting the impact of the funding structure and bank-specific factors, such as those that proxy for the credit and liquidity risks:

$$PM_{bct} = IS_{bct} + \alpha \cdot FS_{bct} + \beta \cdot R_{bct} \tag{2}$$

As shown in Figure 4 (left panel), over the sample period the mean level of the pure spread in

the euro area has declined. Although the level of variation in pure spreads has remained relatively stable, the difference between the highest and the lowest values has actually grown. Our calculations also reveal sizeable cross-country variation in pure spreads (right panel of Figure 4). In 2020, the difference between countries with the highest (Malta) and lowest (France) levels stood close to 3 percentage points. Put simply, the interest rate on new loans to NFCs in Malta was on average approximately 3 percentage points higher than in France even after controlling for differences in deposit rates, funding structure and imperfection indicators of the respective banks. Expectedly, the Baltic countries are among the countries with highest pure spreads. Thus, in 2020, the difference between Latvian banks and the banks in Germany was close to 2 percentage points (2.5 percentage points against French banks). Estonia and Lithuania exhibited similar although slightly smaller gaps. Furthermore, the gap seems to have widened in the most recent years, at least in the cases of Lithuania and Estonia.

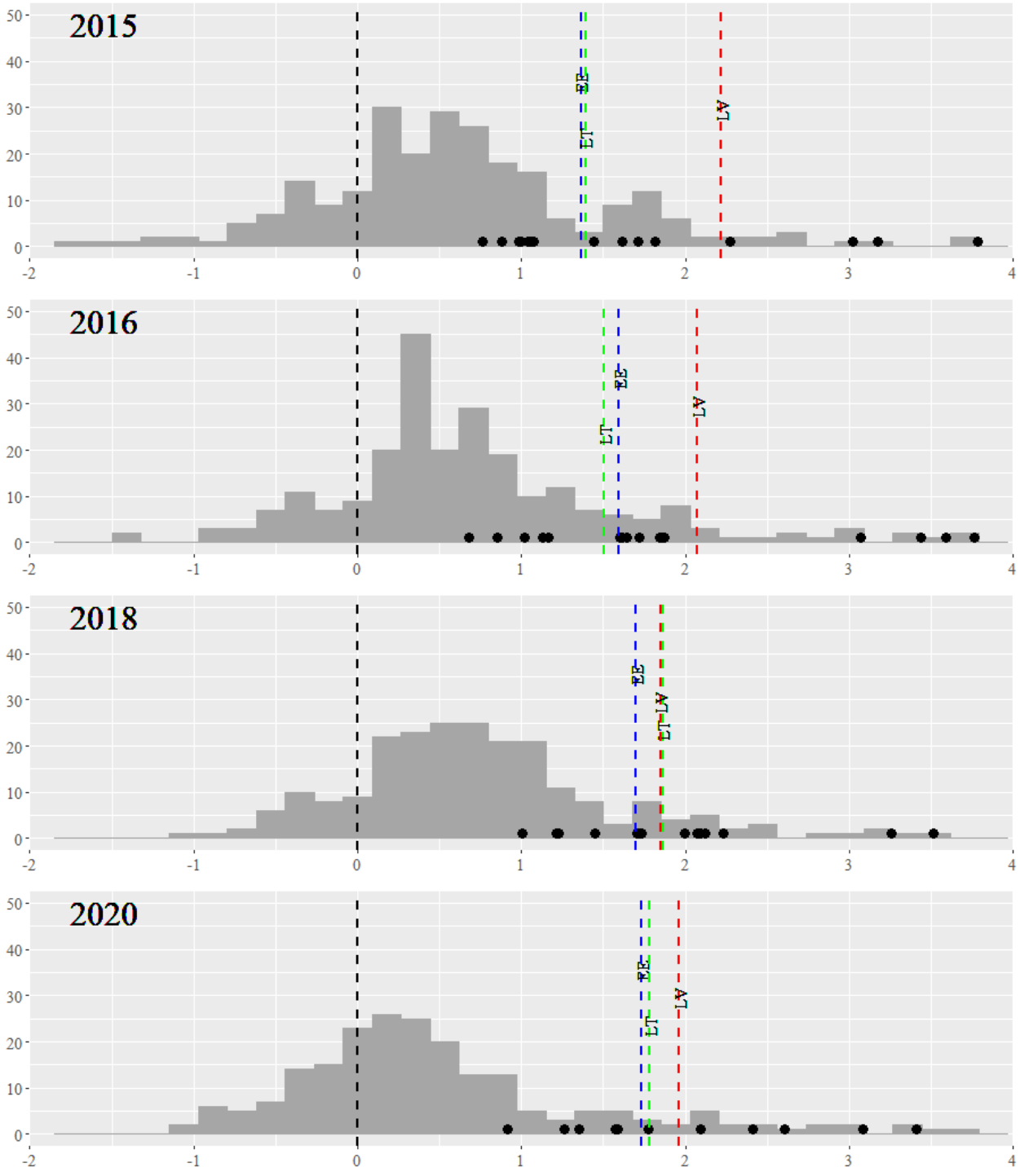
Figure 4: Pure spreads for the euro area banks



Notes: In the right panel, the pure spreads for individual countries are standardized against the average pure margin of banks in Germany in the respective year.
Source: IMIR, authors' estimation

Turning to the calculation of the pure spread for individual banks (see Figure 5), in 2015 only four out of 16 Baltic banks were found between the 25th and 75th percentile of the pure spread distribution, while seven banks recorded very high spreads that fell between the 75th and 90th percentile. In 2020, the level of pure spreads of banks in the Baltic countries shifted even further to the right in the distribution: six out of 13 banks were between the 75th and 90th percentiles, while the remaining seven banks fell into the top decile.

Figure 5: Distribution of the pure spreads in the euro area banks

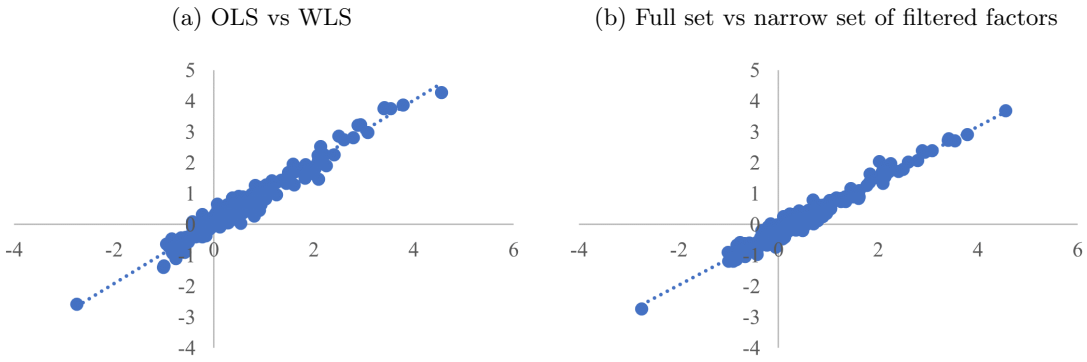


Notes. The pure spreads are standardized against the average figure of banks in Germany. The black dots show the average pure spreads for individual banks in Estonia, Latvia and Lithuania. The vertical dotted lines denote the country-level averages.
Source: IMIR, authors' estimation.

These calculations show that there is a significant fragmentation in the euro area in terms of access and costs of funds for NFCs. Interest rates on new loans to NFCs in almost all Baltic banks were significantly higher than the euro area average, even taking into account different funding structures and bank risk indicators. In addition, the recent deviation of the Baltic pure spreads from the rest of the euro area may indicate an impaired transmission of unconventional monetary policy measures to interest rates on new loans in the Baltics.

The evidence of fragmentation is robust to both the econometric approach used to estimate the parameters of equation (1)[13] and to the use of a narrower set of indicators filtered out from the interest rate spread to obtain the pure spread in (2). Thus, the alternative definition of the pure spread relies on the exclusion of only those bank-specific factors that are specifically related to the credit risk, and keeps other indicators (total assets, loans to assets, capital to assets and liquidity) in the spread. In both cases the relative position of individual banks within the distribution remains practically unchanged (Figure 6).[14]

Figure 6: Pure spreads in the euro area banks in 2020, robustness checks



Notes. Pure spreads are standardized against the average figure of banks in Germany. Left panel: x (y) axis shows the pure spreads computed using the parameters obtained from OLS (WLS) regression. Right panel: x (y) axis shows the pure spreads computed by subtracting the full (narrow) set of bank-specific imperfection variables.
Source: IMIR, authors' estimation.

[13] We only compare the pure spreads obtained using OLS and WLS. We cannot calculate pure spreads from the regression that introduces country-time fixed effects because it does not contain any country-specific variables, including the share of NPLs and recovery rate.

[14] However, the estimated levels of pure spreads somewhat change when using a narrow set of bank-specific imperfection factors.

5 Discussion of results

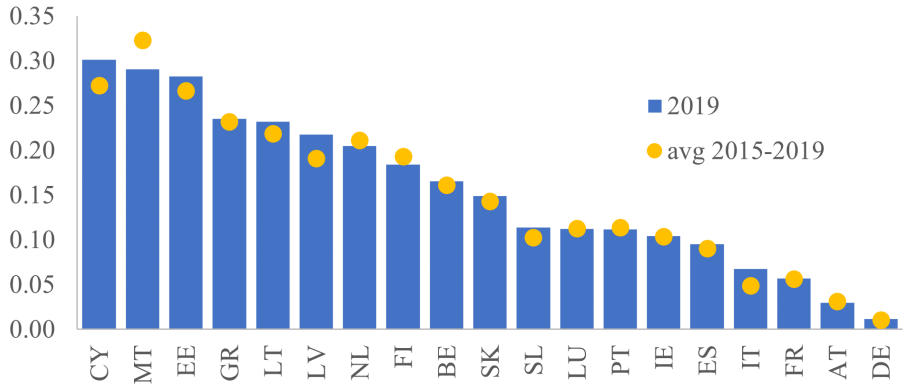
Our findings show that there are significant differences in interest rates on new loans to NFCs between euro area banks, even after accounting for the differences (albeit small) in deposit rates as well as after accounting for differences in the structure of financing and the degree of risk that the respective banks assume. In 2020, the gap in the pure spread between the highest and lowest deciles in the euro area was approximately 2.3 percentage points. The calculations also suggest that there is a geographic dimension to this difference between banks, with some countries (including the Baltic countries) persistently displaying higher interest rates than others. Relatively high levels of the pure spread have been observed in almost all banks in the Baltics and are not indicative of a few outliers. The calculations presented above show that relatively high interest rates on new loans to NFCs in the Baltic countries cannot be explained by traditional factors alone. In other words, interest rates on new loans to NFCs in the Baltic countries seem to be higher than elsewhere in the euro area, even taking into account the traditional factors that determine spreads.

In the previous literature, cross-country differences in pure margin (in our paper – pure spread) were explained by different degrees of competition in the financial market. In fact, our findings also suggest that market structure explains much of the difference in interest rate spreads between euro area banks. To quantify the economic impact of all variables, including the HHI, we consider the change in interest rate spread associated with one standard deviation change in the explanatory factor and use the coefficients from the baseline regression. The results for the euro area as a whole and separately for the Baltic countries are presented in Table A3. The corresponding increase (decrease) in HHI is associated with an increase (decrease) in the interest rate spread by 1.022 and 0.435 percentage points in the euro area and the Baltic countries respectively.[15] Given the high degree of market concentration in the Baltics (see Figure 7) these results suggest that this may be one of the reasons why interest rates in Latvia, Lithuania and Estonia are among the highest in the euro area. However, the calculated impact should be interpreted with caution. First, a simple indicator of concentration at the country level may not reflect the underlying market structure and competition if the loan market is highly fragmented. Second, the obtained estimation results may include the effect of omitted unobservable country-specific variables affecting the spread, which are correlated with the market structure.

However, there are other possible explanations as to why pure spreads differ between countries in

[15] Although the effects get smaller due to the included interactions.

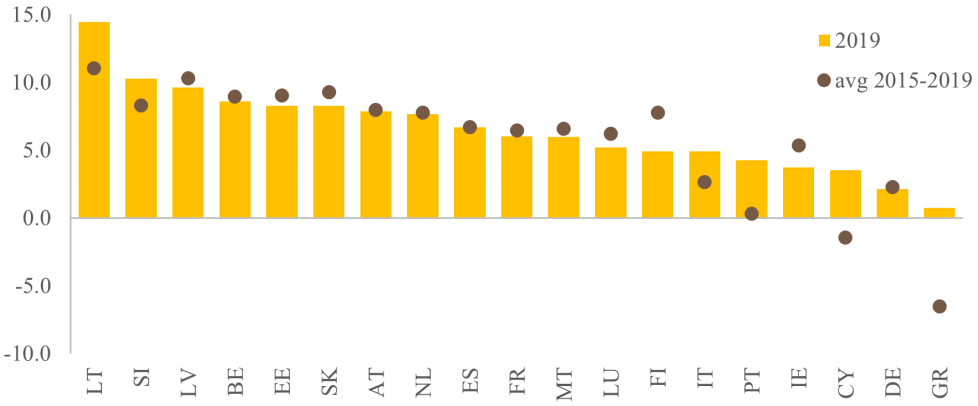
Figure 7: HHI in the euro area (pp)



Notes. HHI ranges from 0 to 1. Higher HHI values denote higher market concentration.
Source: SSI.

the euro area. For example, high interest rates on loans to NFCs may reflect higher administrative or fixed costs, particularly in smaller countries, such as Latvia, Lithuania and Estonia (lower economies of scale). Similarly, lower interest rate spreads may be offset by income from other sources (such as hidden fees) and therefore may not reflect actual differences in funding costs for NFCs between euro area countries. In both cases, this would mean that high pure spreads are not necessarily a sign of high profits. Nevertheless, this does not seem to be the case as the level of profitability in the banking sector in the Baltic countries is one of the highest in the euro area (Figure 8).[16]

Figure 8: Bank profitability in the euro area (ROE)



Source: CBD2.

Apart from the higher financial market concentration, there are other possible explanations consistent with relatively high pure spreads and sizeable profitability ratios. One such factor, which

[16] We do not have data on profitability measures for individual banks.

is often invoked by representatives of the financial sector in Latvia, is that banks assess risk over a longer period of time (e.g. over the business cycle) instead of relying on current risk indicators. In such a case, countries that have experienced a marked deterioration in their loan portfolio during the financial crisis and sovereign debt crisis, would have higher interest rates than current risk indicators suggest. In our econometric approach this would imply that we underestimate the contribution of the risk component. Although this could certainly have been the case in the Baltics, given the sharp rise in the problem loans during the financial crisis, there is little reason to believe that the Baltic countries are an exception. In fact, in many euro area countries the deterioration in loan quality has been even more pronounced (and more persistent) than in the Baltics. Furthermore, in most cases this deterioration took place more recently, at least for the countries which were at the epicentre of the sovereign debt crisis. Therefore, even if our analysis underestimates the risk component of interest rate spreads (and hence overestimates the pure spreads), this should not affect the relative position of Baltic banks in the euro area.[17]

6 Conclusions

Over the last 10 years, lending rates in the euro area have fallen considerably, mostly driven by accommodative monetary policy. There have been exceptions in this downward trend: the Baltic states were among the few euro area countries where the decline in interest rates on new loans was relatively muted. As a result, the Baltic banking system has demonstrated exceptionally high interest rate spreads. The presence of this gap in spreads may indicate that monetary policy measures do not transmit effectively across all countries in the euro area.

To find out whether the spreads recorded by banks in the Baltics can be explained by conventional factors, this study employs Ho and Saunders (1981) theoretical framework and examines the effect of both bank-specific and country-specific determinants of spreads. For this purpose, it uses panel data for 269 banks in 19 euro area countries over the period from the fourth quarter of 2014 to the fourth quarter of 2020 and employs the single-stage panel regression approach.

The estimation results demonstrate that the impact of the most widely used determinants of spreads corresponds to our prior expectations. However, these factors are not able to explain a notable share of spreads recorded in the Baltic countries. After filtering credit risk and other bank imperfection factors out of the spreads, the so-called pure spread still exhibits a lot of variation in

[17] Furthermore, this does not explain the increase in the interest rates observed over the last few years of our sample.

the euro area with the Baltic countries being on the top of the distribution. Partly, such a high level of pure spreads may be explained by market structure, proxied by the HHI in this study. However, the bulk of the difference between the Baltics and the rest of the euro area remains unexplained.

Overall, the findings of this paper call for nuanced discussion on the reasons for relatively high interest rates in the Baltic countries and the policy measures to address them. Lower lending rates would enable more effective transmission of monetary policy measures and boost lending and economic recovery in the Baltics in the post-Covid environment.

References

Angbazo, L. (1997). Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking. *Journal of Banking & Finance 21*(1), 55–87.

Angori, G., D. Aristei, and M. Gallo (2019). Determinants of banks' net interest margin: Evidence from the euro area during the crisis and post-crisis period. *Sustainability 11*(14), 1–20.

Aydemir, R. and B. Guloglu (2017). How do banks determine their spreads under credit and liquidity risks during business cycles? *Journal of International Financial Markets, Institutions and Money 46*(C), 147–157.

Birchwood, A., M. Brei, and D. M. Noel (2017). Interest margins and bank regulation in Central America and the Caribbean. *Journal of Banking & Finance 85*(C), 56–68.

Brock, P. L. and L. Rojas-Suarez (2000). Understanding the behavior of bank spreads in latin america. *Journal of Development Economics 63*(1), 113–134.

Carbo-Valverde, S. and F. Rodríguez-Fernández (2007). The determinants of bank margins in european banking. *Journal of Banking & Finance 31*(7), 2043–2063.

Claeys, S. and R. Vander Vennet (2008). Determinants of bank interest margins in central and eastern europe: A comparison with the west. *Economic Systems 32*(2), 197–216.

Cruz-García, P. and J. Fernández de Guevara (2020). Determinants of net interest margin: the effect of capital requirements and deposit insurance scheme. *The European Journal of Finance 26*(11), 1102–1123.

Cruz-García, P., J. Fernández de Guevara, and J. Maudos (2019). Determinants of bank's interest margin in the aftermath of the crisis: the effect of interest rates and the yield curve slope. *Empirical Economics 56*(1), 341–365.

Dietrich, A. and G. Wanzenried (2011). Determinants of bank profitability before and during the crisis: Evidence from switzerland. *Journal of International Financial Markets, Institutions and Money 21*(3), 307–327.

Doliente, J. S. (2005). Determinants of bank net interest margins in southeast asia. *Applied Financial Economics Letters 1*(1), 53–57.

Dumicic, M. and T. Rizdak (2013). Determinants of banks' net interest margins in central and eastern europe. *Financial Theory and Practice 37*(1), 1–37.

Entrop, O., C. Memmel, B. Ruprecht, and M. Wilkens (2015). Determinants of bank interest margins: Impact of maturity transformation. *Journal of Banking & Finance 54*(C), 1–19.

Fungáčová, Z. and T. Poghosyan (2011). Determinants of bank interest margins in russia: Does bank ownership matter? *Economic Systems 35*(4), 481–495.

Hanafi, M. M., F. Santi, and Muazaroh (2013). The impact of ownership concentration, commissioners on bank risk and profitability: Evidence from indonesia. *Eurasian Economic Review 3*(2), 183–202.

Heider, F., F. Saidi, and G. Schepens (2019). Life below zero: Bank lending under negative policy rates. *Review of Financial Studies 32*(10), 3728–3761.

Ho, T. S. Y. and A. Saunders (1981). The determinants of bank interest margins: Theory and empirical evidence. *Journal of Financial and Quantitative Analysis 16*(4), 581–600.

Islam, M. S. and S.-I. Nishiyama (2016). The determinants of bank net interest margins: A panel evidence from south asian countries. *Research in International Business and Finance 37*(C), 501–514.

Khan, M. and A. Jalil (2020). Determinants of interest margin in pakistan: A panel data analysis. *Economies 8*(2), 1–14.

Liebeg, D. and M. Schwaiger (2007). Determinants of bank interest margins in central and eastern europe. Financial Stability Report 14, Oesterreichische Nationalbank (Austrian Central Bank).

López-Espinosa, G., A. Moreno, and F. Pérez de Gracia (2011). Banks' net interest margin in the 2000s: A macro-accounting international perspective. *Journal of International Money and Finance 30*(6), 1214–1233.

Martinez Peria, M. and A. Mody (2004). How foreign participation and market concentration impact bank spreads: Evidence from latin america. *Journal of Money, Credit and Banking 36*(3), 511–37.

Maudos, J. and J. Fernandez de Guevara (2004). Factors explaining the interest margin in the banking sectors of the european union. *Journal of Banking & Finance 28*(9), 2259–2281.

Maudos, J. and L. Solís (2009). The determinants of net interest income in the mexican banking system: An integrated model. *Journal of Banking & Finance 33*(10), 1920–1931.

Saunders, A. and L. Schumacher (2000). The determinants of bank interest rate margins: an international study. *Journal of International Money and Finance 19*(6), 813–832.

Tennant, D. and A. Folawewo (2009). Macroeconomic and market determinants of interest rate spreads in low- and middle-income countries. *Applied Financial Economics 19*(6), 489–507.

Williams, B. (2007). Factors determining net interest margins in australia: Domestic and foreign banks. *Financial Markets, Institutions & Instruments 16*(3), 145–165.

Yuksel, S. and S. Zengin (2017). Influencing factors of net interest margin in turkish banking sector. *International Journal of Economics and Financial Issues 7*(1), 178–191.

Zhou, K. and M. Wong (2008). The determinants of net interest margins of commercial banks in mainland china. *Emerging Markets Finance and Trade 44*(5), 41–53.

Appendix

Table A1: Description of variables used in the study

Dependent variable	Definition	Source
Net interest spread	Difference between the weighted average loan rate on newly originated loans and deposit rate on newly attracted deposits of bank b in country c at time t	IMIR
	Funding structure	
Demand deposits	The proportion of demand deposits in newly attracted total deposits of bank b in country c at time t	IBSI, IMIR
Individual deposits	The proportion of deposits from private persons in newly attracted total deposits of bank b in country c at time t	IBSI, IMIR
Bonds	The proportion of issued bonds in total liabilities of bank b in country c at time t	IBSI
Bonds*CDS	...interacted with credit default swap of country c at time t	IBSI, SSI
Bonds*Capital-to-assets	...interacted with the ratio of total capital and reserves to assets of bank b in country c at time t	IBSI
Liabilities to MFIs	The proportion of liabilities to credit institutions in total liabilities of bank b in country c at time t	IBSI
Liabilities to MFIs*CDS	...interacted with credit default swap of country c at time t	IBSI, SSI
Liabilities to MFIs*Capital-to-assets	...interacted with the ratio of total capital and reserves to assets of bank b in country c at time t	IBSI
Liabilities to CBs	The proportion of liabilities to the central bank in total liabilities of bank b in country c at time t	IBSI
Liabilities to CBs*TLTRO II	...interacted with the time dummy equal to one when the Eurosystem conducted TLTRO II operations (from Q2 2016)	IBSI
Liabilities to CBs*TLTRO III	...interacted with the time dummy equal to one when the Eurosystem conducted TLTRO III operations (from Q2 2019)	IBSI
Government bonds	The proportion of government bonds in total assets of bank b in country c at time t	IBSI
Government bonds*APP	...interacted with the time dummy equal to one when the Eurosystem conducted net purchases of public sector securities under the APP (asset purchase program) (from Q2 2015)	IBSI
Government bonds*PEPP	...interacted with the time dummy equal to one when the Eurosystem conducted net purchases of public sector securities under the PEPP (pandemic emergency purchase program) (from Q3 2020)	IBSI
	Imperfection variables (bank level)	
Loans to assets	The ratio of total loans to domestic non-financial corporations to assets of bank b in country c at time t	IBSI
Total assets	Log of total assets of bank b in country c at time t	IBSI
Capital to assets	The ratio of total capital and reserves to assets of bank b in country c at time t	IBSI
Liquidity	Log of the sum of cash holdings, loans to credit institutions and reserves held at the CB of bank b in country c at time t	IBSI
Short-term loans	The proportion of newly issued short-term loans (¡1 year) in total newly issued loans of bank b in country c at time t	IMIR
Small loans	The share of newly issued loans below 1 mill EUR in total newly issued loans to non-financial corporations of bank b in country c at time t	IMIR
	Imperfection variables (country level)	
Non-performing loans	The share of non-performing loans to non-financial corporations in country c at time t	CBD2
Non-performing loans*recovery rate	...interacted with the recovery rate from resolving insolvency (used as a proxy for 1 – loss given default) in country c at time t	CBD2, Doing Business
	Determinants of pure spread	
Total loans	Log of total loans issued to domestic non-financial corporations in country c at time t	BSI
Market concentration	Herfindahl-Hirschman index (HHI), calculated for country c at time t by squaring the share of loans by each bank b and summing the resulting numbers	SSI
Market concentration*Loans	...interacted with the log of total credits issued in country c at time t	SSI, BSI
Inflation	The change in HICP in country c at time t	Eurostat
GDP growth	Real GDP growth in country c at time t	Eurostat

Table A2: Summary statistics

	Euro Area						Baltic countries					
	Mean	Median	SD	P25	P75	N	Mean	Median	SD	P25	P75	N
Bank-specific variables												
Net interest spread	1.914	1.668	1.037	1.284	2.312	6240	2.916	2.719	0.950	2.211	3.635	380
Demand deposits	0.815	0.919	0.229	0.713	0.984	6240	0.923	0.941	0.079	0.888	0.986	380
Private persons	0.633	0.709	0.280	0.528	0.840	6240	0.518	0.547	0.142	0.428	0.636	380
Bonds	0.102	0.049	0.145	0.002	0.137	6240	0.010	0.000	0.034	0.000	0.000	380
Liabilities to MFIs	0.159	0.120	0.167	0.050	0.198	6240	0.035	0.008	0.079	0.002	0.032	380
Liabilities to CBs	0.025	0.000	0.046	0.000	0.034	6240	0.009	0.000	0.021	0.000	0.003	380
Government bonds	0.065	0.050	0.062	0.019	0.093	6240	0.043	0.022	0.053	0.009	0.048	380
Loans to assets	0.200	0.175	0.133	0.107	0.269	6240	0.267	0.264	0.102	0.202	0.359	380
Total assets	10.39	10.39	1.518	9.349	11.34	6240	8.239	8.231	0.638	7.777	8.738	380
Capital to assets	0.096	0.086	0.055	0.060	0.120	6240	0.128	0.131	0.059	0.095	0.148	380
Liquidity	0.201	0.153	0.180	0.074	0.262	6240	0.294	0.249	0.249	0.059	0.460	380
Small loans	0.285	0.212	0.245	0.090	0.424	6240	0.228	0.185	0.146	0.123	0.313	380
Short-term loans	0.791	0.900	0.256	0.673	0.984	6240	0.943	0.995	0.117	0.950	1.000	380
Country-specific variables												
Non-performing loans	12.469	6.161	13.876	3.823	13.834	522	6.006	4.850	3.383	2.930	8.925	78
Credit default swap	102.0	49.7	215.6	18.5	90.2	522	63.6	62.5	11.7	57.2	64.7	78
Recovery rate	65.3	70.5	19.9	43.8	84.6	522	41.5	40.5	3.59	40.0	41.1	78
Market concentration	0.152	0.144	0.088	0.094	0.218	522	0.228	0.232	0.037	0.200	0.260	78
Loans	10.93	11.14	1.760	9.297	12.55	522	8.831	8.864	0.157	8.703	8.938	78
Inflation	0.007	0.008	0.014	0.000	0.015	522	0.009	0.015	0.026	0.000	0.026	78
GDP growth	0.016	0.019	0.047	0.008	0.034	522	0.015	0.029	0.038	0.006	0.040	78

Table A3: The impact of determinants of interest spread in the euro area vs the Baltic countries

Variable	Euro area	Baltic countries
Interest rate spread (mean)	1.914	2.916
Demand deposits	0.008	0.003
Private person deposits	0.044	0.022
Bonds	-0.091	-0.021
Bonds*CDS	0.375	0.005
Bonds*Capital-to-assets	0.000	0.000
Liabilities to MFIs	0.066	0.031
Liabilities to MFIs*CDS	0.001	0.000
Liabilities to MFIs*Capital-to-assets	-0.025	-0.013
Liabilities to CBs	0.092	0.042
Liabilities to CBs*TLTRO II	-0.032	-0.014
Liabilities to CBs*TLTRO III	0.003	0.001
Government bonds	0.035	0.030
Government bonds*APP	-0.028	-0.024
Government bonds*PEPP	-0.007	-0.006
Loans to assets	0.016	0.013
Total assets	0.211	0.089
Capital to assets	-0.036	-0.039
Liquidity	-0.008	-0.011
Short-term loans	-0.021	-0.010
Small loans	0.057	0.034
Non-performing loans	0.611	0.149
Non-performing loans*(1-LGD)	-0.111	-0.005
Total loans	0.556	0.050
Market concentration	1.022	0.435
Market concentration*Loans	-0.192	-0.007
Inflation	0.010	0.019
GDP growth	0.003	0.003