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What drove the rise in bank lending rates in Lithuania during the low-rate era?

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ABSTRACT

While Euro area interest rates were responding to accommodative monetary policy and decreasing throughout 2015-2019, in stark contrast, Lithuania's bank lending rates increased. Although the rates dropped slightly around the onset of the pandemic, they are still elevated and well above the EA figures. This paper asks the question: what were the drivers of such interest rate dynamics in Lithuania? By analysing the historical events and practical aspects of loan pricing in Lithuania's banking industry, we build an empirical model that exploits lending rate variation across banks, time and lending segments, and maps it to different drivers of pricing. We find that the recent changes in lending rates can be attributed to average bank margins, which moved largely in response to changes in market concentration.

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1. Introduction

The great shift in monetary policy stance since the Global Financial Crisis has created a low-interest rate environment, where businesses, households, and governments can fund their activities at historically cheap rates. As monetary policy further eased throughout 2015-2019 and the ECB deposit facility rate went below zero, so did the interbank Euribor rate, putting downward pressure on retail lending rates. For example, Euro area (EA) average mortgage interest rates decreased from 2.4% to 2%, and lending rates for non-financial corporations (NFC, up to 1 M EUR) went from 3% to 2.7%.[1]

Unlike most EA countries, Lithuania experienced a pick-up in mortgage and corporate lending rates between 2015 and 2019, thereafter having one of the highest rates in the EA (see Figure 1). In fact, during this period, Lithuania's average mortgage interest rate, the second smallest in the EA at 1.5%, increased to 2.3% - becoming the fifth largest.[2] In a similar fashion, albeit less extreme, interest rates for NFCs increased from 2.9% to 3.4%, and rank-wise moved from the sixth smallest to the fifth largest in the EA. Interestingly, during the second half of 2019 and throughout the COVID-19 pandemic, Lithuanian

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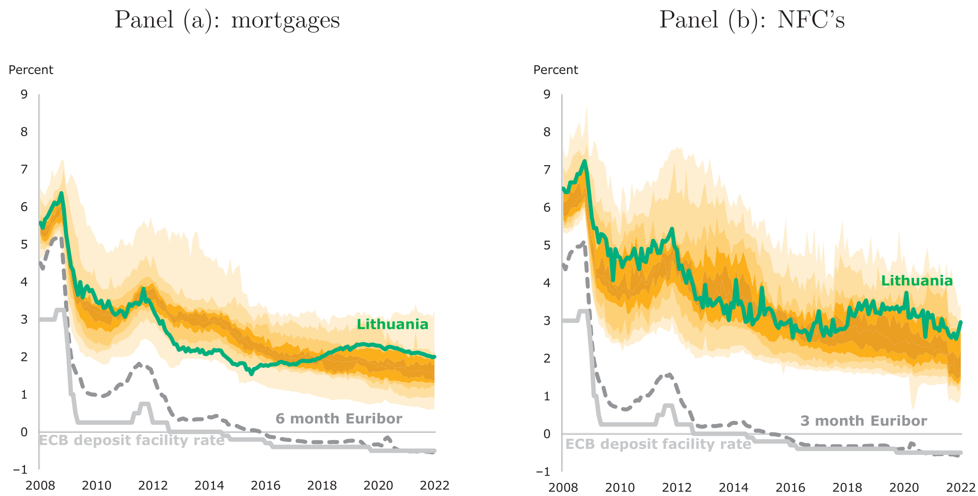


Figure 1. Loan interest rates in Lithuania and the EA. Panel (a): mortgages Panel (b): NFC's.

Notes: Loan (granted in EUR) interest rates for mortgages and NFC's (up to 1 M EUR) for Lithuania are in green. The distribution of interest rates of other EA countries is in yellow.

lending rates started falling, eventually returning to 2018 levels. However, the rates are still elevated above the 2015 figures and, more importantly, well above the EA median.

The aforementioned recent pick-up in Lithuania, which contrasts with other EA countries' experience, deserves notice, as it is important from at least two angles. First and foremost, if the lowered key ECB rates are not fully passed through to the borrower, the monetary policy transmission mechanism may be dysfunctional. The literature on interest rate pass-through, which considers how monetary policy and reference rates are transmitted to lending rates, is quite large and the results vary by country. For example, Leroy and Lucotte (2015) study a panel of EA countries and find a significant degree of heterogeneity in pass-through across countries, which can be explained by structural factors, such as the level of banking competition or development of financial markets. Similarly, a meta-analysis carried out by Gregor et al. (2021) suggests that the pass-through is impacted by country's macro-financial and institutional factors, depth of capital markets and central bank independence. Although the literature on pass-through is related to our topic, we do not consider the estimation of money market rate pass-through, as money markets play a limited role in Lithuania's banking industry, which is mostly retail-funded. Moreover, the vast majority of loan contracts use a variable rate, which is directly tied to the Euribor rate, implying a one-to-one pass-through, also confirmed by a bank-level error-correction analysis of Naruševičius (2017). Instead, we focus on deconstructing potential drivers behind the lending rate rise, which occurred over 2015-2019.

Second, interest rate levels and their variability have significance from the financial stability perspective. For example, rising interest rates may have a counter-cyclical effect on the expansion of credit and asset prices, potentially dampening bubble formation; however, they leave borrowers vulnerable. Future increases in ECB policy rates would increase Euribor and top up the heightened margins, amplifying their effect and putting debtors at risk.

The widened gap between loan interest rates and the Euribor suggests that bank lending margins were heightened, which may be linked to concurrent increases in market concentration and bank capital requirements. However, there may be other factors at play, such as high loan demand, increased lenders' perception of credit risk, or even the negative deposit facility rate.

In this paper, we comprehensively investigate the recent mortgage and NFC interest rate pick-up by looking at the history of lending rate dynamics and the concurring events that may have shaped it. On the basis of some practical aspects of loan pricing in the banking industry, as well as a stylized model of interest rate setting, we estimate a bank-segment-level panel data model for lending margins. The model relates the historical lending margin variation across banks and different loan segments, including mortgages, NFC loans, consumer and other loans, to pricing determinants, such as funding costs, market concentration, capital requirements and others. The inclusion of consumer loans in our analysis is important, as their lending margin dynamics were entirely different from other loan segments throughout 2015-2019. Specifically, while the NFC and mortgage rates increased along with increasing market concentration, consumer rates were falling together with consumer lending concentration. By exploiting this cross-segment variation, we can better infer the impact of concentration and other potential factors.

We find that although capital requirements may have elevated lending rates by an average of 0.1 p.p., the primary driver behind the interest rate rise in 2015-2019 and the subsequent fall is market concentration, which may have altered lending structure and bank conduct. While other factors played a limited role, the reduced number of competitors and high credit demand have created favourable conditions for bank management to seek higher returns, and thus to raise lending rates. The findings for the business segment are confirmed by a loan-level pricing model, which suggests that the rise in NFC rates cannot be explained by loan quality.

The paper is organized as follows. Section 2 discusses the historical dynamics of interest rate margins and their potential determinants. Section 3 looks into the practical aspects of loan pricing and describes a stylized model, upon which Section 4 builds an empirical model and discusses its results. Lastly, we conclude by summarizing our findings.

2. Bank interest rate margins in Lithuania

The Lithuanian banking industry can be characterized as a traditional banking business that accepts deposits and issues loans.[3] Banking profits are mainly generated from the lending business and strong fee and commission revenue, bolstered by high efficiency and relatively low loan impairment levels. Asset structure is mainly comprised of mortgages (30%), loans to NFCs (29%), cash and central bank reserves (20%) and consumer loans (9%), based on 2019 data. As per the liabilities side in 2019, retail deposits were the dominant form of funding, amounting to around 80% of total assets, with the share of bonds being less than 1%.

Regarding the lending rates in Lithuania, they may be either variable or (semi-)fixed.[4] However, variable rates are most prevalent and became even more so in the low-rate environment, amounting to around 98% of new loans for businesses and households for house purchases. The rates are contractually arranged as a mark-up over a zero-floored reference rate, such as the Euribor.[5] The latter varies over the life cycle of the loan and is usually reset at 6-month or 3-month intervals. Since the Euribor rate is exogenous and taken as given, banks have direct influence only over the non-variable part of the rate, namely the margin, which is our main focus hereafter. The historical dynamics of average lending margins are depicted in Figure 2.

2.1. Pre-2015 period

Until the middle of 2015, the history of loan margin rates can be roughly divided into three periods: low-margin, recessionary and normalization.

The **low-margin period** can be characterized by financial deepening, fierce competition, risk-taking behaviour and under-pricing of risks by credit institutions, which also contributed to the boom-and-bust cycle of the 2000s.[6] Following the collapse of Lehman Brothers, during the **recessionary period**, drained funding and huge losses,

Figure 2. Historical variation of average loan interest margins in Lithuania.

Notes: Includes only new loan agreements granted in EUR. The margins are computed as the difference between the interest rate and zero-floored Euribor - 6-month for mortgages and 3-month for NFC's. The vertical dashed lines mark the following events: (1) the collapse of Lehman Brothers; (2) the adoption of Euro (€) in Lithuania; (3) the introduction of the Capital Conservation Buffer (CCoB) and other capital requirements in Lithuania; (4) withdrawal of Danske Bank from Lithuanian lending market; (5) pan-Baltic DNB-Nordea merger into Luminor; (6) the beginning of the first Covid-19 quarantine in Lithuania.

which led to a significant depletion in capital, forced banks to decrease loan supply, putting upward pressure on margins.[7]

The **normalization period** began around 2012-2013, when the EA sovereign debt crisis subsided and the spreads in the financial markets declined. The panic of 2008-2009 was long over and banks were more self-reliant, primarily funded by cheap domestic deposits. On 1 January 2015, Lithuania adopted the Euro and entered the EA. This structural change implied that there were no more currency mismatches and foreign exchange risk, which helped boost access to cheap funding from the markets. These events, as well as lessons from past mistakes of under-pricing, have helped loan rates to normalize and better reflect the underlying credit risk and financing costs.[8]

2.2. Mid-2015 to 2019 period

In mid-2015, average mortgage margins were around 1.7%. Shortly thereafter they began to rise, reaching 2.4% in 2019. Margins for loans to NFCs started increasing later, at around the end of 2017, moving from 2.3% to 3% in 2019. During this period, the ECB's monetary policy was highly accommodative and pressed the Euribor downwards. Therefore, there must be factors that drove the rates upwards. Here we outline the key events and some of the potential drivers for the 2015-2019 rise in margins (see Figure 2) that also drove the lending rates (see Figure 1).

(a) Concentration
A distinct element of the banking landscape in Lithuania was the changing structure of the market, i.e. a decrease in the number of significant lenders and loan portfolio sales, which translated into higher concentration levels in both mortgage and NFC markets (see Figure 3 Panel (a)).[9] In fact, according to ECB data, the Lithuanian banking industry in 2019 became the fourth most concentrated in the EU in terms of assets, and fifth most concentrated in terms of credit portfolio.

The recent change in the number of credit providers might have altered the conduct of the incumbent banks, as well as their pricing behaviour.[10] One potential source of higher average loan margins is the breakdown of relationships between the exiting banks and their clients. Customers needed to find new credit providers who were at an informational disadvantage in terms of screening or had higher overall funding costs and lower efficiency. Also, it may be the case that the incumbent banks, which then faced lower competition, started to more accurately price the underlying customer credit risk - a competition-risk pricing channel, highlighted by Müller et al. (2021), using Norwegian micro-data. Another source is that the incumbent banks simply exerted more market power during the loan contract negotiation process and offered higher lending rates, as the number of competitors decreased and clients' bargaining power eroded. On the other hand, increased market concentration could have contributed to higher efficiency and to some extent lowered funding costs, as highlighted by Markevičius (2018). The concentration-efficiency channel could have at least partially outweighed the pressure to increase lending margins. For empirical analyses of bank competition's effect on lending rates, see examples in Corvoisier and Gropp (2002), Maudos and Fernandez de

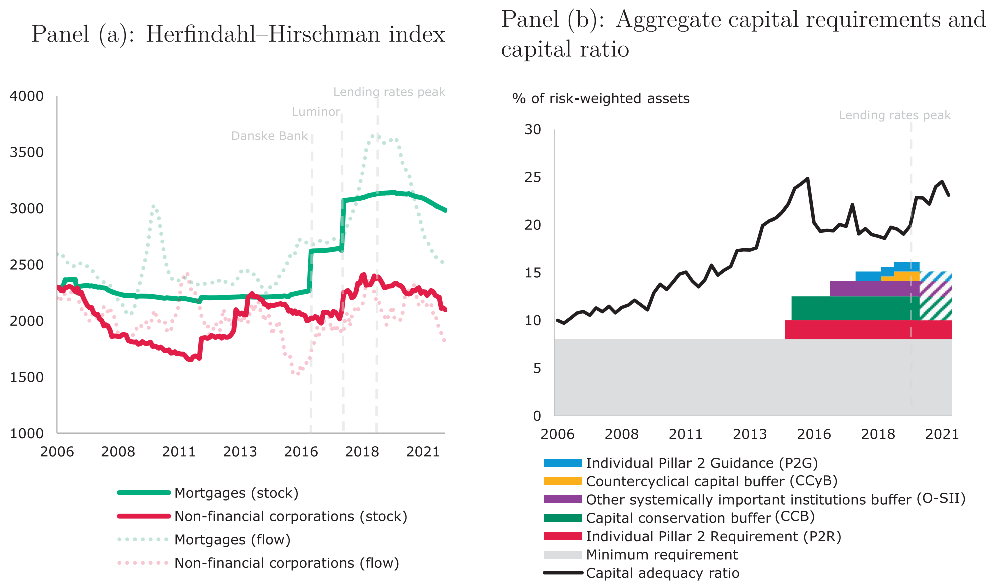


Figure 3. Capital and concentration in Lithuania's banking sector. Panel (a): Herfindahl-Hirschman index. Panel (b): Aggregate capital requirements and capital ratio.

Notes: (a) HHI index for banking and credit union sector loan portfolios, and 12-month credit flows. (b) Average P2R, P2G and O-SII sizes for the whole banking sector are provided. During the pandemic, the CCyB of 1% was released and banks were allowed to operate temporarily below the level of capital defined by the P2G and the combined buffer requirement, which in Lithuania consisted of the CCB and the O-SII buffer. In addition, banks were also allowed to partially use capital instruments that do not qualify as Common Equity Tier 1 (CET1) capital, for example, Additional Tier 1 or Tier 2 instruments, to meet the P2R.

Guevara (2004), Gambacorta (2008), Van Leuvensteijn et al. (2013), and the literature review therein.

(b) Capital requirements

Year 2015 marked the introduction of bank capital buffer requirements, namely, the capital conservation buffer (CCB) of 2.5% and the institution-specific Pillar 2 Requirement (P2R) of 2% (average). As can be seen in Figure 3 Panel (b), preceding 2015, there was only a flat capital requirement of 8% of the risk-weighted assets (RWA). In 2015-2019, a gradual build-up of various other buffer requirements occurred, i.e. the counter-cyclical capital buffer (CCyB) of 1%, other-systemically important institution's buffer (O-SII) of 1.6% (average), and Pillar 2 Guidance (P2G) of 1% (average). Over time, banks were required to hold a combined 8.1 p.p. capital buffer, in addition to the usual 8% minimum - essentially a doubling of capital requirements.

From the theoretical perspective, assuming that the Modigliani-Miller theorem does not hold and capital financing is more expensive than debt financing, capital requirements could have been priced in higher loan rates, depending on the Modigliani-Miller offset.[11] For empirical evidence on the positive effect on lending spreads, see, e.g. BIS (2010), Kashyap et al. (2010), King (2010), Martins and Schechtman (2013), Baker and Wurgler (2015), with more recent results in Glancy and Kurtzman (2022), Bichsel et al. (2022), and De Bandt et al. (2022). The estimate of a 1 p.p. impact of increased capital requirement on loan rates usually ranges from 0 to 20 BP. However, Lithuania's banking system has always had a significantly higher actual capital ratio over the combined buffer requirement (see Figure 3). Therefore, the rise in total capital requirements was not too restrictive for the industry as a whole and may have suppressed the impact on final interest rates.[12] Moreover, average risk weights, which measure the relative riskiness of each asset type and can be thought of as the intensity of capital requirements, were decreasing over the course of 2015-2019 (see Valinskytė et al., 2018).[13]

(c) Other factors

Beyond increases in concentration and bank capital requirements, there were other concurrent factors that affected the banking industry and could have possibly influenced pricing decisions. We itemize and briefly discuss each of the potential, non-exhaustive factors:

- In 2015-2019, Lithuania's economy experienced high economic and wage growth and historically low unemployment, which could have contributed to the lending rate rise through **heightened credit demand**. For example, based on a disequilibrium model for small-scale corporate lending, the demand for business loans was increasing throughout 2015-2018, with a shortage of credit supply in around 2017-2018 (see Box 2 in the Financial Stability Review of Lietuvos bankas, 2021). In addition, Karmelavičius and Petrokaitė (2022) find that the demand for mortgage credit increased and an excess demand-supply gap emerged, which could have exerted upward pressure on mortgage lending rates. While increased demand might not be the main determinant behind the increase in credit margins, it may have created favourable conditions for banks to raise interest rates.
- During the period analysed, some banks experienced **higher operating costs**, which could have translated into higher lending rates. The increase in costs may be related to several different factors, including, but not limited to, high salary growth and investment in digitalization (see panel (c) of Figure A2). However, according to bank financial statements data, the increase in operating expenses was largely offset by increasing efficiency and banking asset size in relative terms, as well as greater generation of fee and commission income.
- Other expenses and **contributions paid to regulatory authorities** may have partially added to an increase in lending margins. Besides contributions to the national Deposit Insurance Fund (DIF), since 2015 banks pay annual contributions to the European Single Resolution Fund (SRF) which amount to around 0.02% of banking assets. In addition, due to the applied negative deposit facility rate on excess reserves, in 2015-2019 banks were paying interest amounting to around 0.06% of their asset size on an annual basis. While the deposit base and excess reserves increased, banks did not impose negative deposit rates on households, but may have transferred a fraction of these expenses to the borrower side in terms of heightened lending margins by a couple of basis points, or raised their commission fees. On the other hand, it must be noted that the relative increases in SRF and deposit facility payments have been largely offset by the reduction in the DIF contribution rate, which has been lower since mid-2017.

- Lastly, there may have been **discrete bank management decisions** to unilaterally increase margins - especially for institutions that were undergoing transformation, due to profitability pressures. It must be highlighted that during the period, Lithuanian lending rates, initially the lowest among the Baltic countries, increased and converged to levels observed in Latvia and Estonia. One can only speculate that this happened as a banking group-wide policy to equalize rates across the Baltic region, in order to reach uniform profitability targets (see Figure A1).

2.3. Late 2019 and the COVID-19 pandemic

During the second half of 2019, bank lending rates peaked and started falling. Although the turmoil at the beginning of the COVID-19 pandemic in early 2020 briefly raised the margins by a couple of basis points, the process of declining rates continued throughout the rest of 2020 and in 2021. For example, mortgage rates went from a peak of 2.4% in mid-2019 to 2% by the start of 2022. The rates fell by around 40 BP, however, they were still above 2017 levels, and well above the levels of 2015 (see Figures 1 and 2). We shortly discuss the potential factors behind this interest rate decline.

First, since mid-2019, the concentration in both markets has started to decrease (see Figure 3 Panel (a)). Lending flows became more diverse, as some of the banks, which had undergone structural changes, started to compete more actively and increased their loan issuance.[14] Moreover, in response to the pandemic, capital requirements were partly relaxed, i.e. the CCyB was set to 0% and banks were allowed to temporarily deviate from the P2G, as well as from the CCB and O-SII buffer requirements (see Figure 3 Panel (b)). Assuming that banks take these buffers into account when making pricing decisions, the relaxation of these requirements may have accelerated the downward revision of lending rates. Finally, monetary policy stance further eased in 2019-2021. For example, the deposit facility rate of −0.4 % was further decreased to −0.5 % in September 2019 (see also Figure 1). However, such a change did not have a big downward impact on lending rates, as the Euribor had already been negative, and zero-floored in credit contracts.

While it is possible that any of the above-mentioned factors contributed to the lending margin dynamics throughout 2015-2021, such argumentation is susceptible to the *post hoc ergo propter hoc* fallacy, and does not offer any quantification of the drivers' importance. However, the discussed episodes and bank-level data contain enough variation for us to exploit it econometrically, using a panel model, described in Section 4. But before describing the results of the empirical model, the next section will discuss the practical aspects of loan pricing from a bank's perspective.

3. Loan pricing determinants

Here we shed some light on the practical aspects of interest-rate setting, and building on that, develop a stylized model that will serve as a basis for the empirical analysis of Section 4.

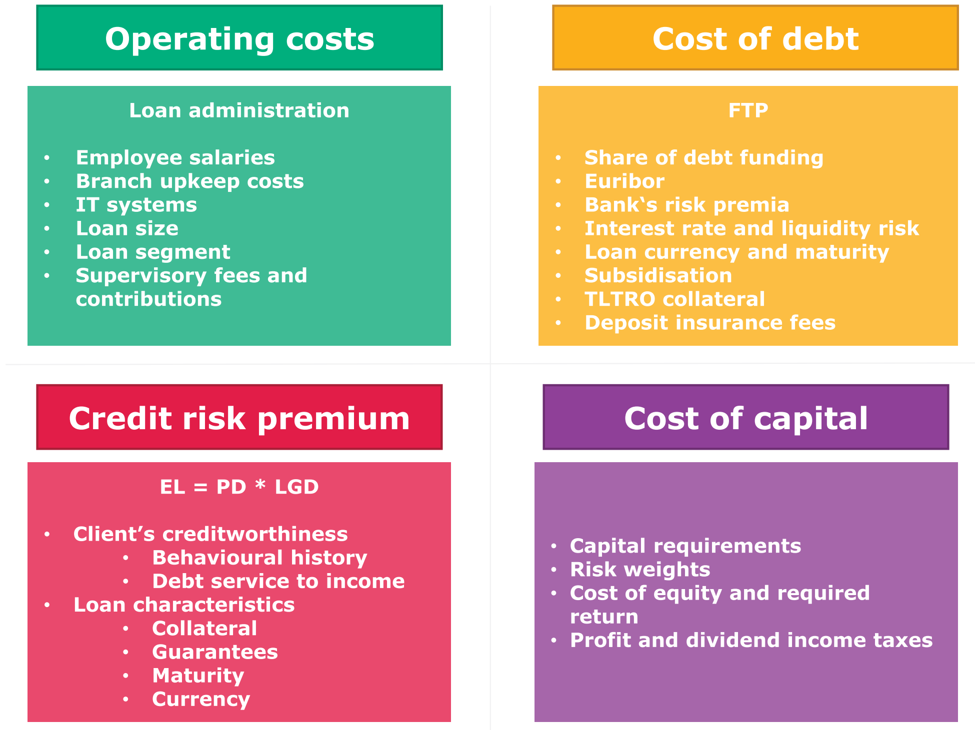


Figure 4. Key components of loan interest rates.
Notes: The explicit sub-components are non-exhaustive examples of each major pricing component.

3.1. Interest rate setting in practice

Although borrowers usually perceive their credit interest rates as the zero-floored Euribor plus a mark-up, the factual calculus is more nuanced. The international practice of banking usually views lending rates as a sum of four key components: operating costs, cost of debt, credit risk premium, and the cost of capital (see Figure 4). If any of these components are incorrectly accounted for, the lending business may be either unprofitable or uncompetitive. In this subsection, we provide an overview of some practical aspects of interest rate setting by briefly discussing each major component of pricing.

3.1.1. Operating costs

This component of the lending rate is dedicated to covering the administrative costs of issuing and book-keeping of a loan. Credit institutions may also elect to include some fraction of operating expenses not in the interest rate but in the administrative fee that is covered by the client during the initiation phase of a loan.

Operating costs typically cover employee compensation such as salaries and bonuses, as well as physical branch upkeep costs, such as rental fees and expenses on equipment. As IT systems become more sophisticated, they also have a significant impact on credit institutions' operating costs and investment outlays, which also need to be covered by revenues from the lending business. Other costs, such as supervisory fees and contributions, can also be accounted for.

Since loans differ by type of segment (e.g. corporate, mortgage, consumer) and size, they may differ in their operating cost-intensity. For instance for large corporate loans, in spite of typically requiring more due diligence, administrative costs are rather negligible compared to the interest revenue - an economies of scale argument. Likewise, if a consumer loan is granted using an automated machine-learning solution, operating expenses have less impact on the interest rate.

3.1.2. Cost of debt

The debt funding component is probably the most important one, as it reflects the traditional banking business of taking deposits and issuing loans, profiting off the spread between lending and deposit rates. Traditionally, banks separate funding and lending operations into distinct departments, where the credit department acquires funds from the treasury. In modern times, in a number of large institutions, the price at which these funds are transferred is called a funds transfer price (FTP). The FTP concept came into prominence after the Global Financial Crisis, during which banks were hurt partly because they had previously mispriced their funding costs and the associated risks (see Dermine, 2013; Moss & Kunghehian, 2018). The aim of using an FTP framework is to ensure that all funding costs are correctly priced in the lending business, and all other risks, such as liquidity or market, are accounted for.

Loan-specific FTP, a mapping from bank's debt funding costs and loan characteristics to a per cent scale, is a major component of loan interest rate. The exact FTP for a given loan usually considers all debt instruments that are pooled to finance the lending activity.[15] It reflects the overall weight and cost of various items on the liabilities side, either retail, such as sight and term deposits, or wholesale, such as bonds and subordinated debt.

The pricing of liability instruments can be based on average factual costs (backward looking), marginal costs (forward looking) or opportunity costs. The average cost approach considers the current debt service expenses that a bank incurs, whereas the marginal costs describe how much it would cost to acquire new funds. Using the marginal cost approach, the FTP could include a base rate such as the swap, Euribor or Libor, and a bank-specific risk premium (Wyle & Tsaig, 2011).

As funding is typically short-term and loans, especially mortgages, have longer maturities, a term liquidity premium is usually added, which increases along the maturity term of a loan (for more details, see Grant, 2011). In some cases, e.g. to meet the LCR requirement, banks hold a significant portion of assets in the form of liquid instruments, such as bonds or excess central bank reserves, that usually carry low or negative returns. An FTP can also reflect an add-on rate for new credit agreements in order to subsidize the holding of these liquid assets (see Moss & Kunghehian, 2018). For banks where a significant amount of funding is obtained using retail deposits that are covered by the deposit insurance scheme, an FTP framework can include deposit insurance fees.

If an extended loan is fixed-rate or denominated in foreign currency, the FTP should entail a premium to hedge against interest rate and foreign exchange risks. Additionally, if a credit agreement can be collateralized when obtaining funds from the markets, i.e. covered bonds, or from the central bank, say the TLTRO programme, the FTP for that particular instrument can be downward-adjusted.

3.1.3. Credit risk premium

A loan's interest rate typically includes a credit risk premium in order to compensate for expected credit losses. Most importantly, as the true credit risk is an unobservable factor and unknown to the bank, the premium reflects the credit risk that is perceived or expected at the inception of a loan. Such expectations are based on the historical performance of a bank's portfolio and associated modelling solutions, as well as the state of the general economy or a specific sector, and non-performing loans level.

The credit risk premium can be thought of as a product of the probability of default (PD) and loss-given default (LGD). These two parameters are tied to the client's as well as the instrument's features. For example, the PD of a loan can depend on the borrower's behavioural history, income, indebtedness, various household characteristics, external credit ratings, etc. In some cases, it may also include macroeconomic variables which describe either the point-in-time or the through-the-cycle environment. As per loan features, they may include loan size and type of loan, the time to maturity, which usually increases credit risk, loan-to-collateral value (LTV), etc. An LGD parameter is mostly related to the collateral of a loan and its (stressed) market value, but can also reflect government or personal guarantees, which act as risk-mitigating instruments, in addition to other factors, such as recourse and legal environment, or administrative fees associated with foreclosure and bankruptcy.

3.1.4. Cost of capital

While the above-discussed elements are aimed to cover the actual costs of lending, the cost of the capital component can be understood as a profit margin.[16] The inclusion of capital costs in the pricing formulae is mainly intended to compensate the shareholders for the provision of their own funds.

Some level of capital is required by the regulatory agencies to ensure that bankers have *skin in the game* to mitigate the moral hazard problem, as well as to account for unexpected losses. Therefore, capital requirements influence the overall cost of capital that is included in the lending rate. The exact amount which is required for a certain loan is governed by the risk weight that is attached to the exposure. Risk weights are designed by regulation to generally increase with the riskiness of the loan, either using the standardized approach (SA) or the previously-mentioned IRB method, which takes into account the PD and LGD parameters.

Based on the level of bank capital, shareholders require a certain return, which is usually expressed as a return on equity (ROE), or risk-adjusted return on capital ratio (RAROC), which can be specific to each loan segment. The required returns are based on the market cost of equity, and adjusted for the relevant profit and dividend tax rates. In an environment where market returns are high, the opportunity costs of investment in a bank will also be high; thus, there will be mounting pressure on bank's profitability as well.

The cost of capital is the part where credit demand, concentration and market power enter the pricing puzzle. The shareholders derive their profitability targets not only on the basis of the cost of equity, but also on the credit market conditions. If the market allows it, e.g. high credit demand and few competitors, bank owners may expect a high return on equity. However, if the demand for credit is subdued and there is a number of low-cost competitors, high required rates of return could not be justifiable.

3.2. Stylized model of interest rates

Here we develop a stylized model of interest rates, which is based on the practical pricing features outlined in the previous subsection. Later, the pricing model will be used as a base for the general specification in econometric analysis, carried out in Section 4.

The model builds on the main features of the Lithuanian banking industry, which were mentioned in Section 2. We assume a representative bank that has only one type of asset - loans (L), and funds its lending activities using deposits (D), foreign funding (F), and equity (E) which approximates bank capital. The bank's structure can be described by the following static balance sheet identity:

$$L_t = D_t + F_t + E_t, \tag{1}$$

where all variables are end of time t stocks. The profit (π_t) of such bank can be expressed as:

$$\pi_t = r_t L_t - r_t^D D_t - r_t^F F_t - \chi_t L_t - O_t, \tag{2}$$

where r_t, r_t^D, r_t^F respectively denote interest rates on loans, deposits and cost of borrowing from abroad. χ_t is the credit loss rate, arising due to customer insolvency, and O_t denotes operating expenses.

Suppose that shareholders require a level of profit (π_t^*), and seek an interest rate (r_t^*) that would reach that profit target. After rearranging Equation (2), we get:

$$r_t^* = \chi_t + r_t^D \frac{D_t}{L_t} + r_t^F \frac{F_t}{L_t} + \frac{O_t}{L_t} + \frac{\pi_t^*}{L_t},$$

with π_t^*/L_t being the required return on assets (ROA_t^*). The latter ratio has a close relationship with the return on equity (ROE_t^*) and the capital ratio (CR_t):

$$ROA_t^* = \frac{\pi_t^*}{L_t} = \frac{\pi_t^*}{L_t}\frac{E_t}{E_t}\frac{\omega_t}{\omega_t} = \left(\frac{\pi_t^*}{E_t}\right)\left(\frac{E_t}{\omega_t L_t}\right)\omega_t = ROE_t^* \cdot CR_t \cdot \omega,$$

where ω_t is the average loan risk weight and $\omega_t L_t$ is risk-weighted assets (RWA). Expression $CR_t \cdot \omega_t$ can be understood as the bank's (inverse) leverage ratio ($LR_t := E_t/L_t$).

Let us assume that the bank's management bases its pricing decisions not on the actual capital ratio (CR_t), but on a capital requirement (μ_t), set by the regulatory authority.[17] The loan interest rate (r_t^*) that ensures the ROE_t^* target would be:

$$r_t^* = \underbrace{\underbrace{r_t^D \frac{D_t}{L_t} + r_t^F \frac{F_t}{L_t}}_{\text{FTP}} + ROE_t^* \cdot \mu_t \cdot \omega_t}_{\text{WACC}} + \frac{O_t}{L_t} + \chi_t. \tag{3}$$

The above formula can be understood as a loan interest rate pricing equation, which is similar to that of Gambacorta (2008), Slovik and Cournède (2011), and Glancy and Kurtzman (2022).[18] In fact, Equation (3) represents all the pricing components discussed in the previous subsection. The operating costs component is represented by the average operating costs (O_t/L_t), debt funding costs, or the FTP, is the ($r_t^D D_t/L_t + r_t^F F_t/L_t$), capital costs are ($ROE_t^* \cdot \mu_t \cdot \omega_t$), and ($\chi_t$) denotes the credit risk premium. The sum of the FTP term and the cost of capital is the widely known weighted average cost of capital (WACC) term.[19]

Suppose the bank's loan portfolio is comprised of mortgages, loans to NFC, and loans to households for consumption. The interest rate pricing equation (3) can be generalized for each loan segment:

$$r_t^{i*} = r_t^D \frac{D_t}{L_t} + r_t^F \frac{F_t}{L_t} + ROE_t^{i*} \cdot \mu_t \cdot \omega_t^i + \frac{O_t^i}{L_t^i} + \chi_t^j, \tag{4}$$

where ROE_t^{i*}, ω_t^i, O_t^i/L_t^i and χ_t^i stand for variables that are specific to the *i*-th loan segment. As discussed earlier, the ROE_t^{i*} component may take into account the conditions of the given market, cost of equity and other relevant factors. For example, shareholders may require a high rate of return on mortgages, given the low-risk nature of the asset class, its administrative efficiency, and prevailing market structure. All these asset class-specific features, as well as the funding costs, determine the pricing of lending rates, as illustrated in Figure 4.

3.2.1. Interest rate margin

The stylized equation (4) considers the pricing of the lending rate, whereas the actual contractual arrangement of a given loan generally includes a base and a margin:

$$r_t^i = \underline{e}_t + m_t^i, \tag{5}$$

where $\underline{e}_t$ denotes the zero-floored reference rate, such as Euribor, being the variable component, and m_t^i denotes the margin, which is fixed over the life cycle of the loan.

We turn to the expression of a similar stylized pricing equation (4) for the margin. Similarly to loans, the deposit and parent bank funding rates may be expressed with respect to the reference rate:

$$r_t^D = \underline{e}_t + m_t^D, \tag{6}$$

$$r_t^F = \underline{e}_t + m_t^F, \tag{7}$$

where m_t^D is a margin on deposits and m_t^F is the bank spread on funding from parent banks.

Using Equations (5)-(7), we rewrite Equation (4) in funding margin terms:

$$m_t^{i*} = m_t^D \frac{D_t}{L_t} + m_t^F \frac{F_t}{L_t} + ROE_t^{i*} \cdot \mu_t \cdot \omega_t^i + \frac{O_t^i}{L_t^i} + \chi_t^j. \tag{8}$$

Equation (8) ignores term $-\underline{e}_t \frac{E_t}{L_t}$, implicitly assuming a full pass-through of the reference rate ($\underline{e}_t$) to the borrowers. The full pass-through assumption is not binding in our setting for several reasons. First, 98% of loan contracts in Lithuania are set as variable-rate, which directly includes a one-to-one pass-through of Euribor. Second, the importance of money markets is limited in Lithuania, as the banking sector is primarily funded using retail deposits, whose interest rate (r_t^D and m_t^D) is already included in the specification above. Third, Naruševičius (2017) finds a full pass-through of money market rates on lending rates, using an error-correction model on Lithuanian banking data. Lastly, the term $-\underline{e}_t \frac{E_t}{L_t}$ is typically quite small, as the leverage ratio (*E/L*) is usually below 5%.

Overall, this model provides a simple framework, characterizing the factors that influence the bank margin, capturing the logic outlined in Section 3.1. For instance, the higher the amount of foreign liabilities in the financing structure ($\uparrow F_t/L_t$), the more sensitive the interest rate on loans is to the rate of foreign financing (r_t^F). Accordingly, the higher the shareholders' required return ($\uparrow ROE_t^*$), the more the interest rate responds to capital requirements (μ_t).

4. Empirical analysis

In the above discussion, we saw that the observed rise in lending rates over 2015-2019 was associated with an increase in average bank interest margins (see Figures 1 and 2). Here we provide an empirical model that is aimed to explain the dynamics of lending margins, employing historical variation across banks and different loan segments. The exercise dwells on the discussion of the practical aspects of pricing in Section 3.1, while the specification is built on the stylized model outlined in Section 3.2.

4.1. Data and selection of variables

We use quarterly information ranging from 2006 to 2021 for an unbalanced panel of eight banks: Citadele, Danske Bank (Sampo bank until mid-2008), Luminor (DNB until end-2018), Medicinos bankas, Nordea, SEB, Swedbank, Šiaulių bankas, together covering around 96% of total banking assets in Lithuania between 2015 and 2021. As our econometric model is trained on data that spans from 2006 to 2021, we use weighted average loan interest rates, including both Euro- and Litas-denominated loans. Likewise, for other items, such as reference interest rates or deposit rates, we also use weighted averages of the respective Euro and Litas rates. This is done to accommodate the fact that a significant portion of loans, other assets and liabilities were denominated in Litas before the adoption of Euro in 2015.

4.1.1. Dependent variable: loan margin ($m_{b,i,t}$)

In our panel data setting, we define the bank-segment-specific margin $m_{b,i,t}$ on new loans as the difference between the **loan interest rate on newly issued loans** $r_{b,i,t}$ and the relevant floored reference rate:

$$m_{b,i,t} := r_{b,i,t} - \underline{e}_{b,i,t}. \tag{9}$$

The average loan interest rate $r_{b,i,t}$ charged by b-th bank for the i-th loan segment at time t is defined as the weighted average of Litas and Euro respective interest rates for new lending flows. Interest rate and lending flow data are taken from the Bank of Lithuania's Monetary Financial Institution database (MFI), containing bank-specific loan rates for four segments (i): loans to non-financial corporations (*NFC's*), mortgages (loans for house purchase, *hh*), consumer loans (*hc*), and other loans to households (*ho*).

The floored reference rate is defined as $\underline{e}_{b,i,t} := \max\{Avibor_{b,i,t}, 0\}$.[20] Avibor stands for the weighted average between the Vilibor and Euribor reference rates, as Vilibor was the primary reference rate for Litas-denominated loans until 2015. The aggregation is specific to each bank-segment and reflects the proportions of Litas/Euro loan flows at a given time period. The relevant Euribor, Vilibor and Avibor historical series are depicted in Panel (a) of Figure A2 in the Appendix.

The average lending margins between 2006 and 2021 are shown in Panel (b) of Figure A2 in the Appendix, with summary statistics of bank-level data for each series tabulated in Table A1(a). We observe that over the sample period, margins on consumer loans were considerably higher than those on mortgages, NFCs and other loans to households, whereas mortgage lending margins were usually the lowest. In addition, loan segments with the highest loan margins typically exerted greater variability across banks and over time. Moreover, consumer loan margin dynamics were entirely different from other loan segments throughout 2015-2019. Specifically, they have been declining in line with the concentration of consumer loans, while mortgage and NFC margins, on the contrary, have been increasing along with the increasing market concentration (see Panel (c) of Figure A2). These differences between segments are particularly important and will be used to explore the effects of concentration and other factors on margins.

4.1.2. Explanatory variables

We categorize all potential drivers of lending margins into four groups, which correspond to the pricing components discussed in Section 3.

Operating costs ($\frac{O_{b,t}}{L_{b,t}}$)

In our empirical specification, we divide operating costs into administrative expenses and contributions paid to regulatory authorities. Less efficient banks operating at higher costs tend to require higher interest margins (see Shamshur & Weill, 2019); therefore, the expected sign of the coefficients of these variables is positive.[21]

Administrative expenses ($\frac{A_{b,t}}{L_{b,t}}$) are defined by the ratio of annual administrative expenses to total assets. Specifically, we take into account administrative expenses that are not covered by non-interest income, measured as: [Administrative Expenses - Operating Income - (Interest Income - Interest Expenses)]. This allows us to take full account of income/expenses incurred outside lending activities, such as net fee and commission income and other net operational income. Bank-specific data is taken from the FINREP profit-and-loss statement.

Contributions to regulators ($\frac{C_{b,t}}{L_{b,t}}$) are defined by the ratio of overall annual contributions paid to regulatory authorities to total assets. Specifically, we consider contributions to the Deposit Insurance Fund, and from 2015 onwards also contributions to the Single Resolution Fund, as well as payments on excess reserves.[22] We use internal Bank of Lithuania bank-level data.

Debt funding costs - FTP ($m^D_{b,t}\frac{D_{b,t}}{L_{b,t}} + m^F_{b,t}\frac{F_{b,t}}{L_{b,t}}$)

As discussed in Sections 2 and 3, banks operating in Lithuania typically raise funds through two types of funding: deposits (D_t) and parent bank funding (F_t). Therefore, each bank's FTP should be mostly reflected by deposit interest rates and parent bank funding rates.

Cost of deposit funding ($m^D_{b,t}$) is defined as a margin on deposits, which is the difference between the bank-specific deposit interest rate and the Avibor, as in Equation (6). More specifically, we consider a weighted average of household and NFC deposit rates to reflect the overall cost of retail deposits.

Cost of foreign funding ($m^F_{b,t}$).

Regarding parent bank funding, using historical transaction data on interbank funding, we see that subsidiaries and branches that operate in Lithuania usually borrow from their respective parent institutions at a Euribor rate. Since the primary source of these funds was usually the financial markets, we assume that banks use bond yields to reflect the cost of parent funding when pricing lending rates. A bank's parent funding spread (m^F_t) can be represented as the difference between a relevant bond yield and Euribor (see Equation (7)). In particular, we use covered bond yields for mortgages and senior bond yields for business, consumer and other loans to households.[23]

Credit risk ($\chi_{b,t+2}$)

The two-quarter lead of provision-to-loan ratio is used as a proxy for credit risk.[24] The values of this ratio are taken with a lead, because the actual credit risk cannot be reflected in the data contemporaneously, since banks book provisions based on an estimate of expected future loan losses. Banks with higher loan credit risk are likely to require a higher risk premium as a compensation and therefore this variable is expected to have a positive sign on the interest margin. We use bank-specific data from the FINREP database.

Cost of capital ($\mu_{b,t} \cdot \omega_{b,i,t} \cdot ROE^{i*}_t$)

The last element of the stylized model in Equation (8) is the cost of capital. It takes into account a level of capital required by regulators, including capital requirements ($\mu_{b,t}$) and risk weights ($\omega_{b,i,t}$), as well as a return on equity, which is required by shareholders (ROE^{i*}_t). Since the bank-segment-specific required return is unobserved and essentially reflects market conditions, it is proxied by market concentration and loan demand indicators, as discussed in Section 3.

Capital requirements ($\mu_{b,t} \cdot \omega_{b,i,t}$) are defined as the product of regulatory capital requirements and risk weights. The latter product is equivalent to a loan segment-specific leverage requirement.[25] The bank-specific capital requirements ($\mu_{b,t}$) are composed of the minimum Pillar 1 requirement, the institution-specific Pillar 2 requirement and the combined capital buffer requirements, including the CCoB, the CCyB, the O-SII capital buffer and the P2G. The risk weights ($\omega_{b,i,t}$) are measured by the ratio of risk exposure amount to the original exposure, which is bank-segment-specific. A positive sign is expected, as the cost of maintaining the required high levels of bank capital is needed to compensate the shareholders for the provision of their own funds.

Market concentration in loan segment i is measured by the Herfindahl-Hirschman index ($HHI_{i,t}$), which is computed as a sum of squared market shares for each loan segment:

$$HHI_{i,t} = \sum_b \left(\frac{L^{flow}_{b,i,t}}{L^{flow}_{i,t}} \times 100 \right)^2$$

where $L^{flow}_{b,i,t}$ is new annual lending flows of bank b in the loan segment i.[26] Market concentration is expected to allow shareholders to require higher returns, thus positively contributing to loan margins, as theorized in the traditional structure-conduct-performance hypothesis.

Loan demand ($\Delta L^{flow}_{i,t}$) is measured by the average annual logarithmic difference of sector-wide loan flow in segment i. A positive sign of the coefficient is expected, as banks gain greater market power when credit demand increases, allowing them to be more selective towards borrowers and increase interest margins (Gambacorta, 2008).

Weighted averages of explanatory variables used in the empirical model are presented in Panel (c) of Figure A2, with summary statistics of bank-level data for each series tabulated in Panel (b) of Table A1 in the Appendix. Overall, the descriptive statistics suggest that the development of interest margins and their determinants exhibit different tendencies for different loan segments over time. The following subsection analyses the quantitative impact of these determinants on the interest margin by means of regression analysis.

4.2. Econometric specification

Our empirical approach is entailed by regressing loan interest margins $m_{b,i,t}$ on the explanatory variables, described in the previous subsection. Specifically, on the basis of the discussion in Section 3.2 and the stylized pricing equation (8), we consider a panel data regression model of the following form:

$$m_{b,i,t} = \alpha_1 \frac{A_{b,t}}{L_{b,t}} + \alpha_2 \frac{C_{b,t}}{L_{b,t}} + \alpha_3 \left(m^D_{b,t} \frac{D_{b,t}}{L_{b,t}} \right) + \alpha_4 \left(m^F_{b,t} \frac{F_{b,t}}{L_{b,t}} \right) + \alpha_5 \chi_{b,t+2} + \alpha_6 \left(\mu_{b,t} \cdot \omega_{b,i,t} \right) + $$
$$+ \alpha_8 HHI_{i,t} + \alpha_9 \Delta L^{flow}_{i,t} + \theta_{b,i} + e_{b,i,t}.$$

The notations for the explanatory variables are contained in Section 4.1.2. $\theta_{b,i}$ denotes bank-segment-specific fixed effects, which capture the individual characteristics of each bank b and segment i, and $e_{b,i,t}$ denotes residuals, which reflect all other margin determinants that cannot be captured by the model.[27] It should be noted that we include only the observable features of loan pricing, while other determinants, such as discrete bank management decisions, could be associated with model residuals.

The model is estimated by combining the *within* estimator and a weighted regression method to account for the considerable heterogeneity across banks and loan segments. For weights, we use the share of a bank's loan flow relative to total loans (granted by all banks) in a given segment, which ensures that a higher weight in the estimate is assigned to larger banks. Finally, since our regression model is essentially an inverse supply equation, i.e. margins regressed on loan growth and other features, we use instruments to be able to identify the supply equation and to tackle the potential endogeneity problem associated with the loan demand variable ($\Delta L^{flow}_{i,t}$). Specifically, we instrument the loan growth variable with demand-side variables, namely, the annual GDP growth for NFC loans and an indicator of consumer sentiment for mortgages, consumer loans and other household loans.

4.3. Results

4.3.1. Regression estimates

Based on the general specification in Equation (10), we estimate five different models. The first model considers the entire banking sector, pooling four loan segments: loans to NFC's, mortgages, consumer loans and other loans to households. Second, we consider each of the four loan segments separately. In the former case, we use bank-sector-

Table 1. Regression results.

	Dependent variable: loan interest margins				
	all (1)	nfc (2)	hh (3)	ho (4)	hc (5)
Administrative expenses	0.07	−0.02	0.29***	−0.02	0.74*
	(0.08)	(0.09)	(0.07)	(0.14)	(0.41)
Contributions to regulators	0.72*	1.04**	0.63	−3.92***	11.94***
	(0.40)	(0.48)	(0.39)	(1.00)	(2.56)
Cost of deposit funding	0.88***	0.66***	0.61***	1.39***	4.94***
	(0.06)	(0.05)	(0.05)	(0.13)	(0.27)
Cost of foreign funding	0.20**	0.13	0.32***	0.09	−1.67***
	(0.10)	(0.13)	(0.07)	(0.24)	(0.44)
Credit risk	0.02*	0.02	0.06***	−0.02	0.12**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.06)
Capital requirements	0.01	0.03**	0.01	0.05**	0.14**
	(0.01)	(0.01)	(0.02)	(0.03)	(0.06)
Concentration (flow)	0.44***	0.39***	0.41***	0.51	−0.84**
	(0.07)	(0.13)	(0.05)	(0.39)	(0.42)
Loan demand	−0.004	−0.004	0.03	−0.31	0.93
	(0.004)	(0.004)	(0.14)	(0.69)	(0.96)
Bank-sector FE	YES	-	-	-	-
Bank FE	-	YES	YES	YES	YES
Weighted regression	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES
Adjusted R^2	0.31	0.3	0.6	0.26	0.54
Observations	1,708	483	408	431	386

Note: Column (1) shows the estimates for a model that considers the overall banking sector, and columns (2)-(5) show estimates for each loan segment separately, respectively, for margins on loans to NFCs (*nfc*), mortgages (*hh*), other loans to households (*ho*) and consumer loans *hc*. All the estimates are weighted by the size of the bank's loan portfolio, in order to account for a considerable heterogeneity with respect to the volume of loans issued by banks operating in Lithuania. The sample period is 2006-2021. Robust standard errors are presented in the parentheses. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. *Within R*-squared values are reported.

specific fixed effects, $\theta_{b,i}$, and in the latter - bank-specific fixed effects, θ_b. The results of the regressions are presented in Table 1. Column (1) shows the estimates for the loan interest margins of the overall banking sector, whereas the results for each loan segment are presented in columns (2)-(5).

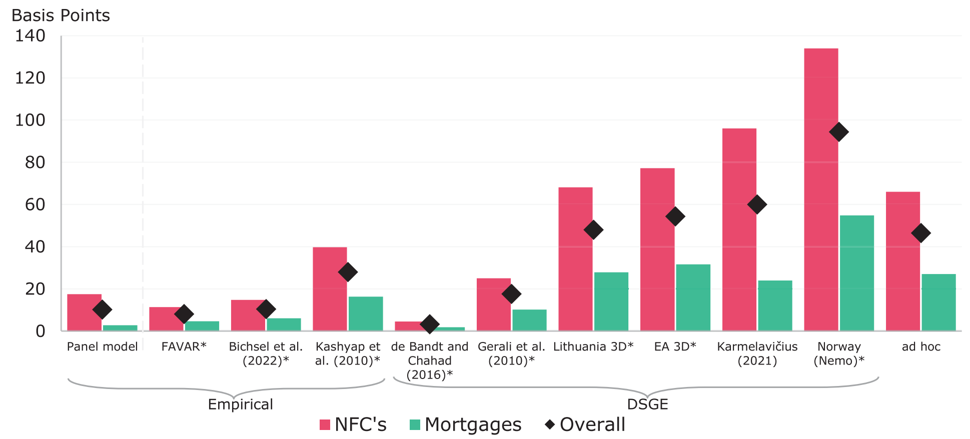
The estimates in the first two rows of column (1) show the expected positive sign, indicating that banks' *operational costs* (i.e. administrative expenses and contributions paid to regulators) are translated into higher interest margins. The coefficient related to administrative expenses, compared to the coefficient on contributions to regulators, is considerably smaller and statistically not significant at 10% level. This supports the hypothesis discussed in Section 3.1, according to which credit institutions may include a certain fraction of administrative expenses not in the interest margin, but in other fees and commissions borne by the clients at the origination stage of the loan. However, the segment-specific results in columns (2)-(5) differ in sign and magnitude, confirming the intuition that different loan types might differ in their operational cost-intensity. For instance, we find that the strongest effect of operational expenses is on consumer loan margins.

The coefficients on *funding costs*, both via deposits and from parent banks, in rows 3 to 4 are positively related to loan interest margins. As can be seen from the magnitude of the estimates in column (1), it is found that a 1 p.p. increase in funding costs through deposits leads to a 0.88 p.p. increase in the interest margins.[28] Note that this relationship is statistically significant in all cases (columns (1)-(5)), suggesting that banks with easier access to deposit funding can offer lower interest margins on loans. The corresponding increase in the funding costs from foreign banks is found to be related only to a 0.20 p.p. increase in margins. However, the magnitude of funding costs varies across the four loan segments analysed (see columns (2)-(5)). For example, around 60% of the increase in funding costs via deposits is passed on to the margins of NFC's and mortgage loans, whereas the pass-through is higher for other household and consumer loans.

The coefficients of *credit risk* are positive and statistically significant at a 10% level, suggesting that banks demand higher margins to compensate for greater potential losses. On average, a 1 p.p. increase in the loan loss provision to assets ratio would result in a 0.02 p.p. increase in loan interest margins. The effect is stronger in the household loan segment, in particular on consumer loan margins (see column (5)), where the corresponding increase would lead to an increase in margins of around 0.12 p.p. In contrast, the effect is smaller and statistically not significant on NFC margins.[29] We acknowledge that this relationship may be underestimated, as we use bank-level data rather than loan-level data. Therefore, in Section 4.4 we will further investigate this effect at the micro level.

Turning to *capital requirements*, which are really a product of the required capital ratio and the risk weights ($\mu_{b,t} \cdot \omega_{b,i,t}$), we find that they are positively related to interest margins, but the effect varies across loan segments (see columns (2)-(5)). More specifically, a 1 p.p. increase in the required leverage ratio is on average associated with a 0.14 p.p. increase in consumer loan margins; 0.05 p.p. - in margins on other loans to households; 0.03 p.p. - in NFC margins; and only 0.01 p.p. - in mortgage margins. However, the latter effect is not statistically significant. Moreover, the effect is also not significant when the entire banking sector in column (1) is considered. This weak and statistically insignificant effect might reflect the fact that banks operating in Lithuania typically had high capital buffers; thus, changes in regulatory capital requirements might have not affected banks' capital ratios, and hence, loan margins. Also, in spite of the increased capital ratio requirements across the banking industry, risk weights generally decreased, putting less pressure on banks to increase their margins, rendering the estimated coefficients small and insignificant.

Furthermore, we isolate the effect of changing risk weights and provide estimates for the lending rate impact of an 8.1 p.p. total increase in capital requirements throughout 2015-2019 (see Section 2 and Panel (b) of Figure 3). The overall results are compared to other models and depicted in Figure 5. On the basis of the estimated panel model, we see that the net impact on corporate lending rates is around 18 BP, whereas the mortgage impact is much smaller and equal to only 3 BP. To put these numbers into perspective, if risk-sensitive capital requirements were returned to the levels of 2014, lending rates would be on average 0.1 p.p. lower. The magnitude of these estimates is similar to those obtained from a macroeconometric FAVAR model, using Lithuanian time series data, and also in proximity to the figures obtained by Bichsel et al. (2022). In contrast, Kashyap et al. (2010) found the impact on lending rates to be a bit higher, so that the



(Basis Points)	Panel model	FAVAR*	Bichsel et al. (2022)*	Kashyap et al. (2010)*	de Bandt and Chahad (2016)*	Gerali et al. (2010)*	Lithuania 3D*	EA 3D*	Karmelavičius (2021)	Norway (Nemo)*	ad hoc
Overall	10	8	10	28	3	18	49	55	61	96	47
NFC's	18	11	15	40	5	25	69	78	97	136	67
Mortgages	3	5	6	16	2	10	28	32	24	55	27

Figure 5. Lending rate impact of an 8.1 p.p. increase in capital requirements.

Notes: (1) The chart and the corresponding table contain the lending rates impact of an 8.1 p.p. increase in bank capital requirements. The original estimates are based on the effect of a 1 p.p. increment in capital ratios, which is multiplied by 8.1 to compute the total impact; (2) Panel model estimates are based on Table 1, with average risk weights of 66% and 27% for NFC loans and mortgages, respectively; (3) the FAVAR* model estimate is based on Budnik et al. (2019), using Lithuanian data, and kindly provided by L. Naruševičius; (4) Lithuania 3D* estimates are based on a calibrated model of Clerc et al. (2015), and provided by L. Naruševičius; (5) *ad hoc* is computed using equation (8), with $ROE^* = 10\%$ and average risk weights of $\omega^{NFC} = 66\%$ and $\omega^{mortgage} = 27\%$, and profit tax rate of 20%; 6) De Bandt and Chahad (2016), Gerali et al. (2010)*, EA 3D* for EA and Norway (Nemo)* estimates are based on Table 4 in De Bandt et al. (2022); 7) * denoted estimates are original only for the overall impact. The impact on NFC lending rates is assumed to be 2.44 (= 66/27 - risk weight ratio) higher than that for mortgages, and the overall impact is the average of the two.

net amount on average lending rates would be around 0.28 p.p. On the other hand, not all authors find capital requirements to be positively, or statistically significantly, linked to lending margins. For example, Ehrenbergerova et al. (2022) estimate the impact of capital ratios to be positive only for corporate lending rates; however, this impact is not statistically significant.[30]

The estimates become much larger if based on theoretical DSGE-type models or ad hoc rules. For instance, DSGE models that are calibrated to Lithuanian data (3D - Clerc et al., 2015, also Karmelavičius, 2021) suggest the overall impact to be around 0.49-0.61 p.p. - a roughly fivefold higher number, compared to the empirical counterpart (panel model). This discrepancy between the empirical and theoretical model estimates can also be explained by the fact that Lithuania's banks had significant capital surpluses over the requirement. Therefore, as the empirical model suggests, the heightened capital requirements may have been only partially translated into higher lending rates.

Regarding the *market concentration*, the obtained results show that a shift to a more concentrated market is generally associated with higher bank loan margins. The estimates suggest that a 1000-point increase in the HHI index would lead to an average increase in loan interest margins by 0.44 p.p. The corresponding increase in the HHI of the NFC and mortgage markets, respectively, would be associated with a similar 0.39 and 0.41 p.p.

increase in margins. High statistical significance of this variable supports the market power hypothesis, suggesting that banks operating in highly concentrated markets may charge higher lending margins, owing to their dominant position in the market. Finally, our results are robust when using an HHI calculated using data of loans outstanding (see Table A2).

Finally, the results in the last row show that the effect of *loan demand* is estimated to have no significant effect on interest margins.

Overall, we acknowledge that the results related to margins on other loans to households and consumer loans, in columns (4)-(5) respectively, may not fully reflect the actual margin pricing as they only constitute a small part of the banks' loan portfolio. As a result, some of the price determinants observed at the bank level rather than at the bank and sector level, such as operating costs, may be not accurately assessed. These unobserved factors are more constraining for the smaller segments, which is why in the next section we focus on the two largest loan segments: mortgages and NFC loans.

4.3.2. Margin decomposition

Here we further explore the drivers of lending margins through a decomposition analysis, which is based on the regression results presented in Table 1 columns (2) and (3). Figure 6 depicts the historical decomposition of sector-wide lending margins for NFC loans and mortgages. The results show that different factors explain the evolution of margins over the years.

Until mid-2015, the main determinants of lending margins were funding costs and credit risk. The low-cost lending between 2006 and 2008 was enabled by cheap but short-term funding obtained from the Scandinavian parent banks that pooled resources from their respective domestic deposits and the financial markets. In particular, during the boom of the 2000s, the banking sector relied heavily on wholesale funding from the Nordic parent banks and foreign-bank deposits accounted for as much as 45% of total banking assets in 2008.[31] Subsequently, as the crisis of 2008-2009 hit, the financial markets closed and parent banks found it difficult to obtain stable and cheap funding, it contributed to the withdrawal of resources from the Lithuanian banking system and increased pressure on local loan rates. According to our results, the increase in funding costs between mid-2008 and mid-2010 can be associated with an increase in lending margins by around 1-1.5 p.p. In addition, during the Global Financial Crisis, non-performing loans started accumulating, the perception of risk changed radically and lenders started to better price credit risk in their loan rates. According to our estimates, this led to a 0.25 and 0.5 p.p. increase in margins on loans to NFC's and mortgages, respectively.

The recent increase in margins **from mid-2015 to 2019** can be mainly attributed to the changing market structure of the banking sector, which affected average lending rates via two main channels. First, as some banks exited the market during this period, market concentration reached new historical heights and allowed the incumbent banks to enjoy high market power, and thus raise their mortgage rates by 0.4 p.p. and NFC rates by 0.2 p.p. Second, the compositional effects - weighted averages of bank fixed effects - are also largely responsible for the increase in average margins, especially in the NFC market, where they contributed by around 0.3 p.p. In our analysis, the compositional effects are

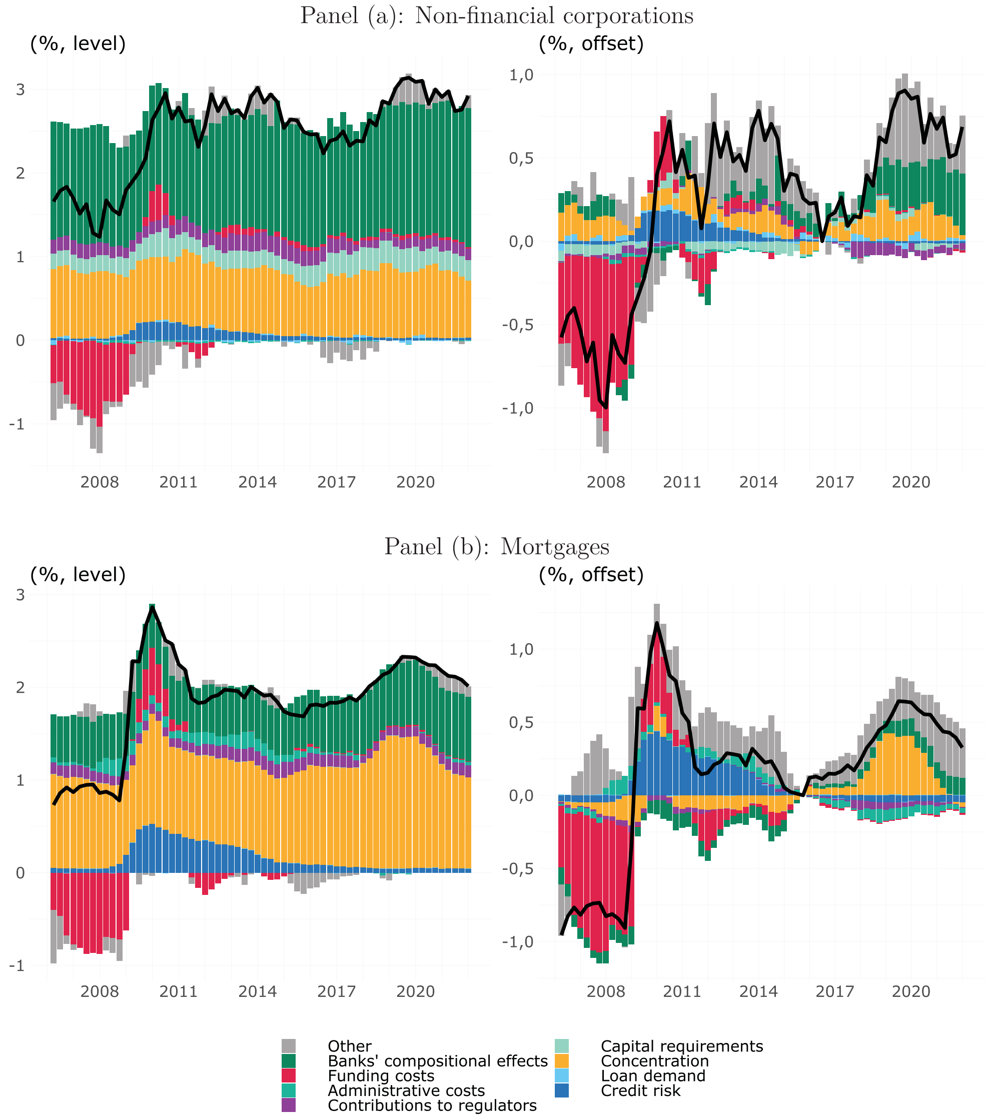


Figure 6. Decomposition of lending margins. Panel (a): Non-financial corporations. Panel (b): Mortgages.

Notes: The plots show the decomposition of weighted average loan margins for non-financial corporations (panel a) and mortgage loans (panel b). The plots on the left-hand side decompose the level of margins, while the right-hand side charts contain the decomposition of a cumulative change in margins, compared to a reference point. As reference points we have chosen moments when margins were the lowest: mid-2016 for the NFC segment and mid-2015 for mortgages.

the weighted average of estimated bank fixed effects, with bank lending shares serving as weights ($L^{flow}_{b,i,t}/L^{flow}_{i,t}$): $\sum_b (\frac{L^{flow}_{b,i,t}}{L^{flow}_{i,t}}\hat{\theta}_{b,i})$, where $i \in \{nfc, hh\}$. The compositional effects are time-varying with changing bank lending shares in a given market. For example, if a bank with generally high-interest rates, which cannot be explained by the observable model features, reaches higher market share, the compositional effect will increase.

Essentially, after some banks exited the market, clients switched and started borrowing from banks that had already been lending at high rates. As with the impact of concentration, this compositional effect also has to do with the changing structure of the market, i.e. decreasing number of competitors. However, the compositional effect mainly acts through the changing structure of lending - with banks that used to charge higher interest rates gaining larger market shares.

Moreover, our modelling results show that the increase in NFC and mortgage margins by around 0.55 and 0.3 p.p., respectively, remains unexplained by the model and the observable drivers, such as funding costs and credit risk. The rise in average rates may be related to other, unobservable factors, such as discrete bank management decisions in pursuit of higher profits, risk aversion or economic growth. Lastly, as in the previous discussion, it does not seem that the tightened capital requirements were a cause of mortgage rate variation, while the effect on NFC rates is small but tangible, as they carry higher risk weights and thus are more capital-intensive.

In addition to decomposition analysis, we have re-estimated the regression in Table 1 columns (1)-(3) adding an interaction term for a period going from mid-2015 to 2019. The results presented in Table A3, support the main findings discussed in this section. First, we find that market *concentration* is an important determinant over entire analysed period with no significant difference in the sub-sample. Second, we find that the effect of *administrative expenses*, *contributions to regulators* and *credit risk* is negative, thus, not related to the increase in the margin rates over the period of interest 2015-2019. On the other hand, the effect of *capital requirements* over the 2015-2019 period was positive and statistically significant when the entire banking sector in column (1) and NFCs sector in column (2) of Table A3 are considered, while the effect is statistically not significant in the full sample. Although the effect of *cost of deposit funding* is positive, it is economically insignificant as cost of deposit funding was nearly zero over the sub-sample.

The subsequent decline in bank lending rates **throughout late 2019 and the COVID-19 pandemic** coincides with the decreasing market concentration in the NFC and especially mortgage segments. In addition, the decline in corporate margins is also strongly related with the contraction of other, unobserved factors and, to a minor extent, with the relaxation of capital requirements. The reduction in funding costs as a result of the ECB's monetary policy discussed in Section 2.3 had no significant effect on lending margins in both sectors.

4.4. Additional NFC loan-level pricing model

The analysis of the drivers of business loan margins in the previous section showed that bank-level data cannot explain quite a significant part of the increase in loan interest margins over 2015-2019. Moreover, the loan provision ratio for NFC loans did not show any material increase in credit risk that could explain the increase in lending margins. However, as the provision ratio used merely captures the realized risk, rather than the actual one, it serves only as a proxy. Also, the so-called compositional effects showed that a significant amount of lending rate increase can be attributed to borrowers switching to other more expensive banks.

To address these issues and complement the previous findings, we present a micro-level loan pricing model for NFCs.[32] The model is based on around 61,000 newly issued business loans between 2015 and 2019, utilizing Bank of Lithuania's Loan Risk Database (PRDB), firm-level financial statements and *Scorify* credit ratings.[33] These types of rich data provide us with a more accurate picture of loan-level credit risk; hence, an understanding of whether there were any changes in the actual risk that could have altered pricing decisions. We briefly describe the model and its estimates, and later provide the drivers of aggregated lending margins.

Similarly to Equations (8) and (10), we model loan-level interest rate margin (m_i), which is defined as the difference between the *i*-th loan's interest rate and the corresponding reference rate, e.g. Euribor. In order to identify which factors influence the issued loan margin, we formulate the following regression:

$$m_i = \theta_b + \boldsymbol{\gamma_1}\mathbf{X}_i + \boldsymbol{\gamma_2}\mathbf{Z}_i + e_i,$$

where θ_b is a creditor (bank) dummy, $\mathbf{X}_i$ are loan characteristics, $\mathbf{Z}_i$ are firm characteristics and e_i are the idiosyncratic residual pricing terms that are not captured by the explanatory variables.[34] The combination of loan characteristics - variables like duration, collateral, and guarantees - and firm characteristics, such as credit rating, firm size, financial ratios, allows us to model how different sub-components affect pricing decisions (see components of pricing in Section 3.1).

Loan characteristics

As outlined in Section 3.1, operating costs are one of the main components of loan pricing. While we do not have direct administrative expense data at the loan-level, the loans can be segmented based on their type (credit lines, credit card debt, mortgage, overdraft and other), purpose (investment, production, transportation, real-estate and other), as well as the loan amount, duration and the number of co-debtors. We also include the creditor fixed effects in order to capture the operating costs and risk premia differences between different lenders. To account for the credit risk, an indicator variable for the borrower-lender relationship, as well as the ratio of various collateral types (real estate, insurance, personal and government guarantees and other) to the loan amount are also included in the model. In order to capture changes to the costs of debt, the interest index term - the frequency at which the interest rate is recalculated - is also included in the model.

Firm characteristics

Borrower location (municipality), as well as economic activity could also affect the lenders risk premia, since firms financial structure differs between economic sectors and locations.[35] We also expect that older and larger firms are more reliable in terms of their credit worthiness, so we include these variables in our model. The ratio of long-term assets, tangible assets and equity to assets, as well as the net profit to equity ratio can be used to measure a firms liquidity. We expect that firms with a higher liquidity would pose a lower risk (and therefore, a lower risk premium). Furthermore, to capture additional firm obligation and creditworthiness effects, we include the number of queries on the borrower's liability information and the number of institutions making these requests to the PRDB. These queries are used to make (periodic) queries on existing borrowers, as well as to aid in decisions on loan approval for new borrowers. Finally, we also

Table 2. NFC loan-level pricing regression results.

		Dependent variable: NFC loan interest margin (m_i)		
		γ		
Loan	(Intercept)	7.26	***	(0.09)
	Number of debtors	0.05		(0.05)
	Loan duration, years	−0.07	***	(0.003)
	log(Loan size, EUR)	−0.32	***	(0.004)
	(RE Collateral / Loan amount)	−0.001	***	(0.0002)
	(Other Collateral / Loan amount)	−0.0001		(0.001)
	(Personal Gaurantees / Loan amount)	0.06	***	(0.004)
	(Government Gaurantees / Loan amount)	−0.02	***	(0.01)
	(Insurance / Loan amount)	−0.01		(0.01)
	New lending relationship	0.06	***	(0.01)
Firm	Firm size 2: Medium Enterprise	0.31	***	(0.01)
	Firm size 3: Small Enterprise	0.51	***	(0.02)
	Firm size 4: Micro Enterprise	0.84	***	(0.02)
	Firm age: [5,10)	−0.06	***	(0.01)
	Firm age: [10,20)	−0.15	***	(0.01)
	Firm age: 20+	−0.18	***	(0.01)
	Rating: B	0.11	***	(0.01)
	Rating: C	0.17	***	(0.02)
	Rating: D	0.50	***	(0.05)
	Rating: E	0.39	***	(0.14)
	Rating: Not rated	0.08	***	(0.01)
	(Long-term assets / Assets)	−0.16	***	(0.02)
	(Equity / Assets)	0.01		(0.02)
	(Tangible assets / Assets)	0.001		(0.002)
	(Net Profit / Equity)	0.0000		(0.0002)
	Current ratio	−0.0000		(0.0001)
	Number of employees	−0.0000		(0.0000)
	Number of institutions requesting borrower liability information	−0.01	***	(0.004)
	Number of queries requesting borrower liability information	0.0001	***	(0.0000)
Firm	Economic activity effects	YES		
	Municipal effects	YES		
Loan	Creditor compositional effects (θ_b)	YES		
	Loan type effects	YES		
	Loan purpose effects	YES		
	Loan index term effects	YES		
	Observations	61,380		
	R^2	0.69		
	Adjusted R^2	0.69		

Note: Estimation is based on the micro-level loans that were issued in 2015-2019. Standard errors are presented in the parentheses. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. The reference category for firm size is large enterprises, for age - less than 5 years, and for the rating - an A rating.

include a *Scorify* credit rating of a firm to capture any other firm reliability effects, which are not covered by the previously discussed variables.

Regression estimates

The estimated regression model is presented in Table 2, with variables and their coefficients grouped by loan and firm characteristics. We will briefly describe the main qualitative results. Starting with loan-level features, we find that loan size significantly and negatively affects lending rates, as we discussed in Section 3.1. To our surprise, loan duration in years also negatively affects lending margins. On one hand, the higher the duration, the higher the probability of default over the lifetime of the loan, also the higher the liquidity risk, stemming from maturity mismatch. On the other hand, large loans and especially those with longer durations yield higher absolute returns for the creditor;

thus, there is no need to charge high lending rates. This channel may explain the coefficient sign for both variables. Unsurprisingly, we see that if the loan is well-collateralized or guaranteed, the interest rates decrease, as there is lower credit risk via the loss given default (LGD) associated with that loan. Importantly, if the lending relationship between the firm and the creditor is new, the loan interest rate will be on average higher by 6 BP. This can in part explain the previous finding that after some banks had exited the market, the borrowers needed to form new lending relationships, which were, at least initially, more pricey.

Turning to firm characteristics, modelling results indicate that loan margins are highly dependent on firm size, age and the *Scorify* credit rating. For instance, small and newly established firms that have a poor credit rating are very likely to receive a loan, if any, with relatively high interest rates. The regression results also include coefficient estimates for various financial ratios; however, they are not very significant as the financials are mostly captured in the credit rating, along with other variables related to a firm's creditworthiness. Finally, the model also includes various dummy control variables for NFC economic activity types and their geographic location, as well as loan type and purpose, interest reference index type and reset frequency, and creditor dummies (θ_b), which serve as compositional effects.

Aggregate drivers of loan-level margins

Figure 7(a) shows that the rise in interest margins between 2017 and 2019 covered all major sectors, but was mostly pronounced in the services and construction sector, also mainly due to compositional effects and unexplained factors. These results confirm that the rise in interest margins was not related to an increase in factual credit risk, which did not change according to firms' financials and credit rating, nor was it associated with a deterioration in certain economic sectors. Instead, the increase in average NFC lending rates was rather common to all firms in all sectors, the majority of which is not explained by the granular observable risk factors.

Using the estimated loan-level pricing model, presented in Table 2, we further investigate how different aggregate pricing components affected the average NFC lending margins throughout 2015-2019. Panel (b) of Figure 7 shows the drivers of the weighted average interest rate margin on non-leasing NFC loans. We see that, in line with the results of the panel model depicted in Figure 6, the increase in average loan margins in 2015-2019 can be primarily explained by creditor compositional effects and unexplained factors, rather than by an increase in the *factual* credit risk, which remained constant. Specifically, the increase in the creditor compositional effects reflects the change in the structure of NFC borrowing, with firms shifting towards creditors that usually charge higher interest margins. In addition, other unaccounted effects add to the rise in interest rates, which may be related to banks' discretionary attempts to limit their credit exposures. According to Bank of Lithuania and Competition Council study in 2021, while the general economy was growing in 2015-2019, there were increasing signs of a slowdown, highlighted by a downward revision of economic forecasts by the Bank of Lithuania. These slowdown expectations could have altered credit institutions' perception of credit risk, to some extent feeding into higher lending rates.

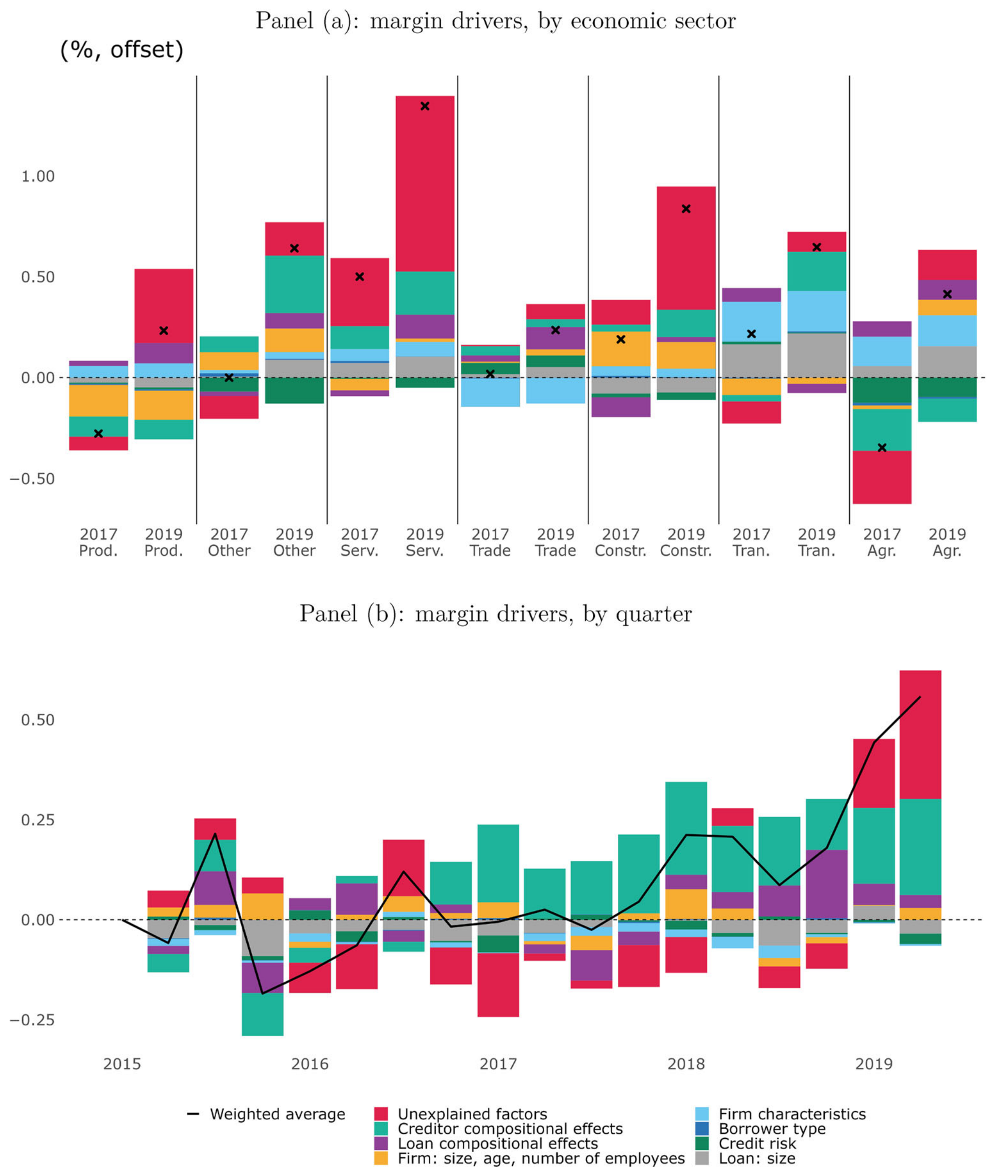


Figure 7. Decomposition of NFC loan interest margins. Panel (a): margin drivers, by economic sector. Panel (b): margin drivers, by quarter.

Notes: The plots show the decomposition of the weighted average loan margins for non-leasing loans to 1 million EUR by sector for 2017 and 2019 in panel (a), while panel (b) shows the decomposition from Q1 2015 to Q2 2019. All the values are displayed as differences compared to Q1 2015. *Unexplained factors* are the difference between the observed weighted average and the weighted average calculated from the model-fitted values. *Creditor compositional effects* consist of indicator variables ($\hat{\theta}_b$) for banks and credit unions, while *loan compositional effects* include loan type, purpose and index term. *Firm characteristics* cover firm location, economic activity (sector), number of inquiring institutions and number of queries requesting borrower liability information. *Borrower type* indicates new lending relationships. Finally, *credit risk* contains credit rating, ratio of long-term assets, tangible assets and equity to total assets, net profit to equity ratio, current ratio, number of debtors, loan duration, and loan amount, as well as collateral, guarantees and insurance to the loan amount ratio.

5. Conclusions

Bank lending rates across the EA are very low by historical standards. However, despite the fact that monetary policy eased, over the last seven years Lithuanian lending margins increased and remain elevated among the EA countries. In this paper, we attempted to find the drivers behind the lending rate rise throughout 2015-2019 and subsequent fall in 2019-2021. Our historical event analysis suggests that many things, including increased banking concentration, heightened capital requirements, loan demand created and other possible factors, may have shaped the dynamics of interest rates. To answer this question, we have estimated a bank-sector-level panel data model to explain the historical lending margin dynamics. We conclude this paper by offering three key findings.

First, while the Euribor reference rate remained below zero, loan interest rates have increased in Lithuania, suggesting heightened bank lending margins. As banks' operating and financing costs were relatively stable and there was no material rise in the observable credit risk, other factors, including unobserved ones, may have put pressure on interest rate changes.

Second, bank exits, mergers and acquisitions have markedly increased the concentration in Lithuania's banking industry, largely contributing to the interest rate rise throughout 2015-2019 in both mortgage and business loan markets. However, the impact of the changing market structure was not uniform across the two lending segments. While the incumbent banks, who then enjoyed less competitive pressures in the mortgage market, raised their interest rates, a significant portion of the NFC lending rate rise can be attributed to compositional or structural effects. More specifically, bank-level and micro loan-level modelling results suggest that the average NFC interest rates increased, mostly since clients had to switch their borrowing from exiting banks to other banks that had already been lending at higher interest rates. Interestingly, as some banks started to more actively issue loans and compete between mid-2019 and 2021, average interest rates fell in both mortgage and NFC markets. Our finding that the interest rates were mainly driven by increased concentration is consistent with Benkovskis et al. (2021), who find that high spreads of the Baltic NFC market can be partly explained by concentration, in comparison to other EA countries.

Third, while the more stringent bank capital requirements may have had some effect on lending rates, the impact was rather small. Based on our modelling results, the 8.1 p.p. rise in capital requirements throughout 2015-2019 may have heightened the NFC rates by at most 0.18 p.p., and mortgage rates by only 3 p.p. The estimates are similar in magnitude to other empirical models' results, yet are quite small, compared to figures from more theoretical DSGE settings. The somewhat limited empirical effect on lending rates may be explained by the fact that the Lithuanian banking industry already had high levels of capital; thus, the additional capital requirements were not binding. Furthermore, some of the increases in capital requirements could have been offset by decreasing average risk weights, which limited the capital cost of exposures, especially for banks that use the IRB method.

Overall, our findings imply that the increases in bank lending rates cannot be attributable to costs, but rather to a rise in shareholders' margins. Potentially, and at least to some extent, the increases in lending margins were purposeful discrete bank management decisions that were made in a relatively favourable economic environment with high credit demand, low banking competition and somewhat declining prospects of a few economic sectors. Our results suggest that policy-makers should continue, in a prudent manner, to promote competition in the local banking industry. For example, this can be done by strengthening new market participants and fostering their organic growth, in order to pose greater, yet reasonable, competition for the incumbents. Additionally, as also highlighted by Cuestas et al. (2020) and enacted in Lithuanian law, regulatory bodies should actively *ex ante* assess the impact of banking mergers and acquisitions on competition and systemic risk, and prevent these transactions in cases where market or financial stability conditions are likely to deteriorate.[36]

Notes

1. The terms mortgage, housing loan and loan for house purchase will be used interchangeably. Likewise, for NFC loans we will also use terms such as corporate, commercial or business loans.
2. On average, the highest mortgage interest rates in the EA in 2019M6 were in: Greece, Ireland, Malta, Latvia and Lithuania. Nevin (2018) found for Ireland that the increase in the net interest margin was mainly driven by cheaper funding costs. Benkovskis et al. (2021) argue that the high interest rate spreads in the Baltic countries compared to the other EA countries can be explained by the high market concentration of the financial sector. They also provide evidence that the highest financial market concentration in the EU, apart from the Baltic countries, is in Cyprus, Malta and Greece.
3. For detailed information on the banking industry and its recent developments, see Jočienė (2015) and Markevičius (2018). For a general overview of the financial sector, see the OECD (2017) report.
4. The fixation period is mostly for 2, 5, or 10 years, after which the loan rate becomes variable.
5. Until 2015, the reference rate for loans in Litas was the Vilibor - Vilnius interbank offer rate. Moreover, in some rare cases, banks also used prime pricing, i.e. internally computed reference rates that directly reflect bank's short-term funding costs, or a combination of Euribor and some other reference rate, such as EBIFN.
6. For extensive coverage of the pre-crisis period, see Ramanauskas (2005, 2007, 2011), Kuodis and Ramanauskas (2009), Ramanauskas et al. (2018).
7. For a discussion of the crisis and its drivers, as well as the increase in Vilibor and subsequent rise in Litas-denominated loan rates, see Jakelinas (2010), Šiaudinis (2010), Ramanauskas (2011) and Ramanauskas et al. (2018).
8. It should be borne in mind that the word 'normalize' is not necessarily a good description of the mortgage rate dynamics in 2012-2014, as they became relatively low compared to the rest of the EA.
9. In September 2015, Danske Bank announced plans to sell its Baltic retail portfolio to Swedbank, with the deal being finalized in June 2016. The transfer was associated with around 484 M EUR worth of retail loans in Lithuania (3.2% of outstanding loans to the private non-financial sector). In August 2016, a plan was announced to merge Nordea and DNB banks that were operating in the Baltic region. The merger was finalized in October 2017, with the new bank being named Luminor.
10. Concentration, however, is not synonymous with competition or bank conduct, as it merely reflects the number of participants and their shares in the market. For example, a simple Bertrand duopoly model suggests that in a highly concentrated market, firm conduct could be the same as in a competitive market. Non-competitive behaviour can occur when there is product differentiation, or producers experience Edgeworth-type capacity constraints, such

as capital or liquidity requirements, or asymmetric information (e.g. see Crawford et al., 2018; Stroebel, 2016) is present - all standard features of banking.

11. See Hanson et al. (2011), Dagher et al. (2016), Birn et al. (2020).
12. One has to acknowledge the possibility that a bank's management prices in the actual level of capital rather than the requirement. However, around 2016-2017 some subsidiary banks had capital ratios over 30% of RWA, because of their group-wide capital allocation decisions, yet the interest rate increases were relatively small. The latter example suggests a limited significance of voluntary buffers in pricing decisions.
13. Decreasing risk weights act as a compensatory measure to partially offset the impact of capital buffer requirements on the absolute required level of capital, hence, loan pricing. This has been the case at least for the banks, which use the Internal Ratings-Based (IRB) method for risk weight determination. The primary reasons for such IRB model outcomes and risk weight dynamics is the appreciation in asset prices, good macroeconomic conditions, as well as the increasing time-distance from the crisis of 2008-2009 and the gradual clean-up of legacy NPLs.
14. For example, between the end of 2018 and 2021, Luminor successfully issued bonds (covered and non-covered), attracting at least 1.75 B EUR in cheap long-term financing, which significantly increased the bank's self-sustainability and boosted their lending capacity. See announcements of issuance on Luminor website, by year: 2018, 2019, 2020, 2020, 2021.
15. FTP method can be adjusted to include not only the debt funding costs but capital costs, and credit risk component, as well.
16. Not to be confused with the weighted average cost of capital (WACC), used in the capital asset pricing model (CAPM), which refers to the general cost of financing, including both debt and equity. By the term *cost of capital*, we refer to shareholders' equity and bank regulatory capital, which is mostly comprised of the CET1 capital in Lithuania.
17. If this assumption is too binding, one can add an additional pricing component ($ROE_t^* \cdot \beta_t \cdot \omega_t$), related to the voluntary buffer ($\beta_t := CR_t - \mu_t$). The voluntary buffer component may be more or less stable over time, if bank management's policy is to set the actual level of capital as a constant mark-up over the requirement.
18. In a DSGE setting, assuming a similar banking structure as well as inter-temporal optimization, subject to endogenous credit risk, Karmelavičius (2021) derives a steady state loan pricing equation that resembles Equation (3).
19. The term *capital* in the WACC definition, contrary to the general use in this paper, refers to the total sum of debt and equity funding.
20. For mortgages we use the six-month reference rate, while for loans to NFCs, consumer loans and other loans to households we use three-month reference rates.
21. Operating costs, contributions to regulators, credit risk and funding costs are not broken down by sector, as this data is not available. This is a major limitation as the intensity of these costs may vary across loan segments.
22. Alternatively, DIF fees and payments on excess reserves could be assigned to the cost of debt category, however, as the series were lumped together with SRF, we categorized them as operating costs. In addition, the series available from 2015 onwards (i.e. SRF contributions and payments on excess reserves), if used in isolation, could lead to measurement error in the regression model.
23. We use Danish banks' bond yields for Danske Bank parent funding costs; Swedish - for Swedbank and SEB bank; Scandinavian (Norwegian) - for DNB, Luminor and Nordea banks; and European - for the remaining banks. We take bond yields from the *Refinitiv* database.
24. Several studies use this ratio to proxy credit risk, including Hainz et al. (2014), Cruz-García and de Guevara (2020). Similarly, Ehrenbergerova et al. (2022) use four-quarter lead of NPL ratios.
25. To see this, note that the μ capital requirement entails the following inequality: $E \geq \mu\omega L$. After rearranging terms, we get: $E/L \geq \mu\omega$, which is essentially a leverage ratio requirement.
26. HHI calculated using loan flows might be endogenous to loan interest margins; therefore, for a robustness check we also compute the HHI index using data on loan portfolio. Overall, HHI

is a widely used proxy for market concentration (e.g. see Corvoisier & Gropp, 2002; Valverde & Fernández, 2007, among others).

27. Time fixed effects are not used, as they would not allow to assess the impact of market concentration, which is segment- and not bank-specific. In addition, the use of time fixed effects would also make it potentially difficult to assess the impact of capital requirements, which were increased in 2015 across all banks.
28. It should be noted that the interpretation is based on the assumption made in Section 3.2.1 that the money market interest rate (Avibor) is fully passed on to the cost of deposits. It therefore implies an increase in the deposit margin.
29. These results are in line with Ehrenbergerova et al. (2022), who study loan interest rate and margin determinants in the Czech Republic over the period 2004-2019 and find that banks tend to charge higher margins on loans to households due to generally higher risk premiums compared to corporate loans.
30. The list of empirical studies on this topic is not exhaustive, there are other studies by Basten (2020), Glancy and Kurtzman (2022), among others.
31. This source of funding became negligible over time, now amounting to around 1%.
32. The model was first presented and published as part of Lietuvos bankas ir Konkurencijos taryba (2021).
33. The data covers not only the issuance of loans by banks, but also includes credit unions.
34. Note that this type of regression is purely cross-sectional, as we only model interest margins during the initiation phase of each loan.
35. For example, firms operating in the construction sector have different operating costs, compared to firms in the wholesale and trade sector. In addition, if a firm is located in a city with a high cost of living - this is usually reflected in its employee wages as well as operating costs in that city.
36. For example, a recent change in the Lithuanian Law on Banks allows Bank of Lithuania to prevent mergers and acquisitions in order to limit the risk to financial stability that may arise from excessive concentration in the banking sector https://www.lb.lt/lt/naujienos/lietuvos-banko-valdybos-nutarimai-194 (news in Lithuanian), https://www.lb.lt/en/financial-stability-instruments-1#ex-1-5 (link in English).

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References

Baker, M., & Wurgler, J. (2015). Do strict capital requirements raise the cost of capital? Bank regulation, capital structure, and the low-risk anomaly. *American Economic Review*, *105*(5), 315-320. https://doi.org/10.1257/aer.p20151092

Basten, C. (2020). Higher bank capital requirements and mortgage pricing: Evidence from the counter-cyclical capital buffer. *Review of Finance*, *24*(2), 453-495.

Benkovskis, K., Tkacevs, O., & Vilerts, K. (2021). *Interest rate spreads in the Baltics and the rest of the Euro area: Understanding the factors behind the differences* (Discussion papers 2021/02). Latvijas Banka.

Bichsel, R., Lambertini, L., Mukherjee, A., & Wunderli, D. (2022). The pass-through of bank capital requirements to corporate lending spreads. *Journal of Financial Stability*, *58*, 100910. https://doi.org/10.1016/j.jfs.2021.100910

Birn, M., de Bandt, O., Firestone, S., Gutiérrez Girault, M., Hancock, D., Krogh, T., Mio, H., Morgan, D. P., Palvia, A., Scalone, V., Straughan, M., Uluc, A., von Hafften, A. H., & Warusawitharana, M. (2020). The costs and benefits of bank capital - A review of the literature. *Journal of Risk and Financial Management*, *13*(4), 74. https://doi.org/10.3390/jrfm13040074

BIS (2010). *Assessing the macroeconomic impact of the transition to stronger capital and liquidity requirements* (Final report). Bank for International Settlements, Macroeconomic Assessment Group.

Budnik, K., Affinito, M., Barbic, G., Hadj, S. B., Chretien, E., Dewachter, H., Gonzalez, C. I., Hu, J., Jantunen, L., Jimborean, R., Manninen, O., Martinho, R., Mencia, J., Mousarri, E., Naruševišius, L., Nicoletti, G., O'Grady, M., Ozsahin, S., Pereira, A. R., …Velasco, S. (2019). *The benefits and costs of adjusting bank capitalisation: Evidence from Euro area countries* (Working Paper Series 2261). European Central Bank.

Clerc, L., Derviz, A., Mendicino, C., Moyen, S., Nikolov, K., Stracca, L., Suarez, J., & Vardoulakis, A. P. (2015). Capital regulation in a macroeconomic model with three layers of default. *International Journal of Central Banking*, *15*(3), 9-63.

Corvoisier, S., & Gropp, R. (2002). Bank concentration and retail interest rates. *Journal of Banking & Finance*, *26*(11), 2155-2189. https://doi.org/10.1016/S0378-4266(02)00204-2

Crawford, G. S., Pavanini, N., & Schivardi, F. (2018). Asymmetric information and imperfect competition in lending markets. *American Economic Review*, *108*(7), 1659-1701. https://doi.org/10.1257/aer.20150487

Cruz-García, P., & de Guevara, J. F. (2020). Determinants of net interest margin: The effect of capital requirements and deposit insurance scheme. *The European Journal of Finance*, *26*(11), 1102-1123. https://doi.org/10.1080/1351847X.2019.1700149

Cuestas, J. C., Lucotte, Y., & Reigl, N. (2020). Banking sector concentration, competition and financial stability: The case of the Baltic countries. *Post-Communist Economies*, *32*(2), 215-249. https://doi.org/10.1080/14631377.2019.1640981

Dagher, J., Dell'Ariccia, G., Laeven, L., Ratnovski, L., & Tong, H. (2016). Benefits and costs of bank capital. *Staff Discussion Notes*, *16*(04), 1. https://doi.org/10.5089/9781498387712.006

De Bandt, O., & Chahad, M. (2016). *A DSGE model to assess the post-crisis regulation of universal banks* (Working papers 602). Banque de France.

De Bandt, O., Durdu, B., Ichiue, H., Mimir, Y., Mohimont, J., Nikolov, K., Roehrs, S., Sahuc, J.-G., Scalone, V., & Straughan, M. (2022). *Assessing the impact of Basel III: Evidence from structural macroeconomic models* (Working papers 864). Banque de France.

Dermine, J. (2013). Fund transfer pricing for deposits and loans, foundation and advanced. *Journal of Financial Perspectives*, *1*(1), 169-178.

Ehrenbergerova, D., Hodula, M., & Gric, Z. (2022). Does capital-based regulation affect bank pricing policy? *Journal of Regulatory Economics*, *61*(2), 135-167. https://doi.org/10.1007/s11149-022-09448-5

Gambacorta, L. (2008). How do banks set interest rates? *European Economic Review*, *52*(5), 792-819. https://doi.org/10.1016/j.euroecorev.2007.06.022

Gerali, A., Neri, S., Sessa, L., & Signoretti, F. (2010). Credit and banking in a DSGE model of the Euro area. *Journal of Money, Credit and Banking*, *42*(S1), 107-141. https://doi.org/10.1111/jmcb.2010.42.issue-s1

Glancy, D., & Kurtzman, R. (2022). How do capital requirements affect loan rates? Evidence from high volatility commercial real estate. *The Review of Corporate Finance Studies*, *11*(1), 88-127. https://doi.org/10.1093/rcfs/cfab013

Grant, J. (2011). *Liquidity transfer pricing: A guide to better practice* (Occasional paper 10). Bank for International Settlements.

Gregor, J., Melecký, A., & Melecký, M. (2021). Interest rate pass-through: A meta-analysis of the literature. *Journal of Economic Surveys*, *35*(1), 141-191. https://doi.org/10.1111/joes.v35.1

Hainz, C., Horváth, R., & Hlaváček, M. (2014). The interest rate spreads in the Czech Republic: Different loans, different determinants?. *Economic Systems*, *38*(1), 43-54. https://doi.org/10.1016/j.ecosys.2013.10.002

Hanson, S. G., Kashyap, A. K., & Stein, J. C. (2011). A macroprudential approach to financial regulation. *Journal of Economic Perspectives*, *25*(1), 3-28. https://doi.org/10.1257/jep.25.1.3

Jakeliūnas, S. (2010). *Lietuvos krizės anatomija*. Kitos knygos.

Jočienė, A. (2015). *Business models of Scandinavian banks subsidiaries in the Baltics: Idenfitication and analysis* (Occasional paper series 5). Bank of Lithuania.

Karmelavičius, J. (2021). Risky mortgages and macroprudential policy: A calibrated DSGE model for Lithuania. *Ekonomika*, *100*(2), 6-39. https://doi.org/10.15388/Ekon.2021.100.2.1

Karmelavičius, J., Petrokaitė, A., & Mikaliūnaitė-Jouvanceau, I. (2022). *Housing and credit misalignments in a two-market disequilibrium framework* (Occasional paper series 42/2022). Bank of Lithuania.

Kashyap, A., Stein, J. C., & Hanson, S. G. (2010). *An analysis of the impact of 'substantially heightened' capital requirements on large financial institutions*. mimeo, Booth School of Business, University of Chicago.

King, M. R. (2010). *Mapping capital and liquidity requirements to bank lending spreads* (BIS working papers 324). Bank for International Settlements.

Kuodis, R., & Ramanauskas, T. (2009). From boom to bust: Lessons from Lithuania. *Pinigų Studijos*, *13*(1), 96-104.

Leroy, A., & Lucotte, Y. (2015). *Structural and cyclical determinants of bank interest rate pass-through in Eurozone* (Working papers 198). Narodowy Bank Polski.

Lietuvos bankas. (2021). *Finansinio stabilumo apžvalga*. Financial Stability Review, Bank of Lithuania.

Lietuvos bankas ir Konkurencijos taryba. (2021). *Smulkiojo ir vidutinio verslo finansavimo galimybių tyrimas* (Analizė ir tyrimai Nr. 11/2021). Lietuvos bankas.

Markevičius, J. (2018). *Overview of Lithuania's banking sector sustainability in the post-crisis environment* (Occasional paper series 21). Bank of Lithuania.

Martins, B., & Schechtman, R. (2013). *Loan pricing following a macro prudential within-sector capital measure* (Working papers series 323). Central Bank of Brazil, Research Department.

Maudos, J., & Fernandez de Guevara, J. (2004). Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking & Finance*, *28*(9), 2259-2281. https://doi.org/10.1016/j.jbankfin.2003.09.004

Moss, K., & Kunghehian, N. (2018). *Funds-transfer-pricing in Banks: What are the main drivers?* (White paper). Moody's Analytics.

Müller, C., Juelsrud, R., & Andersen, H. (2021). *Risk-based pricing in competitive lending markets* (Working papers 19/2021). Norges Bank Research.

Naruševičius, L. (2017). *Bankų naujų paskolų palūkanų normų nustatymas* [Bank setting of new lending rates]. Unpublished topical commentary at the Bank of Lithuania.

Nevin, C. (2018). *Irish retail bank profitability 2003-2018* (Technical report). Central Bank of Ireland.

OECD. (2017). *Lithuania: Review of the financial system*. Organisation for Economic Cooperation and Development. https://www.oecd.org/finance/Lithuania-financial-markets-2017.pdf

Ramanauskas, T. (2005). Bankų kredito didėjimas makroekonominiu požiūriu [Assessment of bank credit growth from macroeconomic perspective]. *Pinigų Studijos*, *9*(3), 78-97.
Ramanauskas, T. (2007). Assessment of credit growth in Lithuania. In C. E. Enoch & I. Otker-Robe (Eds.), *Rapid credit growth in Central and Eastern Europe: Endless boom or early warning?* Palgrave MacMillan.
Ramanauskas, T. (2011). *What caused the recent boom-and-bust cycle in Lithuania? Evidence from a macromodel with the financial sector* (Working paper series 10). Bank of Lithuania.
Ramanauskas, T., Matkėnaitė, S., & Rutkauskas, V. (2018). *Application of the integrated accounts framework for empirical investigation of the economic and financial cycle in Lithuania* (Occasional paper series 20). Bank of Lithuania.
Shamshur, A., & Weill, L. (2019). Does bank efficiency influence the cost of credit?. *Journal of Banking & Finance*, *105*, 62-73. https://doi.org/10.1016/j.jbankfin.2019.05.002
Šiaudinis, S. (2010). What drove the 6-month vilibor during the late-2000's economic crisis? *Pinigų Studijos*, *14*(2), 5-28.
Slovik, P., & Cournède, B. (2011). *Macroeconomic impact of Basel III* (OECD economics department working papers 844). OECD.
Stroebel, J. (2016). Asymmetric information about collateral values. *The Journal of Finance*, *71*(3), 1071-1112. https://doi.org/10.1111/jofi.2016.71.issue-3
Valinskytė, N., Ivanauskaitė, E., Kulikauskas, D., & Krėpšta, S. (2018). *Leverage ratio as a macroprudential policy instrument* (Occasional paper series 18). Bank of Lithuania.
Valverde, S. C., & Fernández, F. R. (2007). The determinants of bank margins in European banking. *Journal of Banking & Finance*, *31*(7), 2043-2063. https://doi.org/10.1016/j.jbankfin.2006.06.017
Van Leuvensteijn, M., Sørensen, C. K., Bikker, J. A., & A. A. van Rixtel (2013). Impact of bank competition on the interest rate pass-through in the Euro area. *Applied Economics*, *45*(11), 1359-1380. https://doi.org/10.1080/00036846.2011.617697
Wyle, R. J., & Tsaig, Y. (2011). *Implementing high value funds transfer pricing systems* (White paper). Moody's Analytics.

Appendix

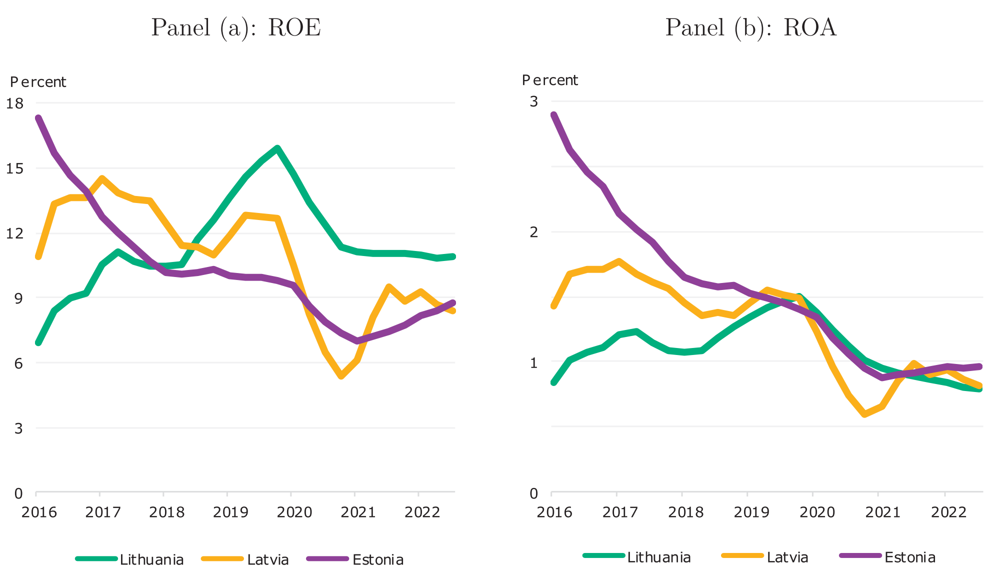

Figure A1. ROE and ROA in Lithuania's banking sector. Panel (a): ROE. Panel (b): ROA.

Notes: return on equity (ROE) in panel (a) and return on assets (ROA) in panel (b) presented as four-quarter moving averages. The data is from EBA risk dashboard

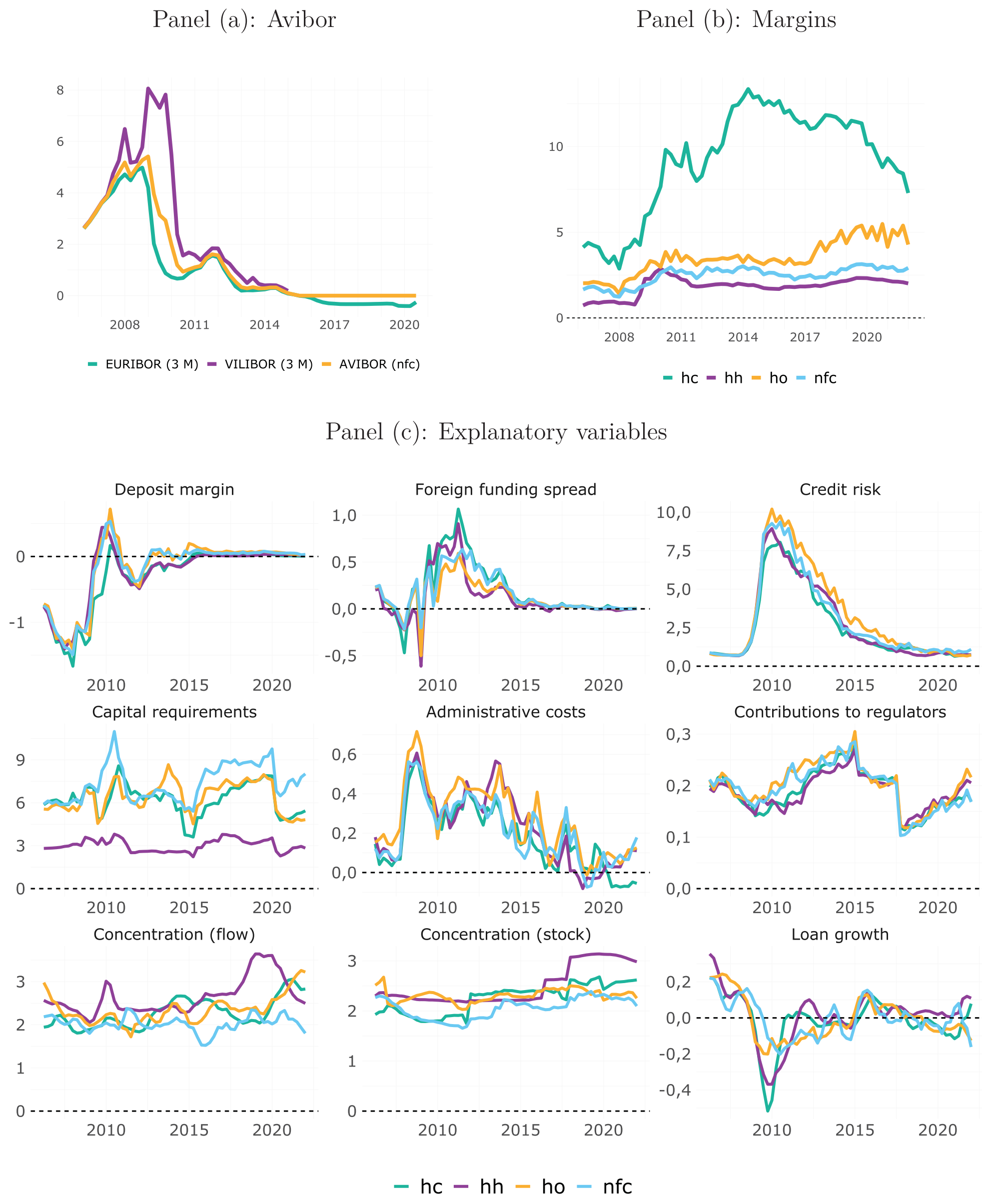

Figure A2. Dependent and explanatory variables. Panel (a): Avibor. Panel (b): Margins. Panel (c): Explanatory variables.

Notes: Panel (a) shows Avibor rate, which is a weighted average between the Vilibor and Euribor reference rates computed as: (i) weighted average of Euribor and Vilibor (reference rate for Litas-denominated loans) before 2015; (ii) Euribor as of Lithuania's adoption of the Euro in 2015. Bank-sector-specific loan flows are used as weights. Panel (b) shows the weighted average interest margins on consumer loans (hc), mortgages (hh), other loans to households (ho) and loans to non-financial corporations (nfc). Panel (c) shows the weighted average of the explanatory variables used in the regression analysis. All variables, except those in the last row, are in percentage points. Concentration is measured by the Herfindahl-Hirschman Index (HHI) divided by 1000, loan growth is expressed as an average annual logarithmic difference in sector-specific loan flows.

Table A1. Descriptive statistics of the main bank-level variables.

(a) Dependent variable - loan margins				
Statistic	Mean	St. Dev.	Min	Max
Loans to business (NFC)	2.96	1.23	0.28	7.62
Mortgages	2.08	0.89	0.46	5.30
Other loans to households	3.66	1.43	0.62	12.32
Consumer loans	8.05	4.48	1.08	18.67
(b) Explanatory variables				
Statistic	Mean	St. Dev.	Min	Max
Administrative expenses	0.48	0.56	−2.20	2.27
Contributions to regulators	0.19	0.07	0.05	0.37
Cost of deposit funding	−0.03	0.61	−2.80	3.70
Cost of foreign funding	0.17	0.37	−1.52	2.31
Credit risk	3.63	3.86	0.19	21.14
Capital requirements	6.57	2.75	1.42	16.09
Concentration (flow)	2.30	0.38	1.52	3.64
Concentration (stock)	2.26	0.30	1.65	3.14
Loan demand	−0.0003	0.13	−0.52	0.35

Notes: The table shows summary statistics of bank-level data for each series used in the regression analysis in Section 4. Concentration is measured by the Herfindahl-Hirschman Index divided by 1000, loan demand is expressed as an average annual logarithmic difference in sector-specific loan flows, other variables are in percentage points. For more detail, see Section 4.1.

Table A2. Regression results, using different HHI.

	Dependent variable: loan interest margin				
	all (1)	nfc (2)	hh (3)	ho (4)	hc (5)
Administrative expenses	0.14* (0.07)	0.08 (0.09)	0.29*** (0.07)	−0.15 (0.12)	0.85** (0.40)
Contributions to regulators	0.80** (0.38)	1.04** (0.44)	0.89** (0.36)	−4.47*** (1.02)	9.35*** (2.43)
Cost of deposit funding	0.80*** (0.06)	0.59*** (0.05)	0.59*** (0.05)	1.51*** (0.13)	4.14*** (0.32)
Cost of foreign funding	0.32*** (0.10)	0.26* (0.14)	0.40*** (0.08)	−0.01 (0.22)	−1.27*** (0.38)
Credit risk	0.05*** (0.01)	0.06*** (0.02)	0.08*** (0.01)	−0.06** (0.02)	0.23*** (0.06)
Capital requirements	0.004 (0.01)	0.03** (0.01)	0.03* (0.02)	0.07*** (0.02)	0.11* (0.06)
Concentration (stock)	0.81*** (0.09)	0.87*** (0.21)	0.58*** (0.05)	−1.06** (0.50)	1.74** (0.72)
Loan demand	−0.003 (0.004)	−0.002 (0.004)	0.04 (0.14)	0.01 (0.60)	1.30 (1.04)
Bank-sector FE	YES	-	-	-	-
Bank FE	-	YES	YES	YES	YES
Weighted regression	YES	YES	YES	YES	YES

(*Continued*)

Table A2. Continued.

	Dependent variable: loan interest margin				
	all	nfc	hh	ho	hc
	(1)	(2)	(3)	(4)	(5)
Robust SE	YES	YES	YES	YES	YES
Adjusted	0.34	0.33	0.59	0.25	0.6
Observations	1,708	483	408	431	386

Note: This table shows the results of robustness checks when replacing the HHI loan flow-based measure of concentration (see results in Table 1) with HHI measured using loan portfolio data. For a comparison of both measures, see Panel (c) of Figure A2. Column (1) shows the estimates for a model that considers the overall banking sector, and columns (2)-(5) show estimates for each loan segment separately, for margins on loans to NFCs (*nfc*), mortgages (*hh*), other loans to households (*ho*) and consumer loans *hc*, respectively. All the estimates are weighted by the size of the bank's loan portfolio, in order to account for considerable heterogeneity with respect to the volume of loans issued by banks operating in Lithuania. The sample period is 2006-2021. Robust standard errors are presented in the parentheses. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. *Within R*-squared values are reported.

Table A3. Regression results, including interaction term.

	Dependent variable: loan interest margins		
	all	nfc	hh
	(1)	(2)	(3)
Administrative expenses	0.11	0.02	0.32***
	(0.09)	(0.11)	(0.08)
Contributions to regulators	1.23**	1.23**	0.69
	(0.49)	(0.61)	(0.42)
Cost of deposit funding	0.89***	0.71***	0.66***
	(0.06)	(0.05)	(0.06)
Cost of foreign funding	0.23**	0.16	0.32***
	(0.11)	(0.14)	(0.07)
Credit risk	0.02**	0.01	0.05***
	(0.01)	(0.01)	(0.01)
Capital requirements	−0.02	0.01	0.06*
	(0.02)	(0.02)	(0.03)
Concentration (flow)	0.55***	0.27	0.46***
	(0.11)	(0.19)	(0.07)
Loan demand	−0.01	−0.01	0.10
	(0.01)	(0.01)	(0.21)
Administrative expenses (2015-2019)	−0.18*	−0.24*	−0.17*
	(0.10)	(0.14)	(0.09)
Contributions to regulators (2015-2019)	−0.90	−1.39*	−0.68*
	(0.59)	(0.73)	(0.40)
Cost of deposit funding (2015-2019)	2.23***	2.27***	0.99
	(0.36)	(0.44)	(0.66)
Cost of foreign funding (2015-2019)	0.70	0.42	0.38
	(0.54)	(0.66)	(0.39)
Credit risk (2015-2019)	−0.09**	−0.14**	−0.005
	(0.04)	(0.06)	(0.03)
Capital requirements (2015-2019)	0.06***	0.09***	0.01
	(0.01)	(0.03)	(0.04)

(*Continued*)

Table A3. Continued.

	Dependent variable: loan interest margins		
	all	nfc	hh
	(1)	(2)	(3)
Concentration (flow) (2015-2019)	−0.06	−0.23	−0.02
	(0.05)	(0.16)	(0.04)
Loan demand (2015-2019)	0.01	0.01	−0.15
	(0.01)	(0.01)	(0.24)
Bank-sector FE	YES	-	-
Bank FE	-	YES	YES
Weighted regression	YES	YES	YES
Robust SE	YES	YES	YES
Adjusted R^2	0.35	0.33	0.61
Observations	1708	483	408

Note: This table shows the regression estimates of columns (1)-(3) of Table 1 when an interaction term is included for the period from mid-2015 to 2019. Coefficients related to this period are in rows 9-16. Column (1) shows the estimates for a model that considers the overall banking sector, columns (2)-(3) show estimates, respectively, for margins on loans to NFC's *(nfc)* and mortgages *(hh)*. All the estimates are weighted by the size of the bank's loan portfolio, in order to account for a considerable heterogeneity with respect to the volume of loans issued by banks operating in Lithuania. The full sample period is 2006-21. Robust standard errors are presented in the parentheses. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. *Within R*-squared values are reported.