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Details matter: loan pricing and transmission of monetary policy in the euro area

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This paper contains research conducted within the network “Challenges for Monetary Policy Transmission in a Changing World Network” (ChaMP). It consists of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the European System of Central Banks (ESCB).

ChaMP is coordinated by a team chaired by Philipp Hartmann (ECB), and consisting of Diana Bonfim (Banco de Portugal), Margherita Bottero (Banca d’Italia), Emmanuel Dhyne (Nationale Bank van België/Banque Nationale de Belgique) and Maria T. Valderrama (Oesterreichische Nationalbank), who are supported by Melina Papoutsi and Gonzalo Paz-Pardo (both ECB), 7 central bank advisers and 8 academic consultants.

ChaMP seeks to revisit our knowledge of monetary transmission channels in the euro area in the context of unprecedented shocks, multiple ongoing structural changes and the extension of the monetary policy toolkit over the last decade and a half as well as the recent steep inflation wave and its reversal. More information is provided on its website.

Abstract

Does the maturity of the relevant risk-free rate influence the strength of monetary policy pass-through to interest rates on new loans? To address this question, we present novel empirical evidence on lending practices across all euro area countries, using AnaCredit data covering nearly seven million new loans issued to non-financial corporations in 2022–2023. We document substantial variation in (a) the prevalence of fixed- vs floating-rate loans, (b) rate fixation periods, and (c) reference rates. This variation results in lending rates being exposed to different segments of the risk-free rate yield curve which, in turn, influence their sensitivity to monetary policy changes. We show that loans linked to shorter-maturity risk-free rates experience more pronounced monetary pass-through. Importantly, this effect is not purely mechanical, as part of the effect is offset by adjustments in the premium, revealing previously less-explored heterogeneity in the pass-through to lending rates.

Keywords: Lending Rates, Interest Rate Pass-Through, Fixed-Rate Loans, Floating-Rate Loans

JEL Codes: E52, E43, G21, E58

Non-technical summary

This study leverages unique loan-level information from the euro area's credit dataset (AnaCredit), encompassing nearly seven million newly issued loans to non-financial corporations (NFCs) in 2022–2023, to examine the lending practices across all euro area countries and investigate how these can shape the transmission of monetary policy.

The mere classification of loans into fixed- or floating-rate fails to fully capture their distinct sensitivity to monetary policy changes. This study shows that even within these two broad loan categories, other characteristics play a significant role in the transmission of monetary policy. First, the maturity of the reference rate for floating-rate loans can vary substantially. Loans with shorter reference rate maturities are more exposed to changes in monetary policy, as their interest rates quickly reflect shifts in short-term rates. Similarly, for fixed-rate loans, the degree of sensitivity depends on loan maturity. Newly issued fixed-rate loans with shorter maturities are priced based on shorter-term reference rates, which tend to closely track changes in policy rates. By contrast, longer-maturity fixed-rate loans are less responsive, as the underlying reference rate reacts more moderately to monetary policy shifts.

The fact-finding exercise of the study provides empirical evidence about previously less-explored variation in lending practices across euro area. Specifically, it documents the prevalence of fixed- and floating-rate loans, the differences in duration of rate fixation periods as well as reference rates used in loan pricing. Building on this novel empirical evidence the study moves beyond the binary classification of fixed- vs floating-rate loans and proposes a nuanced measure of loan sensitivity to short-term rate changes. The main advantage of the approach is that it accounts for the maturity of the risk-free rate that is relevant for each loan. For fixed-rate loans, this corresponds to loan maturity at origination, while for floating-rate loans, to maturity of the underlying reference rate. Thus, the study identifies the specific segment of the risk-free rate yield curve that influences loan's interest rate.

A key insight of the paper is a decomposition of the loan interest rate into the relevant risk-free rate at the time of issuance and the corresponding premium which serves as a more granular measure of sensitivity reflecting the maturity of the relevant risk-free rate. Since monetary policy impacts risk-free rates differently depending on their maturity, the study shows that differences in maturity of relevant risk-free rates contributed to variations in how lending rates reacted during the post-pandemic monetary tightening. The interest rate increase for new

loans between 2022Q1 and 2023Q4 was largely driven by the rise in the relevant risk-free rates. Importantly, the rise in risk-free rates was partially offset by a decline in the premium, which limited the overall rise in lending rates. This smoothing role of the premium is consistently present throughout the sample period and is not driven by time-varying bank heterogeneity. These results suggest that banks adjusted premium in a way that limits the increase in lending rates for loans most exposed to rising short-term risk-free rates. This helped to smooth cross-loan differences in lending rate changes that would have been larger if lending rates had moved purely in line with the relevant risk-free rates.

Finally, the study analyzes new loans to NFCs issued within a six-week period around 15 ECB Governing Council (GovC) meetings held between February 2022 and October 2023 to show that pass-through of unexpected changes in monetary policy rates strengthens for new loans linked to shorter-maturity risk-free rates – regardless of whether they are fixed- or floating-rate. However, this effect is not purely mechanical, as part of the increase in risk-free rates is offset by adjustments in premium.

From a monetary policy perspective these results are important as they reveal previously less-explored heterogeneity in the pass-through of monetary policy to lending rates within the single monetary union that depends on how monetary policy affects the shape of the yield curve.

1 Introduction

Despite the single currency and common monetary policy, credit markets across euro area member states exhibit significant heterogeneity in several dimensions (Altavilla, Gürkaynak, and Quaedvlieg 2024; Kosekova, Maddaloni, Papoutsi, and Schivardi 2023). One notable example is the prevalence of fixed- versus floating-rate loans (Albertazzi, Fringuellotti, and Ongena 2024). Fixed-rate loans feature nominal interest rates that remain constant over the entire duration of the loan, whereas floating-rate loans have interest rates that change over time, typically indexed to a reference rate. The latter have been shown to be more sensitive to short-term money market rate fluctuations, amplifying the transmission of monetary policy to both new and outstanding loans (Ippolito, Ozdagli, and Perez-Orive 2018; Tzamourani 2021).

In this paper, we argue that the mere classification of loans into fixed- or floating-rate fails to fully capture their distinct sensitivity to monetary policy changes. Our results show that even within these two broad loan categories, other characteristics play a significant role in the transmission of monetary policy. First, the maturity of the reference rate for floating-rate loans can vary substantially.[1] Loans with shorter reference rate maturities are more exposed to changes in monetary policy, as their interest rates quickly reflect shifts in short-term rates. Similarly, for fixed-rate loans, the degree of sensitivity depends on loan maturity (Gürkaynak, Karasoy-Can, and Lee 2022). Newly issued fixed-rate loans with shorter maturities are priced based on shorter-term reference rates, which tend to closely track changes in policy rates. By contrast, longer-maturity fixed-rate loans are less responsive, as the underlying reference rate reacts more moderately to monetary policy shifts.[2] Taken together, a fixed-rate loan with, for instance, a six-month maturity will most likely have an interest rate closer to the monetary policy rate than a floating-rate loan with a twelve-month reference rate.

In this study we address the following question: does the maturity of the relevant risk-free rate affect the strength of monetary policy pass-through to interest rates on new loans? We leverage unique loan-level information from the euro area's credit dataset (AnaCredit), encompassing nearly seven million newly issued loans to non-financial corporations (NFCs) in 2022–2023, to examine the lending practices across all euro area countries and investigate how

[1] The frequency of interest rate adjustments can also vary to a large extent. However, our analysis shows that this, in most cases, aligns closely with the maturity of the underlying reference rate.

[2] For outstanding fixed-rate loans the residual maturity is another important factor for the sensitivity to monetary policy changes. Loans with shorter residual maturities are more exposed to the prevailing monetary policy rates if they need to be refinanced, which is particularly important during periods of sharp changes in interest rates, such as the post-pandemic monetary tightening.

these can shape the transmission of monetary policy.[3] We first document the prevalence of fixed- and floating-rate loans, the differences in duration of rate fixation periods as well as reference rates used in loan pricing. We build on this novel empirical evidence to move beyond the binary classification of fixed- vs floating-rate loans and propose a nuanced measure of loan sensitivity to short-term rate changes. The main advantage of our approach is that we are able to account for the maturity of the risk-free rate that is relevant for each loan. For fixed-rate loans, this corresponds to loan maturity at origination, while for floating-rate loans, to the maturity of the underlying reference rate. Thus, we identify the specific segment of the risk-free rate yield curve that influences a loan's interest rate.

The fact-finding exercise provides empirical evidence about previously less-explored variation in lending practices across the euro area: (i) Floating-rate loans predominate in smaller euro area countries (e.g. Latvia, Lithuania, Cyprus, Finland, Estonia and Ireland), accounting for approximately 90% of new loans in 2022–2023, whereas they account for only about one-third in the Netherlands, Belgium and Germany. (ii) For floating-rate loans, much of the observed variation across countries stems from the maturity of reference rates, which range from overnight rates to 12-month rates. For example, although Cyprus and Estonia have a high share of floating-rate loans, the reference rate maturities differ substantially. In Cyprus, over one-third of floating-rate loans are tied to reference rates with maturities of one month or less, whereas in Estonia, the majority are benchmarked to reference rates with maturities of three to six months. (iii) For fixed-rate loans, the variation arises from differences in loan maturity which, again, varies considerably across euro area countries. In France and Italy, fixed-rate loans account for more than half of all new loans to NFCs, yet their typical maturities differ markedly. In Italy, most fixed-rate loans have a maturity of one year or less while in France, the majority exceeds five years or even ten years.

In light of this observed variation across euro area countries, we provide a more granular measure of sensitivity reflecting the maturity of the relevant risk-free rate. Specifically, we decompose the loan interest rate into the relevant risk-free rate at the time of issuance and the corresponding premium.[4] We show that the average maturity of the relevant risk-free rate for

[3] We consider the EA-19 composition of the euro area valid in 2022: Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. Croatia adopted the euro on January 1, 2023, and AnaCredit data for Croatia is available starting from only 2023.

[4] Overnight Indexed Swap (OIS) rates serve as a robust proxy for risk-free rates, as they are directly linked to central bank policy rates. OIS rates reflect market expectations of monetary policy actions, since they are derived from overnight lending rates, which are closely guided by central bank interventions. Additionally, OIS

new loans ranges from approximately six months in Latvia and Ireland to over five years in the Netherlands, Malta and France. However, the average maturity of the relevant risk-free rates does not show a clear distinction between countries where fixed-rate loans predominate and those where floating-rate loans are more prevalent.

Since monetary policy impacts risk-free rates differently depending on their maturity, we next show that differences in the maturity of relevant risk-free rates contributed to variations in how lending rates reacted during the post-pandemic monetary tightening. The interest rate increase for new loans between 2022Q1 and 2023Q4 was largely driven by the rise in the relevant risk-free rates. The contribution of these rates was particularly pronounced in some euro area countries such as Latvia and Ireland, where floating-rate loans with short fixation periods predominate, as well as Italy, where shorter-maturity fixed-rate loans are common. In contrast, countries like the Netherlands and France, where longer-term risk-free rates play a more significant role in loan pricing, experienced a more moderate increase in lending rates due to smaller increases in these rates. This finding holds after controlling for a large set of loan-level variables and a rich set of fixed effects to account for differences in lending rate levels across countries, macroeconomic sectors, regions and firm size. Importantly, the rise in risk-free rates was partially offset by a decline in the premium,[5] which limited the overall rise in lending rates. We find that this smoothing role of the premium is consistently present throughout the sample period and is not driven by time-varying bank heterogeneity. These results suggest that banks adjusted the premium in a way that limits the increase in lending rates for loans most exposed to rising short-term risk-free rates. This helped to smooth cross-loan differences in lending rate changes that would have been larger if lending rates had moved purely in line with the relevant risk-free rates.

We go one step further and analyze new loans to NFCs issued within a six-week period around 15 ECB Governing Council (GovC) meetings held between February 2022 and October 2023 to show that pass-through of unexpected changes in monetary policy rates strengthens for new loans linked to shorter-maturity risk-free rates. Our findings reveal that loans with shorter maturities of the relevant risk-free rates – regardless of whether they are fixed- or floating-rate – experience a more pronounced pass-through of monetary policy surprises. How-

markets are highly liquid and transparent, enabling real-time tracking of how monetary policy decisions influence interest rate expectations.

[5] The term "premium" used in this study does not refer exclusively to compensation for the default risk of the borrower. Instead, it encompasses compensation for all risks a lender assumes beyond the risk-free alternative.

ever, this effect is not purely mechanical, as part of the increase in risk-free rates is offset by adjustments in the premium. Using our estimates, a straightforward calculation suggests that the variation in the extent to which loans are exposed to short-term rates has significant implications for the aggregate pass-through from monetary policy rates to lending rates. Specifically, the pass-through in the euro area is approximately 13% stronger than it would be if all new loans had fixed interest rates for their entire duration. Conversely, the pass-through is significantly weaker (by about 30%) than if all loans were tied to risk-free rates with maturities of one month or less (e.g. if all loans were floating-rate loans linked to the 1-month EURIBOR). From a monetary policy perspective, these results are important as they reveal previously less-explored heterogeneity in the pass-through of monetary policy to lending rates within the single monetary union that depends on how monetary policy affects the shape of the yield curve.

Our study contributes to two strands of the existing literature. First, we add to previous studies that have documented significant variation in lending practices across euro area countries. Kosekova et al. (2023) focus on the 11 largest euro area economies, and reveal substantial cross-country differences across multiple dimensions, including the use of various loan instruments, loan maturities, the number of bank-firm relationships and the reliance on the main bank. Additionally, they identify large cross-country differences in average lending rates, which persist even after controlling for variations in firm characteristics and loan instrument types. Similarly, Altavilla et al. (2024) document substantial differences in lending rates across the 10 largest euro area countries, which they subsequently decompose into country-, bank-, firm-, and loan-level factors. Their analysis shows that country-level fixed effects account for approximately half of the variance in lending rates at the loan level, with the remaining variation being largely explained by bank- and firm-level factors. We extend this literature by providing detailed insights into how lending rates are constructed across euro area countries, focusing particularly on loans' sensitivity to changes in short-term rates.[6]

Although answering the question of why there are cross-country differences in lending practices falls outside the scope of this paper, the existing literature suggests that the observed variation reflects a complex set of determinants that includes various borrower and lender characteristics, macroeconomic conditions, information asymmetries, and regulatory or institutional factors. For example, Albertazzi et al. (2024) find that borrower-side factors play a prominent

[6] Importantly, we also include the smaller euro area countries in our sample, a step that further highlights the observed heterogeneity in lending practices.

role in driving the prevalence of fixed-rate mortgage loans. They also show that the share of new fixed-rate loans is significantly higher in countries with lower historical inflation volatility. In the context of corporate lending, Vickery (2008) shows that credit-constrained, bank-dependent firms are more likely to opt for fixed-rate debt to hedge against the risk of rising interest costs. On the supply side, banks that are sensitive to rising interest rates prefer a higher proportion of floating-rate loans. Banks' interest rate preferences also depend on capital requirements and regulatory frameworks, among other factors.[7]

Second, we add to a growing body of literature that lists reasons why monetary policy transmission might vary across countries, banks, firms and loan types (see Altavilla, Canova, and Ciccarelli 2020; Altavilla, Andreeva, Boucinha, and Holton 2019; Beyer 2024; Bittner, Bonfim, Heider, Saidi, Schepens, and Soares 2022; Fricke, Greppmair, and Paludkiewicz 2024; Holton and Rodriguez d'Acri 2018; Horvath, Kotlebova, and Siranova 2018; Kashyap and Stein 2000; Kho 2023, among many others). In particular, we add to the literature examining the role of floating-rate loans in amplifying the transmission mechanism of monetary policy. While most of the previous studies have focused of mortgage markets (Corsetti, Duarte, and Mann 2020; Di Maggio, Kermani, Keys, Piskorski, Ramcharan, Seru, and Yao 2017; Eichenbaum, Rebelo, and Wong 2022; Flodén, Kilström, Sigurdsson, and Vestman 2020; Garriga, Kydland, and Šustek 2017; Pica 2022; Tzamourani 2021), transmission to firms is relatively less explored (with a couple of notable exceptions: Core, Marco, Eisert, and Schepens 2024; Gürkaynak et al. 2022; Ippolito et al. 2018).

The amplification role of floating-rate loans arises through two distinct mechanisms: first, the pricing of new loans reacts more strongly to changes in monetary policy rates, as the reference rates for floating-rate loans typically have shorter maturities; and second, the pricing of outstanding floating-rate debt adjusts periodically, directly exposing borrowers to changes in monetary policy rates. Our study focuses exclusively on the first transmission mechanism and demonstrates that it is not only the interest rate type but also specific loan characteristics that determine which segment of the risk-free rate yield curve a loan is exposed to. This, in turn, influences how sensitive interest rates on new loans are to changes in monetary policy.

In turn, the prior literature mostly emphasizes the second mechanism: the cash flow channel of monetary policy.[8] Ippolito et al. (2018) develop a theoretical framework where unhedged

[7] In a more general setting, there is an extensive body of literature on the effect of bank competition on the cost of credit; see, for example, Beck, Demirgüç-Kunt, and Maksimovic (2004); Fungáčová, Shamshur, and Weill (2017).

[8] One potential reason why the role of fixed- and floating-rate loans in the transmission of monetary policy to

floating-rate debt for financially constrained firms means that changes in monetary policy rates directly affect a firm's interest expenses on existing debt, draining its internal liquid resources and thereby constraining its ability to finance investment. They further demonstrate that the quantitative significance of this mechanism increases with the maturity of the debt, as firms remain exposed to interest rate fluctuations for a longer period. Similarly, Gürkaynak et al. (2022) explore the cash flow channel by examining whether firm-level stock price responses to monetary policy changes are influenced by differences in liability structures – specifically, the proportion of fixed- vs floating-rate debt. Their findings indicate that firms with a greater share of unhedged floating-rate debt experience more pronounced stock price reactions to monetary policy changes. These firms also face stronger real effects, such as sharper declines in capital investment, total assets and net worth.

Finally, most prior research distinguishes between fixed- and floating-rate loans, but ignores the variation within both groups which might lead to different lending rate sensitivity to changes in short-term rates. One exception is Gürkaynak et al. (2022), who argue that the differences between fixed- and floating-rate debt in terms of sensitivity to monetary policy changes depends on loan maturity. Fixed-rate debt with short maturities closely resembles floating-rate debt, as both are influenced by prevailing short-term rates. However, for longer maturities, the differences become more pronounced. Floating-rate debt with long maturities effectively resets periodically, aligning with new short-term rates at each adjustment. In contrast, long-term fixed-rate debt locks in its interest rate until maturity, remaining unaffected by fluctuations in short-term rates. Building on this insight, we demonstrate that the sensitivity of loans to changes in short-term interest rates depend not only on loan maturity and rate type but also on the maturity of the underlying reference rate.

The remainder of the paper is organized as follows: Section 2 introduces the dataset and highlights key stylized facts about cross-country differences in loan pricing practices across the euro area. Section 3 outlines the econometric framework used to analyze whether differences in lending practices explain the variation in how lending rates were adjusted across euro area countries during the post-pandemic episode of monetary tightening. It also details the methodology for examining how the pass-through of monetary policy changes to lending rates varies

new lending has received relatively limited attention is the lack of a panel structure – each newly issued loan represents a unique contract. This constrains the ability to control for loan demand and unobserved firm-time variation. However, the rich dataset available in AnaCredit allows us to partially offset these limitations (see Section 3).

across different maturities of the relevant risk-free rates. Section 4 presents the study's findings, and Section 5 provides concluding remarks.

2 Data and stylized facts

In this section, we describe the dataset and outline sample selection. We then provide some stylized facts about cross-country differences in the prevalence of fixed- and floating-rate loans, the duration of rate fixation periods, and the reference rates used in loan pricing across all euro area jurisdictions. Building on this evidence, we propose a more nuanced measure of loan interest rate sensitivity to short-term rates which captures the maturity of the relevant risk-free rate.

2.1 AnaCredit and sample selection

Our main data source is AnaCredit, a confidential dataset maintained by the European System of Central Banks which provides harmonized transaction-level information on lending to firms, covering resident banks from all euro area countries.[9] Banks are required to report all loans to firms if their total exposure to a given borrower is equal to or exceeds EUR 25,000. The data is available at a monthly frequency and includes a comprehensive set of variables that capture bank-level (ownership, total assets, etc.), firm-level (size, sector, etc.) and loan-level (loan amount, interest rate, maturity etc.) characteristics.[10]

We impose several restrictions when selecting the sample for our analysis. We include only euro-denominated loans granted to NFCs domiciled in the euro area. Following Kosekova et al. (2023), we limit the sample to borrowers categorized as S.11 (non-financial corporations) under the ESA 2010 classification, from which we exclude firms that fall under NACE codes 64–66. These NACE categories cover a spectrum of financial activities, including traditional banking and credit services (NACE 64), insurance and pension funding (NACE 65), and auxiliary financial services (NACE 66) such as financial consulting, brokerage, fund management, and other support functions for the financial and insurance industries. By excluding these sectors, we ensure a targeted focus on NFCs.

[9] We consider the EA-19 composition of the euro area valid in 2022: Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. Croatia adopted the euro on January 1, 2023, and AnaCredit data for Croatia is available starting from only 2023.

[10] For more information see the AnaCredit Manual: https://www.ecb.europa.eu/stats/ecb_statistics/anacredit/html/index.en.html.

AnaCredit covers a broad range of loan types, including financial leases, credit lines, revolving credit, trade receivables and credit card debt, among others. For this study, we limit our sample to credit lines, revolving credit and other loans, as these categories encompass the majority of lending activity across all euro area countries. Other loans include all loans that are not included in any of the other more narrowly defined categories. While this is a residual classification, it is comprised of typical business loans – that are entirely disbursed in one installment and repaid over a set period, primarily with regular payments. Credit lines are instruments characterized by the following features that set them apart from other loan types: (a) debtors can withdraw funds up to a pre-approved credit limit without prior notice to the creditor; (b) the credit can be drawn in multiple tranches; and (c) it is non-revolving, meaning the available credit limit only decreases as funds are withdrawn, and repayments do not replenish the original credit amount. Revolving credit, excluding overdrafts and credit card debt, refers to any credit instrument – aside from a current account with a credit limit or credit card debt – that allows funds to be repeatedly drawn and repaid up to a specified credit limit. We follow Fricke et al. (2024) and limit the sample to these types of instruments to ensure a reasonable level of homogeneity across the loans included in our analysis. Moreover, the three above-mentioned types of loans represent the majority of overall new loans issued to NFCs in all euro area countries (between 65% and 99% of the new loans' value, see Table A1 in the Appendix). As a robustness check, we exclude revolving loans from our analysis. The maturity of these loans is inherently ambiguous, as borrowers can draw on the credit line and repay it as long as it remains open, making it challenging to align with our focus on well-defined loan maturities.

To ensure comparability across all countries in our sample, we exclude loan exposures below EUR 25,000, as some countries report these smaller exposures while others do not. Also, we limit the sample to loans with positive interest rates and exclude any loans not reported in AnaCredit within six months of their inception date. Harmonization of the data across countries comes at the price of a substantial decline in the number of observations for some countries, although coverage remains high in terms of the loan value (see Table A1 in the Appendix). Additionally, we exclude syndicated loans and loans with multiple creditors, as AnaCredit only records euro area credit institutions that are involved in syndicated loans, regardless of the reporting institution's role as lead arranger or agent.

The sample includes newly issued loans[11] from January 2022 to December 2023, capturing

[11] Loans are considered newly issued in AnaCredit when all of the following conditions are met. First, the unique

Table 1. Summary statistics for the newly issued loans to NFCs in euro area countries, 2022–2023

Country	Number of loans	Total value, bill. of EUR	Number of banks	Value of the loan, thsnd. of EUR			Rate, weighted mean, %	Maturity, weighted mean, years	Domestic, share, %	
				mean	median	s.d.			number	value
AT	114,660	114.6	437	999.7	147.0	4,164.8	3.39	7.52	97.2	88.8
BE	301,076	138.4	44	459.5	95.6	2,559.2	3.66	3.51	98.8	89.8
CY	7,169	4.1	12	577.3	100.8	2,658.1	4.45	7.69	99.3	86.5
DE	1,580,626	511.9	861	323.9	42.0	8,189.1	3.57	3.48	98.8	92.3
EE	5,116	4.9	10	966.7	140.0	3,642.2	5.30	4.00	99.9	97.7
ES	1,436,303	309.8	127	215.7	54.3	5,821.2	3.53	3.38	99.7	98.0
FI	52,863	32.4	156	612.1	80.4	7,019.5	3.30	5.85	99.8	99.6
FR	1,815,906	484.6	175	266.9	50.0	4,164.2	3.07	7.01	99.9	97.5
GR	34,097	33.1	19	972.2	102.7	7,692.3	4.64	7.51	99.9	99.7
IE	50,165	40.5	19	806.5	56.3	5,974.1	3.94	3.54	80.9	47.4
IT	1,203,663	544.2	222	452.1	61.3	5,084.1	3.54	2.27	99.7	98.1
LT	8,892	5.6	19	629.0	80.6	3,814.6	4.95	5.20	99.9	96.4
LU	30,948	57.2	74	1,849.6	199.8	17,047.5	3.06	2.36	21.2	28.1
LV	2,835	2.6	14	900.7	125.0	3,694.8	4.79	4.03	99.1	94.1
MT	1,902	2.3	9	1,232.7	350.0	4,236.7	4.69	8.12	95.0	85.7
NL	53,807	93.1	29	1,729.7	200.0	9,272.3	3.68	7.86	94.7	69.4
PT	192,039	37.7	121	196.3	52.6	1,201.7	3.88	4.57	100.0	99.6
SI	17,209	9.0	15	522.3	100.0	1,905.1	3.46	3.49	99.0	97.9
SK	23,142	13.0	19	563.0	70.0	3,949.8	3.68	3.46	99.9	98.1
Euro area	6,932,418	2,439.0	2,382	351.8	50.0	5915.7	3.48	4.35	99.0	92.3

Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with positive interest rate, credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. First column represents the country of residence of the bank.

the post-pandemic period of monetary tightening. Unlike most previous studies, our sample covers banks from all euro area countries except for Croatia, where AnaCredit data is only available starting from its euro area accession in 2023. Table 1 presents the summary statistics for the new loans to NFCs included in our analysis.[12]

Our final sample consists of nearly seven million newly issued loans from January 2022 to December 2023, encompassing data from 2,382 banks. Among all countries, France has the highest number of observations, contributing 26.2% of the total, followed by Germany with 22.8% and Spain with 20.7%. At the other end of the spectrum are Malta (0.03%), Latvia (0.04%) and Estonia (0.07%). The summary statistics reveal substantial variation across euro area countries in several dimensions, including average loan size, maturity and interest rates. These differences partially reflect the varying popularity of different loan types (see Figure A1)

combination of creditor, debtor and instrument identifiers appear in AnaCredit for the first time. Second, the loan has not been reissued or extended as part of a renegotiation. Third, the time between the reporting date and the instrument's inception date is no more than six months. This third condition ensures that loans extended far in the past are not classified as "newly issued" simply because they are reported late due to a borrower only recently exceeding the EUR 25,000 threshold. The findings in the following sections remain robust to changes in the time difference threshold.

[12] Several adjustments were made to address discrepancies in Malta's loan data reporting, particularly in distinguishing between fixed-rate and floating-rate loans. Loans were reclassified by analyzing observed interest rate changes over their lifespan, with single irregularities treated as reporting errors and corrected to align with the dominant behavior. For loans with insufficient data, classifications were inferred based on the lending bank's broader rate-setting practices, including its typical behavior with similar loans. Mixed-rate loans were evaluated for consistency; those showing a clear alignment with a specific rate type were reclassified, while others remained classified as mixed. Overall, any discrepancies in the reported frequency rate of adjustments were corrected to the actual rate adjustment frequency inferred from the data on outstanding loans.

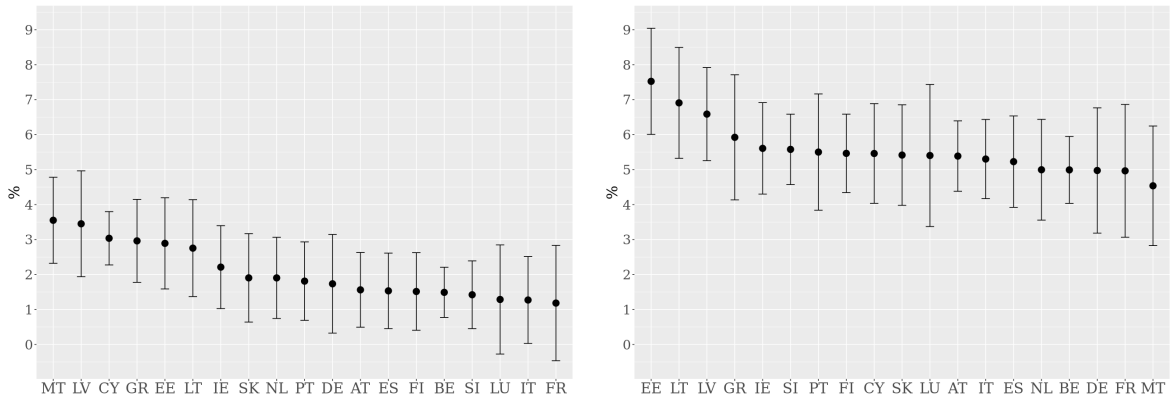
and the diverse sectoral and size composition of borrowers (see Figures A2 and A3). One consistent feature across nearly all euro area countries, except Luxembourg, and to a lesser extent Ireland, Malta and the Netherlands, is that the vast majority of loans are extended to domestic firms. This implies that country-specific institutional environments and lending practices could also contribute to differences in the transmission of monetary policy across euro area countries.

2.2 Interest rates on new loans

In this section, we document differences in lending rates across euro area countries. Figure 1 shows the mean interest rates on newly issued loans to NFCs, along with the one-standard-error band, for the first quarter of 2022 and the fourth quarter of 2023.[13] The first period captures the final quarter before post-pandemic rate hikes commenced in the euro area,[14] while the latter represents the first quarter following the final rate hike in the cycle. Between these two quarters, key monetary policy rates were raised by a cumulative 450 basis points. Rates were then maintained at peak levels for nine months before being lowered in June 2024.

Figure 1. Interest rates of the newly issued loans to NFCs in euro area countries

(a) 2022Q1 **(b)** 2023Q4



Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. The black dot denotes the weighted mean, the error bar represents +/- one weighted standard error. The horizontal axis represents the country of residence of the bank. The countries are arranged according to the weighted average level of interest rates.

Several noteworthy observations arise from Figure 1. First, there is considerable variation in lending rates across euro area jurisdictions in both periods. In the first quarter of 2022, the

[13] Interest rates shown in Figure 1 are very similar to those obtained from the ECB, MFI Interest Rate Statistics (MIR).

[14] Although the initial rate increase occurred in July 2022, financial markets had largely anticipated this move by the second quarter of 2022. The first quarter of 2022 also marks the end of net asset purchases under the ECB's PEPP, which, however, had already been anticipated following the announcement in late 2021.

difference between the highest mean interest rate (Malta, 3.55%) and the lowest (France, 1.18%) amounted to 237 basis points. This disparity had widened by the fourth quarter of 2023, with Estonia displaying the highest mean lending rate (7.52%) and Malta the lowest (4.54%).

Second, the relative position of countries within the lending rate distribution shifted notably between the two periods. For example, Malta moved from having the highest mean lending rate in the first quarter of 2022 to the lowest in the fourth quarter of 2023. Similar shifts, although less extreme, occurred among larger economies: the Netherlands and Germany, initially around the middle of the distribution, ended up among the countries with the lowest rates by the latter period. Estonia saw the largest increase in mean lending rates, with a rise of more than 450 basis points, followed by Slovenia, Lithuania, Luxembourg and Italy, each experiencing increases of around 400 basis points. Conversely, Malta saw a modest increase of 99 basis points, while Cyprus experienced a rise of 250 basis points. Greece, Germany and the Netherlands showed similar increases, each close to 300 basis points. Such pronounced differences in lending rate changes underscore the need to explore why the recent episode of monetary tightening had such varied impacts on lending rates across countries within a single monetary union.

It is possible that cross-country differences in mean lending rates could be partially explained by structural differences. For example, it is possible that for some countries, the composition of the loan portfolio might be tilted more towards loans to large NFCs that tend to have lower interest rates (see Figure A3). In order to account for cross-country differences in loan portfolio structure in terms of loan types, firm size classes and maturities, we calculate the conditional mean interest rates.[15] Figure A4 compares conditional and unconditional mean interest rates across countries for both the pre- and post-tightening periods, while Figure A5 shows the change in these rates between the two periods.

Consistent with the findings of Kosekova et al. (2023), our results reveal that adjusting for differences in firm size, sector and loan type has a minimal effect on cross-country variation,

[15] Like in Kosekova et al. (2023), we use the following regression to compute the mean conditional interest rate ($\alpha_{1,c}$) for the euro area countries:

$$r_{i,t}^{loan} = \sum_{c=1}^{19} \alpha_{1,c} \cdot D_c^{country} + \sum_{k=2}^{4} \alpha_{2,k} \cdot D_{k,i}^{size} + \sum_{s=2}^{21} \alpha_{3,s} \cdot D_{s,i}^{sector} + \sum_{l=2}^{3} \alpha_{4,l} \cdot D_{l,i}^{type} + \sum_{m=2}^{6} \alpha_{5,m} \cdot D_{m,i}^{maturity} + \alpha_6 \cdot D_i^{cross-border} + u_{i,t}$$

The interest rate of loan i issued in period t was regressed on the set of dummies representing country c ($D_c^{country}$), firm size category k ($D_{k,i}^{size}$), macroeconomic sector s ($D_{s,i}^{sector}$), loan type l ($D_{l,i}^{type}$, credit lines, revolving credit, and other loans), and loan maturity category m ($D_{m,i}^{maturity}$). Dummy variable $D_i^{cross-border}$ equals one if loan i is a cross-border loan (the country of a bank does not coincide with the country of a firm, country c corresponds to the location of the bank). The regression is estimated by weighted least squares (WLS) for the new loans to NFCs issued in 2022Q1 and 2023Q4 separately, using loan values as weights.

indicating that such structural factors explain only a small portion of the lending rate differences across euro area countries. Similarly, the changes in mean interest rates between the first quarter of 2022 and the fourth quarter of 2023 remain largely unaffected when comparing conditional and unconditional means.

These findings suggest that other loan characteristics – beyond those typically captured by borrower or loan type – may play a more significant role in explaining cross-country differences in lending rate levels and their responsiveness to monetary policy. One such dimension is the lending rate characteristics, in particular the prevalence of fixed- versus floating-rate contracts and the maturity of the associated reference rates. These characteristics directly shape the sensitivity of lending rates to changes in monetary policy and can vary widely across countries.

2.3 Fixed- vs. floating-rate loans and other rate characteristics

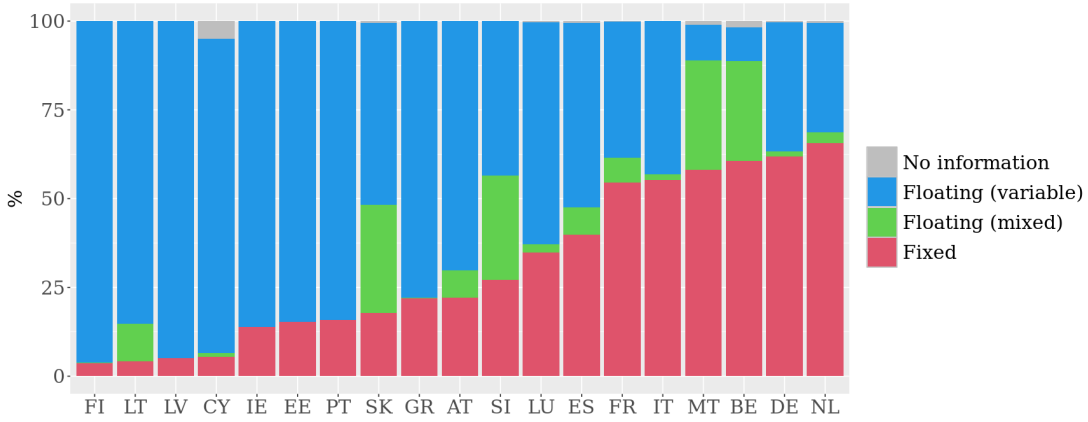
To explore this further, we leverage the unique granularity of AnaCredit data to document the cross-country differences in these lending rate characteristics to provide further context for the observed disparities in lending rate dynamics.

Figure 2 displays the composition of newly issued loans to NFCs, segmented by rate type: fixed, variable and mixed. We treat variable- and mixed-rate loans as floating-rate loans.[16,17] A loan is considered to be a fixed-rate loan if it has an interest rate that remains constant over the entire duration of the loan. In turn, a loan is treated as a floating-rate loan if it has an interest rate that adjusts over time, typically linked to a defined reference rate. The prevalence of each rate type varies significantly across countries. For example, in Latvia, Lithuania, Finland and Cyprus, floating-rate loans predominate, making up over 90% of new loans. Fixed-rate loans make up for only a minor share of new lending in these markets. Conversely, fixed-rate loans comprise nearly two-thirds of new loans to NFCs in the Netherlands, Belgium and Germany. Other euro area countries display a more balanced distribution between fixed- and floating-rate loans.

[16] According to the AnaCredit Manual, instruments that have both a fixed and a variable interest rate over their life are classified as mixed. Therefore, we treat mixed-rate loans as floating-rate loans in our analysis.

[17] If results on the structure of newly issued loans for a particular country contain information regarded as confidential according to the AnaCredit rules, the following adjustments are implemented in the published results. Random numbers are added to the share of all new loan categories within a given country, ensuring that the sum of all shares remains equal to 100%. These random numbers cannot be smaller than 1.5 percentage point or exceed 4 percentage points in absolute terms. If the share of a particular category is very small, an additional rule ensures that the share is adjusted at least twice, but by no more than 50 times in relative terms. This randomization procedure prevents the disclosure of confidential information while preserving overall trends in the results.

Figure 2. Structure of the newly issued loans to NFCs by rate type categories in euro area countries, 2022–2023



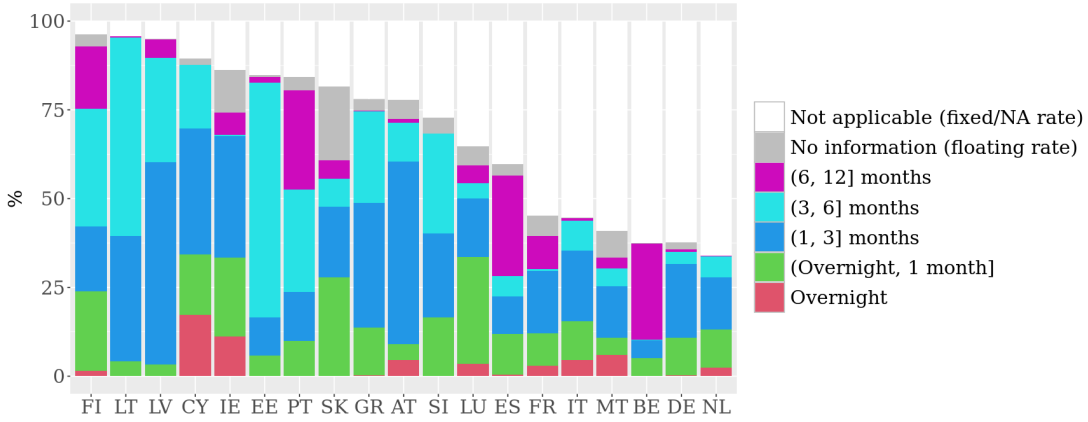
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Moreover, within these two broad loan categories, there is substantial variation across several dimensions. For floating-rate loans, the reference rates used to benchmark lending rates differ notably among euro area countries. While EURIBOR rates are the predominant benchmark in most countries (see Figure A6 in the Appendix), the choice of maturity varies significantly, ranging from overnight rates to 12-month rates (see Figure 3). For example, Cyprus and Estonia both have a similar proportion of floating-rate loans, yet the specific reference rate maturities differ considerably. In Cyprus, over a third of loans are linked to a reference rate with a maturity of one month or less, and nearly three-quarters are benchmarked to a rate with a maturity of three months or less. In contrast, in Estonia, only less than 10% of loans are based on reference rates of a month or less, with most floating-rate loans being linked to reference rates with maturities between three and six months.

Importantly, the frequency of interest rate adjustments for floating-rate loans generally aligns with the maturity of their reference rates (see Figure A7). Consequently, countries with a higher share of floating-rate loans tied to reference rates with shorter maturities are likely to experience greater lending rate fluctuations than those where reference rates have longer maturities, even if the proportion of floating-rate loans is comparable.[18]

[18] To address concerns that monetary policy might influence banks' preferences for certain loan types or interest rate structures, as suggested by Gambacorta (2009) and Takaoka and Takahashi (2022), we compare the structure of newly issued loans to NFCs between 2022Q1 and 2023Q4. Figures A8–A11 in the Appendix reveal that the composition of loan types within each country remains highly stable over time, as does the cross-country variation, suggesting minimal impact of monetary policy on these structural preferences.

Figure 3. Structure of the newly issued floating-rate loans to NFCs by countries and reference rate maturity, 2022–2023

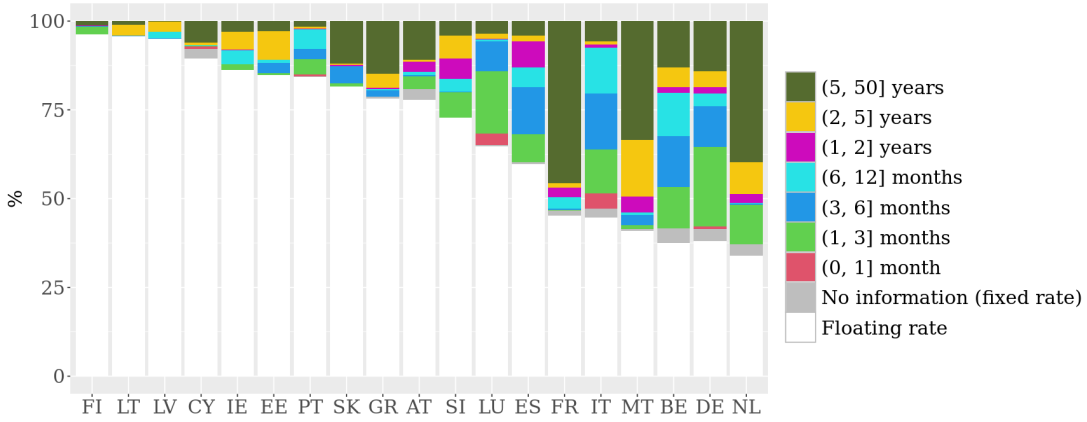


Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

For fixed-rate loans, the interest rate is set for the entire duration of the loan, making their rate fixation period equal to loan maturity at origination. As shown in Figure 4, the maturity structure of fixed-rate loans exhibits substantial heterogeneity across euro area countries. France and Italy illustrate this contrast well: in both countries, fixed-rate loans comprise over half of all loans to NFCs, yet the typical maturity at origination differs markedly. In Italy, most fixed-rate loans have a maturity of one year or less, while in France, the majority have maturities exceeding five years, with many extending beyond ten years. Consequently, the shorter maturities for fixed-rate loans in Italy mean that NFCs face more frequent refinancing, leaving them more vulnerable to fluctuations in lending rates.

In summary, a simple distinction between fixed- and floating-rate loans overlooks significant variation in the reference rates used for pricing loans to NFCs across the euro area. Given that monetary policy impacts risk-free rates differently depending on their maturity (and therefore also the reference rates used for pricing loans), a binary classification of loans may not fully capture the sensitivity of loan interest rates to changes in monetary policy rates. To address this, we develop a loan-level measure of interest rate exposure based on the maturity of the relevant risk-free rate.

Figure 4. Structure of the newly issued fixed-rate loans to NFCs by countries and loan maturity, 2022–2023



Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

2.4 Obtaining the relevant risk-free rate and premium

This section details our approach to identifying the appropriate risk-free rate for each loan. We start by decomposing the interest rate ($r_{i,t}^{loan}$) on each loan i into two components: the relevant risk-free rate ($r_{i,t}^{risk-free}$) at the time of issuance and the corresponding premium ($r_{i,t}^{premium}$).

$$r_{i,t}^{loan} = r_{i,t}^{risk-free} + r_{i,t}^{premium}$$

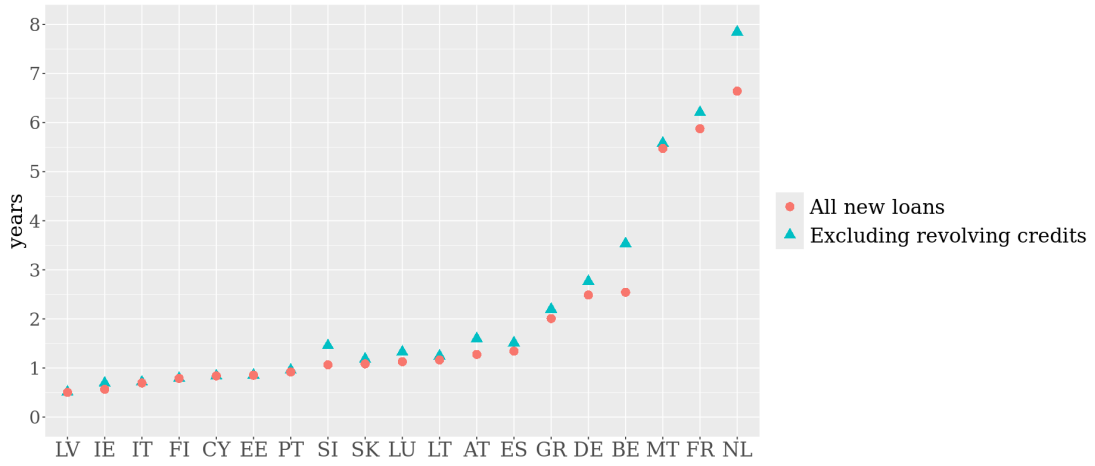
For fixed-rate loans, the relevant risk-free rate is the OIS rate matched to the loan's maturity at the issuance date.[19] For floating-rate loans, the relevant risk-free rate is the OIS rate matching the reference rate's maturity at the time of issuance, which, by definition, is shorter than the loan maturity. For example, the relevant risk-free rate for a 5-year fixed-rate loan is the 5-year OIS rate on the issuance date. In contrast, for a 5-year floating-rate loan which has an interest rate benchmarked against a 3-month EURIBOR and adjusted every 3 months, the relevant risk-free rate would be the 3-month OIS rate. The premium is then calculated as the difference between the lending rate and the relevant risk-free rate.

The maturity of the relevant risk-free rate indicates which segment of the risk-free rate

[19] It is possible that loans labeled as fixed-rate loans in AnaCredit are actually floating-rate loans, but the period of rate fixation exceeds one year. Unfortunately, the AnaCredit database does not provide any information in this respect. In order to check the robustness of our results to the assumption that the relevant risk-free rate maturity coincides with loan maturity, we use an alternative assumption: we assume that for the fixed-rate loans with a maturity exceeding 3 years the relevant risk-free rate is the 3-year OIS rate. Thus, we allow rate adjustment even for fixed-rate loans with long maturities.

yield curve is relevant for determining the loan's interest rate. Figure 5 displays the weighted average maturity of the relevant risk-free rates for new loans to NFCs in euro area countries, while Figures A12 and A13 illustrate the structure of new loans by the maturity of the relevant risk-free rate.

Figure 5. Weighted average maturity of the relevant risk-free rate for the newly issued loans of NFCs in euro area countries, 2022–2023



Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the weighted average maturity of the relevant risk-free rate.

At least two important observations can be made. First, there is significant variation across countries, with relevant risk-free rate maturities ranging from approximately 6 months in Latvia and Ireland to over 6.5 years in the Netherlands. Three countries – Malta, France and the Netherlands – clearly stand out with the highest maturity of the relevant risk-free rates, which is largely due to the relatively high share of fixed-rate loans with longer maturities. These substantial differences in the maturities of the relevant risk-free rates could be one of the reasons for the cross-country variation in the extent to which lending rates changed during the post-pandemic episode of monetary tightening in the euro area. This is illustrated by comparing the OIS curve from the first quarter of 2022 with that of the fourth quarter of 2023 (see Figure A14 in the Appendix). During this period, shorter-term OIS rates, such as the 6-month rate – which reflects the average relevant risk-free rates in Latvia and Ireland – rose by approximately 440 basis points. In contrast, OIS rates with maturities of 5 to 7 years, which represent the average relevant risk-free rates in Malta, France and the Netherlands, increased by only about 250 basis points.

Second, the average maturity of the relevant risk-free rates does not show a clear distinction

between countries where fixed-rate loans predominate and those where floating-rate loans are more prevalent. For instance, countries with the shortest average maturity of relevant risk-free rates include Latvia, Ireland and Cyprus, where floating-rate loans with frequent rate resets are common, as well as Italy, where fixed-rate loans predominate but tend to have shorter maturities. This observation aligns well with Gürkaynak et al. (2022), who argue that fixed-rate loans with short maturities are of a very similar nature to floating-rate loans. A further illustration is Spain, where the average maturity of the relevant risk-free rates is significantly shorter than in Greece, despite fixed-rate loans being nearly twice as common. Both of the facts mentioned above remain unchanged when revolving loans are excluded from the sample. Similarly, despite some changes in the average maturity of the relevant risk-free rate over time, both conclusions are valid for the periods before and after the monetary policy tightening in 2022Q1 and 2023Q4 (see Figure A15 in the Appendix).

In the following analysis, we empirically address two key questions: (1) To what extent can cross-country variations in the changes in average interest rates on new loans between early 2022 and late 2023 be attributed to differences in the risk-free rates used to price loans to NFCs, and how much is due to changes in the premium? (2) Does the pass-through of monetary policy rate changes to interest rates on new loans vary depending on the maturity of the relevant risk-free rate?

3 Methodology

3.1 Before-and-after analysis of lending rates

We begin the econometric analysis by examining whether differences in lending practices help to explain the variation in how lending rates adjusted across euro area countries during the post-pandemic episode of monetary tightening. As shown in the previous sections, lending practices differ significantly across countries in terms of the prevalence of fixed- versus floating-rate loans, loan maturities, reference rates and their maturities, and the frequency of interest rate adjustments. These differences expose borrowers to risk-free rates of varying maturities, suggesting that the impact of rising short-term monetary policy rates may not have been felt uniformly across the euro area.

To conduct this analysis, we use loan-level data on all newly issued loans to NFCs from AnaCredit, which offers significant advantages, such as providing detailed information on contract-

specific characteristics at the most granular level.[20] Similarly to Bredl (2024), we employ a time-difference approach to analyze changes in interest rate levels. Specifically, we compare the rates of new loans issued in the first quarter of 2022 (2022Q1) to those issued in the fourth quarter of 2023 (2023Q4). This timeframe captures the period before the first rate hike of the post-pandemic monetary policy tightening in July 2022 and following the final rate hike in September 2023. The time-difference regression is specified as follows:

$$\begin{bmatrix} r^{loan}_{i,t\in 2022Q1} \\ r^{loan}_{i,t\in 2023Q4} \end{bmatrix} = \beta_0^{loan} + \beta_{1,c}^{loan} \cdot D_c^{country} \cdot \begin{bmatrix} 0 \\ 1 \end{bmatrix} + \sum_j \gamma_j \cdot X_{i,t}^j + u_{i,t} \tag{1}$$

Variable $r_{i,t}^{loan}$ refers to the interest rate of a new loan i issued in period t. Period t corresponds to the inception date of the loan.[21] The regression sample includes loans issued during 2022Q1 ($t \in 2022Q1$), and those issued during 2023Q4 ($t \in 2023Q4$). The interest rate levels are regressed on a dummy variable that equals 0 for loans issued in the first period and 1 for loans issued in the second period. To capture cross-country variation in the extent to which lending rates changed, this dummy variable is interacted with a country-specific dummy, $D_c^{country}$ (representing the country of residence of the bank). The coefficient of interest $\beta_{1,c}^{loan}$ represents the difference in interest rates for new loans issued before and after the monetary tightening in each country.

Changes in monetary policy rates were not the only factor influencing lending rates during

[20] However, using this data presents a notable limitation: the absence of a panel structure, as each newly issued loan represents a unique contract. Potentially, one may address this limitation by aggregating loan data to the bank-firm level across different credit instrument types similar to Coulier, Pancaro, and Reghezza (2024) or Behn, Forletta, and Reghezza (2024). This method does not work well for newly issued loans, however. It focuses exclusively on loans repeatedly issued by bank a to firm b, which substantially reduces the sample size (especially given the short time period covered by the AnaCredit dataset), and introduces a bias towards large firms. Furthermore, even within the same bank-firm pair, loans can vary in key characteristics such as maturity and collateral value. One can aggregate new loans further across broader dimensions, such as countries, sectors, regions or banks. While this method restores the time dimension, it is often less effective for conducting analysis in smaller euro area countries. Limited observations in these cases often necessitate aggregation at the country level or similarly broad categories, which sacrifices the granularity of the dataset.

[21] We implicitly assume that the creditor and debtor agree on the loan rate at the inception date. However, actual practices may deviate from this assumption. First, both parties can set the rate prior to the inception date. Unfortunately, AnaCredit does not provide information to identify such cases, particularly for fixed-rate loans. Second, the rate can be set after the inception date. AnaCredit contains the settlement date for most instruments. On average, loans are settled two weeks after their inception, although the average lag varies across countries, ranging from 0 to 38 days. Even under the extreme assumption that interest rates are set at the settlement date for all newly issued loans, our findings remain qualitatively unchanged. Finally, bias may arise due to the gap between the inception and reference (reporting) dates. We expect this bias to be negligible, as our sample is restricted to loans reported in AnaCredit within six months of their inception. Moreover, approximately 75% of newly issued loans first appear in AnaCredit within the same month or the following month of their inception. Using the reference date instead of the inception date to re-define the loan of the newly issued rate, the risk-free rate, and premium at the inception date does not qualitatively alter our findings. Supporting results are available upon request.

the sample period. To address this, we leverage the granularity of our dataset and include an extensive set of loan-level control variables $X^j_{i,t}$. Specifically, it includes a rich set of fixed effects to account for the characteristics of creditors (bank-level fixed effects), debtors (macroeconomic sector, region, and firm size fixed effects), and loan instruments (fixed effects for loan type, maturity, collateral size, reference rate type, reference rate maturity, rate adjustment frequency, multidebtor loans, cross-border loans). The large set of fixed effects is necessary to control for differences in lending rate levels across countries, macroeconomic sectors, regions and firm sizes. Furthermore, systematic differences in lending rates are highly likely to exist between fixed-rate and floating-rate loans, between loans linked to the six-month EURIBOR and those linked to the three-month EURIBOR, and among other contract variations. Most of the fixed effects are interacted with country fixed effects[22] to capture country specificity of sectoral, firm size, or contract factors. However, there is no need to include time fixed effects in this specification, as the analysis considers only two time periods. By including all the above-mentioned fixed effects simultaneously, we ensure that we compare similar loans in 2022Q1 and 2023Q4 in terms of creditor, debtor and contract features. Additionally, to account for changes in credit risk, we include the loan-level information on the probability of default.[23] Equation (1) is estimated by WLS, where weights are determined by the loan values.

The results obtained from the equation (1) should not be interpreted as causal or used to directly quantify the pass-through of monetary policy rates to lending rates in the euro area countries. This is because the policy rate changes between 2022Q1 and 2023Q4 were neither exogenous nor entirely unexpected. Economic agents had anticipated the tightening to some extent even before 2022. Moreover, the onset of the war in Ukraine in February 2022, along with the associated rise in uncertainty and energy price shocks, influenced expectations. Nevertheless, the before-and-after comparison offers valuable insights into cross-country differences in lending rate responses over the longer term, as the expectations regarding monetary policy changes were likely shared by agents across all countries within the monetary union.

Equation (1) can also be applied to the components of the interest rate: the relevant risk-

[22] We use the bank country of residence. The only exception is the interaction with the sector of activity, where the firm country of residence is used to capture the demand effect.

[23] AnaCredit provides information on the probability of default (PD) for individual loans at the time of issuance. However, coverage of this variable is incomplete (or even absent for some countries), as PD data is not required from all entities (see AnaCredit Manual). To address this limitation, we impute missing PD values using a model that predicts PD based on the ratio of the accumulated impairment amount to the loan value, while controlling for loan maturity, firm size, macroeconomic sector and collateral size fixed effects. Details on the country-level variation in PD coverage after imputation and the quality of the imputation (measured as the correlation between actual and predicted PD values) are presented in Table A2 in Appendix.

free rate ($r_{i,t}^{risk-free}$) and the premium ($r_{i,t}^{premium}$). Since the sample and the set of right-hand side variables remain unchanged, the estimated conditional change in new loan rates can be decomposed into two parts: the change driven by adjustments in the relevant risk-free rates (equation (2)) and the change attributable to shifts in the premium (equation (3)): $\beta_{1,c}^{loan} = \beta_{1,c}^{risk-free} + \beta_{1,c}^{premium}$.

$$\begin{bmatrix} r_{i,t\in 2022Q1}^{risk-free} \\ r_{i,t\in 2023Q4}^{risk-free} \end{bmatrix} = \beta_0^{risk-free} + \beta_{1,c}^{risk-free} \cdot D_c^{country} \cdot \begin{bmatrix} 0 \\ 1 \end{bmatrix} + \sum_j \gamma_j^{risk-free} \cdot X_{i,t}^j + u_{i,t}^{risk-free} \quad (2)$$

The coefficient $\beta_{1,c}^{risk-free}$ captures the extent to which lending rates in country c changed due to shifts in the underlying risk-free rates that are relevant for loan pricing. Cross-country variation in this coefficient arises solely from differences in the maturities of the relevant risk-free rates. It is likely to be larger in countries where short-term risk-free rates predominate, driven by a higher prevalence of floating-rate loans with shorter reference rate maturities or a greater share of fixed-rate loans with shorter maturities. The coefficient $\beta_{1,c}^{premium}$ captures changes in lending rates driven by factors other than adjustments in risk-free rates.

$$\begin{bmatrix} r_{i,t\in 2022Q1}^{premium} \\ r_{i,t\in 2023Q4}^{premium} \end{bmatrix} = \beta_0^{premium} + \beta_{1,c}^{premium} \cdot D_c^{country} \cdot \begin{bmatrix} 0 \\ 1 \end{bmatrix} + \sum_j \gamma_j^{premium} \cdot X_{i,t}^j + u_{i,t}^{premium} \quad (3)$$

Equations (1)–(3) provide valuable insights into the factors underlying cross-country variation in how lending rates adjusted during the post-pandemic episode of monetary policy tightening. However, these equations do not address whether lending rates responded differently across various types of loans. To investigate whether changes in lending rates were influenced by the maturity of the relevant risk-free rate, we extend the framework of equations (1)–(3), replacing the country-specific dummies with various loan-level indicators describing contract features primarily focusing on the maturity of the relevant risk-free rate (see equation (4)).

$$\begin{bmatrix} r_{i,t\in 2022Q1}^{loan} \\ r_{i,t\in 2023Q4}^{loan} \end{bmatrix} = \beta_0 + (\delta_0 + \sum_k \delta_k \cdot Z_{i,t}^k) \cdot \begin{bmatrix} 0 \\ 1 \end{bmatrix} + \sum_j \gamma_j \cdot X_{i,t}^j + u_{i,t} \quad (4)$$

$Z_{i,t}^k$ includes a set of dummies representing various contract features of the loan i issued in

period t. In particular, it includes dummies for the maturity buckets of the relevant risk-free rate associated with loan i. These buckets are: relevant risk-free rate maturity up to 1 month; 1 to 3 months; 3 to 6 months; 6 to 12 months; 1 to 2 years; 2 to 5 years.[24] The loans with the relevant risk-free rate above 5 years serve as a benchmark (omitted category). This approach allows us to assess whether lending rate adjustments differ based on the maturity of the relevant risk-free rate. Additionally, we include a dummy variable that distinguishes between fixed- and floating-rate loans. In order to control for the potential role of other contract features related to the reference rate, we include two dummies indicating loans in which the frequency of interest rate adjustments differs from the maturity of the reference rate (higher and lower frequency, correspondingly). We also allow for different behavior in cases where the reference rate is not EUR-related, is a multiple reference rate or is any other single rate (EURIBOR, ESTR and EUR LIBOR rates serve as a benchmark). Finally, we account for the potential difference in rate changes for the cross-border loans. Similarly to equations (1)–(3), we perform this analysis for the total lending rate and the two sub-components: the relevant risk-free rate and the premium.

3.2 Pass-through of monetary policy rates to lending rates

We next turn to the following question: Does the pass-through of monetary policy rates to lending rates depend on the maturity of the relevant risk-free rates? Since this directly addresses the transmission of monetary policy, our empirical strategy must be adjusted in two key ways. First, we turn our attention to loans issued in close proximity to ECB GovC meetings and use stacked time-difference regression instead of a simple before-and-after comparison (see Bredl 2024).

In total, there were 15 ECB GovC meetings in 2022–2023.[25] For each GovC meeting on date τ, we compare new loans issued within a six-week period before the meeting ($t \in [\tau - 6W, \tau)$) to those issued within a six-week period after the meeting ($t \in (\tau, \tau + 6W]$). Loans issued on the meeting date are excluded from both groups. The six-week windows were chosen because ECB GovC meetings typically occur at six-week intervals. This time frame ensures that, in most cases, only a single monetary policy event affects the loans in each group.[26] We then combine the 15 sets of pre- and post-meeting loan data into a single dataset and apply an approach

[24] The upper bound is included in each bucket, while the lower bound is only included in the first bucket.
[25] Eight meetings in 2022: February 3, March 10, April 14, June 9, July 21, September 8, October 27, December 15. Seven meetings in 2023: February 2, March 16, May 4, June 15, July 27, September 14, October 26.
[26] It is important to note that many loans appear in the stacked regression twice: once in the "before" group and once in the "after" group.

similar to equation (4):

$$\begin{bmatrix} r_{i,t\in[\tau-6W,\tau)} \\ r_{i,t\in(\tau,\tau+6W]} \end{bmatrix} = \beta_\tau + (\delta_0 + \sum_k \delta_k \cdot Z^k_{i,t}) \cdot \begin{bmatrix} 0 \\ \Delta DF_\tau \end{bmatrix} + \sum_j \gamma_j \cdot X^j_{i,t} + u_{i,t}, \tag{5}$$

where the coefficient β_τ represents a GovC meeting-specific intercept, accounting for differences in the level of loan rates around each monetary policy event. The set of controls and fixed effects is unchanged from the earlier specification. However, since equation (5) analyzes numerous monetary policy decisions, all fixed effects are now interacted with the GovC meeting (period) fixed effects. These interactions ensure that all possible country, creditor, debtor, and contract characteristics surrounding each GovC meeting are controlled for. In other words, this approach ensures the comparability of new loans issued before and after each monetary policy decision.

The second adjustment to our methodology concerns the variable representing policy changes, now defined as the announced change in the deposit facility rate (ΔDF_τ) at date τ. Policy rate adjustments between July 2022 and September 2023 were not exogenous and were largely anticipated by economic agents. To address this, we follow the approach of Altavilla, Burlon, Giannetti, and Holton (2022), estimate equation (5) by two stage least squares (TSLS) and instrument ΔDF_τ with monetary policy surprises, measured using high-frequency movements in asset prices around official policy announcements. These surprises are sourced from the Euro Area Monetary Policy Event-Study Database (Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa 2019), widely used in recent empirical research (e.g. Altavilla, Pagano, Boucinha, and Polo 2023; Fungácová, Kerola, and Laine 2023). We employ two instruments simultaneously: Target and Timing surprises. Target surprise captures changes in short-term interest rates during the press release window, while Timing surprise reflects market expectations for policy changes over the next few meetings, measured during the press conference window (Altavilla et al. 2019). This approach aligns broadly with Altavilla et al. (2022), who use changes in OIS rates with maturities of up to three years as instruments. However, we exclude Forward Guidance surprises due to their weak correlation with changes in the deposit facility rate.[27] We instrument ΔDF_τ rather than directly including monetary surprises in equation (5) for two rea-

[27] The correlation between changes in the deposit facility rate and the Target surprise is 0.410 for 2022–2023, and 0.447 for the Timing surprise. In contrast, correlations with Forward Guidance and QE surprises are weaker at 0.134 and -0.225, respectively. Note that these correlations are based on only 15 GovC meetings during 2022–2023, so they should be interpreted with caution.

sons. First, this simplifies the interpretation of regression results, which now describe responses to an unexpected 1 percentage point change in the deposit facility rate. Second, using multiple monetary surprises as instruments enhances the reliability of our estimates. The coefficients of interest, δ_k, estimate the extent to which the pass-through of unexpected changes in the deposit facility rate to lending rates varies across maturity buckets of the relevant risk-free rate ($Z^k_{i,t}$). Individual loan value weights are applied while estimating equation (5). As before, we also decompose the total transmission to lending rates into transmission to relevant risk-free rates and the premium, and $r_{i,t}$ represents $r^{loan}_{i,t}$, $r^{risk-free}_{i,t}$, or $r^{premium}_{i,t}$.

Equation (5) analyzes interest rate pass-through over a relatively short horizon (which we call $h = 1$ in the regression output tables). A period of six weeks following each GovC meeting may be insufficient to capture the full extent of the pass-through to lending rates. To examine longer-term responses to monetary policy surprises, we also estimate the effects over extended horizons: 7 to 12 weeks and 13 to 18 weeks post-monetary surprise. Specifically, we analyze new loans issued within the intervals $t \in (\tau + 6W, \tau + 12W]$ and $t \in (\tau + 12W, \tau + 18W]$, also referred as $h = 2$ and $h = 3$, respectively.

Analyzing longer horizons of monetary transmission presents substantial challenges, as multiple GovC meetings may occur between the pre- and post-meeting periods for newly issued loans. Equation (5) attributes all changes in loan interest rates to the GovC meeting on date τ. This approach does not introduce bias over a long sample period, as monetary policy surprises – used as instruments for changes in deposit facility rates – are not autocorrelated. The absence of autocorrelation in monetary policy surprises is a natural phenomenon; market participants would detect any systematic patterns in monetary policy decisions and adjust their expectations accordingly. However, in very short samples (as is the case in this study), monetary surprises may appear to be autocorrelated, potentially leading to biased estimates of monetary transmission. This limitation should be considered when interpreting results over longer horizons.[28]

4 Results

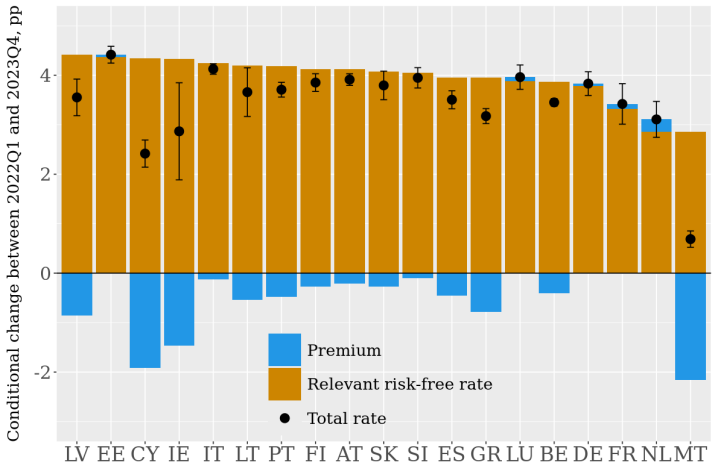
4.1 Variation in lending rate changes during post-pandemic tightening

We begin by presenting the results that quantify the changes in interest rates on newly issued loans to NFCs over the entire monetary tightening period. Figure 6 displays the estimated

[28] The limited time dimension and data constraints in some cases are also the primary reasons why pass-through equations are not estimated separately for each country.

coefficients, $\beta_{1,c}^{loan}$ (shown as dots), derived from equation (1) for each euro area country. It also provides a decomposition of the total changes in lending rates into two key components: adjustments in the relevant risk-free rates and shifts in the premium, as outlined in equations (2) and (3).

Figure 6. Decomposition of conditional changes in the rates of the newly issued loans to NFCs between 2022Q1 and 2023Q4



Source: AnaCredit
Notes: Point depicts the estimated country-specific coefficient $\beta_{1,c}^{loan}$ from equation (1) that shows the difference in interest rates of new loans issued before and after the monetary tightening and the 95% confidence bands. The brown bar is the contribution of changes in the risk-free rate $\beta_{1,c}^{risk-free}$, and the blue bar is the contribution of changes in the premium $\beta_{1,c}^{premium}$. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the contribution of the relevant risk-free rate.

Consistent with the previous literature (e.g. Beyer 2024; Sørensen and Werner 2006), the estimated coefficients exhibit notable variation across euro area countries. In 10 out of 19 countries, the coefficients fall within a relatively narrow range of 3.5pp to 4.0pp in conditional change between 2022Q1 and 2023Q4. However, some countries deviate significantly from this range. The lowest coefficients are found in Malta (0.69pp), Cyprus (2.42pp), Ireland (2.87pp) and the Netherlands (3.11pp), indicating relatively subdued adjustments in lending rates. In contrast, the highest conditional changes are observed in Estonia (4.42pp) and Italy (4.13pp), where lending rates responded more sharply. Across all euro area countries, the increase in relevant risk-free rates was the primary driver of rising lending rates.[29] In fact, in many cases, lending rate changes closely mirrored the adjustments in underlying risk-free rates.

Additionally, three key observations emerge from the analysis. First, the contribution of

[29] Accounting for the heterogeneity in relevant risk-free rate changes across countries helps to explain the cross-country heterogeneity in conditional changes in the rates for new loans. The weighted sum of squares mean deviation in overall lending rate changes across countries equals 0.112, while a similar metric for the premium is 0.072.

risk-free rates to lending rate changes exhibits notable cross-country variation. Eleven countries experienced an increase in relevant risk-free rates exceeding 4pp, with Latvia and Estonia experiencing the highest increases at 4.37–4.41pp. In contrast, the Netherlands and Malta saw risk-free rates rise by only 2.85pp, while France recorded an increase of 3.33pp. These differences stem only from the varying maturities of the risk-free rates relevant for each country, as all euro area members share the same underlying risk-free rates (OIS rates).

Second, the distinction between fixed- and floating-rate loans does not always provide a clear explanation for the observed patterns. For instance, the contribution of relevant risk-free rates was particularly pronounced in countries like Latvia and Ireland, where floating-rate loans with short fixation periods are more prevalent. Similarly, a strong contribution of risk-free rates was observed in Italy, despite its higher reliance on fixed-rate loans, as these loans tend to have shorter maturities.

Third, a large increase in the relevant risk-free rates does not necessarily result in the largest increases in lending rates. In several countries, the rise in relevant risk-free rates was offset by a decline in the premium, which moderated the overall increase in lending rates. Apart from Malta, this compensatory effect was particularly evident in countries like Cyprus, Ireland and Latvia, where the relevant risk-free rates have very short maturities. This suggests that changes in the premium can play a significant role in shaping the total lending rate adjustments.

We therefore proceed to investigate whether lending rate adjustments and factors driving them differ based on the maturity of the relevant risk-free rate. Table 2 presents the estimated coefficients from the regression analysis specified in equation (4).[30]

The results indicate that interest rates increased between 2022Q1 and 2023Q4 for all loans, primarily driven by a notable rise in the relevant risk-free rates (column 2) and a smaller contribution from a change in the premium (column 3). However, the extent of the increase varies based on the maturity of the relevant risk-free rates, with more pronounced increases observed for loans tied to shorter maturities. For example, loans with relevant risk-free rate maturities of between 2 and 5 years experienced a 0.1721 percentage point higher increase in interest rates compared to loans with relevant risk-free rate maturities exceeding 5 years. The

[30] Tables A3 in the Appendix provide the information about the share of outliers. For each euro area country we exclude very large newly issued loans: top 0.1%, or 10 top loans, whichever measure has the highest number of observations. Also, we exclude new loans with interest rates exceeding the top 1 percentile of the distribution in the respective country. Table A4 reports the share of observations with missing information. The value share of observations with missing information is substantial, averaging around 35%. The highest shares of observations with missing data were recorded for Ireland, France and Malta, which should be considered when interpreting the results.

Table 2. Regression results for conditional change in total rate, relevant risk-free rate, and premium between 2022Q1 and 2023Q4

Variables	Total rate	Relevant risk-free rate	Premium
	(1)	(2)	(3)
Dummy for 2023Q4 (D_{2023Q4})	3.107***	2.449***	0.6576***
	(0.0450)	(0.0212)	(0.0401)
D_{2023Q4}×(0, 1] month risk-free rate	1.011***	1.989***	-0.9781***
	(0.1575)	(0.0295)	(0.1510)
D_{2023Q4}×(1, 3] month risk-free rate	0.9195***	1.969***	-1.050***
	(0.1263)	(0.0276)	(0.1178)
D_{2023Q4}×(3, 6] month risk-free rate	0.8004***	1.891***	-1.090***
	(0.1159)	(0.0289)	(0.1134)
D_{2023Q4}×(6, 12] month risk-free rate	0.7315***	1.631***	-0.8992***
	(0.0883)	(0.0409)	(0.0884)
D_{2023Q4}×(1, 2] year risk-free rate	0.3551***	1.203***	-0.8479***
	(0.0793)	(0.0281)	(0.0755)
D_{2023Q4}×(2, 5] year risk-free rate	0.1721**	0.3493***	-0.1773**
	(0.0560)	(0.0218)	(0.0598)
D_{2023Q4}×Floating rate	0.0014	0.0744***	-0.0730
	(0.1402)	(0.0212)	(0.1419)
D_{2023Q4}×Adjustment more frequent than reference rate maturity	0.0978	0.0034	0.0944
	(0.1916)	(0.0183)	(0.1927)
D_{2023Q4}×Adjustment less frequent than reference rate maturity	-0.0709	-0.0104	-0.0606
	(0.2360)	(0.0312)	(0.2269)
D_{2023Q4}×Non-EUR reference rate	0.2611*	-0.0350	0.2961*
	(0.1185)	(0.0194)	(0.1206)
D_{2023Q4}×Other single reference rate	-0.1335	-0.0221	-0.1113
	(0.1678)	(0.0587)	(0.1640)
D_{2023Q4}×Multiple reference rates	-0.2788	-0.1591*	-0.1197
	(0.2840)	(0.0623)	(0.3165)
D_{2023Q4}×Cross-border loans	-0.1772	0.0055	-0.1827
	(0.1446)	(0.0207)	(0.1480)
Probability of default (imputed if missing)	9.501***	0.0028	9.498***
	(1.116)	(0.0686)	(1.120)
Fixed-Effects:			
Bank	Yes	Yes	Yes
Loan type × Creditor country	Yes	Yes	Yes
Debtor sector × Debtor country	Yes	Yes	Yes
Debtor region	Yes	Yes	Yes
Firm size class × Creditor country	Yes	Yes	Yes
Loan maturity × Creditor country	Yes	Yes	Yes
Collateral size × Creditor country	Yes	Yes	Yes
Cross-border loan × Creditor country	Yes	Yes	Yes
Multidebtor loan × Creditor country	Yes	Yes	Yes
Reference rate type × Creditor country	Yes	Yes	Yes
Risk-free rate maturity × Creditor country	Yes	Yes	Yes
Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes
Number of observations	1,133,053	1,133,053	1,133,053
R^2	0.85	0.99	0.46
Within R^2	0.78	0.98	0.09
Standard errors clustered by	Bank	Bank	Bank

Source: AnaCredit
Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. Sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with positive interest rate. The sample consists of following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Results are obtained by WLS, where weights are determined by the loan values. D_{2023Q4} denotes a binary variable that equals one for 2023Q4 and zero for 2022Q1. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

estimated coefficients steadily rise as maturities shorten, with the highest coefficient (1.011) being observed for loans with relevant risk-free rate maturities of 1 month or less.

Interestingly, the coefficient for floating-rate loans is statistically insignificant. This indicates that the sensitivity of lending rates is not simply driven by whether a loan has a fixed or floating rate. Instead, it is influenced by a more nuanced set of factors that characterize the maturity of the relevant risk-free rate. Most other factors characterizing lending rates do not show a statistically significant effect on changes in lending rates. One exception is loans referenced to non-EUR reference rates, which experienced a more pronounced increase in lending rates.

It is important to note that the differences in lending rate changes are smaller than expected given the mechanical differences in risk-free rates. This is because loans linked to risk-free rates with shorter maturities saw premia decline more substantially. For instance, loans with risk-free rate maturities of 1 month or less saw a 0.9781 percentage point greater reduction in premia compared to those with maturities exceeding 5 years. Consequently, although the relevant risk-free rates for these loans increased by 1.989 percentage points more, the differences in overall lending rate adjustments were less pronounced.

These results suggest that banks adjusted premia in a way that partially offset the increase in lending rates for loans most exposed to rising short-term risk-free rates. This behavior helped to smooth cross-loan differences in lending rate changes that would have been larger if lending rates had moved purely in line with the relevant risk-free rates. To ensure that this finding is not driven solely by our choice of the "after" period and a particular configuration of the risk-free yield curve, we re-estimate equation (4) iteratively, varying the post-tightening period from 2023Q4 to each quarter between 2022Q2 and 2023Q3. The estimated coefficients for the baseline relevant risk-free rate maturity bracket and for the interaction term between the post dummy and the respective relevant risk-free rate maturity bracket across different horizons are summarized in Table A5.

Our results indicate that the findings are robust to the choice of the "after" period. The smoothing role of the premium is evident throughout the sample period, as differences in lending rate adjustments consistently remain more muted than what would be expected based solely on changes in the underlying risk-free rates.[31]

[31] Importantly, the offsetting mechanism goes beyond what would simply emerge as a result of a constant incomplete pass-through. If the pass-through of the relevant risk-free rate was incomplete and constant over loan categories and time, offsetting would follow "mechanically". Imagine the pass-through was 0.8 for all loans. If the relevant risk-free rate increased by 4 percentage points, the lending rate would increase by 3.2 percentage points and the premium would decline by 0.8 percentage points. If the relevant risk-free rate for another loan category

There are at least two potential reasons why the adjustment in the premium may depend on the maturity of the relevant risk-free rate. First, we argue that such adjustments may be driven by bank-specific factors that vary over time. For example, banks issuing new loans tied to shorter-maturity risk-free rates (assuming consistent pricing with outstanding loans) were likely to experience a more substantial increase in net interest income, as their loan portfolios reprice more quickly in response to monetary policy changes than their funding costs, particularly deposits (see, for example, Altunok, Arslan, and Ongena 2023; Beyer 2024). As a result, deposit spreads may have been large enough to sustain or increase banks' profitability without the need for a high loan spread. This allowed banks more exposed to short-term rates to benefit from stronger gains in net interest income compared to those relying more on longer-maturity benchmarks. The resulting additional income could have allowed them to reduce the premium – to either gain market share, prevent a credit crunch or support borrower resilience. To test whether the observed smoothing of lending rate changes is driven by time-varying bank heterogeneity, we re-estimate equation (4), this time including bank-period fixed effects. These fixed effects control for any variation in how individual banks were affected across the "before" and "after" period (see Table A6). Our results suggest that the smoothing effect of the premium does not disappear when bank-period fixed effects are included.

Alternatively, a premium may smooth out monetary policy-induced increases in the risk-free rates due to "composition effects" from the supply side and the demand side. On the supply side, the literature suggests that financial institutions may change their risk taking depending on the monetary policy conditions (e.g. Chodorow-Reich 2014). According to this view, increases in policy rates raise the hurdle rate for new investment projects, making it more costly or less feasible for projects with lower expected returns or higher variance (riskier projects) to secure external financing. Likewise, a higher interest rate environment may reduce banks' incentives to reach for yield or may increase their risk aversion. In our context, such behavior may lead banks to shift their lending portfolios toward relatively less risky borrowers than prior to the tightening cycle. If borrowers of loans with shorter-maturity risk-free rates are more sensitive

increased by 2 percentage points, lending rates in this category would increase by 1.6 percentage points and the premium would decline by 0.4 percentage points only. Hence, the premium for the category with a stronger increase in the relevant risk-free rate would "mechanically" decline more strongly. Our results suggest that the pass-through is time-varying and fosters the offsetting pattern. The pass-through for loans with relevant risk-free rate maturity exceeding 5 years was quite low in the second quarter 2022 (0.5682/1.162=0.49, see Table A5) when relevant risk-free rates in this category had risen more than in other categories but quite strong in the fourth quarter 2023 (3.107/2.449=1.27, see Table A5) when a relevant risk-free rates in this category had risen less than in other categories.

to such reallocation – consistent with their higher rollover risks or credit spreads (e.g. Diamond 1991; Chen, Xu, and Yang 2021) – these loans may have experienced a relatively sharper decline in premium. Although we control for these possible compositional effects through the inclusion of loan-specific probabilities of default, we cannot rule out that our results may to some extent be driven by these supply-side shifts. From another perspective, as borrowers on short-term loans have flexibility to manage their leverage (e.g. Dangl and Zechner 2021), reaching, for example, for higher maturity or fixed-rate loans amid rising reference rates, banks may narrow the spreads on new shorter maturity loans relatively more to retain their investment returns or market shares. This should be more prevalent in less concentrated banking systems in which deposit spreads are likely to widen relatively less after rate hikes, in the spirit of Drechsler, Savov, and Schnabl (2017). These insights on the smoothing role of loan premia amid policy tightening point to an interesting interplay between the bank lending channel and the bank risk-taking channel and the market composition which has been largely unexplored.

Finally, on the demand side, one might argue that there might have been an "opportunistic" shift in borrower demand towards loan categories for which the increase in relevant risk-free rates was relatively lower. This demand shift then might have induced an increase in the premium in these categories relative to the categories that experienced a sharper increase in relevant risk-free rates. However, our data are not well suited to directly test these hypotheses, and we leave a more detailed investigation of these mechanisms to future research.

4.2 Pass-through of monetary policy rates to lending rates: the role of loan characteristics

Building on the previous results, we now aim to draw more concrete conclusions about monetary policy transmission. Specifically, we examine how the pass-through of monetary policy rate changes varies across loans with different maturities of the relevant risk-free rates, now using the full set of actual changes in the policy rate (not just before-after dummies), instrumented by high-frequency surprises. Table 3 shows the estimated coefficients from equation (5).

The pass-through from monetary policy rates to lending rates strengthens as the maturity of the relevant risk-free rates shortens. This effect becomes particularly pronounced over longer horizons (columns 1–3), i.e. when considering horizon $h = 2$ or $h = 3$ instead of our default horizon $h = 1$.[32] The most substantial pass-through is observed for loans with risk-free rates of

[32] See the second to last paragraph in Section 3.2 for the definition of the default and extended horizons. Horizon

one month or less. For these loans, an unexpected 1 percentage point increase in the deposit facility rate results in a 1.473 percentage point larger rise in lending rates after 13–18 weeks compared to loans where the relevant risk-free rates have maturities exceeding five years. The pass-through becomes more muted for loans with progressively longer maturities of the relevant risk-free rates: 1 to 3 months (1.241), 3 to 6 months (0.9814), 6 to 12 months (0.5895), and 1 to 2 years (0.6345).

$h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the GovC meeting.

Table 3. Regression results for the pass-through of monetary policy rates to lending rates, relevant risk-free rate and premium

Variables	Total rate			Relevant risk-free rate			Premium		
	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change in DF rate (ΔDF instrumented by Target and Timing surprises)	0.1696*	0.5895***	0.3715***	-0.2078***	-0.1747***	-0.6478***	0.3774***	0.7643***	1.019***
	(0.0806)	(0.1376)	(0.1029)	(0.0194)	(0.0217)	(0.0270)	(0.0878)	(0.1325)	(0.1057)
$\Delta DF \times$(0, 1] month risk-free rate	0.3333*	0.7779**	1.473***	1.097***	1.525***	2.247***	-0.7640***	-0.7471**	-0.7741**
	(0.1362)	(0.2499)	(0.2337)	(0.0493)	(0.0599)	(0.0741)	(0.1360)	(0.2713)	(0.2629)
$\Delta DF \times$(1, 3] month risk-free rate	0.1938	0.6451	1.241***	0.7695***	1.213***	1.909***	-0.5757***	-0.5680	-0.6675*
	(0.1307)	(0.3290)	(0.2608)	(0.0469)	(0.0466)	(0.0504)	(0.1164)	(0.3479)	(0.2762)
$\Delta DF \times$(3, 6] month risk-free rate	0.0479	0.4009**	0.9814***	0.6430***	1.061***	1.658***	-0.5951***	-0.6602***	-0.6763***
	(0.1125)	(0.1375)	(0.1329)	(0.0383)	(0.0336)	(0.0456)	(0.1179)	(0.1464)	(0.1546)
$\Delta DF \times$(6, 12] month risk-free rate	0.2206*	0.3447	0.5895**	0.5588***	0.8828***	1.348***	-0.3382***	-0.5381*	-0.7584***
	(0.0964)	(0.1934)	(0.2080)	(0.0489)	(0.0557)	(0.0583)	(0.0903)	(0.2118)	(0.2184)
$\Delta DF \times$(1, 2] year risk-free rate	0.3883*	0.1306	0.6345***	0.6439***	0.8866***	1.342***	-0.2556	-0.7560***	-0.7078***
	(0.1610)	(0.1596)	(0.1899)	(0.0381)	(0.0445)	(0.0674)	(0.1639)	(0.1604)	(0.1721)
$\Delta DF \times$(2, 5] year risk-free rate	-0.0960	-0.1616	0.2666*	0.1771***	0.0602*	0.5250***	-0.2731*	-0.2218	-0.2584*
	(0.1135)	(0.1857)	(0.1142)	(0.0263)	(0.0288)	(0.0383)	(0.1175)	(0.1885)	(0.1200)
$\Delta DF \times$Floating rate	0.0134	-0.3679	-0.4028	-0.1335**	-0.1070*	-0.0858	0.1469	-0.2609	-0.3170
	(0.1071)	(0.2430)	(0.2266)	(0.0478)	(0.0526)	(0.0854)	(0.0907)	(0.2704)	(0.2740)
$\Delta DF \times$Adjustment more frequent than reference rate maturity	0.0226	0.1438	0.0159	0.0348	0.0719*	-0.0992	-0.0123	0.0719	0.1151
	(0.0915)	(0.1319)	(0.1812)	(0.0338)	(0.0348)	(0.0830)	(0.0829)	(0.1332)	(0.2200)
$\Delta DF \times$Adjustment less frequent than reference rate maturity	-0.0665	-0.0873	0.2286	0.0283	0.0303	0.1025	-0.0948	-0.1176	0.1261
	(0.2142)	(0.2630)	(0.2816)	(0.0576)	(0.0706)	(0.1088)	(0.2035)	(0.2838)	(0.2727)
$\Delta DF \times$Non-EUR reference rate	-0.1451*	0.0834	-0.1059	0.1104	0.0885	0.1687**	-0.2556**	-0.0050	-0.2745*
	(0.0639)	(0.0880)	(0.1032)	(0.0585)	(0.0607)	(0.0568)	(0.0880)	(0.0839)	(0.1142)
$\Delta DF \times$Other single reference rate	-0.0837	-0.1383	-0.3534	-0.0378	-0.0307	-0.0113	-0.0459	-0.1076	-0.3421
	(0.1001)	(0.1616)	(0.2013)	(0.0591)	(0.0728)	(0.0869)	(0.1120)	(0.1994)	(0.2178)
$\Delta DF \times$Multiple reference rates	-0.4246	-0.5782	-0.1658	0.2627***	0.4806**	0.4289**	-0.6873	-1.059**	-0.5947
	(0.4592)	(0.3698)	(0.3327)	(0.0746)	(0.1841)	(0.1418)	(0.4519)	(0.3466)	(0.4335)
$\Delta DF \times$Cross-border loans	0.2317	0.1611	-0.1275	0.0480	0.0698	0.1094	0.1837	0.0913	-0.2369
	(0.1634)	(0.1975)	(0.2284)	(0.0323)	(0.0374)	(0.0659)	(0.1660)	(0.1973)	(0.2617)
Probability of default (imputed if missing)	8.215***	8.117***	7.948***	0.0051	-0.0902	-0.1639	8.210***	8.207***	8.112***
	(0.7959)	(0.7423)	(0.7409)	(0.0456)	(0.0652)	(0.0951)	(0.8012)	(0.7535)	(0.7599)
Fixed-Effects:									
GovC period × Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor sector × Debtor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Firm size class × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Collateral size × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Cross-border loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Multidebtor loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6,240,534	6,172,211	5,922,246	6,240,534	6,172,211	5,922,246	6,240,534	6,172,211	5,922,246
R^2	0.81	0.80	0.78	0.98	0.97	0.95	0.61	0.60	0.59
Within R^2	0.03	0.07	0.10	0.15	0.35	0.33	0.03	0.03	0.03
Standard errors clustered by	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Source: AnaCredit

Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. Sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022 and 2023, denominated in EUR, exceeding EUR 25,000, with positive interest rate. The sample consists of following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Horizon $h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the Governing Council meeting. Results are obtained by weighted TSLS, where weights are determined by the loan values. Changes in the deposit facility rate are instrumented by Target and Timing surprises. ΔDF denotes changes in DF rate. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

The differences in the strength of pass-through are largely driven by how the risk-free rates relevant to each group of loans respond to monetary policy changes (columns 4–6). The estimated coefficients suggest that the pass-through of unexpected changes in monetary policy rates is significantly stronger for risk-free rates with shorter maturities. This reflects what can be considered the automatic component of pass-through, as shorter-maturity risk-free rates tend to adjust more directly and rapidly to shifts in policy rates.[33] Consequently, loans tied to these rates exhibit a more pronounced sensitivity to monetary policy surprises.

However, this mechanical pass-through is not the only factor at play, as adjustments in premia act to smooth differences in pass-through across loan categories. Loans linked to shorter-maturity risk-free rates also experienced a comparatively smaller increase in premia (columns 7-9), which partially offsets the differences in the aggregate pass-through to lending rates. For example, for loans that have risk-free rates with maturities of one month or less, an unexpected 1 percentage point increase in the deposit facility rate leads to a 2.247 percentage point larger rise in underlying risk-free rates compared to loans with relevant risk-free rates exceeding five years. However, the difference in pass-through to lending rates is more muted (1.473 percentage points), due to a more substantial increase in premia for loans with longer-term risk-free rates. Thus, while loans linked to shorter-maturity risk-free rates experience a more pronounced pass-through of monetary policy surprises, the effect is not purely mechanical.

Other factors characterizing lending rates, such as a binary variable distinguishing between floating- and fixed-rate loans, do not exhibit a statistically significant effect on how monetary policy rate changes are passed through to lending rates. This underscores that the maturity of the relevant risk-free rate plays a pivotal role in explaining the variation in lending rate sensitivity to monetary policy changes, capturing much of the heterogeneity that a simple fixed-versus-floating classification fails to account for.

This variation in how loans are exposed to risk-free rates of different maturities has significant implications for the aggregate transmission of monetary policy. The first row of Table 4 shows that the estimated pass-through of an unexpected 1 percentage point increase in the deposit facility rate to lending rates is close to unity. However, this pass-through is approximately 30%

[33] It is noteworthy that the estimated pass-through to short-term risk-free rates exceeds unity at longer horizons ($h = 2$ and $h = 3$). The regression coefficient captures the response of risk-free rates to an unexpected 1 percentage point change in the deposit facility rate. However, an unexpected increase in the deposit facility rate may signal additional changes that markets subsequently anticipate. This effect is particularly pronounced during our sample period, characterized by predominantly positive monetary surprises and a steady increase in policy rates.

Table 4. Interest rate pass-through to lending rates from unexpected 1 percentage point increase in the deposit facility rate, %

	$h = 1$	$h = 2$	$h = 3$
Existing structure of new loans	0.325	0.819	0.978
All new loans become floating-rate loans with 1-month reference rate	0.517	1.009	1.416
Floating-rate loans have 1-month reference rate, no changes for fixed-rate loans	0.380	0.906	1.129
All floating-rate loans become fixed-rate loans, no changes in maturity	0.270	0.782	0.855

Source: AnaCredit
Notes: Horizon $h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the Governing Council meeting.

weaker than it would be if all new loans were tied to risk-free rates with maturities of one month or less (e.g. if all loans were floating-rate loans linked to the 1-month EURIBOR). Notably, even if only the floating-rate loans were indexed to a 1-month reference rate, the pass-through would be about 15% stronger. Conversely, if all new loans had fixed interest rates for the entire loan duration, the pass-through would be approximately 13% weaker. From a monetary policy perspective, these results are important as they reveal heterogeneity in the pass-through of monetary policy to lending rates that depends on how monetary policy affects the shape of the yield curve.

4.3 Robustness checks

We perform several robustness checks of our findings, both for the analysis of conditional changes in rates of new loans before and after monetary policy tightening, and for the analysis of the pass-through of monetary policy rates to lending rates. First, we acknowledge the specific nature of revolving credits. The fact that the maturity of revolving credits is inherently ambiguous provides additional challenges in defining the relevant risk-free rate. Thus, we check the robustness of our findings to the exclusion of revolving credits. Despite a notable reduction in the number of observations, Tables A7 and A10 in the Appendix provide the same story, stressing the importance of the maturity of the relevant risk-free rate for new other loans and credit lines other than revolving credits. Also, the decomposition of the total rate changes by euro area countries remains robust in Figure A16a.

The period of 2022–2023 saw a rapid increase in interest rates across the euro area, presenting additional challenges for estimating monetary policy transmission, even over short horizons. During the weeks leading up to each GovC date τ ($t \in [\tau - 6W, \tau)$), interest rates on new loans often exhibited significant fluctuations, rarely remaining stable. This raises the possibility that estimates of pass-through from monetary policy rates to lending rates might primarily

reflect the continuation of pre-surprise trends rather than the actual effect of monetary policy measures. To address this issue, we perform a robustness check by incorporating changes in the six-month OIS rate during the "before" period (from $\tau - 6W$ to $\tau - 1$) into our regressions. This variable captures the potential continuation of pre-existing trends in interest rates. To ensure that this adjustment is appropriately applied, only new loans issued after the GovC meeting are influenced by this variable. Consequently, we include the term $\beta_2 \cdot [0, \quad \Delta r^{OIS6M}_{\tau-6W,\tau-1}]^T$ on the right-hand side of equation (5). Note that while the baseline specification of equation (5) tends to overestimate the monetary policy transmission in 2022–2023, the adjusted specification underestimates it. More important in the context of our research is that the results of Table A11 still point to the crucial role of the maturity of the relevant risk-free rate.

We account for the possibility that loans labeled as fixed-rate loans in AnaCredit are actually floating-rate loans, but the period of rate fixation exceeds one year. Unfortunately, the AnaCredit database does not provide any information in this respect. In order to test the robustness of our results to the assumption that the relevant risk-free rate maturity coincides with a loan maturity, we use an alternative assumption: we assume that for the fixed-rate loans with maturity exceeding 3 years, the relevant risk-free rate is the 3-year OIS rate. Tables A8 and A12, and Figure A16b in the Appendix prove the robustness of our findings to this assumption.

Finally, we re-run the regressions excluding new loans with imputed probabilities of default. Despite the selection bias introduced – only certain banks that are required to report the probability of default to AnaCredit – Tables A9 and A13 lead to the same conclusion, stressing the importance of the maturity of the relevant risk-free rate for transmission.

5 Conclusions

This study provides new insights into the heterogeneity of lending practices across euro area countries and the implications it has for the transmission of monetary policy. Using granular loan-level data from AnaCredit, covering nearly seven million new loans issued to NFCs in 2022–2023, we document significant variation in the prevalence of fixed- and floating-rate loans, rate fixation periods, and reference rates used for pricing loans. These differences have important implications for how lending rates respond to changes in monetary policy.

To provide a deeper understanding of interest rate sensitivity, we introduce a nuanced measure based on the maturity of the relevant risk-free rate, which identifies the segment of the

risk-free rate yield curve that influences a loan's interest rate. Our analysis reveals substantial cross-country variation in the average maturity of these relevant risk-free rates, ranging from approximately six months in countries like Latvia and Ireland to over five years in the Netherlands, Malta and France.

Since monetary policy impacts risk-free rates differently depending on their maturity, such disparities contribute to variations in how lending rates adjusted across euro area economies during the post-pandemic episode of monetary tightening. Some of the smaller euro area countries such as Latvia and Ireland, where floating-rate loans with short reference rate maturities predominate, and Italy, where fixed-rate loans with shorter maturities are prevalent, experienced larger increases in the relevant risk-free rates, leading to more pronounced rises in lending rates. In contrast, countries like the Netherlands and France, where longer-term risk-free rates play a significant role in loan pricing, observed more moderate adjustments in lending rates.

This study also shows that the pass-through of monetary policy changes to lending rates is strongest for loans linked to shorter-maturity risk-free rates, though this effect is not purely mechanical. Specifically, the increase in relevant risk-free rates for these loans is partially mitigated by a more muted rise in premia, compared to loans linked to longer-maturity reference rates. This behavior helped smooth cross-loan differences in lending rate adjustments that would have been more pronounced had lending rates moved solely in line with changes in the relevant risk-free rates. While the precise mechanisms underlying the differential adjustment in premia lie beyond the scope of this study, we demonstrate that this finding is robust to the choice of the sample period and is not driven by any particular configuration of the risk-free yield curve. Moreover, we show that the observed smoothing is not attributable to time-varying heterogeneity across banks, but rather reflects within-bank variation in loan pricing behavior.

Several potential explanations for these dynamics exist. One possibility is that premia smooth monetary policy-induced increases in risk-free rates due to "composition effects" arising from both the supply and demand sides. On the supply side, financial institutions may adjust their risk-taking behavior in response to tighter monetary policy shifting lending toward less risky borrowers. If borrowers of loans linked to shorter-maturity risk-free rates are more affected by such reallocation, these loans may have experienced a more pronounced decline in premia.

On the demand side, there may have been an opportunistic shift toward loan categories where the increase in the relevant risk-free rate was more moderate, placing upward pressure on premia in those segments. While we control for borrower risk through loan-specific probabilities

of default, we cannot fully rule out the influence of such composition effects. Further research is needed to disentangle the relative contributions of these supply- and demand-side channels.

Overall, this study contributes to the literature by demonstrating how lending practices and the characteristics of loans can shape the effectiveness of monetary policy. Specifically, our findings illuminate how variations in lending practices drive cross-country differences in lending rate dynamics, offering a deeper understanding of the mechanisms underlying these divergences. Furthermore, our work opens avenues for further investigation into the drivers of cross-country heterogeneity in lending practices. While we document these differences and their implications, the underlying causes – whether rooted in institutional factors or firm- and bank-level characteristics – remain unexamined. Finally, our analysis focuses exclusively on the pass-through to interest rates on new loans, leaving the pass-through to interest rates on outstanding loans as a promising area for future research.

References

Albertazzi, U., F. Fringuellotti, and S. Ongena (2024). Fixed rate versus adjustable rate mortgages: Evidence from euro area banks. *European Economic Review 161*, 104643.

Altavilla, C., D. Andreeva, M. Boucinha, and S. Holton (2019, May). Monetary policy, credit institutions and the bank lending channel in the euro area. Occasional Paper Series 222, European Central Bank.

Altavilla, C., L. Brugnolini, R. S. Gürkaynak, R. Motto, and G. Ragusa (2019). Measuring euro area monetary policy. *Journal of Monetary Economics 108*(C), 162–179.

Altavilla, C., L. Burlon, M. Giannetti, and S. Holton (2022). Is there a zero lower bound? The effects of negative policy rates on banks and firms. *Journal of Financial Economics 144*(3), 885–907.

Altavilla, C., F. Canova, and M. Ciccarelli (2020). Mending the broken link: Heterogeneous bank lending rates and monetary policy pass-through. *Journal of Monetary Economics 110*, 81–98.

Altavilla, C., R. S. Gürkaynak, and R. Quaedvlieg (2024). Macro and micro of external finance premium and monetary policy transmission. *Journal of Monetary Economics 147*, 103634. Monetary Policy challenges for European Macroeconomies.

Altavilla, C., M. Pagano, M. Boucinha, and A. Polo (2023, October). Climate Risk, Bank Lending and Monetary Policy. CSEF Working Papers 687, Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy.

Altunok, F., Y. Arslan, and S. Ongena (2023, July). Monetary Policy Transmission with Adjustable and Fixed Rate Mortgages: The Role of Credit Supply. Working Papers 202305, University of Liverpool, Department of Economics.

Beck, T., A. Demirgüç-Kunt, and V. Maksimovic (2004). Bank competition and access to finance: International evidence. *Journal of Money, Credit and banking*, 627–648.

Behn, M., M. Forletta, and A. Reghezza (2024, July). Buying insurance at low economic cost – the effects of bank capital buffer increases since the pandemic. Working Paper Series 2951, European Central Bank.

Beyer, R. (2024, 01). Monetary policy pass-through to interest rates: Stylized facts from 30 european countries. *IMF Working Papers 2024*, 1.

Bittner, C., D. Bonfim, F. Heider, F. Saidi, G. Schepens, and C. Soares (2022, February). The Augmented Bank Balance-Sheet Channel of Monetary Policy. ECONtribute Discussion Papers Series 149, University of Bonn and University of Cologne, Germany.

Bredl, S. (2024). Regional loan market structure, bank lending rates and monetary transmission.

Chen, H., Y. Xu, and J. Yang (2021). Systematic risk, debt maturity, and the term structure of credit spreads. *Journal of Financial Economics 139*(3), 770–799.

Chodorow-Reich, G. (2014). Effects of unconventional monetary policy on financial institutions. *Brookings Papers on Economic Activity*, 155–204.

Core, F., F. D. Marco, T. Eisert, and G. Schepens (2024). Inflation and floating-rate loans: Evidence from the euro-area (October 31, 2024). Working papers, SSRN.

Corsetti, G., J. B. Duarte, and S. Mann (2020, June). One Money, Many Markets: Monetary Transmission and Housing Financing in the Euro Area. IMF Working Papers 2020/108, International Monetary Fund.

Coulier, L., C. Pancaro, and A. Reghezza (2024, July). Are low interest rates firing back? Interest rate risk in the banking book and bank lending in a rising interest rate environment. Working Paper Series 2950, European Central Bank.

Dangl, T. and J. Zechner (2021, 01). Debt maturity and the dynamics of leverage. *The Review of Financial Studies 34*(12), 5796–5840.

Di Maggio, M., A. Kermani, B. J. Keys, T. Piskorski, R. Ramcharan, A. Seru, and V. Yao

(2017, November). Interest rate pass-through: Mortgage rates, household consumption, and voluntary deleveraging. *American Economic Review 107*(11), 3550–88.

Diamond, D. W. (1991). Debt maturity structure and liquidity risk. *The Quarterly Journal of Economics 106*(3), 709–737.

Drechsler, I., A. Savov, and P. Schnabl (2017, 05). The deposits channel of monetary policy. *The Quarterly Journal of Economics 132*(4), 1819–1876.

Eichenbaum, M., S. Rebelo, and A. Wong (2022, March). State-dependent effects of monetary policy: The refinancing channel. *American Economic Review 112*(3), 721–61.

Flodén, M., M. Kilström, J. Sigurdsson, and R. Vestman (2020, 12). Household Debt and Monetary Policy: Revealing the Cash-Flow Channel. *The Economic Journal 131*(636), 1742–1771.

Fricke, D., S. Greppmair, and K. Paludkiewicz (2024). Excess reserves and monetary policy tightening. Discussion Papers 05/2024, Deutsche Bundesbank.

Fungáčová, Z., A. Shamshur, and L. Weill (2017). Does bank competition reduce cost of credit? cross-country evidence from europe. *Journal of Banking & Finance 83*, 104–120.

Fungácová, Z., E. Kerola, and O.-M. Laine (2023). Monetary policy transmission below zero. Bank of Finland Research Discussion Papers 11/2023, Bank of Finland.

Gambacorta, L. (2009, December). Monetary policy and the risk-taking channel. Technical report, Bank for International Settlements.

Garriga, C., F. E. Kydland, and R. Šustek (2017, 05). Mortgages and Monetary Policy. *The Review of Financial Studies 30*(10), 3337–3375.

Gürkaynak, R., H. G. Karasoy-Can, and S. S. Lee (2022, August). Stock Market's Assessment of Monetary Policy Transmission: The Cash Flow Effect. *Journal of Finance 77*(4), 2375–2421.

Holton, S. and C. Rodriguez d'Acri (2018). Interest rate pass-through since the euro area crisis. *Journal of Banking and Finance 96*, 277–291.

Horvath, R., J. Kotlebova, and M. Siranova (2018). Interest rate pass-through in the euro area: Financial fragmentation, balance sheet policies and negative rates. *Journal of Financial Stability 36*, 12–21.

Ippolito, F., A. K. Ozdagli, and A. Perez-Orive (2018). The transmission of monetary policy through bank lending: The floating rate channel. *Journal of Monetary Economics 95*, 49–71.

Kashyap, A. K. and J. C. Stein (2000, June). What do a million observations on banks say about the transmission of monetary policy? *American Economic Review 90*(3), 407–428.

Kho, S. (2023, August). Deposit market concentration and monetary transmission: evidence from the euro area. Working Papers 790, DNB.

Kosekova, K., A. Maddaloni, M. Papoutsi, and F. Schivardi (2023, June). Firm-bank relationships: a cross-country comparison. Working Paper Series 2826, European Central Bank.

Pica, S. (2022, August). Housing markets and the heterogeneous effects of monetary policy across the euro area. Working paper.

Sørensen, C. K. and T. Werner (2006). Bank interest rate pass-through in the euro area: a cross country comparison. ECB Working Paper 580, Frankfurt a. M.

Takaoka, S. and K. Takahashi (2022). Corporate debt and unconventional monetary policy: The risk-taking channel with bond and loan contracts. *Journal of Financial Stability 60*, 101013.

Tzamourani, P. (2021). The interest rate exposure of euro area households. *European Economic Review 132*, 103643.

Vickery, J. (2008). How and why do small firms manage interest rate risk? *Journal of Financial Economics 87*(2), 446–470.

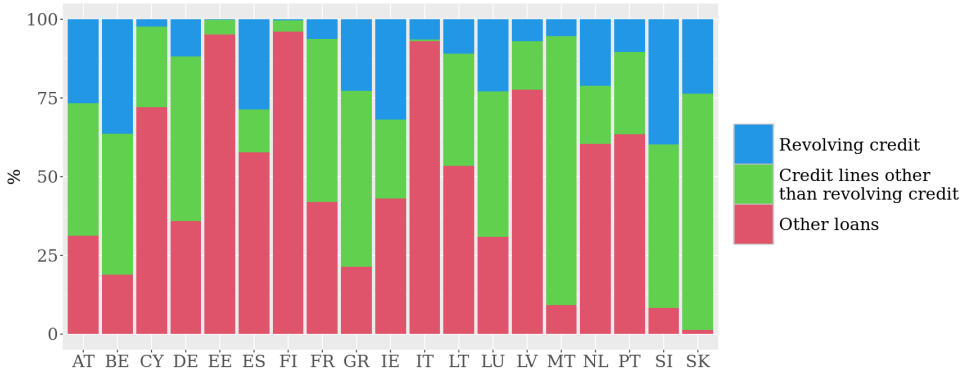
A Appendix

Table A1. Summary statistics for newly issued loans to NFCs by euro area country, 2022–2023

Country	All loans	...of which credit lines, revolving credits and other credits	...of which loans $\geq 25K$, with a positive interest rate, reported within 6 months	...of which loans to NFCs not in financial and insurance sector and non-syndicated loans	Loans included into the analysis	...as a share of all loans
			Value of new loans			
	bill. of EUR	%	%	%	bill. of EUR	%
AT	195.0	94.7	68.5	90.7	114.6	58.8
BE	350.0	97.0	49.8	81.8	138.4	39.5
CY	4.8	94.0	94.8	96.4	4.1	85.9
DE	975.2	87.2	72.1	83.5	511.9	52.5
EE	6.9	88.8	91.1	88.9	4.9	71.9
ES	611.9	80.4	73.3	85.9	309.8	50.6
FI	55.7	89.4	91.1	71.3	32.4	58.1
FR	1,935.5	79.1	41.2	76.8	484.6	25.0
GR	51.1	99.1	76.9	85.2	33.1	64.8
IE	184.4	90.0	34.9	69.8	40.5	21.9
IT	1,172.6	71.6	73.4	88.3	544.2	46.4
LT	9.3	71.9	92.9	90.3	5.6	60.3
LU	222.9	65.1	56.7	69.6	57.2	25.7
LV	3.6	84.1	88.4	94.7	2.6	70.4
MT	4.5	71.1	78.4	93.3	2.3	51.8
NL	234.2	83.6	58.1	81.9	93.1	39.7
PT	66.1	83.8	71.6	95.1	37.7	57.0
SI	14.4	81.5	91.0	84.4	9.0	62.6
SK	22.0	81.8	82.0	88.1	13.0	59.1
			Number of new loans			
	Number	%	%	%	Number	%
AT	370,789	74.1	42.3	98.6	114,660	30.9
BE	927,843	76.6	44.5	95.2	301,076	32.4
CY	26,646	54.5	49.8	99.2	7,169	26.9
DE	5,233,584	75.0	40.7	98.8	1,580,626	30.2
EE	18,237	38.9	72.5	99.5	5,116	28.1
ES	9,469,269	49.3	31.0	99.3	1,436,303	15.2
FI	488,964	24.0	46.6	96.7	52,863	10.8
FR	8,588,863	51.6	42.1	97.2	1,815,906	21.1
GR	65,140	79.2	66.7	99.0	34,097	52.3
IE	229,090	61.8	36.7	96.6	50,165	21.9
IT	8,328,146	32.1	45.4	99.3	1,203,663	14.5
LT	43,405	35.1	58.8	99.2	8,892	20.5
LU	171,241	25.7	75.5	93.2	30,948	18.1
LV	9,125	36.8	84.7	99.6	2,835	31.1
MT	197,493	1.4	69.5	98.4	1,902	1.0
NL	341,831	91.3	18.1	95.3	53,807	15.7
PT	695,999	71.2	38.8	99.8	192,039	27.6
SI	147,704	22.8	51.7	99.0	17,209	11.7
SK	143,285	24.7	66.0	99.2	23,142	16.2

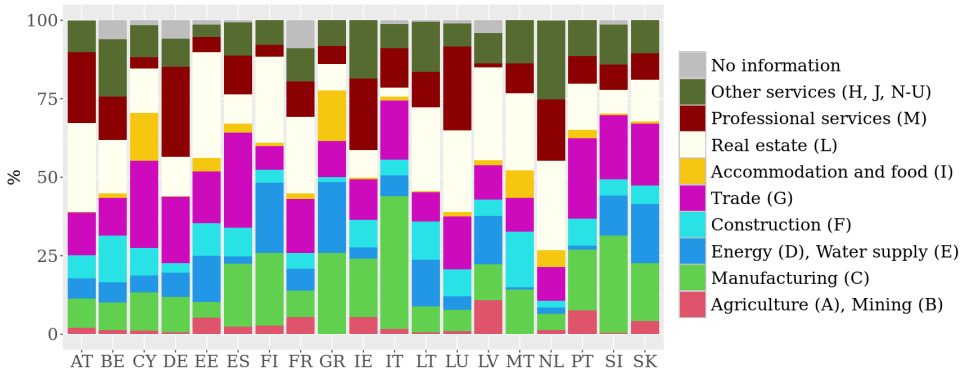
Source: AnaCredit
Notes: New loans to euro area NFCs issued in 2022–2023, denominated in EUR. First column represents the country of residence of the bank.

Figure A1. Structure of newly issued loans to NFCs in euro area countries by loan type, 2022–2023



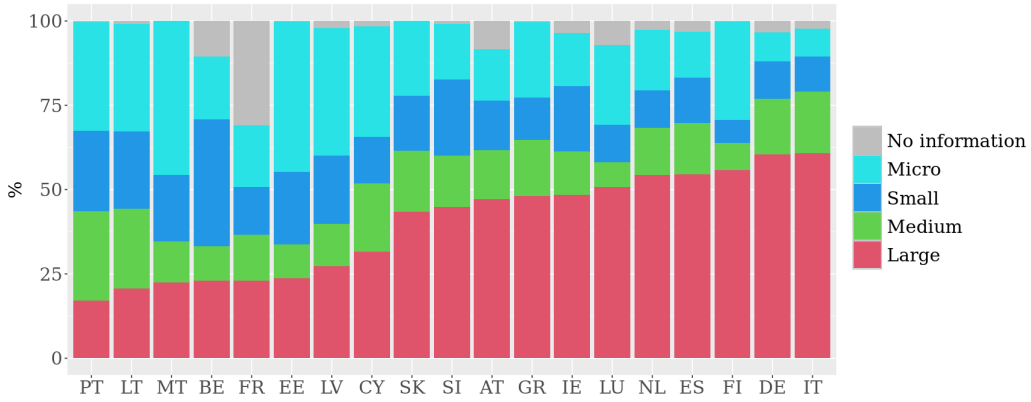
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A2. Structure of newly issued loans to NFCs in euro area countries by borrower's macroeconomic sector, 2022–2023



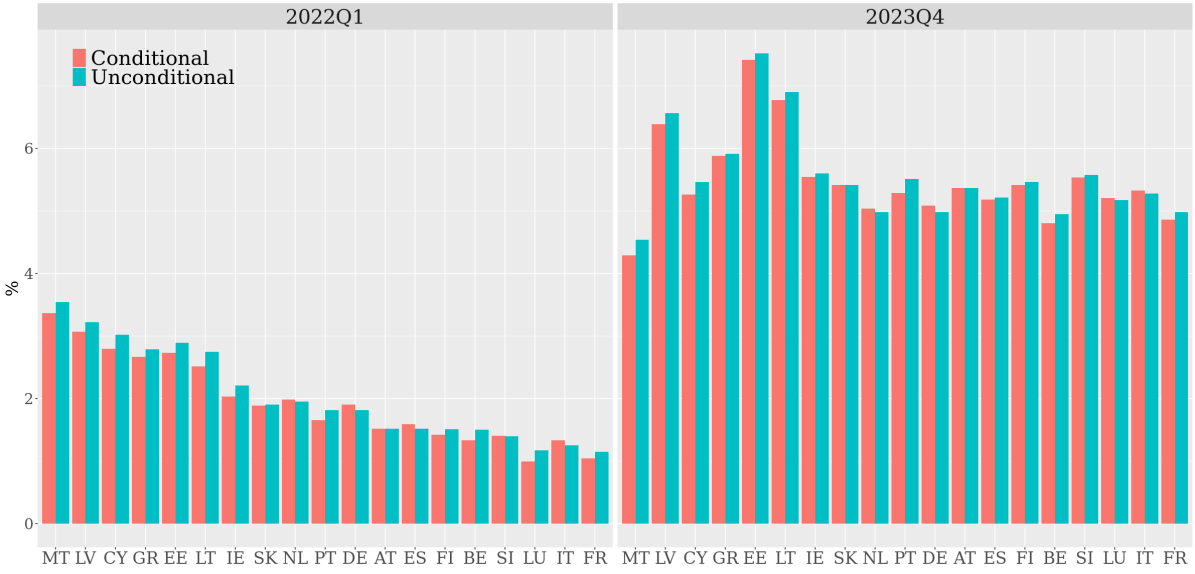
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A3. Structure of newly issued loans to NFCs in euro area countries by borrower's size class, 2022–2023



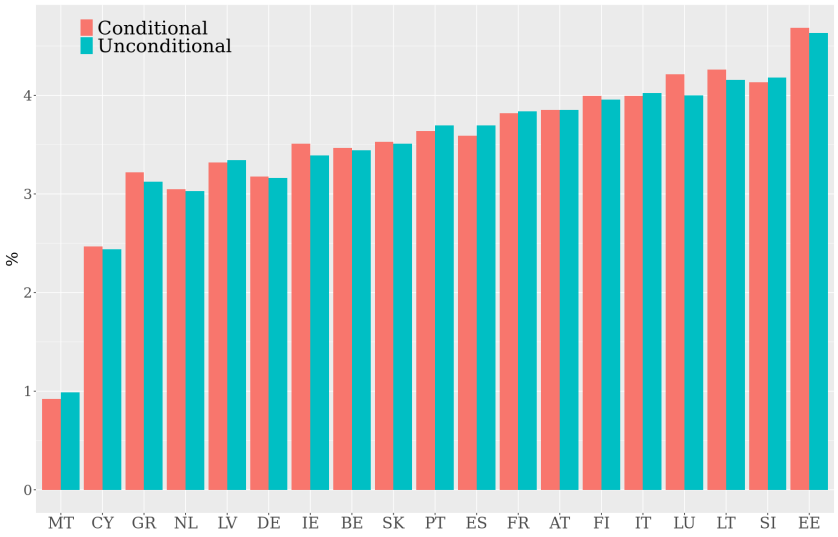
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Shares are value-weighted. Countries are arranged according to the share of loans to large enterprises. The horizontal axis represents the country of residence of the bank. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A4. Unconditional and conditional interest rates of newly issued loans to NFCs, 2022Q1 and 2023Q4



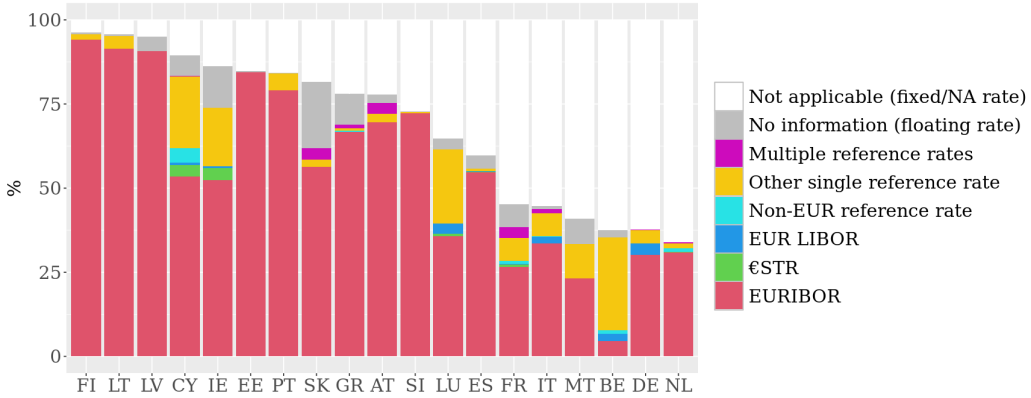
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with positive a interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. The unconditional bar represents the unconditional weighted average, while the conditional bar depicts the weighted average controlling for the firm size category, macroeconomic sector, maturity category, loan type and cross-border loan dummies (see footnote 15). The horizontal axis represents the country of residence of the bank. Countries are arranged according to the unconditional weighted average level of interest rates in 2022Q1.

Figure A5. Changes in unconditional and conditional mean interest rates of newly issued loans to NFCs in euro area countries between 2022Q1 and 2023Q4



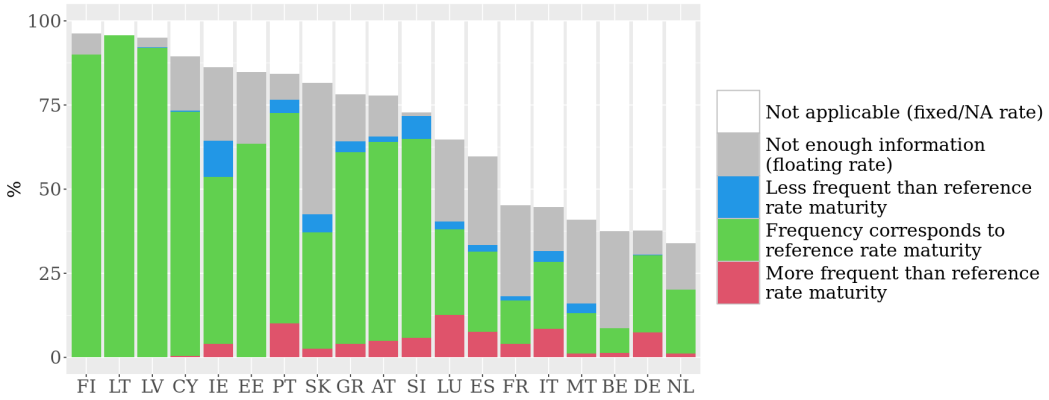
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. The unconditional bar represents the unconditional weighted average, while the conditional bar depicts the weighted average controlling for the firm size category, macroeconomic sector, maturity category, loan type and cross-border loan dummies (estimated for 2022Q1 and 2023Q4 separately, see footnote 15). The horizontal axis represents the country of residence of the bank. Countries are arranged according to the change in unconditional weighted mean interest rate in 2023Q4 compared with 2022Q1.

Figure A6. Structure of newly issued floating-rate loans to NFCs in euro area countries by reference rates, 2022–2023



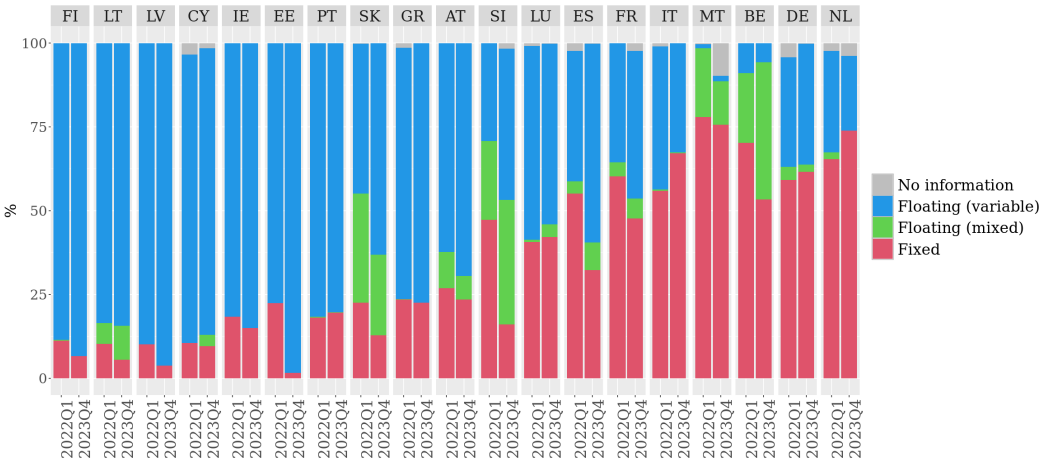
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A7. Structure of newly issued floating-rate loans to NFCs in euro area countries by correspondence between frequency of rate adjustments and reference rate maturity, 2022–2023



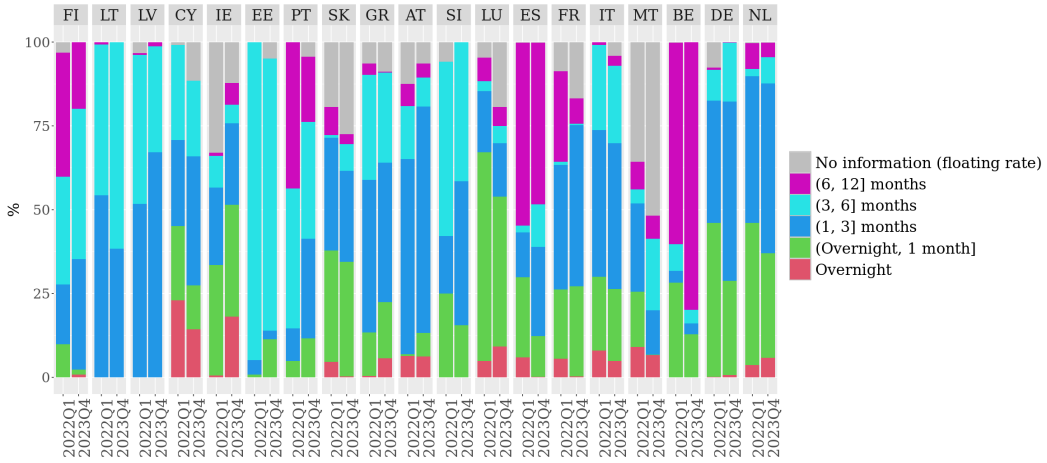
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A8. Structure of newly issued loans to NFCs in euro area countries by rate type category, 2022Q1 and 2023Q4



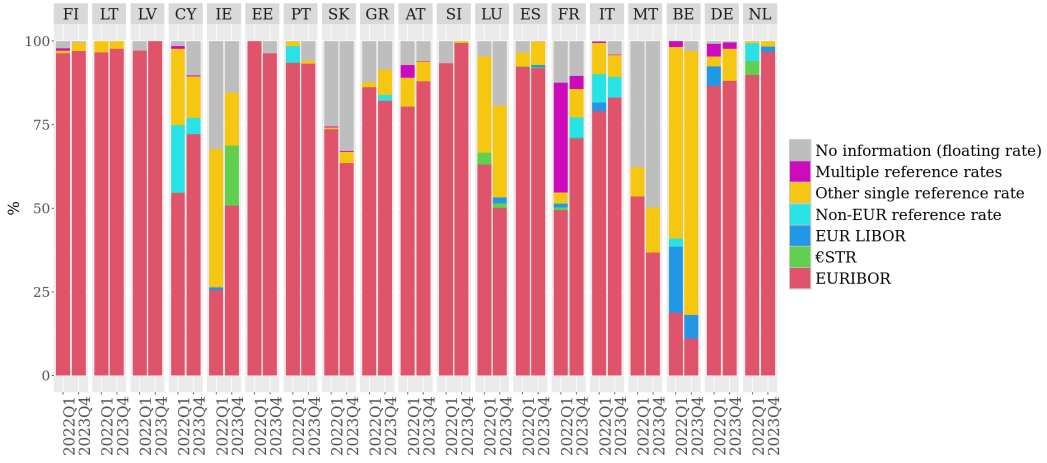
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates in 2022-2023. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A9. Structure of newly issued floating-rate loans to NFCs in euro area countries by reference rate maturity, 2022Q1 and 2023Q4



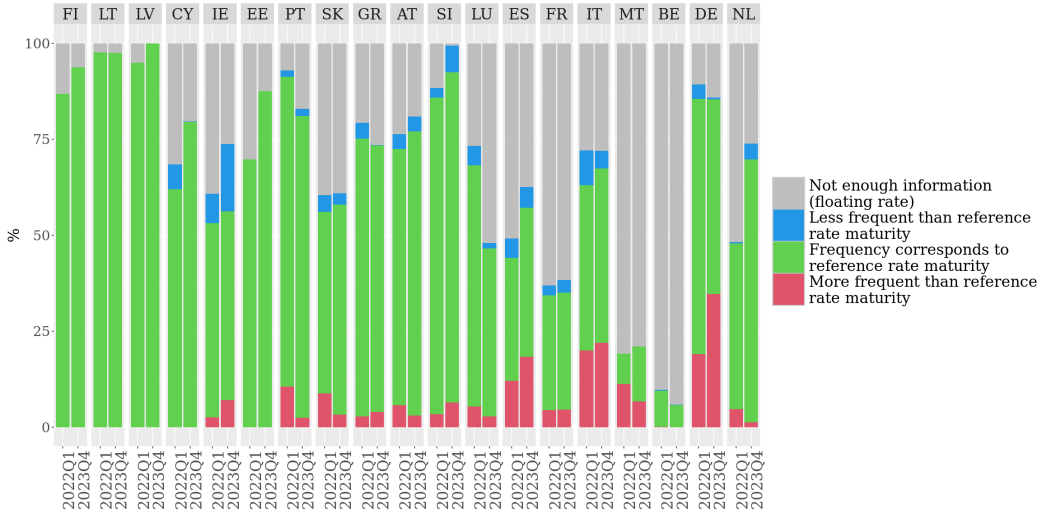
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates in 2022-2023. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A10. Structure of newly issued floating-rate loans to NFCs in euro area countries by reference rate, 2022Q1 and 2023Q4



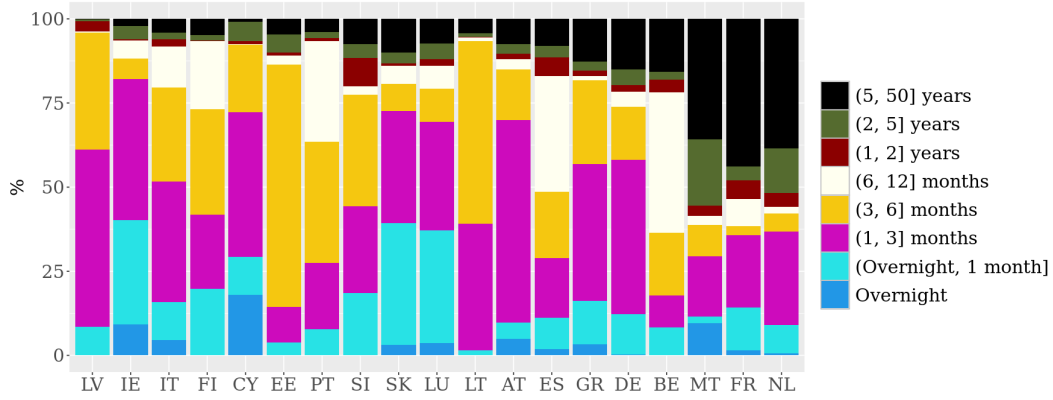
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates in 2022-2023. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A11. Structure of newly issued floating-rate loans to NFCs in euro area countries by correspondence between frequency of rate adjustment and reference rate maturity, 2022Q1 and 2023Q4



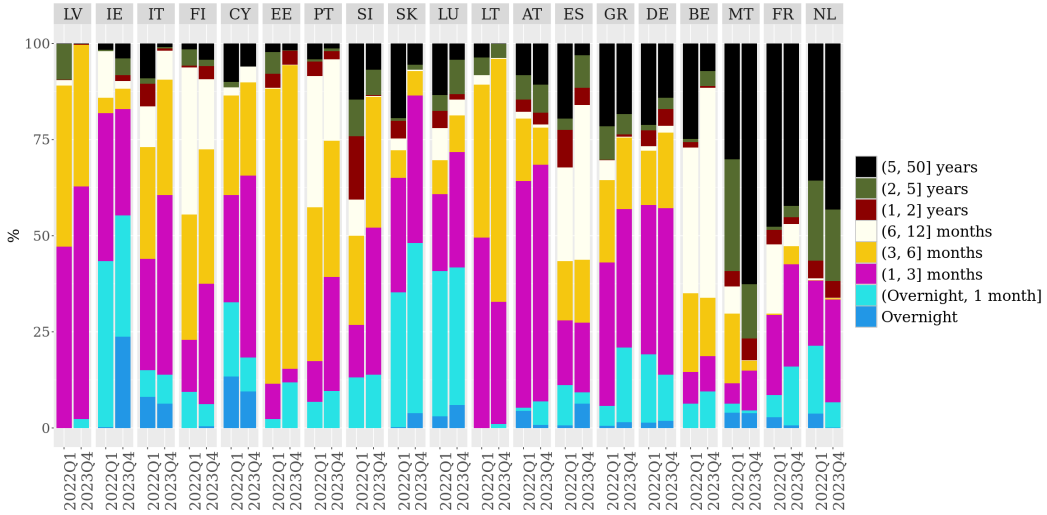
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. Fixed-rate loans have interest rates that remain constant over the entire duration of the loan. Floating-rate loans have interest rates that adjust over time. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the share of new loans with fixed interest rates in 2022-2023. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A12. Structure of newly issued loans to NFCs by maturity of the relevant risk-free rate in euro area countries, 2022–2023



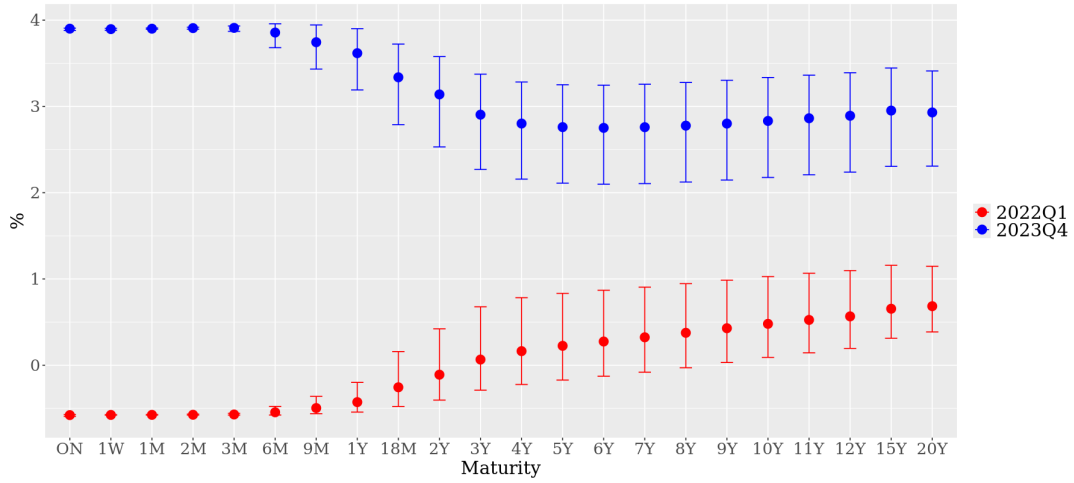
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the weighted average maturity of the relevant risk-free rate. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A13. Structure of newly issued loans to NFCs by maturity of the relevant risk-free rate in euro area countries, 2022Q1 and 2023Q4



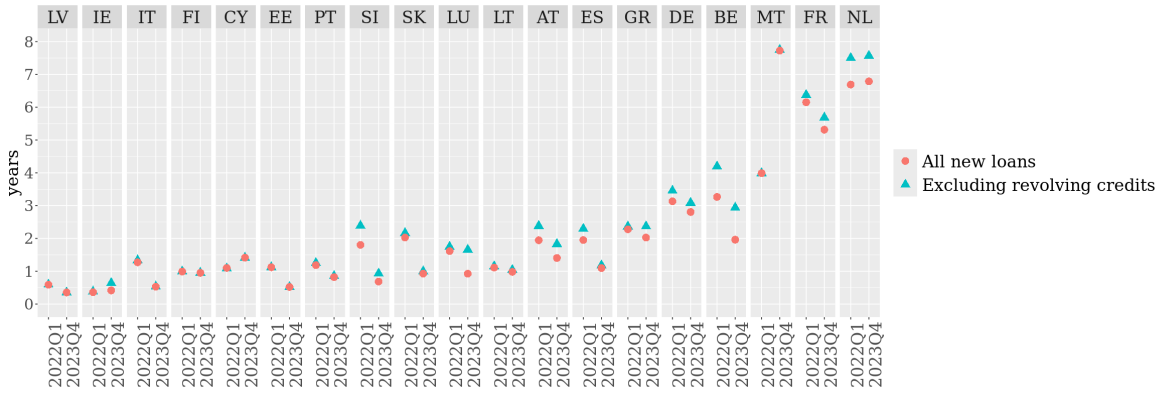
Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Shares are value-weighted. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the weighted average maturity of the relevant risk-free rate. The results for several countries were subject to additional randomization in order to avoid the disclosure of confidential information. In such cases, the figure does not report precise results, though the randomization procedure preserves the overall trends (see footnote 17).

Figure A14. OIS (risk-free) rates in 2022Q1 and 2023Q4



Source: ECB SDW
Notes: Dots denote the average level of the OIS rate during the respective period, while bars indicate to the minium and maximum value of the rate.

Figure A15. Weighted average maturity of the relevant risk-free rate for newly issued loans to NFCs in euro area countries, 2022Q1 and 2023Q4



Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the weighted average maturity of the relevant risk-free rate in 2022–2023.

Table A2. PD and imputed PD data availability for newly issued loans to NFCs by euro area country, 2022–2023

Country	Number of observations	Total value, bill. of EUR	Coverage of PD after imputation		Correlation, PD and imputed PD
			% of number	% of value	
AT	114,660	114.6	66.9	70.7	0.76
BE	301,076	138.4	91.0	89.2	0.38
CY	7,169	4.1	68.2	65.7	-
DE	1,580,626	511.9	57.3	79.8	0.27
EE	5,116	4.9	86.1	81.9	0.67
ES	1,436,303	309.8	66.4	72.5	0.42
FI	52,863	32.4	81.1	88.8	0.38
FR	1,815,906	484.6	93.4	83.6	0.63
GR	34,097	33.1	60.6	77.9	0.57
IE	50,165	40.5	70.3	58.5	0.37
IT	1,203,663	544.2	84.5	94.4	0.68
LT	8,892	5.6	73.2	81.8	0.70
LU	30,948	57.2	64.8	72.9	0.39
LV	2,835	2.6	89.1	88.7	0.69
MT	1,902	2.3	63.9	65.9	-
NL	53,807	93.1	94.1	70.7	0.55
PT	192,039	37.7	83.3	87.3	0.57
SI	17,209	9.0	88.3	76.8	0.81
SK	23,142	13.0	97.6	94.9	0.63

Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022–2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. The first column represents the country of residence of the bank.

Table A3. Summary statistics before and after the exclusion of outliers, 2022Q1 and 2023Q4

Country	Number of loans	Total value, bill. of EUR	Share of outliers, % of value	W.mean rate, %		W.mean maturity, years		Value of the loan, thsd. of EUR	
				all loans	excl. outliers	all loans	excl. outliers	all loans	excl. outliers
AT	28,182	28,774.3	9.6	3.2	3.2	7.8	8.0	1,021.0	933.1
BE	85,915	41,862.8	11.9	3.8	3.7	3.3	3.3	487.3	434.2
CY	1,849	942.9	20.3	4.2	4.4	7.3	6.7	509.9	413.9
DE	374,444	119,511.6	29.8	3.5	3.5	3.8	4.6	319.2	226.5
EE	1,278	1,112.1	23.4	5.3	5.1	4.1	3.9	870.2	678.7
ES	365,703	78,062.0	23.2	3.5	3.5	3.7	3.4	213.5	165.9
FI	13,978	6,608.0	19.9	3.4	3.4	7.5	8.2	472.7	383.0
FR	448,147	123,952.4	23.6	2.8	2.9	6.8	7.9	276.6	213.7
GR	7,512	6,958.8	22.4	5.1	4.8	7.4	7.2	926.4	727.6
IE	13,414	10,476.1	17.3	3.8	4.0	3.2	3.6	781.0	657.6
IT	329,247	148,139.7	24.8	3.8	3.7	2.3	2.6	449.9	342.0
LT	1,746	1,272.2	26.9	4.8	5.1	5.1	4.7	728.6	542.0
LU	7,444	12,672.8	20.4	2.9	2.9	2.4	2.9	1,702.4	1,371.3
LV	635	487.5	29.3	5.3	5.4	4.4	4.4	767.7	564.4
MT	496	399.4	29.7	4.1	4.3	7.1	6.6	805.2	585.3
NL	14,653	23,909.7	11.6	3.8	3.7	7.5	8.2	1,631.7	1,458.8
PT	50,550	9,342.2	11.9	3.7	3.7	4.5	4.3	184.8	164.6
SI	4,059	2,164.5	13.3	3.6	3.6	3.6	3.6	533.3	468.6
SK	5,621	2,883.3	20.3	3.7	3.9	4.0	4.4	513.0	414.0

Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. The first column represents the country of residence of the bank.

Table A4. Summary statistics before and after the exclusion of loans with missing data, 2022Q1 and 2023Q4

Country	Number of loans	Total value, bill. of EUR	Share of loans with missing data, %		W.mean rate, %		W.mean maturity, years		Value of the loan, thsd. of EUR	
			number	value	all loans	excl. missing	all loans	excl. missing	all loans	excl. missing
AT	27,871	26,005.5	45.3	37.8	3.2	3.2	8.0	7.9	933.1	1,061.6
BE	84,969	36,895.2	21.3	22.5	3.7	3.8	3.3	3.2	434.2	427.5
CY	1,816	751.6	36.9	42.0	4.4	4.4	6.9	6.8	413.9	380.6
DE	370,316	83,859.8	45.4	33.9	3.5	3.6	4.6	4.9	226.5	274.4
EE	1,255	851.8	14.7	19.9	5.05	5.0	3.9	4.1	678.7	637.5
ES	361,680	59,986.3	38.1	31.1	3.5	3.7	3.4	3.4	165.9	184.6
FI	13,821	5,293.7	19.7	18.4	3.4	3.3	8.2	8.1	383.0	389.5
FR	443,043	94,680.5	37.7	54.1	2.9	2.9	7.9	6.0	213.7	157.5
GR	7,426	5,402.9	49.6	36.4	4.8	4.7	7.2	7.0	727.6	917.5
IE	13,175	8,664.0	77.2	58.2	4.0	4.0	3.6	3.5	657.6	1,204.1
IT	325,625	111,354.2	19.8	9.4	3.7	3.7	2.6	2.5	342.0	386.4
LT	1,717	930.5	20.5	22.3	5.1	4.9	4.7	4.8	542.0	529.5
LU	7,357	10,088.4	56.9	43.2	2.9	2.5	2.9	3.1	1,371.3	1,806.4
LV	611	344.9	15.5	23.8	5.4	5.2	4.4	4.5	564.4	509.5
MT	480	280.9	58.5	57.8	4.3	4.6	6.6	6.7	585.3	595.5
NL	14,483	21,128.3	14.2	39.3	3.7	3.9	8.2	9.1	1,458.8	1,032.6
PT	49,993	8,230.7	16.9	13.1	3.7	3.7	4.3	4.3	164.6	172.2
SI	4,006	1,877.2	12.2	23.1	3.6	3.7	3.6	3.8	468.6	410.6
SK	5,550	2,297.5	4.7	17.9	3.9	4.0	4.4	4.8	414.0	356.9

Source: AnaCredit
Notes: New loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. The first column represents the country of residence of the bank.

Table A5. Regression results for conditional change in total rate, relevant risk-free rate and premium between 2022Q1 and 2022Q2, 2022Q3, ..., 2023Q4

		2022Q2	2022Q3	2022Q4	2023Q1	2023Q2	2023Q3	2023Q4
Dummy for post period (D_{post})	Total Rate	0.5682***	1.135***	1.993***	2.442***	2.818***	3.019***	3.107***
		(0.0417)	(0.0468)	(0.0505)	(0.0737)	(0.0407)	(0.0414)	(0.0450)
	Ref Rate	1.162***	1.517***	2.269***	2.378***	2.474***	2.650***	2.449***
		(0.0173)	(0.0185)	(0.0191)	(0.0212)	(0.0215)	(0.0215)	(0.0212)
	Premium	-0.5938***	-0.3824***	-0.2758***	0.0633	0.3442***	0.3687***	0.6576***
		(0.0406)	(0.0454)	(0.0464)	(0.0655)	(0.0347)	(0.0312)	(0.0401)
$D_{post}\times$(0, 1] month risk-free rate	Total Rate	-0.5135***	-0.5961***	-0.3633**	0.1677	0.4851**	0.8803***	1.011***
		(0.0597)	(0.1161)	(0.1746)	(0.1647)	(0.1701)	(0.1612)	(0.1575)
	Ref Rate	-1.424***	-1.067***	-0.5116***	0.4257***	1.129***	1.489***	1.989***
		(0.0359)	(0.0514)	(0.0437)	(0.0373)	(0.0333)	(0.0329)	(0.0295)
	Premium	0.9106***	0.4706***	0.1483	-0.2579	-0.6435***	-0.6084***	-0.9781***
		(0.0652)	(0.1185)	(0.1668)	(0.1588)	(0.1669)	(0.1593)	(0.1510)
$D_{post}\times$(1, 3] month risk-free rate	Total Rate	-0.5322***	-0.6329***	-0.3388***	0.0753	0.5006***	0.7857***	0.9195***
		(0.0472)	(0.0665)	(0.0961)	(0.1107)	(0.0938)	(0.1238)	(0.1263)
	Ref Rate	-1.258***	-0.7136***	-0.1223***	0.7209***	1.314***	1.579***	1.969***
		(0.0382)	(0.0364)	(0.0312)	(0.0339)	(0.0299)	(0.0289)	(0.0276)
	Premium	0.7253***	0.0807	-0.2165**	-0.6456***	-0.8129***	-0.7929***	-1.050***
		(0.0570)	(0.0743)	(0.0979)	(0.1030)	(0.0877)	(0.1150)	(0.1178)
$D_{post}\times$(3, 6] month risk-free rate	Total Rate	-0.5104***	-0.4059***	-0.1453	0.2930**	0.5933***	0.8330***	0.8004***
		(0.0399)	(0.0624)	(0.0838)	(0.1019)	(0.0953)	(0.1242)	(0.1159)
	Ref Rate	-1.049***	-0.3930***	0.1848***	0.9678***	1.418***	1.600***	1.891***
		(0.0322)	(0.0331)	(0.0323)	(0.0387)	(0.0321)	(0.0300)	(0.0289)
	Premium	0.5384***	-0.0129	-0.3301***	-0.6748***	-0.8243***	-0.7666***	-1.090***
		(0.0520)	(0.0652)	(0.0849)	(0.0893)	(0.0904)	(0.1202)	(0.1134)
$D_{post}\times$(6, 12] month risk-free rate	Total Rate	-0.3446***	-0.0293	0.0867	0.4511***	0.6915***	0.7967***	0.7315***
		(0.0604)	(0.0963)	(0.1208)	(0.0907)	(0.0738)	(0.0812)	(0.0883)
	Ref Rate	-0.8200***	-0.0880**	0.4611***	1.084***	1.433***	1.553***	1.631***
		(0.0261)	(0.0315)	(0.0321)	(0.0414)	(0.0379)	(0.0365)	(0.0409)
	Premium	0.4755***	0.0588	-0.3744***	-0.6329***	-0.7414***	-0.7567***	-0.8992***
		(0.0549)	(0.0826)	(0.1129)	(0.0687)	(0.0613)	(0.0735)	(0.0884)
$D_{post}\times$(1, 2] year risk-free rate	Total Rate	-0.3986***	-0.1533**	-0.0254	0.2380**	0.3846***	0.5099***	0.3551***
		(0.0377)	(0.0737)	(0.0849)	(0.0833)	(0.0722)	(0.0805)	(0.0793)
	Ref Rate	-0.6170***	-0.0222	0.5410***	1.035***	1.249***	1.326***	1.203***
		(0.0268)	(0.0299)	(0.0254)	(0.0265)	(0.0263)	(0.0243)	(0.0281)
	Premium	0.2184***	-0.1311	-0.5665***	-0.7967***	-0.8644***	-0.8159***	-0.8479***
		(0.0484)	(0.0722)	(0.0903)	(0.0898)	(0.0770)	(0.0811)	(0.0755)
$D_{post}\times$(2, 5] year risk-free rate	Total Rate	-0.1266**	-0.0353	0.1286*	0.1592*	0.1656*	0.1944*	0.1721**
		(0.0421)	(0.0524)	(0.0521)	(0.0753)	(0.0827)	(0.0972)	(0.0560)
	Ref Rate	-0.1152***	-0.0238	0.3179***	0.5098***	0.5265***	0.5238***	0.3493***
		(0.0178)	(0.0244)	(0.0183)	(0.0224)	(0.0277)	(0.0198)	(0.0218)
	Premium	-0.0113	-0.0115	-0.1893***	-0.3506***	-0.3609***	-0.3293***	-0.1773**
		(0.0398)	(0.0486)	(0.0518)	(0.0725)	(0.0876)	(0.0929)	(0.0598)

Source: AnaCredit
Notes: This table replicates results from Table 2 for all post-quarters from 2022Q2 until 2023Q4. Only results for post-quarter dummy variables are reported for brevity. *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. Ref Rate stands for risk-free rate. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Results are obtained by WLS, where weights are determined by the loan values. D_{post} denotes a binary variable that equals one for a respective post quarter and zero for 2022Q1. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Table A6. Regression results for conditional change in total rate, relevant risk-free rate and premium between 2022Q1 and 2023Q4, including bank-quarter fixed effects

Variables	Total rate	Relevant risk-free rate	Premium
	(1)	(2)	(3)
Dummy for 2023Q4 (D_{2023Q4})	-	-	-
D_{2023Q4}×(0, 1] month risk-free rate	0.5747***	1.809***	-1.235***
	(0.1325)	(0.0461)	(0.1295)
D_{2023Q4}×(1, 3] month risk-free rate	0.7758***	1.837***	-1.061***
	(0.1015)	(0.0421)	(0.0947)
D_{2023Q4}×(3, 6] month risk-free rate	0.7292***	1.756***	-1.027***
	(0.0955)	(0.0423)	(0.0924)
D_{2023Q4}×(6, 12] month risk-free rate	0.7295***	1.520***	-0.7901***
	(0.0969)	(0.0468)	(0.1042)
D_{2023Q4}×(1, 2] year risk-free rate	0.3452***	1.129***	-0.7842***
	(0.0759)	(0.0302)	(0.0777)
D_{2023Q4}×(2, 5] year risk-free rate	0.2114***	0.3096***	-0.0982
	(0.0599)	(0.0201)	(0.0649)
D_{2023Q4}×Floating rate	0.4236***	0.1583***	0.2653**
	(0.0878)	(0.0340)	(0.0984)
D_{2023Q4}×Adjustment more frequent than reference rate maturity	-0.0365	-0.0035	-0.0329
	(0.0861)	(0.0221)	(0.0986)
D_{2023Q4}×Adjustment less frequent than reference rate maturity	-0.0362	0.0076	-0.0438
	(0.1772)	(0.0591)	(0.1397)
D_{2023Q4}×Non-EUR reference rate	-0.2028**	-0.0535.	-0.1494.
	(0.0698)	(0.0294)	(0.0848)
D_{2023Q4}×Other single reference rate	-0.1368	-0.1317.	-0.0050
	(0.1343)	(0.0763)	(0.1654)
D_{2023Q4}×Multiple reference rates	0.3902	-0.1574	0.5476
	(0.8256)	(0.1027)	(0.9191)
D_{2023Q4}×Cross-border loans	-0.2236	-0.0009	-0.2227
	(0.1550)	(0.0244)	(0.1691)
Probability of default (imputed if missing)	9.447***	-0.0219	9.469***
	(1.086)	(0.0641)	(1.098)
Fixed-Effects:			
Bank × Quarter	Yes	Yes	Yes
Loan type × Creditor country	Yes	Yes	Yes
Debtor sector × Debtor country	Yes	Yes	Yes
Debtor region	Yes	Yes	Yes
Firm size class × Creditor country	Yes	Yes	Yes
Loan maturity × Creditor country	Yes	Yes	Yes
Collateral size × Creditor country	Yes	Yes	Yes
Cross-border loan × Creditor country	Yes	Yes	Yes
Multidebtor loan × Creditor country	Yes	Yes	Yes
Reference rate type × Creditor country	Yes	Yes	Yes
Risk-free rate maturity × Creditor country	Yes	Yes	Yes
Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes
Number of observations	1,133,053	1,133,053	1,133,053
R^2	0.87	0.99	0.52
Within R^2	0.07	0.64	0.07
Standard errors clustered by	Bank	Bank	Bank

Source: AnaCredit
Notes: This table replicates results from Table 2 but with fixed effects at the bank-quarter level. As a consequence, the coefficient for D_{2023Q4} is no longer identified. *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Results are obtained by WLS, where weights are determined by the loan values. D_{2023Q4} denotes a binary variable that equals one for 2023Q4 and zero for 2022Q1. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Table A7. Regression results for conditional change in total rate, relevant risk-free rate and premium between 2022Q1 and 2023Q4, excluding revolving credits

Variables	Total rate	Relevant risk-free rate	Premium
	(1)	(2)	(3)
Dummy for 2023Q4 (D_{2023Q4})	3.108***	2.420***	0.6883***
	(0.0471)	(0.0189)	(0.0404)
D_{2023Q4}×(0, 1] month risk-free rate	1.134***	2.036***	-0.9019***
	(0.1770)	(0.0307)	(0.1722)
D_{2023Q4}×(1, 3] month risk-free rate	0.9265***	2.010***	-1.083***
	(0.1310)	(0.0267)	(0.1262)
D_{2023Q4}×(3, 6] month risk-free rate	0.8202***	1.924***	-1.103***
	(0.1299)	(0.0292)	(0.1323)
D_{2023Q4}×(6, 12] month risk-free rate	0.7679***	1.648***	-0.8806***
	(0.0947)	(0.0386)	(0.0926)
D_{2023Q4}×(1, 2] year risk-free rate	0.3051***	1.189***	-0.8838***
	(0.0824)	(0.0328)	(0.0818)
D_{2023Q4}×(2, 5] year risk-free rate	0.1995***	0.3382***	-0.1387*
	(0.0551)	(0.0193)	(0.0573)
D_{2023Q4}×Floating rate	-0.0364	0.0731**	-0.1095
	(0.1547)	(0.0234)	(0.1565)
D_{2023Q4}×Adjustment more frequent than reference rate maturity	0.1784	-0.0085	0.1869
	(0.2042)	(0.0186)	(0.2039)
D_{2023Q4}×Adjustment less frequent than reference rate maturity	-0.1141	-0.0356	-0.0785
	(0.2465)	(0.0272)	(0.2332)
D_{2023Q4}×Non-EUR reference rate	0.1827	-0.0434	0.2261*
	(0.1100)	(0.0244)	(0.1139)
D_{2023Q4}×Other single reference rate	-0.3731	-0.0514	-0.3217
	(0.2901)	(0.0350)	(0.2822)
D_{2023Q4}×Multiple reference rates	-0.4101	-0.0782	-0.3319
	(0.2802)	(0.0493)	(0.2956)
D_{2023Q4}×Cross-border loans	-0.2117	0.0062	-0.2179
	(0.1627)	(0.0232)	(0.1647)
Probability of default (imputed if missing)	9.231***	0.0012	9.230***
	(1.145)	(0.0726)	(1.134)
Fixed-Effects:			
Bank	Yes	Yes	Yes
Loan type × Creditor country	Yes	Yes	Yes
Debtor sector × Debtor country	Yes	Yes	Yes
Debtor region	Yes	Yes	Yes
Firm size class × Creditor country	Yes	Yes	Yes
Loan maturity × Creditor country	Yes	Yes	Yes
Collateral size × Creditor country	Yes	Yes	Yes
Cross-border loan × Creditor country	Yes	Yes	Yes
Multidebtor loan × Creditor country	Yes	Yes	Yes
Reference rate type × Creditor country	Yes	Yes	Yes
Risk-free rate maturity × Creditor country	Yes	Yes	Yes
Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes
Number of observations	1,031,655	1,031,655	1,031,655
R^2	0.85	0.99	0.48
Within R^2	0.78	0.98	0.09
Standard errors clustered by	Bank	Bank	Bank

Source: AnaCredit
Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Results are obtained by WLS, where weights are determined by the loan values. D_{2023Q4} denotes a binary variable that equals one for 2023Q4 and zero for 2022Q1. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Table A8. Regression results for conditional change in total rate, relevant risk-free rate and premium between 2022Q1 and 2023Q4, 3-year adjustment for fixed rate loan

Variables	Total rate	Relevant risk-free rate	Premium
	(1)	(2)	(3)
Dummy for 2023Q4 (D_{2023Q4})	3.175***	2.883***	0.2924*
	(0.1229)	(0.0205)	(0.1272)
D_{2023Q4}×(0, 1] month risk-free rate	0.9716***	1.627***	-0.6559***
	(0.1263)	(0.0212)	(0.1200)
D_{2023Q4}×(1, 3] month risk-free rate	0.8704***	1.587***	-0.7167***
	(0.1613)	(0.0199)	(0.1597)
D_{2023Q4}×(3, 6] month risk-free rate	0.7411***	1.497***	-0.7562***
	(0.1077)	(0.0233)	(0.1093)
D_{2023Q4}×(6, 12] month risk-free rate	0.6757***	1.250***	-0.5739***
	(0.0809)	(0.0345)	(0.0900)
D_{2023Q4}×(1, 2] year risk-free rate	0.2836*	0.8633***	-0.5797***
	(0.1417)	(0.0188)	(0.1426)
D_{2023Q4}×(2, 5] year risk-free rate	-	-	-
D_{2023Q4}×Floating rate	-0.0327	-0.0090	-0.0237
	(0.1199)	(0.0149)	(0.1229)
D_{2023Q4}×Adjustment more frequent than reference rate maturity	0.1136	0.0193	0.0943
	(0.1870)	(0.0132)	(0.1867)
D_{2023Q4}×Adjustment less frequent than reference rate maturity	-0.0742	-0.0005	-0.0738
	(0.2351)	(0.0265)	(0.2280)
D_{2023Q4}×Non-EUR reference rate	0.1827	-0.0434	0.2261*
	(0.1100)	(0.0244)	(0.1139)
D_{2023Q4}×Other single reference rate	-0.1195	-0.0338	-0.0857
	(0.1619)	(0.0444)	(0.1557)
D_{2023Q4}×Multiple reference rates	-0.2633	-0.1073*	-0.1560
	(0.2840)	(0.0514)	(0.3102)
D_{2023Q4}×Cross-border loans	-0.1739	-0.0042	-0.1697
	(0.1448)	(0.0170)	(0.1465)
Probability of default (imputed if missing)	9.500***	-0.0404	9.540***
	(1.116)	(0.0603)	(1.119)
Fixed-Effects:			
Bank	Yes	Yes	Yes
Loan type × Creditor country	Yes	Yes	Yes
Debtor sector × Debtor country	Yes	Yes	Yes
Debtor region	Yes	Yes	Yes
Firm size class × Creditor country	Yes	Yes	Yes
Loan maturity × Creditor country	Yes	Yes	Yes
Collateral size × Creditor country	Yes	Yes	Yes
Cross-border loan × Creditor country	Yes	Yes	Yes
Multidebtor loan × Creditor country	Yes	Yes	Yes
Reference rate type × Creditor country	Yes	Yes	Yes
Reference rate maturity × Creditor country	Yes	Yes	Yes
Risk-free rate adjustment frequency × Creditor country	Yes	Yes	Yes
Number of observations	1,133,053	1,133,053	1,133,053
R^2	0.85	0.99	0.45
Within R^2	0.78	0.99	0.07
Standard errors clustered by	Bank	Bank	Bank

Source: AnaCredit
Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying risk-free rate. Results are obtained by WLS, where weights are determined by the loan values. D_{2023Q4} denotes a binary variable that equals one for 2023Q4 and zero for 2022Q1. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

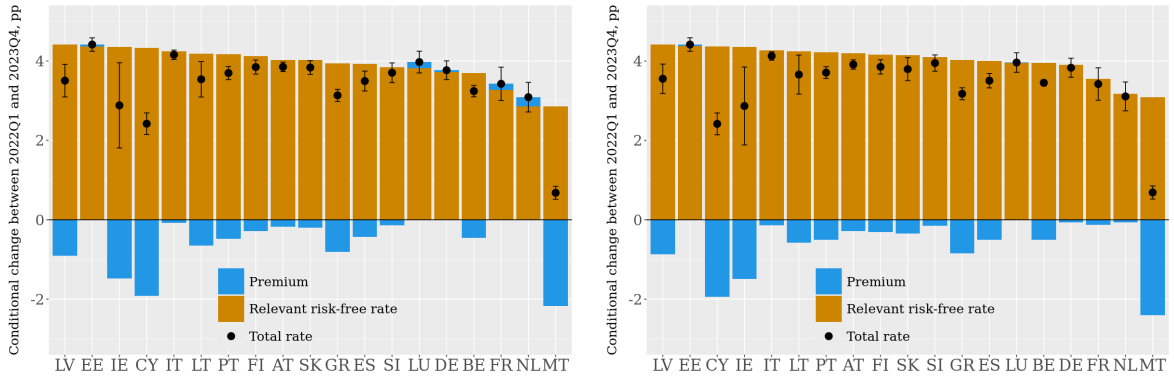
Table A9. Regression results for conditional change in total rate, relevant risk-free rate and premium between 2022Q1 and 2023Q4, using non-imputed PD observations only

Variables	Total rate	Relevant risk-free rate	Premium
	(1)	(2)	(3)
Dummy for 2023Q4 (D_{2023Q4})	3.109***	2.437***	0.6720***
	(0.0582)	(0.0260)	(0.0511)
D_{2023Q4}×(0, 1] month risk-free rate	1.068***	2.013***	-0.9444***
	(0.1827)	(0.0338)	(0.1754)
D_{2023Q4}×(1, 3] month risk-free rate	0.9326***	1.982***	-1.050***
	(0.1514)	(0.0324)	(0.1401)
D_{2023Q4}×(3, 6] month risk-free rate	0.8029***	1.906***	-1.103***
	(0.1377)	(0.0350)	(0.1341)
D_{2023Q4}×(6, 12] month risk-free rate	0.7067***	1.665***	-0.9586***
	(0.1081)	(0.0482)	(0.1049)
D_{2023Q4}×(1, 2] year risk-free rate	0.4620***	1.237***	-0.7748***
	(0.0940)	(0.0349)	(0.0887)
D_{2023Q4}×(2, 5] year risk-free rate	0.2118**	0.3702***	-0.1584
	(0.0767)	(0.0303)	(0.0829)
D_{2023Q4}×Floating rate	0.0181	0.0710*	-0.0530
	(0.1923)	(0.0309)	(0.1943)
D_{2023Q4}×Adjustment more frequent than reference rate maturity	0.2891	0.0087	0.2804
	(0.2300)	(0.0245)	(0.2308)
D_{2023Q4}×Adjustment less frequent than reference rate maturity	-0.1319	-0.0367	-0.0952
	(0.1686)	(0.0322)	(0.1576)
D_{2023Q4}×Non-EUR reference rate	0.1018	-0.0382.	0.1400
	(0.1283)	(0.0231)	(0.1337)
D_{2023Q4}×Other single reference rate	-0.0680	-0.0459	-0.0221
	(0.1585)	(0.0707)	(0.1491)
D_{2023Q4}×Multiple reference rates	-0.8853**	-0.1149	-0.7704**
	(0.2749)	(0.0753)	(0.2690)
D_{2023Q4}×Cross-border loans	-0.3791*	-0.0088	-0.3703
	(0.1917)	(0.0290)	(0.1963)
Probability of default	1.340***	-0.0248*	1.365***
	(0.1144)	(0.0125)	(0.1115)
Fixed-Effects:			
Bank	Yes	Yes	Yes
Loan type × Creditor country	Yes	Yes	Yes
Debtor sector × Debtor country	Yes	Yes	Yes
Debtor region	Yes	Yes	Yes
Firm size class × Creditor country	Yes	Yes	Yes
Loan maturity × Creditor country	Yes	Yes	Yes
Collateral size × Creditor country	Yes	Yes	Yes
Cross-border loan × Creditor country	Yes	Yes	Yes
Multidebtor loan × Creditor country	Yes	Yes	Yes
Reference rate type × Creditor country	Yes	Yes	Yes
Risk-free rate maturity × Creditor country	Yes	Yes	Yes
Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes
Number of observations	841,004	841,004	841,004
R^2	0.85	0.99	0.44
Within R^2	0.78	0.98	0.07
Standard errors clustered by	Bank	Bank	Bank

Source: AnaCredit
Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Results are obtained by WLS, where weights are determined by the loan values. D_{2023Q4} denotes a binary variable that equals one for 2023Q4 and zero for 2022Q1. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Figure A16. Decomposition of conditional changes in the rates of newly issued loans to NFCs between 2022Q1 and 2023Q4, robustness checks

(a) Excluding revolving credits **(b)** 3-year adjustment for fixed-rate loans



Source: AnaCredit
Notes: Points depict the estimated country-specific coefficient $\beta_{1,c}^{loan}$ from equation (1) that shows the difference in interest rates of new loans issued before and after the monetary tightening and the 95% confidence bands. Brown bars show the contribution of changes in the risk-free rate $\beta_{1,c}^{risk-free}$, and blue bars the contribution of changes in the premium $\beta_{1,c}^{premium}$. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022Q1 and 2023Q4, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. The horizontal axis represents the country of residence of the bank. Countries are arranged according to the contribution of the relevant risk-free rate.

Table A10. Regression results for the pass-through of monetary policy rates to lending rates, relevant risk-free rate and premium, excluding revolving credits

Variables	Total rate			Relevant risk-free rate			Premium		
	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change in DF rate (ΔDF instrumented by Target and Timing surprises)	0.1856*	0.6508***	0.4160***	-0.2140***	-0.1737***	-0.6370***	0.3996***	0.8245***	1.053***
	(0.0763)	(0.1380)	(0.0987)	(0.0183)	(0.0221)	(0.0261)	(0.0832)	(0.1330)	(0.1042)
$\Delta DF \times$(0, 1] month risk-free rate	0.1950	0.6777*	1.465***	1.082***	1.544***	2.232***	-0.8869***	-0.8662**	-0.7678**
	(0.1344)	(0.2676)	(0.2332)	(0.0552)	(0.0648)	(0.0826)	(0.1316)	(0.2886)	(0.2650)
$\Delta DF \times$(1, 3] month risk-free rate	0.1426	0.5721	1.168***	0.7755***	1.208***	1.889***	-0.6329***	-0.6363	-0.7204**
	(0.1385)	(0.3569)	(0.2516)	(0.0500)	(0.0470)	(0.0497)	(0.1230)	(0.3785)	(0.2666)
$\Delta DF \times$(3, 6] month risk-free rate	0.0926	0.2892	0.9816***	0.6627***	1.084***	1.648***	-0.5701***	-0.7947***	-0.6660***
	(0.1159)	(0.1665)	(0.1390)	(0.0378)	(0.0368)	(0.0499)	(0.1183)	(0.1790)	(0.1624)
$\Delta DF \times$(6, 12] month risk-free rate	0.2964***	0.3429	0.7188***	0.5764***	0.8827***	1.348***	-0.2800***	-0.5398**	-0.6288**
	(0.0782)	(0.1774)	(0.1999)	(0.0502)	(0.0577)	(0.0584)	(0.0788)	(0.1973)	(0.2066)
$\Delta DF \times$(1, 2] year risk-free rate	0.1699	0.0368	0.7899***	0.6068***	0.8459***	1.320***	-0.4369**	-0.8091***	-0.5303**
	(0.1305)	(0.1642)	(0.1924)	(0.0366)	(0.0427)	(0.0787)	(0.1393)	(0.1723)	(0.1652)
$\Delta DF \times$(2, 5] year risk-free rate	-0.1759	-0.2228	0.3592***	0.1569***	0.0534	0.4953***	-0.3328*	-0.2762	-0.1361
	(0.1300)	(0.2057)	(0.1089)	(0.0267)	(0.0305)	(0.0425)	(0.1348)	(0.2097)	(0.1142)
$\Delta DF \times$Floating rate	0.0881	-0.2613	-0.4321*	-0.1288**	-0.1231*	-0.0791	0.2169*	-0.1382	-0.3530
	(0.1077)	(0.2520)	(0.2125)	(0.0481)	(0.0520)	(0.0918)	(0.0998)	(0.2828)	(0.2637)
$\Delta DF \times$Adjustment more frequent than reference rate maturity	0.0041	0.1492	0.2153	0.0345	0.0749**	-0.0075	-0.0304	0.0743	0.2228
	(0.1007)	(0.1506)	(0.1640)	(0.0302)	(0.0240)	(0.0697)	(0.0953)	(0.1572)	(0.2062)
$\Delta DF \times$Adjustment less frequent than reference rate maturity	-0.1416	-0.1163	0.1116	0.0513	0.0365	0.0861	-0.1929	-0.1527	0.0254
	(0.2582)	(0.2902)	(0.3506)	(0.0622)	(0.0782)	(0.1145)	(0.2429)	(0.2994)	(0.3210)
$\Delta DF \times$Non-EUR reference rate	-0.1259*	0.0024	-0.1302	0.1164	0.0933	0.1402*	-0.2423**	-0.0908	-0.2704**
	(0.0636)	(0.0824)	(0.0964)	(0.0630)	(0.0560)	(0.0595)	(0.0839)	(0.0753)	(0.0897)
$\Delta DF \times$Other single reference rate	-0.1526	-0.3522*	-0.6051**	-0.0209	-0.0501	-0.0152	-0.1316	-0.3021	-0.5900**
	(0.1083)	(0.1765)	(0.2317)	(0.0638)	(0.0817)	(0.0840)	(0.1139)	(0.2008)	(0.2187)
$\Delta DF \times$Multiple reference rates	-0.5605	-0.7087*	-0.4209	0.2251**	0.4999*	0.3569**	-0.7856	-1.209***	-0.7778
	(0.4662)	(0.3375)	(0.3569)	(0.0817)	(0.1948)	(0.1380)	(0.4553)	(0.3012)	(0.4428)
$\Delta DF \times$Cross-border loans	0.4126**	0.2198	-0.0365	0.0716*	0.0834*	0.1551*	0.3409*	0.1364	-0.1917
	(0.1511)	(0.2444)	(0.2910)	(0.0330)	(0.0407)	(0.0703)	(0.1586)	(0.2509)	(0.3389)
Probability of default (imputed if missing)	7.863***	7.783***	7.593***	-0.0338	-0.1084	-0.1661	7.897***	7.892***	7.759***
	(0.8380)	(0.7971)	(0.8022)	(0.0479)	(0.0702)	(0.1013)	(0.8416)	(0.8003)	(0.8058)
Fixed-Effects:									
GovC period × Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor sector × Debtor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Firm size class × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Collateral size × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Cross-border loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Multidebtor loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	5,724,844	5,660,635	5,434,006	5,724,844	5,660,635	5,434,006	5,724,844	5,660,635	5,434,006
R^2	0.81	0.80	0.79	0.98	0.97	0.95	0.63	0.62	0.61
Within R^2	0.03	0.07	0.10	0.15	0.35	0.34	0.02	0.02	0.03
Standard errors clustered by	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Source: AnaCredit
Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022 and 2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Horizon $h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the Governing Council meeting. Results are obtained by weighted TSLS, where weights are determined by the loan values. Changes in the deposit facility rate are instrumented by Target and Timing surprises. ΔDF denotes changes in DF rate. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Table A11. Regression results for the pass-through of monetary policy rates to lending rates, relevant risk-free rate and premium, controlling for the pre-existing trends

Variables	Total rate			Relevant risk-free rate			Premium		
	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change in DF rate (ΔDF instrumented by Target and Timing surprises)	0.2168**	0.6987***	0.8070***	-0.1914***	-0.0281	-0.0818	0.4082***	0.7267***	0.8888***
	(0.0817)	(0.1356)	(0.1132)	(0.0179)	(0.0155)	(0.0491)	(0.0897)	(0.1333)	(0.1088)
$\Delta DF \times$(0, 1] month risk-free rate	0.3350*	0.7767**	1.461***	1.103***	1.528***	2.233***	-0.7682***	-0.7511**	-0.7719**
	(0.1347)	(0.2476)	(0.2103)	(0.0512)	(0.0718)	(0.2071)	(0.1388)	(0.2668)	(0.2822)
$\Delta DF \times$(1, 3] month risk-free rate	0.1882	0.6388*	1.154***	0.7670***	1.208***	1.787***	-0.5788***	-0.5695	-0.6324*
	(0.1318)	(0.3207)	(0.2101)	(0.0454)	(0.0563)	(0.1578)	(0.1201)	(0.3454)	(0.3020)
$\Delta DF \times$(3, 6] month risk-free rate	0.0318	0.3715**	0.8982***	0.6177***	1.009***	1.538***	-0.5859***	-0.6372***	-0.6396***
	(0.1118)	(0.1396)	(0.1333)	(0.0374)	(0.0285)	(0.0862)	(0.1207)	(0.1458)	(0.1565)
$\Delta DF \times$(6, 12] month risk-free rate	0.2225*	0.3555	0.5651**	0.5593***	0.9022***	1.313***	-0.3367***	-0.5467**	-0.7480***
	(0.0981)	(0.2015)	(0.2078)	(0.0462)	(0.0438)	(0.0966)	(0.0929)	(0.2017)	(0.2178)
$\Delta DF \times$(1, 2] year risk-free rate	0.4057*	0.1230	0.5338*	0.6640***	0.8720***	1.194***	-0.2582	-0.7490***	-0.6601***
	(0.1643)	(0.1718)	(0.2154)	(0.0328)	(0.0488)	(0.1079)	(0.1615)	(0.1522)	(0.1662)
$\Delta DF \times$(2, 5] year risk-free rate	-0.0895	-0.1511	0.2227	0.1866***	0.0819**	0.4619***	-0.2760*	-0.2330	-0.2392*
	(0.1135)	(0.1839)	(0.1158)	(0.0217)	(0.0258)	(0.0388)	(0.1170)	(0.1885)	(0.1205)
$\Delta DF \times$Adjustable rate	0.0470	-0.3177	-0.3154	-0.0783	-0.0186	0.0376	0.1253	-0.2991	-0.3530
	(0.1100)	(0.2488)	(0.2060)	(0.0474)	(0.0609)	(0.1534)	(0.0975)	(0.2721)	(0.2867)
$\Delta DF \times$Adjustment more frequent than reference rate maturity	-0.0282	0.0957	0.0109	-0.0593	-0.0189	-0.1114	0.0312	0.1146	0.1223
	(0.0986)	(0.1315)	(0.2513)	(0.0411)	(0.0456)	(0.1597)	(0.0839)	(0.1309)	(0.2034)
$\Delta DF \times$Adjustment less frequent than reference rate maturity	-0.0364	-0.0756	0.3043	0.0608	0.0426	0.2008	-0.0972	-0.1182	0.1035
	(0.2107)	(0.2590)	(0.3470)	(0.0698)	(0.0785)	(0.2237)	(0.2055)	(0.2858)	(0.2662)
$\Delta DF \times$Non-EUR reference rate	-0.1147	0.1283	-0.0728	0.1636*	0.1756	0.2266	-0.2784**	-0.0473	-0.2994*
	(0.0734)	(0.1134)	(0.2987)	(0.0658)	(0.1026)	(0.3516)	(0.1003)	(0.0884)	(0.1305)
$\Delta DF \times$Other single reference rate	-0.1037	-0.1542	-0.4738*	-0.0625	-0.0503	-0.1733	-0.0411	-0.1038	-0.3005
	(0.1023)	(0.1606)	(0.2346)	(0.0639)	(0.0994)	(0.2470)	(0.1111)	(0.1995)	(0.2354)
$\Delta DF \times$Multiple reference rates	-0.5475	-0.8244*	-0.6303	0.0412	0.0397	-0.2447	-0.5887	-0.8641*	-0.3856
	(0.4117)	(0.3571)	(0.6126)	(0.0929)	(0.0828)	(0.4096)	(0.4711)	(0.3609)	(0.3455)
$\Delta DF \times$Cross-border loans	0.2308	0.1446	-0.1847	0.0470	0.0326	0.0214	0.1838	0.1120	-0.2061
	(0.1624)	(0.1918)	(0.2615)	(0.0266)	(0.0337)	(0.0965)	(0.1618)	(0.1984)	(0.2504)
Changes in 6M OIS rate before GovC meeting	0.2823***	0.5588***	0.9246***	0.5620***	1.066***	1.426***	-0.2798***	-0.5073***	-0.5011**
	(0.0545)	(0.1467)	(0.1635)	(0.0281)	(0.0229)	(0.0221)	(0.0558)	(0.1466)	(0.1632)
Probability of default (imputed if missing)	8.218***	8.123***	7.959***	0.0104	-0.0770	-0.1474	8.208***	8.201***	8.106***
	(0.7947)	(0.7409)	(0.7374)	(0.0452)	(0.0630)	(0.0871)	(0.8022)	(0.7557)	(0.7618)
Fixed-Effects:									
GovC period × Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor sector × Debtor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Firm size class × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Collateral size × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Cross-border loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Multidebtor loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6,240,534	6,172,211	5,922,246	6,240,534	6,172,211	5,922,246	6,240,534	6,172,211	5,922,246
R^2	0.81	0.80	0.79	0.99	0.98	0.96	0.61	0.60	0.60
Within R^2	0.04	0.07	0.12	0.23	0.50	0.55	0.03	0.03	0.03
Standard errors clustered by	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Source: AnaCredit

Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022 and 2023, denominated in EUR, exceeding EUR 25'000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Horizon $h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the Governing Council meeting. Results are obtained by weighted TSLS, where weights are determined by the loan values. Changes in the deposit facility rate are instrumented by Target and Timing surprises. ΔDF denotes changes in DF rate. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Table A12. Regression results for the pass-through of monetary policy rates to lending rates, relevant risk-free rate and premium, 3-year adjustment for fixed-rate loans

Variables	Total rate			Relevant risk-free rate			Premium		
	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change in DF rate (ΔDF instrumented by Target and Timing surprises)	0.1460	0.8221**	0.7625***	-0.0346	-0.0788	-0.1604*	0.1806	0.9009**	0.9230***
	(0.1318)	(0.3096)	(0.2284)	(0.0480)	(0.0507)	(0.0728)	(0.1255)	(0.3218)	(0.2578)
$\Delta DF \times$(0, 1] month risk-free rate	0.3676***	0.4773**	1.037***	0.8903***	1.423***	1.763***	-0.5227***	-0.9455***	-0.7261***
	(0.1111)	(0.1800)	(0.1347)	(0.0347)	(0.0395)	(0.0525)	(0.1175)	(0.1846)	(0.1450)
$\Delta DF \times$(1, 3] month risk-free rate	0.2258*	0.3715	0.8229***	0.5733***	1.104***	1.414***	-0.3475**	-0.7329**	-0.5913**
	(0.1042)	(0.2302)	(0.1728)	(0.0330)	(0.0299)	(0.0536)	(0.1067)	(0.2252)	(0.2027)
$\Delta DF \times$(3, 6] month risk-free rate	0.0752	0.1458	0.5733***	0.4434***	0.9439***	1.151***	-0.3682**	-0.7982***	-0.5782**
	(0.1300)	(0.2214)	(0.1725)	(0.0364)	(0.0410)	(0.0618)	(0.1299)	(0.2217)	(0.1890)
$\Delta DF \times$(6, 12] month risk-free rate	0.2500*	0.0836	0.1769	0.3523***	0.7578***	0.8381***	-0.1023	-0.6742**	-0.6612***
	(0.1260)	(0.2166)	(0.1682)	(0.0729)	(0.0751)	(0.0730)	(0.1091)	(0.2205)	(0.1947)
$\Delta DF \times$(1, 2] year risk-free rate	0.4168*	-0.0989	0.2353	0.3751***	0.7054***	0.7739***	0.0417	-0.8043**	-0.5386*
	(0.1914)	(0.2752)	(0.2357)	(0.0507)	(0.0524)	(0.1133)	(0.1995)	(0.2990)	(0.2516)
$\Delta DF \times$(2, 5] year risk-free rate	-	-	-	-	-	-	-	-	-
$\Delta DF \times$Floating rate	0.0037	-0.2884	-0.3539	-0.1089*	-0.1002*	-0.0868	0.1126	-0.1882	-0.2672
	(0.0982)	(0.2274)	(0.2023)	(0.0431)	(0.0437)	(0.0752)	(0.0861)	(0.2490)	(0.2421)
$\Delta DF \times$Adjustment more frequent than reference rate maturity	0.0253	0.1026	-0.0075	0.0361	0.0814*	-0.0840	-0.0107	0.0212	0.0765
	(0.0917)	(0.1371)	(0.1794)	(0.0337)	(0.0337)	(0.0808)	(0.0841)	(0.1395)	(0.2165)
$\Delta DF \times$Adjustment less frequent than reference rate maturity	-0.0706	-0.0834	0.2323	0.0226	0.0391	0.1032	-0.0932	-0.1225	0.1292
	(0.2141)	(0.2615)	(0.2819)	(0.0537)	(0.0711)	(0.1082)	(0.2033)	(0.2816)	(0.2728)
$\Delta DF \times$Non-EUR reference rate	-0.1451*	0.0777	-0.1093	0.1124	0.0870	0.1642**	-0.2575**	-0.0092	-0.2735*
	(0.0636)	(0.0854)	(0.1021)	(0.0627)	(0.0618)	(0.0560)	(0.0915)	(0.0836)	(0.1114)
$\Delta DF \times$Other single reference rate	-0.0804	-0.1621	-0.3689	-0.0163	-0.0413	-0.0084	-0.0641	-0.1208	-0.3605
	(0.0982)	(0.1575)	(0.1979)	(0.0554)	(0.0723)	(0.0883)	(0.1085)	(0.1934)	(0.2143)
$\Delta DF \times$Multiple reference rates	-0.4164	-0.6129	-0.2043	0.1169	0.4731*	0.3652**	-0.5333	-1.086**	-0.5695
	(0.4584)	(0.3705)	(0.3296)	(0.0689)	(0.1866)	(0.1293)	(0.4569)	(0.3479)	(0.4197)
$\Delta DF \times$Cross-border loans	0.2278	0.1505	-0.1124	0.0592	0.0806*	0.1225	0.1686	0.0699	-0.2350
	(0.1644)	(0.1950)	(0.2274)	(0.0311)	(0.0375)	(0.0680)	(0.1653)	(0.1958)	(0.2627)
Probability of default (imputed if missing)	8.215***	8.115***	7.944***	0.0240	-0.0708	-0.1390	8.191***	8.186***	8.083***
	(0.7959)	(0.7420)	(0.7409)	(0.0398)	(0.0622)	(0.0928)	(0.8007)	(0.7524)	(0.7592)
Fixed-Effects:									
GovC period × Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor sector × Debtor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Firm size class × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Collateral size × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Cross-border loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Multidebtor loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	6,240,534	6,172,211	5,922,246	6,240,534	6,172,211	5,922,246	6,240,534	6,172,211	5,922,246
R^2	0.81	0.80	0.78	0.99	0.97	0.95	0.61	0.60	0.59
Within R^2	0.03	0.07	0.10	0.17	0.35	0.34	0.02	0.02	0.02
Standard errors clustered by	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Source: AnaCredit
Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022 and 2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Horizon $h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the Governing Council meeting. Results are obtained by weighted TSLS, where weights are determined by the loan values. Changes in the deposit facility rate are instrumented by Target and Timing surprises. ΔDF denotes changes in DF rate. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

Table A13. Regression results for the pass-through of monetary policy rates to lending rates, relevant risk-free rate and premium, using non-imputed PD observations only

Variables	Total rate			Relevant risk-free rate			Premium		
	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$	$h = 1$	$h = 2$	$h = 3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change in DF rate (ΔDF instrumented by Target and Timing surprises)	0.2177*	0.7104***	0.4508***	-0.1968***	-0.1571***	-0.6566***	0.4145***	0.8675***	1.107***
	(0.0921)	(0.1581)	(0.1158)	(0.0239)	(0.0238)	(0.0321)	(0.1022)	(0.1563)	(0.1184)
$\Delta DF \times$(0, 1] month risk-free rate	0.2379	0.3552	1.216***	1.094***	1.577***	2.311***	-0.8562***	-1.222***	-1.095***
	(0.1535)	(0.2111)	(0.1909)	(0.0517)	(0.0631)	(0.0857)	(0.1600)	(0.2197)	(0.2323)
$\Delta DF \times$(1, 3] month risk-free rate	0.2548*	0.1775	0.9392***	0.7718***	1.242***	1.992***	-0.5170***	-1.064***	-1.053***
	(0.1244)	(0.2054)	(0.1374)	(0.0384)	(0.0496)	(0.0524)	(0.1306)	(0.2014)	(0.1462)
$\Delta DF \times$(3, 6] month risk-free rate	0.0101	0.2017	0.8881***	0.6487***	1.070***	1.678***	-0.6386***	-0.8685***	-0.7904***
	(0.1155)	(0.1561)	(0.1476)	(0.0406)	(0.0352)	(0.0554)	(0.1219)	(0.1644)	(0.1648)
$\Delta DF \times$(6, 12] month risk-free rate	0.1627	0.0379	0.4173*	0.5287***	0.8891***	1.409***	-0.3661***	-0.8512***	-0.9912***
	(0.1104)	(0.1721)	(0.1796)	(0.0535)	(0.0532)	(0.0622)	(0.1031)	(0.1725)	(0.1965)
$\Delta DF \times$(1, 2] year risk-free rate	0.2156	0.1720	0.7000**	0.5821***	0.8645***	1.339***	-0.3665	-0.6925***	-0.6389***
	(0.2035)	(0.1732)	(0.2118)	(0.0466)	(0.0491)	(0.0898)	(0.2082)	(0.1761)	(0.1918)
$\Delta DF \times$(2, 5] year risk-free rate	-0.0442	-0.3843	0.1874	0.1419***	0.0283	0.5514***	-0.1860	-0.4126	-0.3640*
	(0.1417)	(0.3029)	(0.1502)	(0.0374)	(0.0399)	(0.0559)	(0.1463)	(0.3020)	(0.1671)
$\Delta DF \times$Floating rate	-0.0411	-0.1312	-0.2582	-0.1478**	-0.1859**	-0.1472	0.1068	0.0547	-0.1109
	(0.1027)	(0.1543)	(0.1531)	(0.0479)	(0.0594)	(0.1026)	(0.0976)	(0.1723)	(0.2216)
$\Delta DF \times$Adjustment more frequent than reference rate maturity	-0.0160	0.1951	0.1806	0.0039	0.0595	-0.0841	-0.0199	0.1356	0.2647
	(0.1579)	(0.1734)	(0.1510)	(0.0457)	(0.0395)	(0.0761)	(0.1470)	(0.1766)	(0.1922)
$\Delta DF \times$Adjustment less frequent than reference rate maturity	-0.3974	-0.2712	-0.0808	0.0101	-0.0648	0.0673	-0.4075	-0.2064	-0.1481
	(0.3679)	(0.4217)	(0.4343)	(0.0667)	(0.0747)	(0.1918)	(0.3472)	(0.4344)	(0.3736)
$\Delta DF \times$Non-EUR reference rate	-0.1116	0.1487	-0.1135	0.1188*	0.1220*	0.1689**	-0.2304**	0.0267	-0.2824*
	(0.0932)	(0.1059)	(0.1319)	(0.0562)	(0.0574)	(0.0646)	(0.0759)	(0.0867)	(0.1238)
$\Delta DF \times$Other single reference rate	0.1115	-0.1778	-0.3247	-0.0126	0.0410	-0.0268	0.1240	-0.2188	-0.2980
	(0.1202)	(0.1302)	(0.2332)	(0.0736)	(0.0826)	(0.0925)	(0.1248)	(0.1757)	(0.2498)
$\Delta DF \times$Multiple reference rates	-0.3646	-0.6758*	-0.1848	0.2509***	0.7168***	0.5668***	-0.6155	-1.393***	-0.7516
	(0.4927)	(0.3425)	(0.3831)	(0.0618)	(0.1912)	(0.1373)	(0.4988)	(0.2309)	(0.4645)
$\Delta DF \times$Cross-border loans	0.4355	0.4407*	0.2920	0.0193	0.0422	0.1194*	0.4163	0.3985*	0.1726
	(0.2267)	(0.1924)	(0.1736)	(0.0383)	(0.0544)	(0.0560)	(0.2392)	(0.1789)	(0.1542)
Probability of default	1.121***	1.080***	1.081***	0.0221	0.0296	0.0165	1.099***	1.051***	1.064***
	(0.1098)	(0.1069)	(0.1050)	(0.0159)	(0.0184)	(0.0114)	(0.1114)	(0.1098)	(0.1052)
Fixed-Effects:									
GovC period × Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor sector × Debtor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Debtor region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Firm size class × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Loan maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Collateral size × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Cross-border loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Multidebtor loan × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate type × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate maturity × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GovC period × Reference rate adjustment frequency × Creditor country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	4,714,260	4,644,687	4,454,510	4,714,260	4,644,687	4,454,510	4,714,260	4,644,687	4,454,510
R^2	0.80	0.79	0.78	0.98	0.97	0.94	0.59	0.58	0.58
Within R^2	0.02	0.05	0.09	0.14	0.33	0.32	0.01	0.01	0.01
Standard errors clustered by	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Source: AnaCredit

Notes: *** denotes significance at the 99.9% level, ** at 99%, and * at 95%. Standard errors are reported in brackets. The sample includes new loans to euro area NFCs (excluding financial and insurance activities) issued in 2022 and 2023, denominated in EUR, exceeding EUR 25,000, with a positive interest rate. The sample consists of the following types of loans: credit lines other than revolving credits, revolving credits, other loans, excluding syndicated loans. For fixed-rate loans, the maturity of the relevant risk-free rate corresponds to the loan's maturity, while for floating-rate loans, it is equal to the maturity of the underlying reference rate. Horizon $h = 1$ corresponds to the period of six weeks, $h = 2$ to 7–12 weeks, and $h = 3$ to 13–18 weeks following the Governing Council meeting. Results are obtained by weighted TSLS, where weights are determined by the loan values. Changes in the deposit facility rate are instrumented by Target and Timing surprises. ΔDF denotes changes in DF rate. Other variables (except the probability of default) are the binary (dummy) variables that equal one if a loan contract has a corresponding feature.

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