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Changes in the distribution of new loans by risk category throughout the post-pandemic credit cycle in Colombia

Camilo Gómez, Carlos Andrés Quicazán-Moreno and Hernando Vargas-Herrera*

Abstract

Following the pandemic, the Colombia's financial system experienced a pronounced credit cycle, with significant real growth in consumer loans followed by a deceleration from late 2022. This paper uses granular loan-level data to analyse how financial intermediaries adjusted the credit risk composition of new loans throughout this cycle. It examines the implications of these shifts for loan supply dynamics and financial conditions. Additionally, the study explores the interaction between credit risk composition and monetary policy transmission during the 2021–24 period. As monetary tightening led to rising lending rates, changes in loan composition—particularly the increased share of riskier borrowers—amplified the observed transmission of policy rates to average lending costs, especially in the consumer credit segment. The findings highlight the importance of credit risk dynamics in assessing monetary policy effectiveness and demonstrate the value of disaggregated data in understanding macro-financial conditions.

JEL Classification: E43; E52; G21

Keywords: Monetary Policy Transmission; Credit Cycle; Loan Composition; Risk Taking

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Evolución de la distribución de los nuevos préstamos por categoría de riesgo a lo largo del ciclo de crédito de la postpandemia en Colombia

Camilo Gómez, Carlos Andrés Quicazán-Moreno and Hernando Vargas-Herrera*

Resumen

Tras la pandemia, el sistema financiero de Colombia experimentó un marcado ciclo de crédito, con un significativo crecimiento real en los préstamos de consumo, seguido de una desaceleración a partir de finales de 2022. Este estudio utiliza datos granulares a nivel de préstamo para analizar cómo los intermediarios financieros ajustaron la composición del riesgo crediticio en los nuevos préstamos a lo largo de este ciclo. Se examinan las implicaciones de estos cambios en la dinámica de la oferta de crédito y las condiciones financieras. Además, el estudio explora la interacción entre la composición del crédito y la transmisión de la política monetaria durante el período 2021–24. Dado que el endurecimiento monetario elevó las tasas de interés de los préstamos, los cambios en la composición del crédito—particularmente el aumento en la participación de prestatarios más riesgosos—amplificaron la transmisión de las tasas de política a los costos de financiamiento promedio, especialmente en el segmento de crédito de consumo. Los resultados destacan la importancia de la dinámica del riesgo crediticio en la evaluación de la efectividad de la política monetaria y demuestran el valor de los datos desagregados para comprender las condiciones macrofinancieras de la economía.

Clasificación JEL: E43; E52; G21

Palabras Clave: Transmisión de la política monetaria; Ciclo de crédito; Composición de la cartera; Toma de riesgo

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1. Introduction

In the aftermath of the pandemic, financial system loans grew significantly in real terms in Colombia, especially in the consumer loan segment. This was followed by a deceleration that started in late 2022, marking a pronounced credit cycle (Graph 1). Accordingly, banks' credit standards were loose after the pandemic, supporting loan supply, but were gradually tightened from the second quarter of 2022 (Graph 2). This note takes advantage of granular data on individual loans to examine how financial intermediaries changed the credit risk composition of their new loan portfolio throughout the cycle. This adds to the understanding of bank behaviour in these episodes and provides information on the dynamics of loan supply by risk category that may enrich the evaluation of domestic financial conditions.

Moreover, the expansion phase of the credit cycle coincided with the tightening phase of a monetary policy cycle aimed at reducing inflation (Graph 3). It has been noticed that average lending rates reacted more than one on one to policy interest rate (MPR) changes throughout the tightening and easing phases of the monetary policy response in the 2021–24 period (Graph 4).[1] Any assessment of this observation must acknowledge that average lending rate changes involve possible shifts in the composition of new loans by risk categories arising from the monetary policy changes themselves or from other factors affecting the loan market. Thus, rising average lending interest rates may reflect policy rate hikes or greater importance of riskier borrowers (paying higher interest rates) in new loans. Conversely, declining average lending interest rates may include the effects of policy rate cuts or the decreasing importance of riskier borrowers in new loans.[2] Hence, the second part of this note explores the influence that loan composition shifts had on the transmission of actual and expected monetary policy movements to average lending rates in the 2021–24 credit and monetary policy cycles in Colombia.

The analysis of loan distributions by "risk category" suggests that credit establishments[3] shifted their new loan portfolios towards riskier borrowers from the second quarter of 2022, especially in the consumer credit segment, and relapsed into safer portfolios in 2024. In addition, changes in loan composition by "risk category" affected the dynamics of average lending interest rates. Specifically, composition effects increased the observed transmission of actual and expected policy rates to average lending interest rates. This was particularly the case for consumer loan interest rates. The results presented in this document show the importance of examining the dynamics of the credit cycle and loan market conditions when assessing

[1] In Graph 4, commercial loan interest rates are compared with the monetary policy rate (MPR) because around 60% of new loan disbursements are tied to it. By contrast, almost all new consumer loan disbursements correspond to fixed rate contracts. Hence, consumer loan interest rates are compared with the OIS rate with similar maturity.

[2] The transmission of monetary policy shifts to lending interest rates in Colombia has traditionally been evaluated using aggregate (average) rates on new loans, by loan term and loan category (eg commercial, consumer, mortgages, etc). See, for example, Galindo and Steiner (2022), Cristiano-Botia et al (2017), Chavarro-Sánchez et al (2015), Gómez-González et al (2016), Holmes et al (2015), González et al (2010) and Vargas-Herrera et al (2010). The coincidence of different phases in the loan market and monetary policy cycles can also affect the assessment of the bank lending channel of monetary policy. See, for instance, Apergis and Christou (2015).

[3] Credit establishments in Colombia include all credit institutions, comprising commercial banks, investment banks, financial cooperatives and financing companies.

the transmission of monetary policy. This note is also illustrative of the usefulness of disaggregated data in macro and monetary policy analysis.

The rest of this document continues as follows. Section 2 presents the procedure followed to define "risk categories" and describes the credit risk-taking dynamics in the 2021–24 period. Based on the defined "risk categories", Section 3 presents a simple accounting framework to identify the effects of shifts in loan composition on the behaviour of average lending rates. Sections 4 and 5 discuss the results and conclude.

2. The distribution of new loans by risk categories

For risk-neutral banks, the spread between an individual loan interest rate and the MPR or the corresponding maturity OIS rate may reflect: (i) the riskiness of the borrower; (ii) the operational cost of the loan; (iii) overall bank liquidity constraints that affect all loans; and (iv) the market power of banks in the loan market (see Appendix 1). Hence, assuming that there are no significant changes in operational costs, liquidity constraints[4] or banks' market power[5], movements of the distribution of individual loans across spreads are indicative of shifts of bank loan portfolios across risk categories.[6] This idea is used to explore those shifts using granular data.

Individual borrower information on loan amounts and interest rates is available in a quarterly annex reported by credit establishments to the Financial Superintendence of Colombia. Based on this annex, it is possible to identify granular data on new commercial and consumer loans.[7] The average lending interest rates

[4] There were important changes in the liquidity of several banks in the period considered, mostly related to the application of Net Stable Funding Ratio (NSFR) regulation and the concentration of maturities of certificates of deposit. However, as discussed below, the results of the exercise presented here are still suggestive of significant shifts in the distribution of loans across risk categories.

[5] Large changes in banks' market power are unlikely to have occurred between 2021 and 2024. Panzar and Rosse's (1987) indicator shows no statistically significant variations in the degree of competition for Colombian credit establishments in that period (see *Informe especial de concentración y competencia en los mercados de crédito y depósitos de septiembre de 2024*). However, as shown in Appendix 1, even when market power remains unchanged, lending interest rate spreads may move with the policy rate without any variation in banks' risk appetite. Nevertheless, as discussed below, the behaviour of loan quantities and other indicators suggest the relevance of shifts in risk appetite as a determinant of banks' loan portfolios.

[6] With risk-averse lenders, shifts in the spreads between lending interest rates and policy rates may also reflect changing degrees of risk aversion through time. For example, a reduction in risk aversion would probably cut spreads. Interestingly, this implies that the spread on a given loan would be similar to the spread applied to safer loans previously. Hence, an observed increase in the share of loans with a high spread could actually indicate greater exposure of the banks to borrowers with higher default probabilities than those previously included in the same spread group.

[7] This data set ("Annex 341") contains the information on loans granted by credit establishments. It includes, among others, loan amounts, interest rates, maturities and disbursement dates. Credit operations are aggregated by various characteristics (such as credit ratings) for each credit institution-debtor-quarter combination, making it difficult to measure new loans, especially disbursement interest rates. To address this issue, we identified new loans as those with disbursement dates occurring in each quarter. For each credit establishment, we take debtors without loans in the previous quarter. These criteria ensure that observed interest rates are not contaminated by previously disbursed operations, which are aggregated in the annex. The

calculated from these data are close to the aggregate lending rates (comprising all new loans) reported weekly by banks to the Financial Superintendence (Graph 5). This suggests that the results obtained from the analysis of the granular sample could be representative of the Colombian financial system as a whole.[8]

With the individual loan interest rate data, the following procedure was applied to define "risk categories" in the Q1 2021–Q2 2024 credit cycle:

(i) A spread, $s^m_{j,k,t} \equiv i^m_{j,t} - ipol^m_t$, was computed for new loan j of type k in quarter t with maturity m. In this expression, k refers to commercial or consumer loans.[9] Also, $m = \text{six months}, 12 \text{ months}, 18 \text{ months}, \text{two years}, \text{five years}$ for commercial loans, whereas $m = \text{one year}, \text{two years}, \text{four years}, \text{five years}$ for consumer loans.[10] $i^m_{j,t}$ is the individual new loan interest rate. $ipol^m_t$ corresponds to the MPR in the case of commercial loan interest rates and to the OIS^m_t rate in the case of consumer loan interest rates.[11] The reason for this distinction is that almost all new consumer loans are linked to fixed rate contracts, while around 60% of new commercial loans involve variable rate contracts tied to the MPR.

(ii) A histogram of $s^m_{j,k,t}$ was constructed using Sturges' (1926) rule for each loan type.[12] The bins of these histograms are defined as "risk categories" (Graph 6). The use of the whole credit cycle sample ensures that all relevant risk categories are included in the resulting histograms. Loans falling in a particular bin are assumed to be comparable across time in terms of their riskiness.

(iii) Using the risk categories identified in the previous step, a distribution of new loans by type and maturity is produced for every quarter. Graph 7 shows heatmaps that illustrate the dynamics of these distributions for loans of different types and maturities throughout the credit cycle.

For every quarter in the sample period, the heatmaps show the risk categories (from the lowest to the highest risk) and the share of the value of loans that fall into each category.[13] A more intense red colour indicates a

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analysis excludes credit card loans from consumer loans, since their maturity usually reflects the card's expiration date. The resulting quarterly data set spans from Q1 2021 to Q4 2024 and has 463,000 observations in the commercial loan portfolio and 14 million in the consumer loan portfolio.

[8] The observed differences between the interest rate measures arise from the assumptions made to derive new loans from the granular data (see footnote 8) and from the differences in maturity aggregations. In particular, loan maturities can be observed precisely in the granular data, whereas the weekly averages aggregate disbursements by wide maturity intervals.

[9] Small and medium-sized enterprise (SME) and large firm loans in the commercial portfolio, as well as vehicle and other credits in consumer loans, are studied later. Other credits include payroll loans and free-destination loans, among others. For the study of each segment, the methodology is replicated with the corresponding data subset.

[10] To increase the sample coverage, each maturity group m includes credits with an initial credit term equal to $m \pm \text{one month}$.

[11] The correspondence between OIS and loan maturities was set as follows: 12-month OIS for $m = \text{one year}$, two-year OIS for $m = \text{two years}$, three-year OIS for $m = \text{three years}$, four-year OIS for $m = \text{four years}$, and five-year OIS for $m = \text{five years}$.

[12] Sturges' rule defines the bin size as $R/\left(1 + 3.322 \log_{10} N\right)$, where R is the data range and N the number of observations.

[13] In Graph 7, the bins of the interest rate spread histogram are translated into an integer scale of risk categories ranging from one to the total number of bins. Thus, risk category one contains loans in the first spread bin and

larger fraction of loans belonging to a particular category. For example, the distribution of five-year consumer loans in Graph 7 is concentrated in risk categories 5 to 10 in 2021 and the first half of 2022. It then becomes more concentrated in categories 15 to 20 until the second quarter of 2023, to finally cluster in categories 10 to 15 in the last part of the period.

The distributions calculated generally indicate a move towards riskier loans since mid-2022, near the peak of the credit cycle, with a correction between the end of 2023 and the beginning of 2024. This pattern is especially clear for consumer loans with maturities of two years or longer. It is worth noticing that, in this context, the Colombian financial regulator tightened credit-loss provision schemes for consumer loans to penalise credits with high maturities and prevent excessive risk-taking by credit establishments.[14] Within consumer loans, the pattern is also noticeable for both car and other loans (Appendix 2). By firm size (commercial loans), the composition towards riskier categories is more evident for SME loans (Appendix 2).

3. Composition effects in the dynamics of average lending interest rates

To identify the effects of shifts in loan composition on the behaviour of average lending rates, the following procedure was followed for each loan type (eg commercial, consumer, etc) and maturity, based on the distributions computed in the foregoing section:

(i) Let D be the set of all risk categories (bins) in the credit cycle.

(ii) Let $D_t \subseteq D$ be the set of risk categories present in period t.

(iii) Let $\widetilde{D}_t \subseteq D$ be the set of risk categories that *do not appear* in period t.

(iv) Then, the average lending rate in period t can be defined as:

$$i_t = \sum_{h \in D_t} \alpha_{ht} i_{ht},$$

where α_{ht} is the share of loans in risk category h in period t, and i_{ht} is the weighted average of the interest rate on all loans included in category h in period t. Notice that $\alpha_{ht} = 0$ for $h \in \widetilde{D}_t$.

(v) Therefore, the first difference of the average lending rate can be expressed as:

$$\Delta i_t = \sum_{h \in D_t \cap D_{t-1}} (\alpha_{ht-1} \Delta i_{ht} + i_{ht} \Delta \alpha_{ht}) + \sum_{h \in D_t \cap \widetilde{D}_{t-1}} i_{ht} \alpha_{ht} - \sum_{h \in \widetilde{D}_t \cap D_{t-1}} \alpha_{ht-1} i_{ht-1}.$$

(vi) The component $\sum_{h \in D_t \cap D_{t-1}} \alpha_{ht-1} \Delta i_{ht}$ is defined as the "*pure interest rate effect*".

(vii) The component $\sum_{h \in D_t \cap D_{t-1}} i_{ht} \Delta \alpha_{ht}$ is defined as the "*composition effect*".

(viii) The component $\sum_{h \in D_t \cap \widetilde{D}_{t-1}} i_{ht} \alpha_{ht} - \sum_{h \in \widetilde{D}_t \cap D_{t-1}} \alpha_{ht-1} i_{ht-1}$ is defined as the "*net emerging risk category effect*".

is supposed to reflect the lowest credit risk level, whereas the last risk category includes loans in the highest spread bin and is supposed to represent the highest level of credit risk.

[14] See López et al (2014), Jiménez et al (2017), Gómez et al (2020), Morais et al (2021) and Cabrera et al (2022) for references on how credit provisions can reduce credit growth.

The "*pure interest rate effect*" filters composition shift effects. By construction, it closely tracks the movements in the MPR (in the case of commercial loan rates) or the OIS (in the case of consumer loan rates). This is so because the individual loan interest rates falling within a risk category in every quarter have similar spreads with respect to the relevant policy interest rate (MPR or OIS). Thus, their variation in time mostly reflects the movement in the policy rate.

The "*composition effect*" and the "*net emerging risk category effect*" pick up the impact of changes in the distribution of loans by risk categories. If riskier borrowers gain importance in the new loan portfolio, then the average lending interest rates will increase ("*composition effect*"). Likewise, if riskier borrowers were absent in past new loan portfolios and are included in the current one, then, ceteris paribus, the average lending rate will increase. If these borrowers are then excluded from future new loan portfolios, the average lending interest rate will fall ("*net emerging risk category effect*"). The composition and net emerging risk category effects may or may not be a consequence of movements in the policy interest rate. However, they influence the dynamics of average lending interest rates.

Graph 8 shows that the "*composition*" and "*net emerging risk category*" effects are important determinants of the changes in average lending rates, especially for consumer loans. In particular, positive "*composition*" effects are sizeable between Q2 2022 and Q1 2023, while the disappearance of riskier loan categories (negative "*net emerging risk category*" effect) partly explains the fall in several consumer credit interest rates in 2023 and 2024. These effects reflect the aforementioned shifts in the distribution of new loans towards riskier ones from Q2 2022 and their subsequent reversal. For commercial loans, "*composition*" and "*net emerging risk category*" effects tend to be more volatile at the end of the period. The conclusions above generally hold for interest rates on SME and large firm loans, and for car and other consumer loans (Appendices 3 and 4).

4. Discussion

The expansion phase of the 2021–24 credit cycle was characterised by: (i) fast-growing credit volumes, especially in the consumer loan segment; (ii) a shift of the composition of new loans towards riskier ones; (iii) rising policy interest rates; and (iv) faster increases in average lending interest rates explained by loan composition effects. How can these observations be interpreted simultaneously? At least four possible (and not mutually exclusive) "stories" could be compatible with these observations.

First, from a simple microeconomic perspective, a hike in policy interest rates should raise the lending interest rate of a borrower with a given probability of default by more than one on one.[15] Something similar

[15] Take, for example, the lending interest rate decision of a risk-neutral bank that can lend to a borrower with a given probability of default, p, charging her an interest rate, i_L, or can invest in a risk-free alternative (eg a central bank deposit facility) with an interest rate, i. Assuming that there are no operational costs and that the bank cannot recover anything in the event of a default, the following non-arbitrage condition must be met:

$$(1-p)(1+i_L) = (1+i) \;\; or \;\; (1+i_L) = (1+i)/(1-p).$$

Hence, any hike in i will produce a larger increase in i_L. The rise in the lending rate must be enough to ensure that the expected value of the return on the loan matches the increase of the opportunity cost. A more general

occurs when bank market power is present, since it makes the lending interest rate spreads dependent on the policy rate, even if market power itself remains constant (see Appendix 1). In terms of the risk categories defined previously, this means that a borrower with an unchanged default probability will automatically move to a higher risk category (a larger spread between the lending and the policy rates) after an increase in the monetary policy rate. In this case, banks' risk appetite remains constant, but the change in the policy rate may alter credit spreads and the observed distribution of loans across them.

A problem with this "story" is that, in the face of higher spreads and interest rates, credit demand and loan volumes should fall, unlike the large expansion observed. To simultaneously explain higher prices and quantities, an increase in loan demand could be posited as a second "story". This was clearly a possibility, in view of the strong output growth of the Colombian economy in 2021 and 2022 (10.7% and 7.3%, respectively). However, a larger credit demand by itself does not necessarily imply a shift towards riskier loans in banks' portfolios.

A third "story" would explain the movement of the new loan distribution towards higher lending interest rate spreads by the liquidity stress undergone by several banks between Q2 2022 and Q3 2023, when NSFR regulation was applied and there were large concentrations of certificate of deposit (CD) maturities. Graph 9 shows substantial increases in the spreads between CD and OIS interest rates, indicating the presence of liquidity pressures.[16] These pressures would increase lending interest rate spreads equally for all loans of a given type and maturity, shifting the whole loan distribution upwards, without necessarily reflecting a change in risk appetite. Nevertheless, this effect would be similar for all types of loans (especially of longer maturities) since liquidity constraints would apply likewise across them. Graph 7 suggests that, at least visually, this is not the case and that there is variation in the shifts observed in the distribution of loans of different types and maturities.[17]

Hence, a fourth "story" regarding banks' risk appetite could be suitable. Greater risk appetite (as reflected in the relatively loose credit standards shown in Graph 2) could have relaxed lending policies and expanded loan supply to riskier borrowers. Three observations lend support to this "story". First, the share of loans disbursed to new borrowers increased from 4.4% on average in 2017–19 to 4.8% in 2021 and 7.9% in 2022.[18] Second, the "*net emerging risk category*" effects presented in the foregoing section are explanatory factors in the rise and subsequent fall of average lending interest rates of four- to five-year consumer loans, and two- to five-year commercial loans. This means that previously absent risk categories appeared and

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illustration of this point is presented in Appendix 1. This effect is reinforced if the policy rate hike raises the probability of default. See, for instance, Martinez-Miera and Repullo (2010) for a model where default probabilities are endogenous to interest rates.

[16] Appendix 1 explains that, in the presence of binding liquidity constraints, the spreads of deposit and lending rates with respect to policy rates rise.

[17] Moreover, the stringency of liquidity constraints is endogenous and may respond to changes in credit risk appetite. Shifts of banks' asset portfolios towards loans (typically illiquid assets) may make liquidity constraints binding.

[18] In each quarter, new borrowers are defined as debtors that do not have outstanding loans in the previous four years. During 2021–22 there is also an increasing trend in the number of new borrowers in the consumer loan portfolio and a correction in the following years. For more details, see *Informe Especial de Riesgo de Crédito de Septiembre de 2024*.

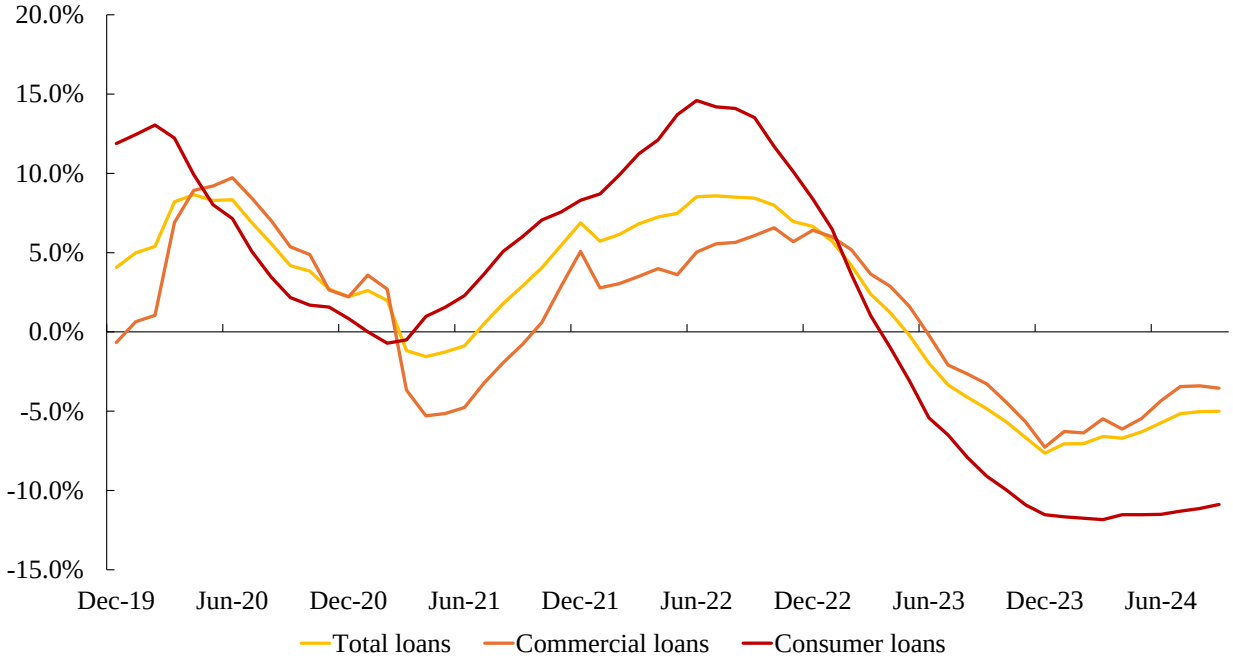
then disappeared from some, but not all, new loan portfolios. Third, losses from the realisation of credit risk in consumer loans (stemming from credit loss provisions) mounted between May 2022 and June 2023, even as unemployment stood at or below estimates of NAIRU and real wages remained stable, indicating exceedingly easy past lending conditions. Moreover, greater bank risk appetite would be likely to reduce lending interest rate spreads for all borrowers; consequently, increases in the share of loans belonging to a high spread category probably involve borrowers that are even riskier than before.

5. Conclusion

This note contributes to the understanding of banks' behaviour in Colombia during the 2021–24 credit cycle. Using disaggregated borrower information, it is found that, as credit establishments rapidly expanded loans, they increased their exposure to riskier borrowers. Afterwards, they reduced loans and concentrated their new loan portfolio in safer borrowers. This was particularly noticeable in the consumer loan segment. Interestingly, increased risk-taking occurred as the monetary policy stance was being swiftly tightened, while de-risking of new loan portfolios coincided with the relaxation of monetary policy. Consequently, average lending interest rates rose faster than actual or expected policy rates, as the weight of riskier loans in the average grew. By the same token, average lending rates fell faster than policy rates in the easing phase of the monetary policy cycle, as new loan portfolios turned safer. These results point to the importance of examining the dynamics of the credit cycle and loan market conditions when assessing the transmission of monetary policy. The results are also illustrative of the usefulness of disaggregated data in macro and monetary policy analysis.

Graph 1

Real annual growth of loan portfolio

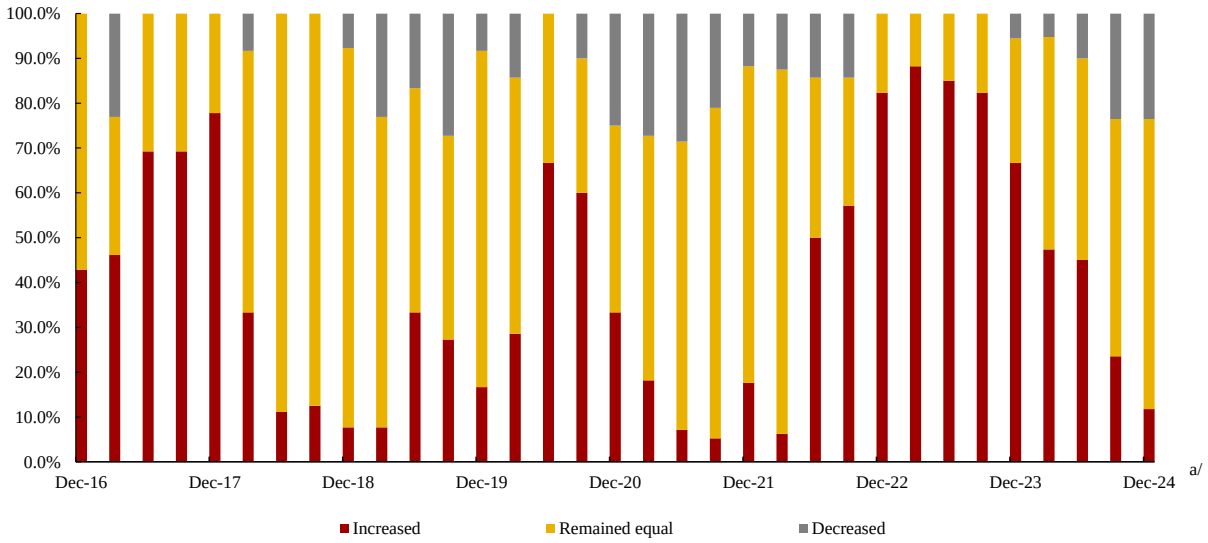


Real growth calculated with the consumer price index excluding food.
Sources: Central Bank of Colombia; Financial Superintendence of Colombia.

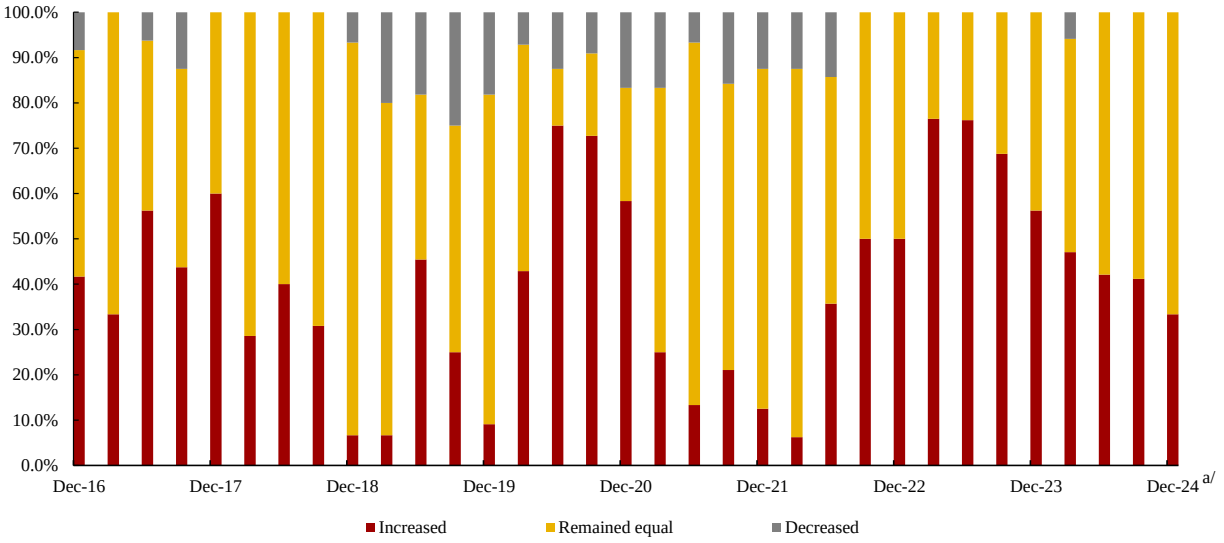
Graph 2

Change in requirements for allocating new loans (banks)

A. Consumer loans



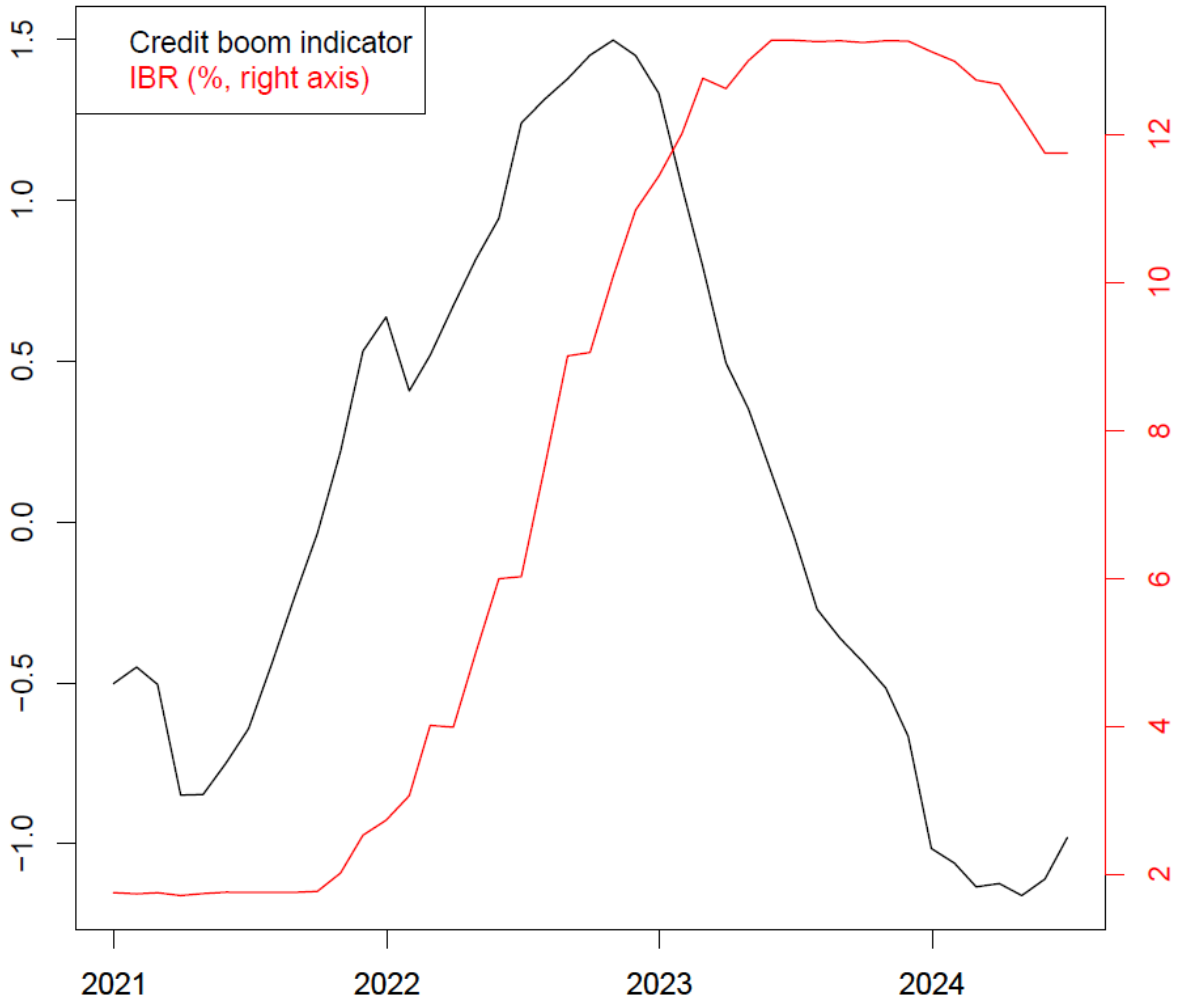
B. Commercial loans



a/ Next quarter expectations. Percentage of responses.
Source: Central Bank of Colombia (2024).

Graph 3

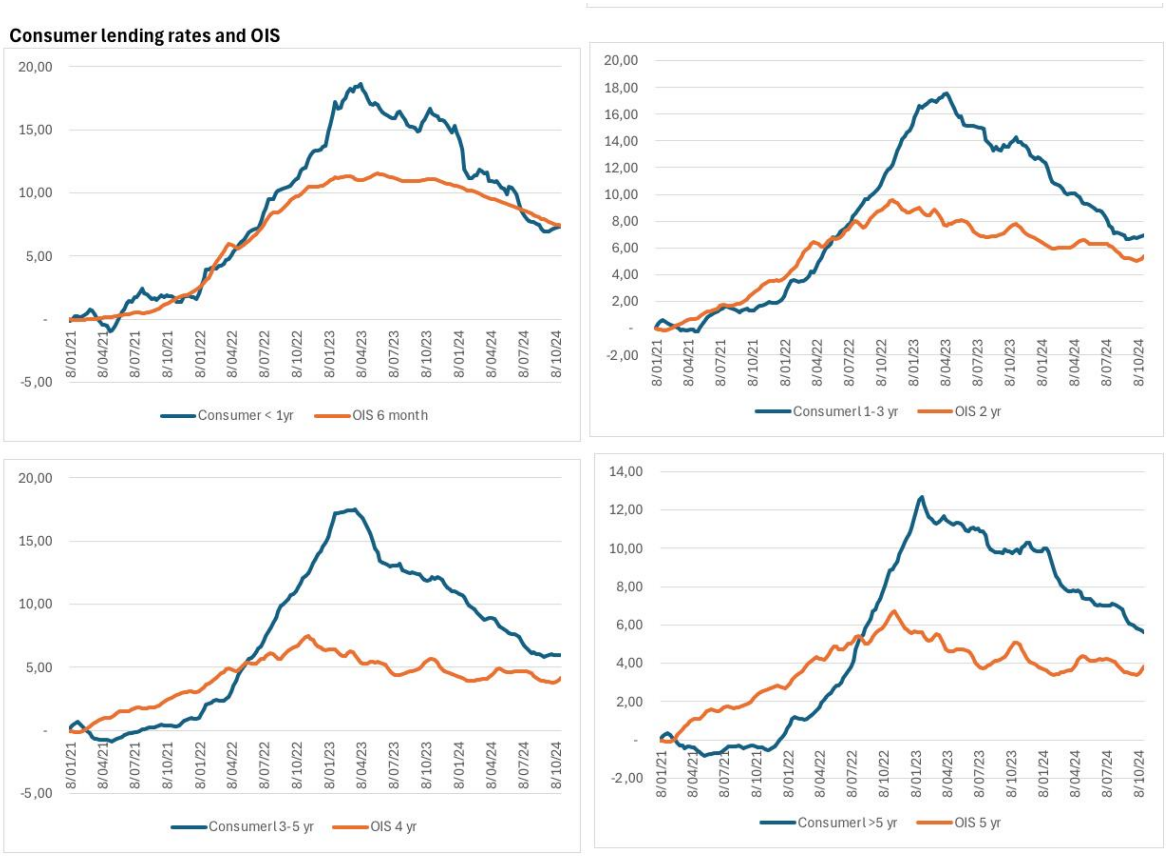
Credit and monetary policy cycles



Credit "boom" indicator constructed for total loans as the sum of the cyclical components of the per capita portfolio and its growth using a Hodrick-Prescott filter. IBR is the overnight interbank loan interest rate. Quarterly data.
Sources: Central Bank of Colombia; Financial Superintendence of Colombia.

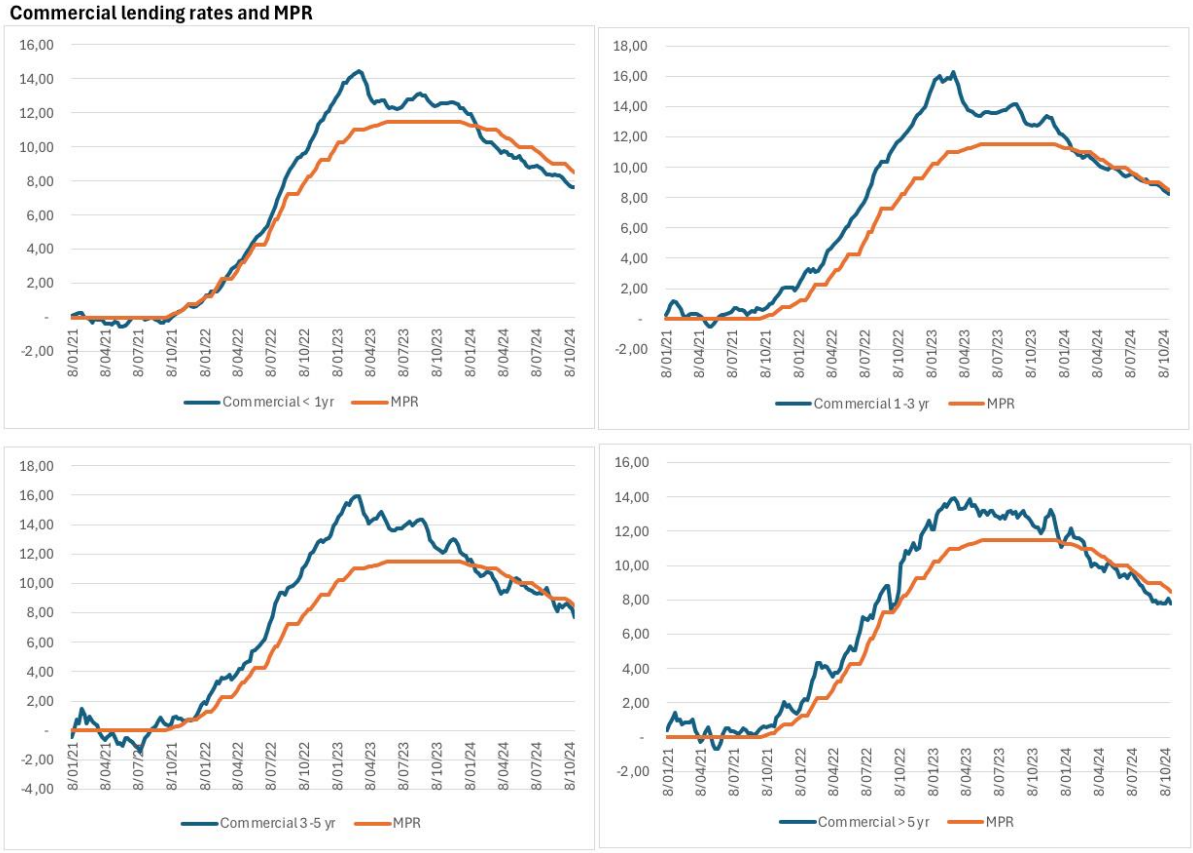
Graph 4

A. Cumulative variation of consumer loan and OIS rates since 1 January 2021



Sources: Central Bank of Colombia; Financial Superintendence of Colombia.

B. Cumulative variation of commercial loan and monetary policy interest rates since January 2021

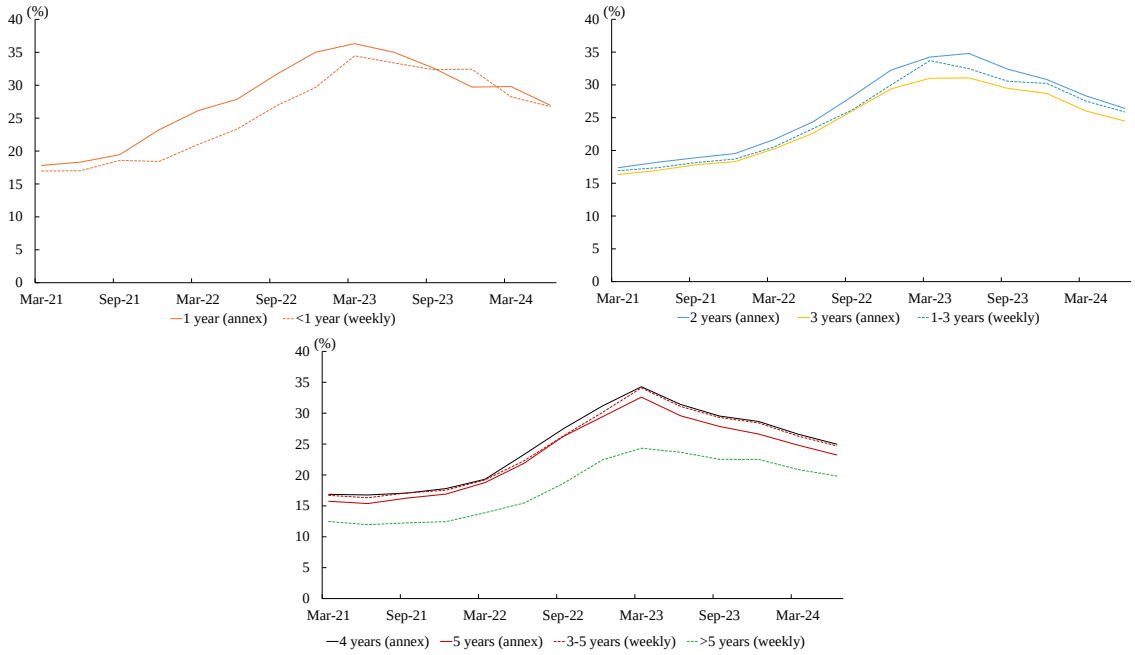


Sources: Central Bank of Colombia; Financial Superintendence of Colombia.

Graph 5

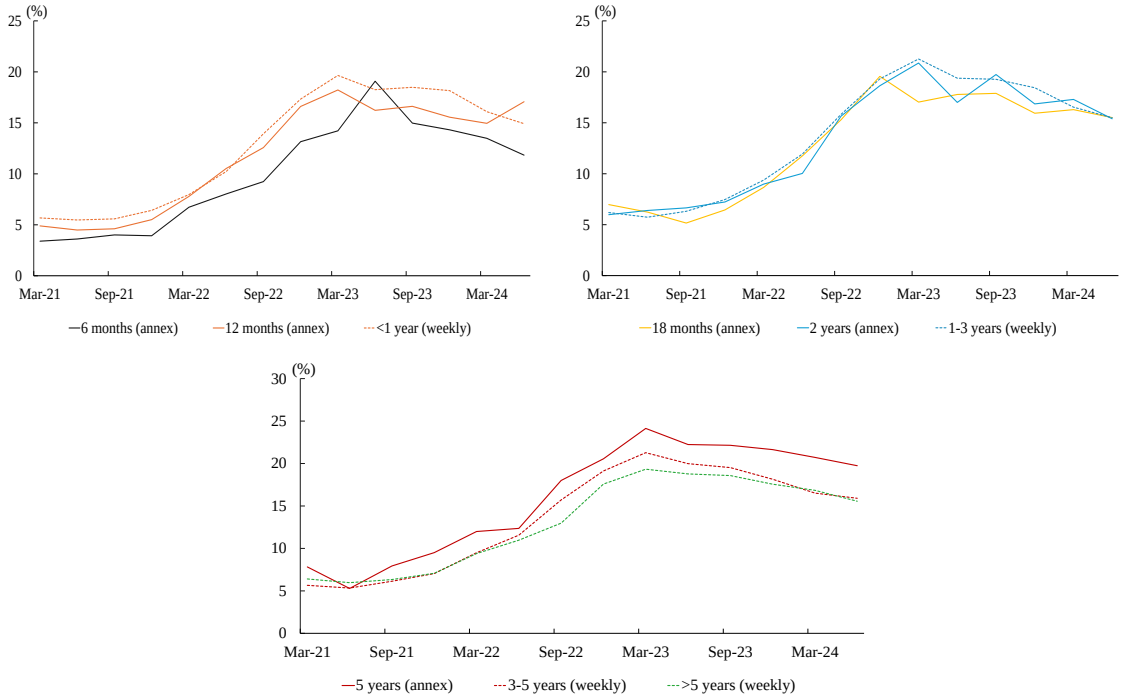
Average lending rates calculated from individual borrower information (annex) vs aggregated lending rates comprising all new loans (weekly)

A. Consumer loans



Quarterly data. The weekly data are aggregated through weighted averages in which the weights are based on the value of the disbursements.
Source: Financial Superintendence of Colombia.

B. Commercial loans



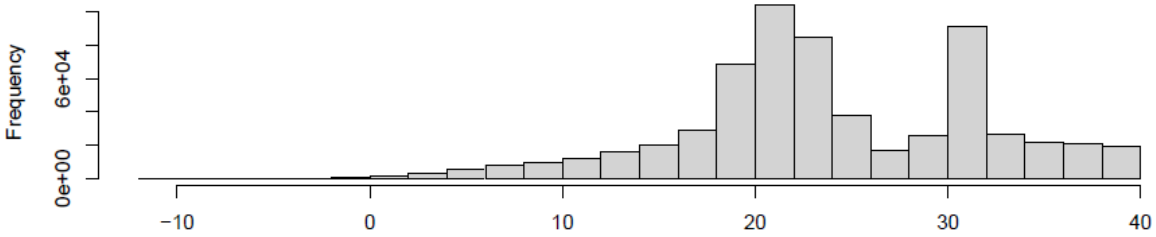
Quarterly data. The weekly data are aggregated through weighted averages in which the weights are based on the value of the disbursements.
Source: Financial Superintendence of Colombia.

Graph 6

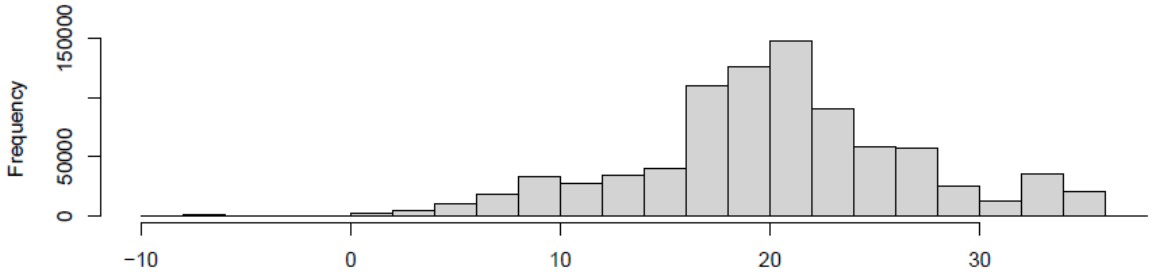
Spread histograms and risk categories for each loan type and maturity

A. Consumer loans

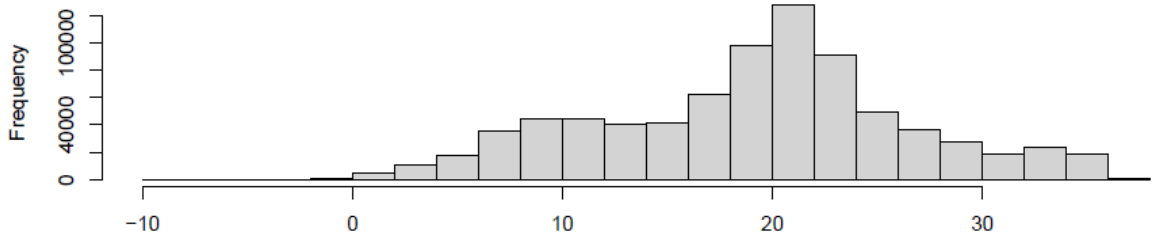
One year



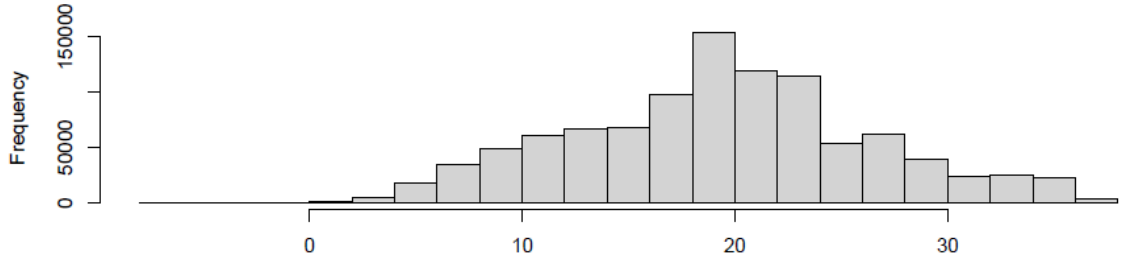
Two years

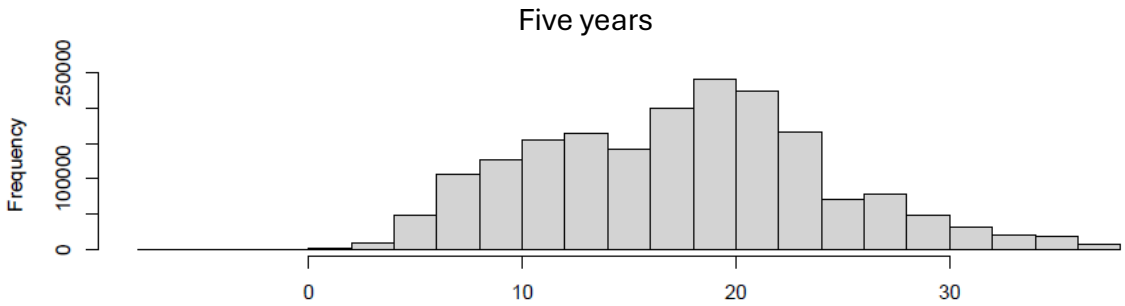


Three years



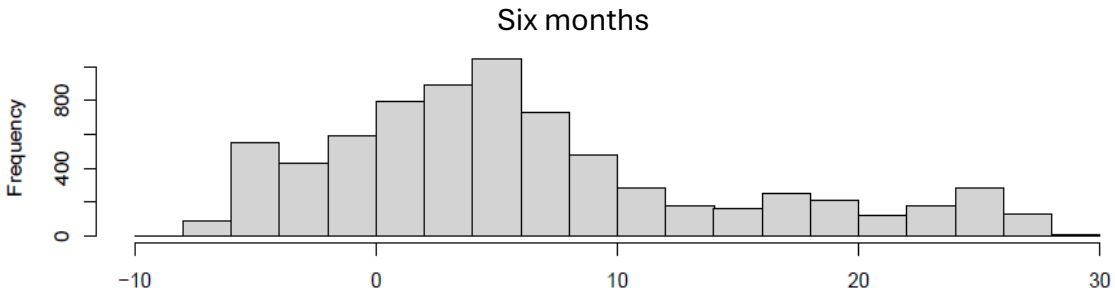
Four years

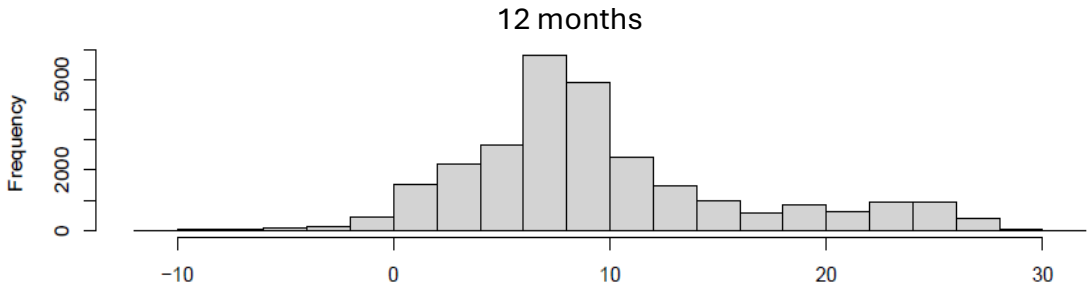


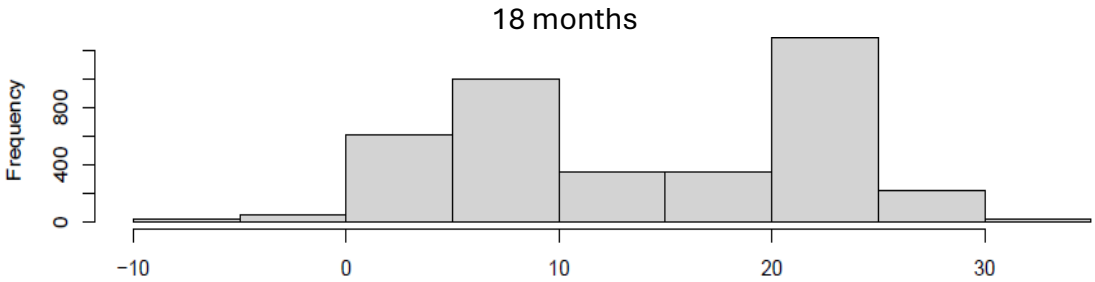


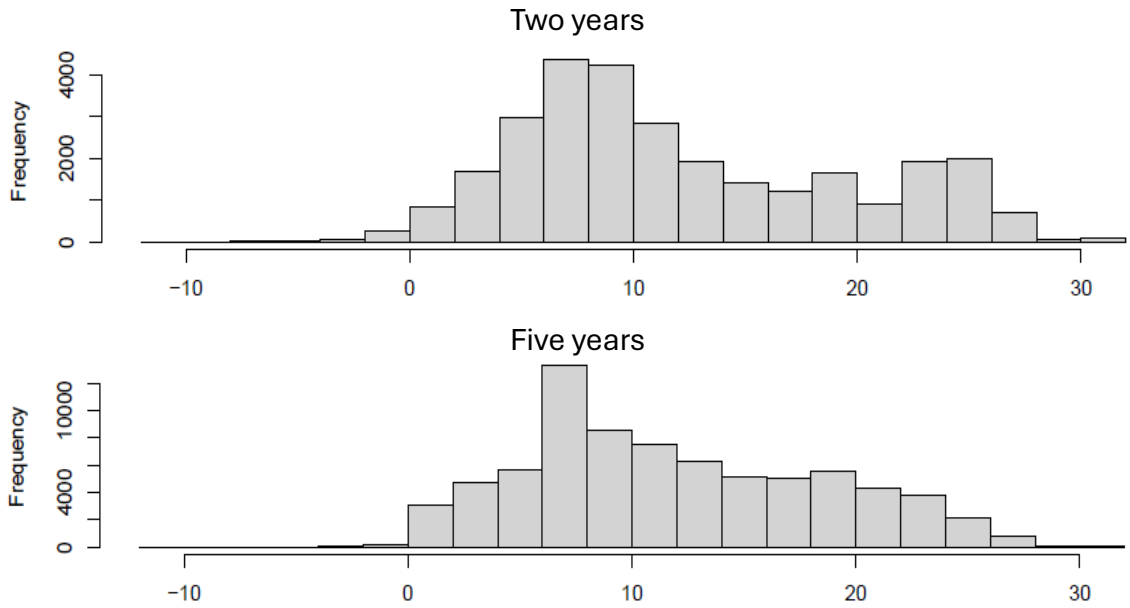
Sources: Financial Superintendence of Colombia; authors' calculations.

B. Commercial loans









Sources: Financial Superintendence of Colombia; authors' calculations.

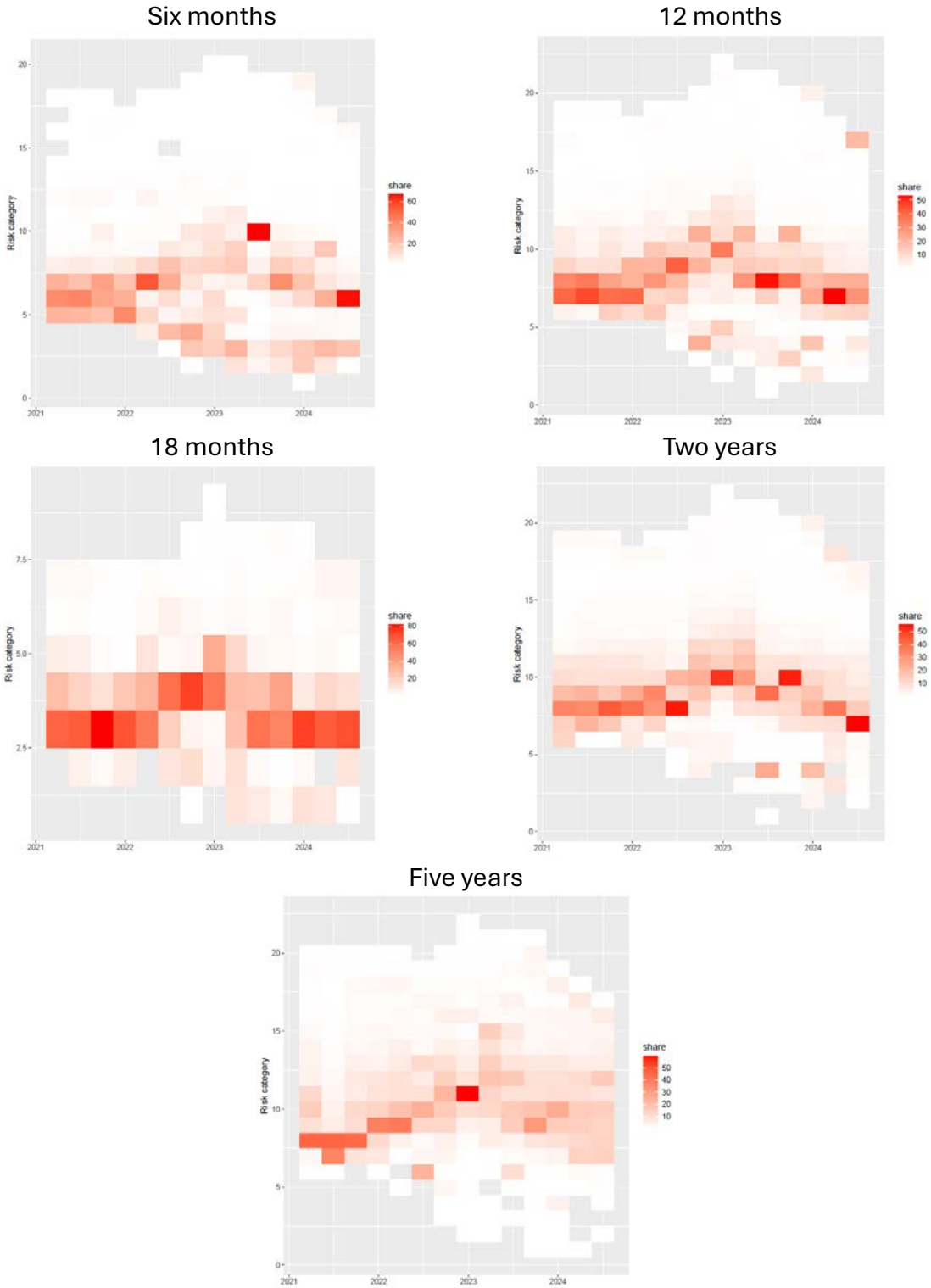
Graph 7

Heatmaps of the distribution of new loans through time by risk categories (as a percentage of new loans)

A. Consumer loans

The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.
Sources: Financial Superintendence of Colombia; authors' calculations.

B. Commercial loans

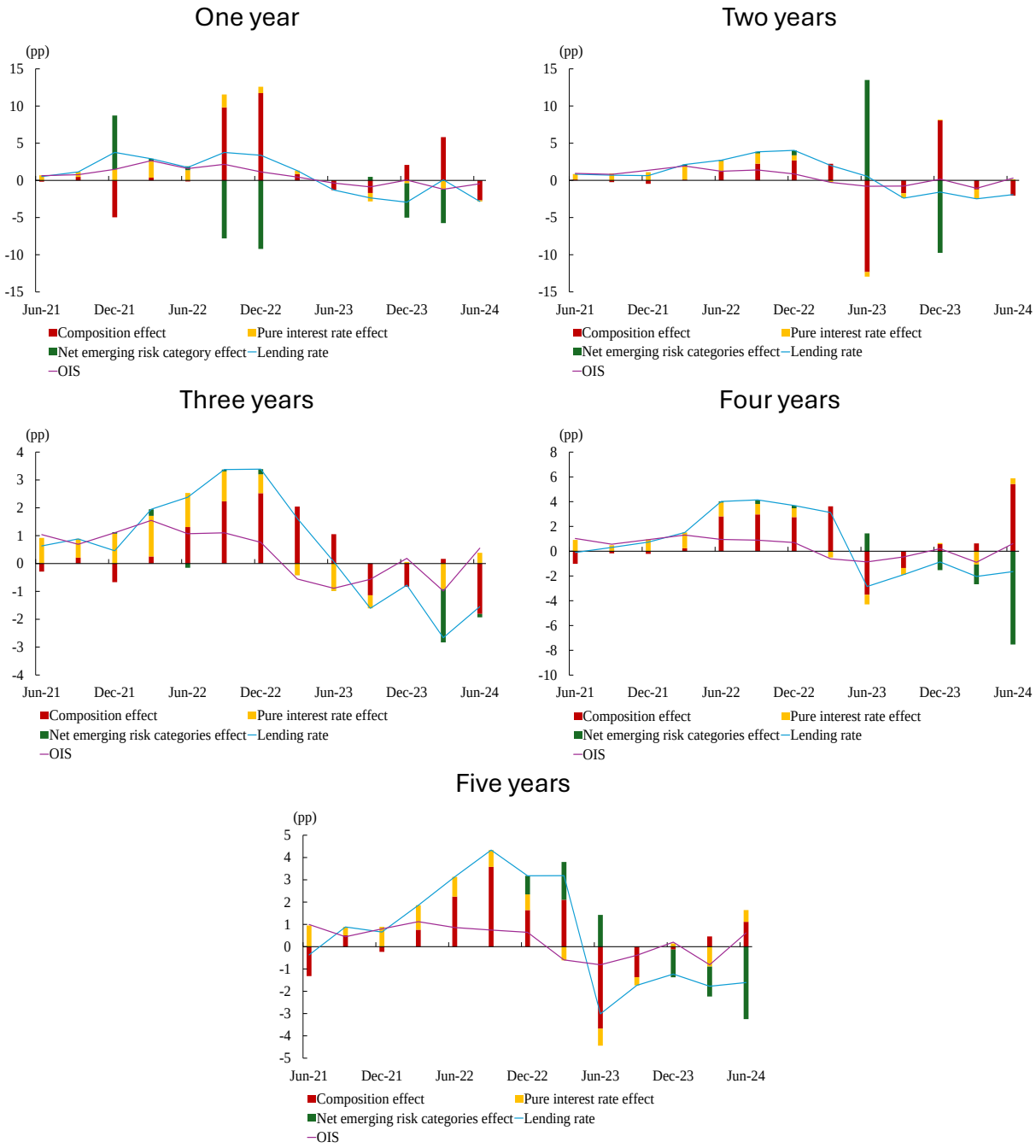


The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.
Sources: Financial Superintendence of Colombia; authors' calculations.

Graph 8

Decomposition of quarterly change of lending rates by pure interest rate effect, composition effect and net emerging risk category effect

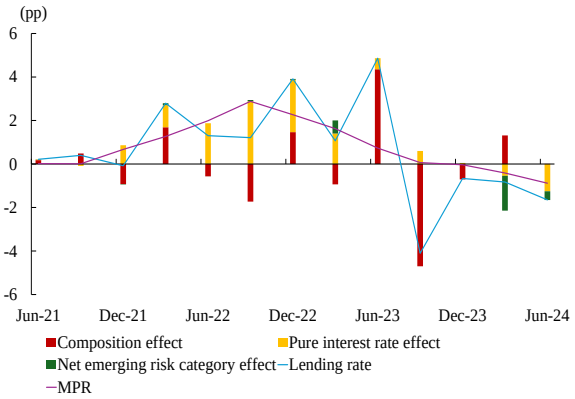
A. Consumer loans



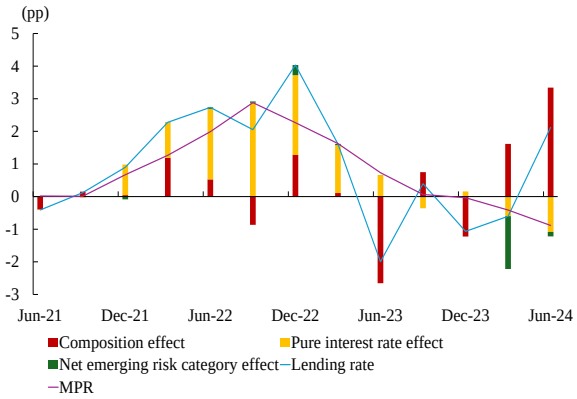
Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

B. Commercial loans

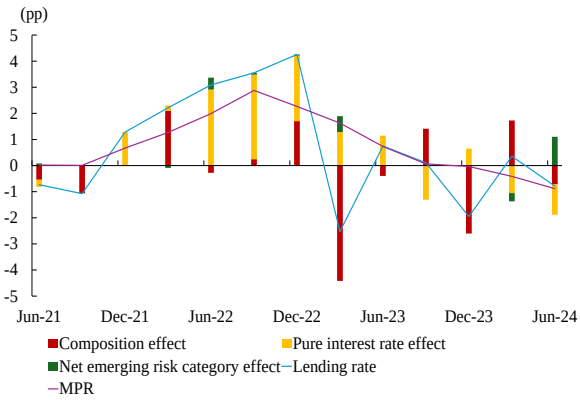
Six months



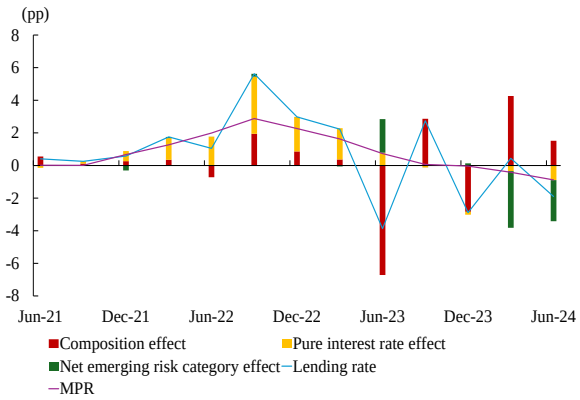
12 months



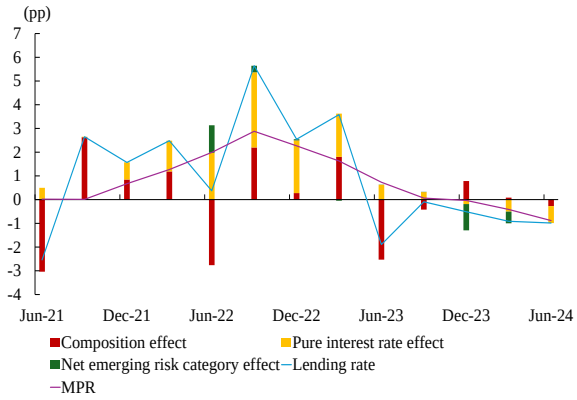
18 months



Two years



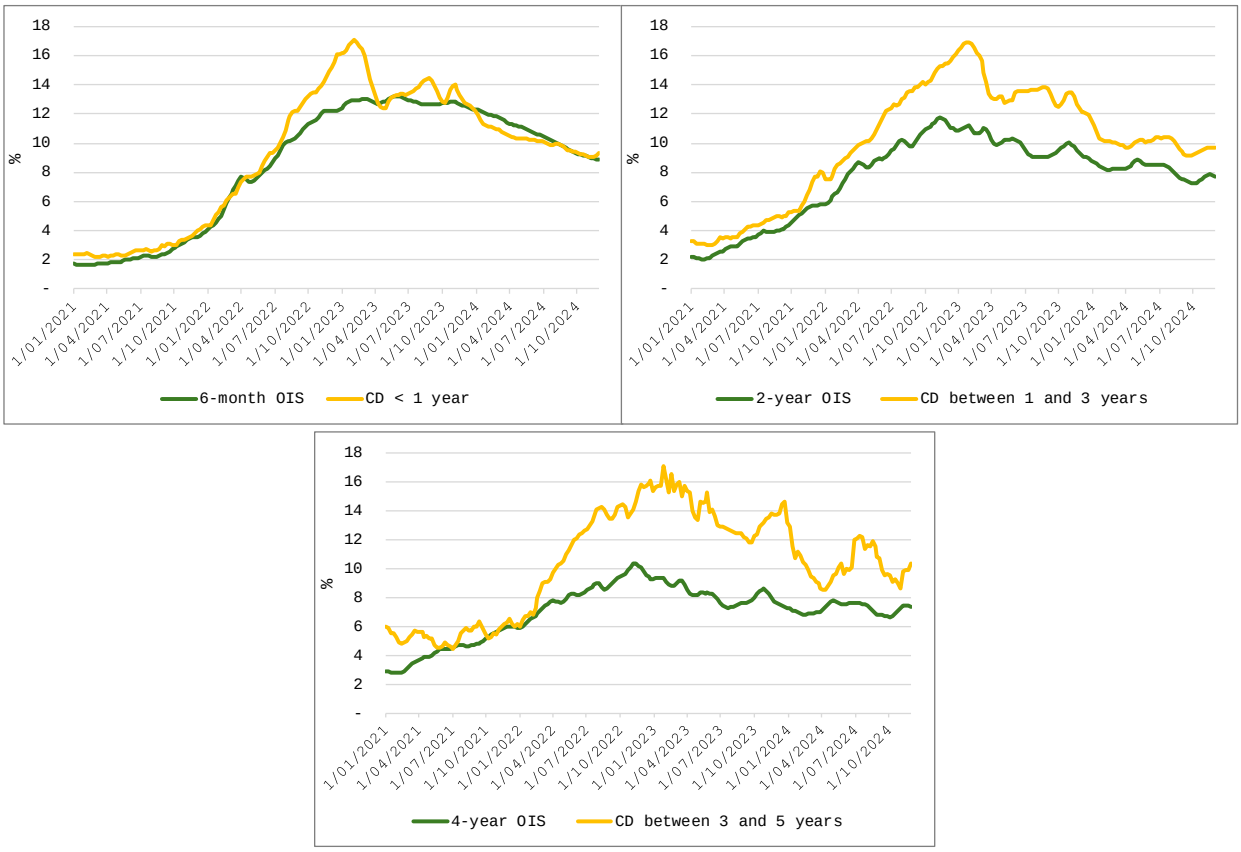
Five years



Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

Graph 9

CD and OIS interest rates



Sources: Central Bank of Colombia; DECEVAL.

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Appendix 1

Interpretation of lending interest rate spreads

To interpret the spread between lending interest rates and the MPR or the corresponding maturity OIS, consider the decision of a competitive, risk-neutral bank that receives deposits from the public, D, and can invest in central bank liabilities, B, or make loans, L, with probability of default, p. The optimisation problem of the bank is as follows:

$$Max \quad i_l L + i\, B - i_d D - c_l L - c_d D - pL$$

$$s.t. \quad L + B = D$$

$$L \leq zD$$

$i_l, i,$ and i_d are the lending, policy (MPR or OIS) and deposit interest rates, respectively. c_l and c_d are the constant unit operational costs of loans and deposits, respectively. $L \leq zD$ is a "liquidity" constraint that limits the amount of (presumably illiquid) loans to a fraction of deposits. Notice that, in case of a default, the bank is able to collect the interest revenue on the loan, although it loses the principal. This optimisation problem can be expressed as:

$$Max \quad i_l L + i\,(D - L) - i_d D - c_l L - c_d D - pL + q(zD - L)$$

where q is the the Lagrange multiplier that represents how stringent the liquidity constraint is. The bank chooses D and L to solve this problem. The first-order optimisation conditions imply:

$$i_l - i = p + c_l + q$$

$$i_d - i = qz - c_d$$

Thus, the spread between the lending and the policy (or OIS) rates reflects the riskiness of the borrowers (their probability of default), the operational cost of the loan and the stringency of the liquidity constraint. Likewise, the spread between deposit and policy rates reflects operational costs of deposits and the stringency of the liquidity constraint.

If the default event includes the interest payments in addition to the loan principal, the above result on lending rates will hold in the following form:

$$i_l - i = p(1 + i_l) + c_l + q$$

Notice that in this case, the lending interest rate spread will change with the value of the lending interest rate. The implications of this feature are considered in the discussion of the results.

Assuming now a monopolistic bank, it can be shown that the expression for the lending interest rate spread when the default applies only to the principal of the loan becomes:

$$i_l - i = \frac{i}{e-1} + \frac{e}{e-1}(p + c_l + q)$$

where e is the price elasticity of loan demand. Hence, given a value for this elasticity, the lending interest rate spread will change with the policy rate. The implications of this feature are also considered in the discussion of the results.

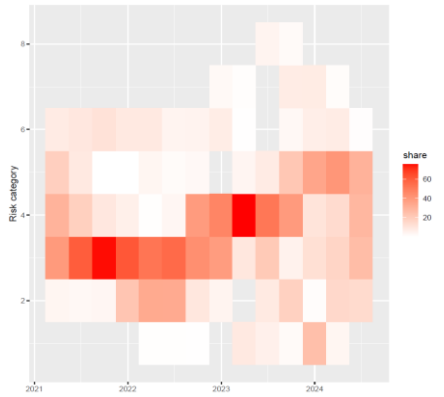
Appendix 2

Heatmaps of the distribution of new loans through time by risk categories (as a percentage of new loans)

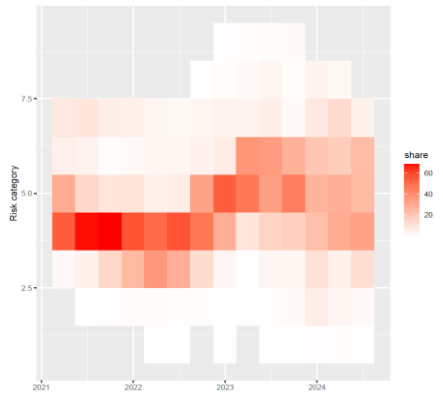
A. Consumer loans by product

Cars

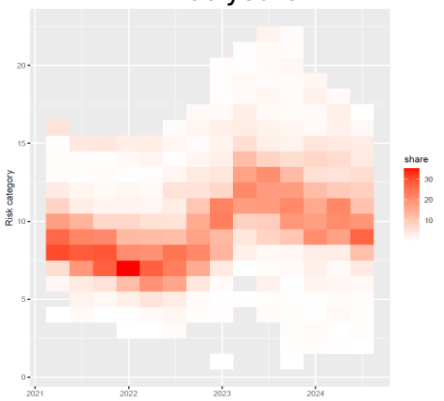
One year



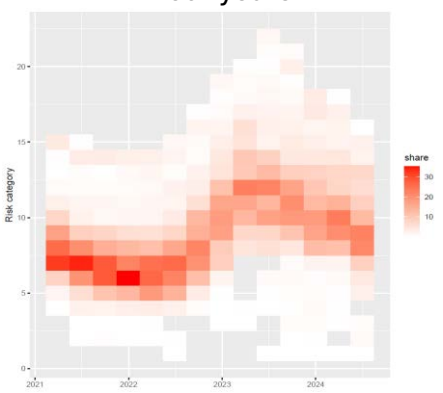
Two years



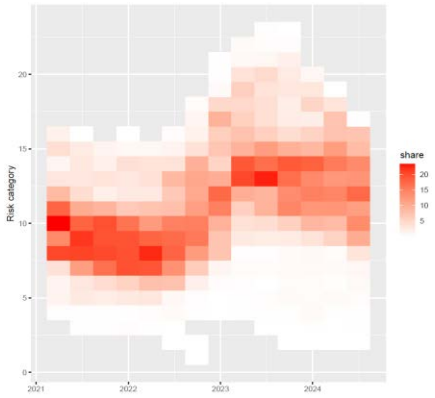
Three years



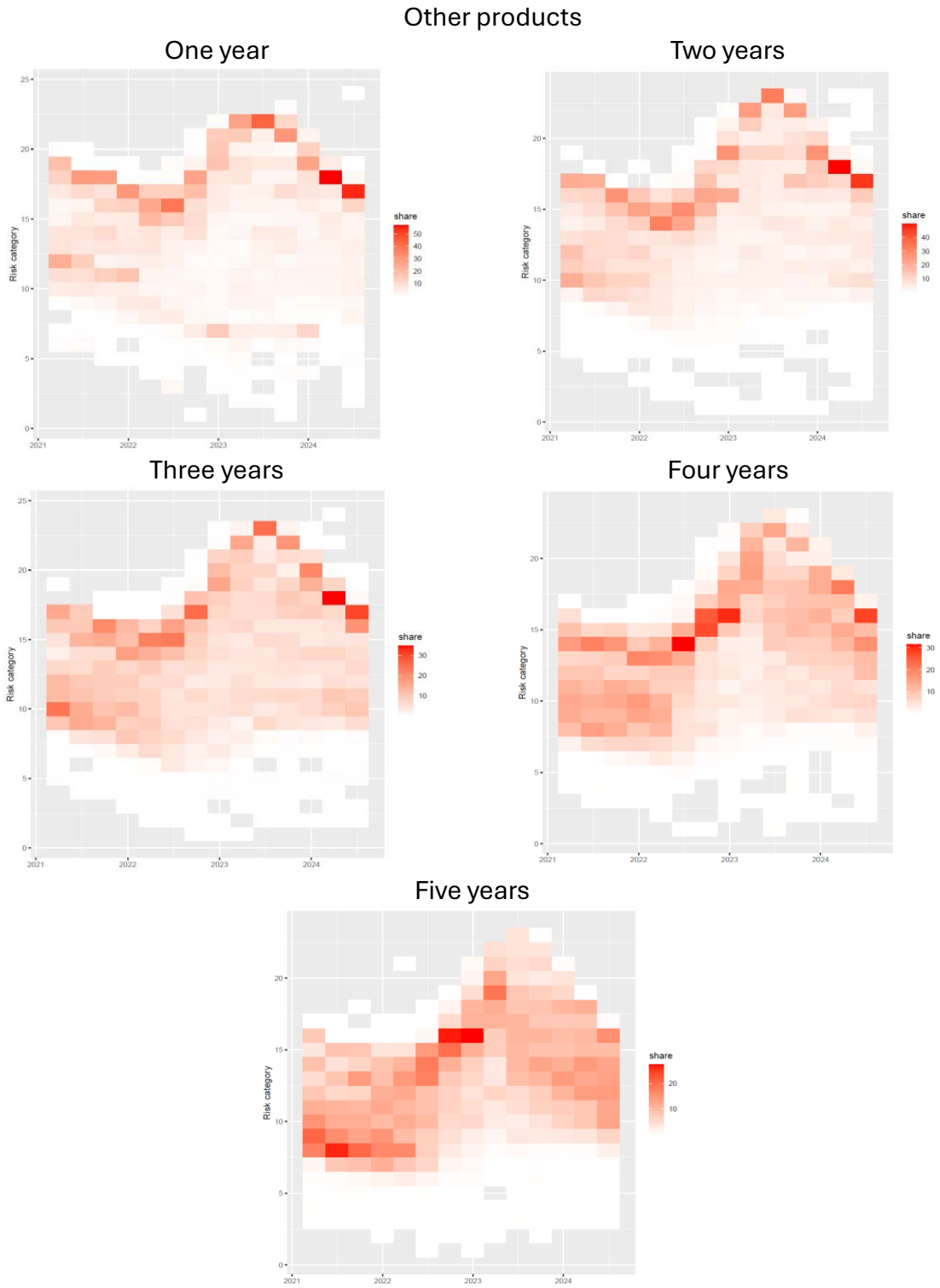
Four years



Five years



The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.
Sources: Financial Superintendence of Colombia; authors' calculations.

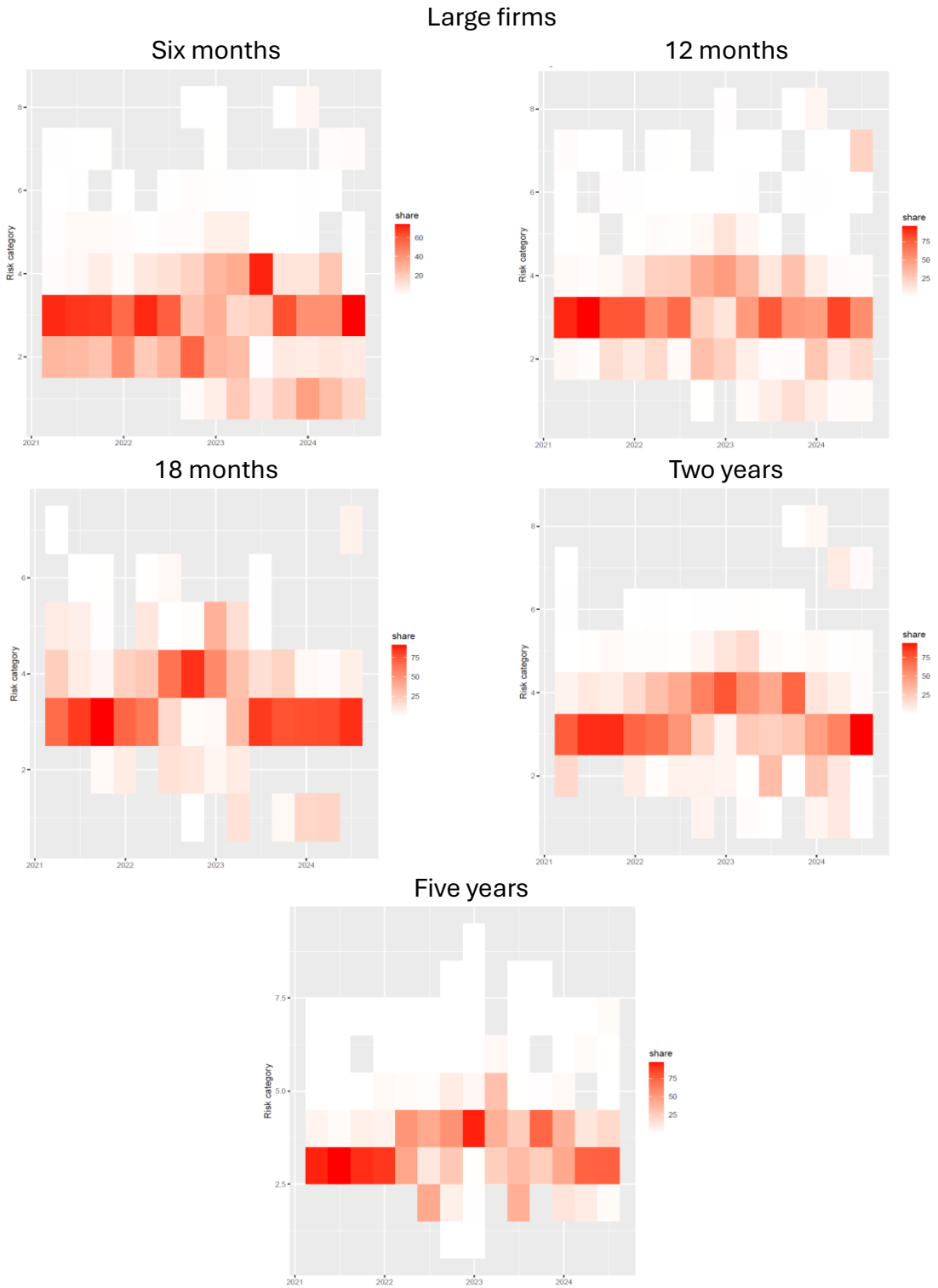


The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.
Sources: Financial Superintendence of Colombia; authors' calculations.

B. Commercial loans by firm size

SMEs

The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.
Sources: Financial Superintendence of Colombia; authors' calculations.



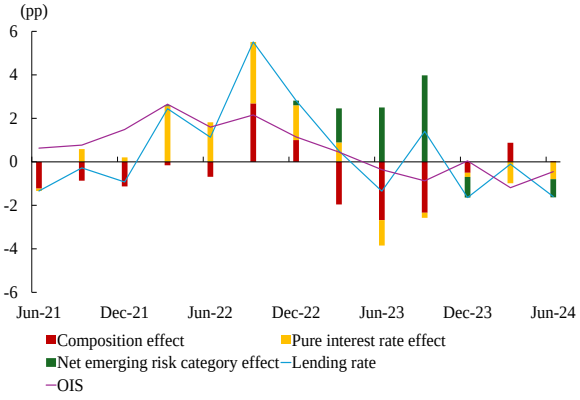
The heatmap shows in a colour scale the share of loans (measured in stocks) in each category and quarter.
Sources: Financial Superintendence of Colombia; authors' calculations.

Appendix 3

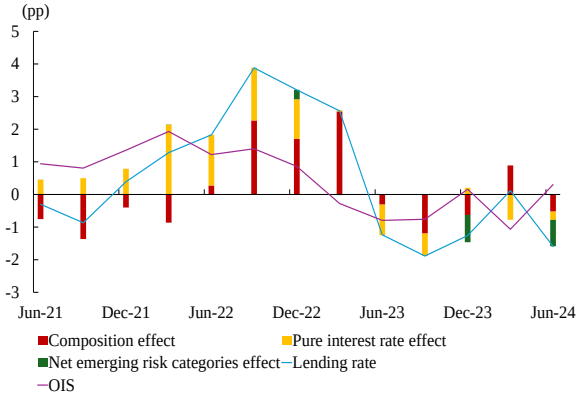
Decomposition of quarterly changes of lending rates by pure interest rate, composition and net emerging risk category effects. Consumer loans by product

Cars

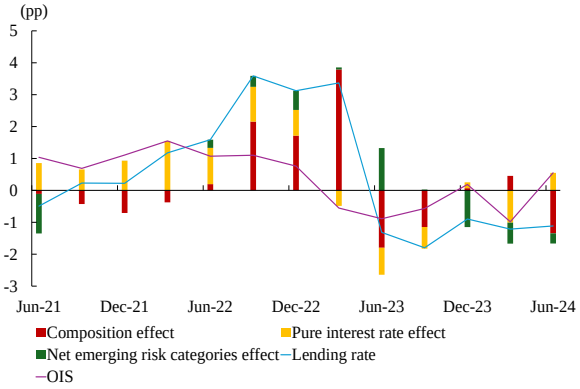
One year



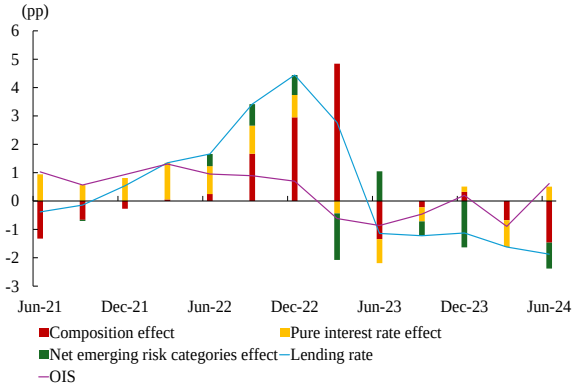
Two years



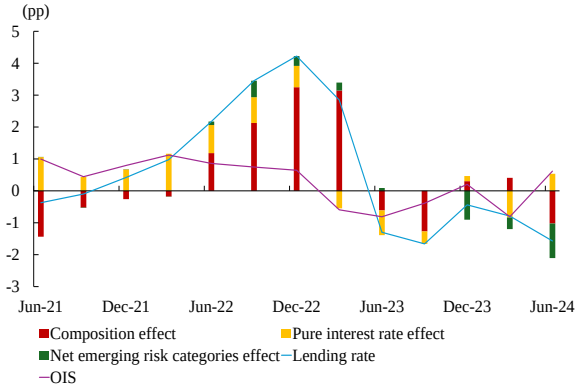
Three years



Four years



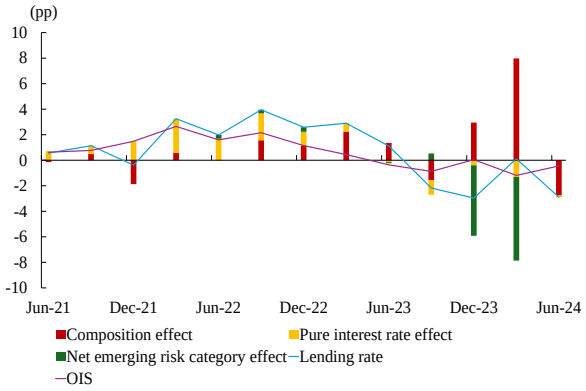
Five years



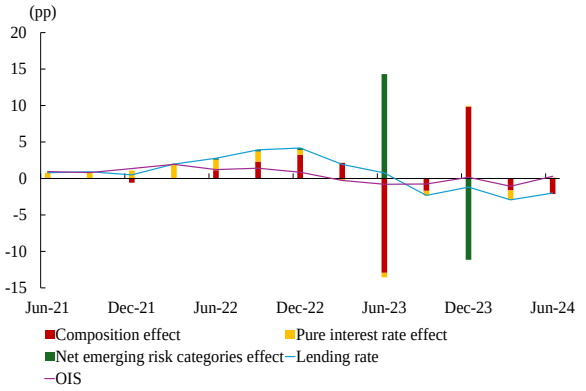
Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

Other loans

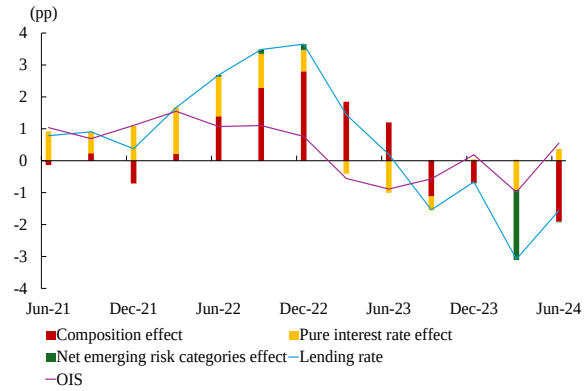
One year



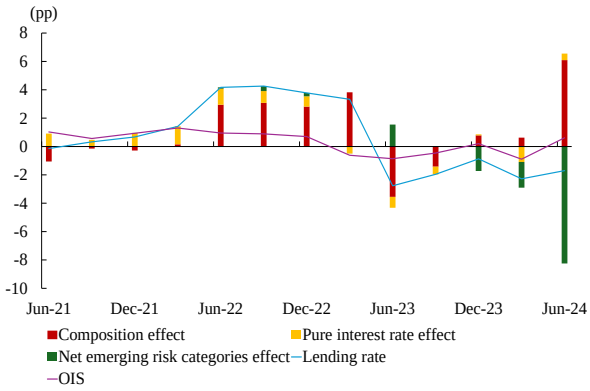
Two years



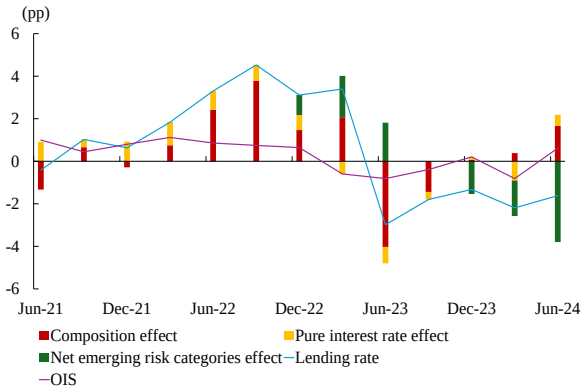
Three years



Four years



Five years



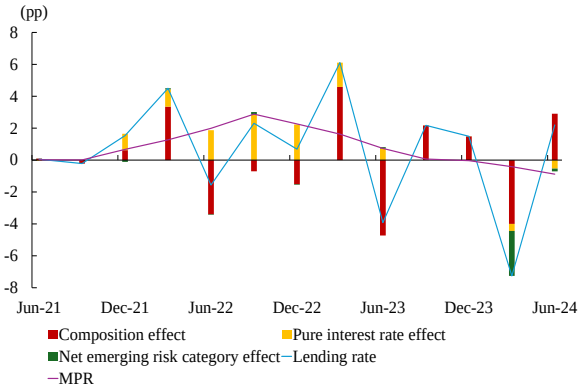
Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

Appendix 4

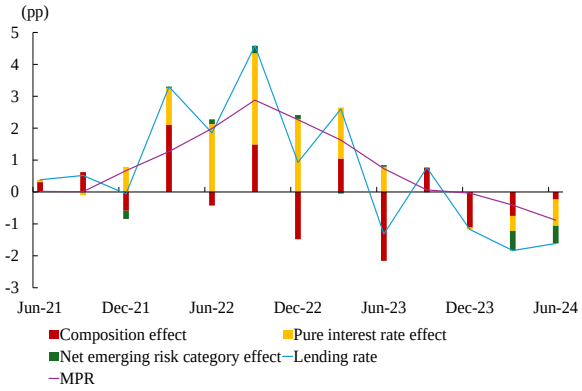
Decomposition of quarterly changes of lending rates by pure interest rate, composition and net emerging risk category effects. Commercial loans by firm size

SMEs

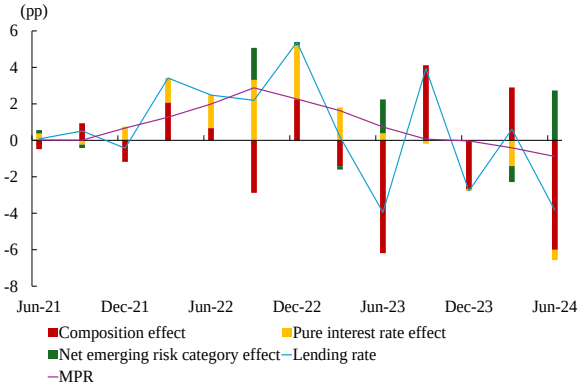
Six months



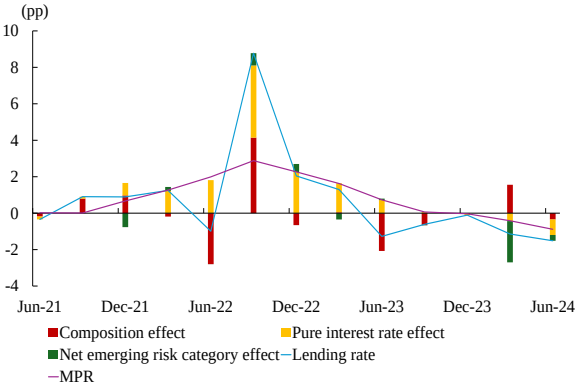
12 months



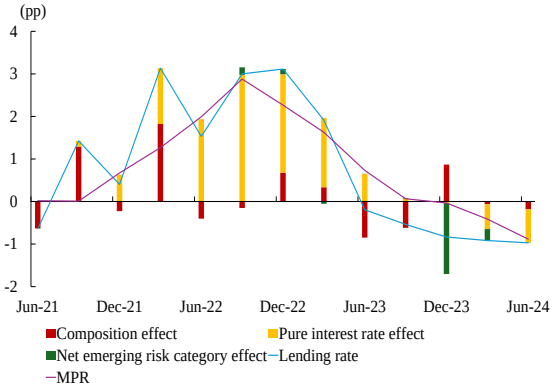
18 months



Two years



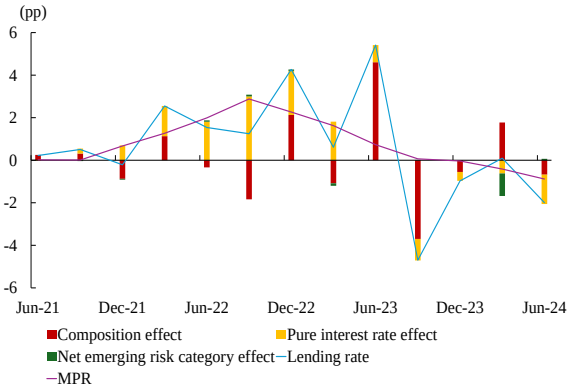
Five years



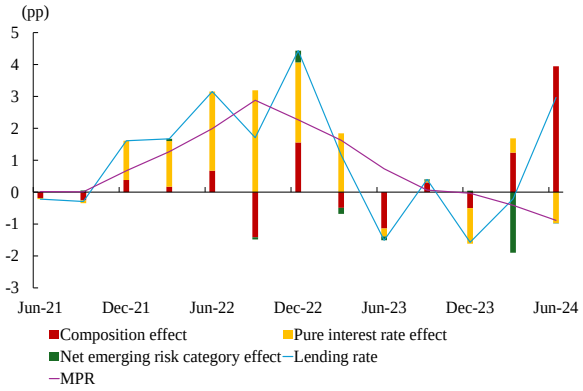
Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.

Large firms

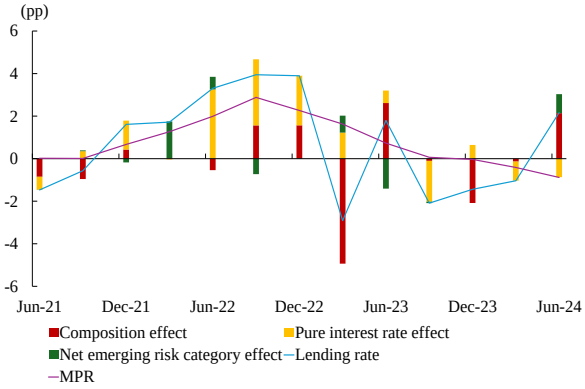
Six months



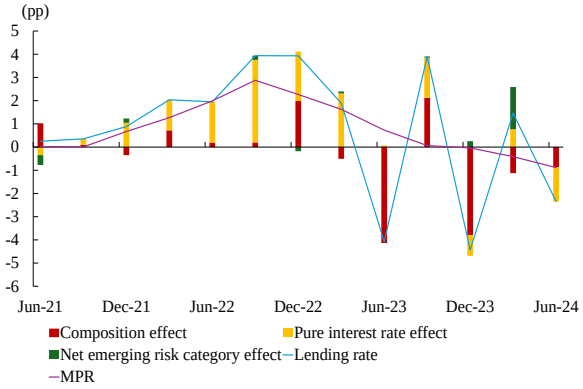
12 months



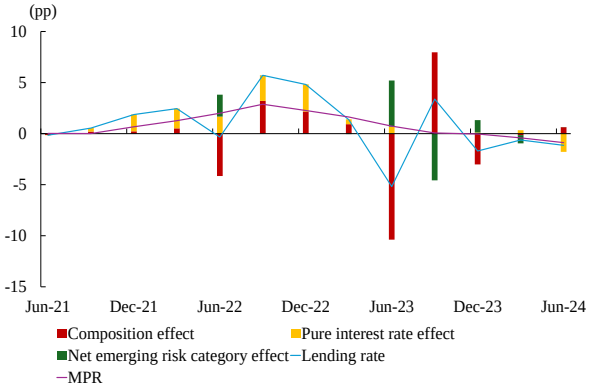
18 months



Two years



Five years



Sources: Central Bank of Colombia; Financial Superintendence of Colombia; authors' calculations.