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Occasional discrepancies between constituent figures and totals as well as percentage changes are due to rounding.

There are no references to sources in tables and graphs originated in the Banco Central do Brasil.

Financial Stability Report

Preface

The Financial Stability Report (FSR) is a semiannual publication issued by the Banco Central do Brasil (BCB) that presents an overview of recent developments and the outlook for financial stability in Brazil, focusing on the main risks and on the domestic financial system resilience, as well as conveys the Financial Stability Committee (Comef) view on the policy and measures to preserve financial stability.

The BCB defines financial stability as the regular operation, over time and in any economic scenario, of the system responsible for the financial intermediation among households, non-financial corporations, and the government.

The Report consists of two chapters. Chapter 1 – Assessment of the National and International Financial Systems – presents an overview of the international financial markets; of the National Financial System (SFN) – with analyses of the risks related to liquidity, credit, profitability, and solvency; of capital and liquidity stress tests and their effects on institutions' solvency; – of the Financial Stability Survey (FSS); and of the operation of systemically important financial market infrastructures (FMIs). Chapter 2 – Selected Issues – discusses relevant and not necessarily recurrent topics that may have implications to financial stability in Brazil.

The Statistical annex shows charts and tables underlying data and can be found on the FSR website, https://www. bcb.gov.br/en/publications/financialstabilityreport, as well.

Moreover, important time series for financial stability monitoring (e.g. total capital ratio, short-term liquidity ratio, delinquency ratio, and return on equity) are available in the Time Series Management System (SGS) on https://www3.bcb.gov.br/sgspub.

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Executive Summary

The Banco Central do Brasil (BCB) analyses indicate there is no relevant risk to financial stability. Capital stress tests show that the banking system has adequate resilience. The National Financial System (SFN) maintains provisions adequate to the level of expected credit losses, and comfortable capitalization and liquidity positions. The evolution of the SFN is in line with the advance of the Gross Domestic Product (GDP).

This perception of the resilience of the SFN is in line with the financial market agents' view, according to the Financial Stability Survey (FSS). For the SFN professionals consulted, the degree of confidence in the System's resilience increased, as did the perception of a recovery in economic activity. Financial institutions (FIs) assess that fiscal risks remain relevant, reflecting concerns about recent measures and uncertainties related to the next presidential term.

At the global level, the scenario deteriorated but the financial systems of the major economies remain resilient. There are concerns about the continuation of the zero-Covid policy and the contraction of the real estate market in China, and about the consequences of the geopolitical conflict on inflation and the economy in Europe. However, stress tests conducted by jurisdictions indicate that the global financial system remains prepared to withstand additional shocks, which minimizes the concern raised in the FSS about the external scenario.

Broad credit[1] growth remained consistent with the current economic fundamentals. Bank credit to households maintained its high growth rate, especially in non-payroll deducted credit and credit cards. Credit to micro, small, and medium-sized enterprises (MSMEs) also continued to grow strongly, especially to finance working capital in micro-companies and investment in medium-sized companies. The larger companies, in turn, continued to access mainly capital markets but once again increased their operations with the banking system. Such growth is compatible with the pace of nominal GDP growth.

FI's risk appetite remained high on micro-companies and household lending. The estimate of the quality of micro-enterprise grantings over the first half of the year remained at a lower level than in previous periods. In households, non-payroll deducted credit continues to grow more in higher risk operations, without guarantee or with a fiduciary guarantee. Regarding vehicles, used car financing, with longer terms, still predominates. In this sense, there is a growing concern about the effect of a possible economic downturn on the materialization of credit risk. Against this backdrop, the Financial Stability Committee (Comef) has repeatedly evaluated that it is important for FIs to continue to preserve the quality of grantings.

Risk materialization increased due to riskier grantings in previous quarters. In micro-enterprises, problem assets (PAs) increased despite strong portfolio growth. Regarding households, risk materialization grew significantly in 2022 in non-payroll deducted credit, credit card, and vehicle financing. In addition, the borrowers' ability to service their debt worsened, even in the face of economic recovery and rising employment. The scenario is still that family income is increasingly compromised with more onerous debts, such as credit cards and non-payroll deducted credit.

1 Here understood as bank credit, private debt instruments, and internalized foreign debt.

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In line with this context, provisions increased, and their level is still above expected losses. Higher provisioning maintained total provisions at a comfortable level to support expected credit losses – according to BCB estimates based on probability of default (PD) and loss given default (LGD) proprietary models, applied to data from BCB's Credit Information System (SCR).

Despite higher provision expenses, the profitability of the banking system remained stable. In line with the base interest rate (Selic) hikes, the increase in the treasury margin offset the reduction in the credit margin. On the one hand, the rise in the Selic rate increased the funding cost, reducing the credit margin; on the other hand, it increased the treasury margin. In the non-interest share of results, services income grew at a slower pace in the first half of 2022, but banks have been able to keep costs under control even in a context of high inflation.

The banking system remains with comfortable liquidity positions to maintain financial stability and the regular operation of the intermediation system. Banks continue to optimize the liquidity management to eliminate excesses and adapt to market conditions and competition for funding. The system has been maintaining enough liquid assets to absorb potential losses in stressed scenarios and comply with regulation.

The capital base is sound. Capitalization remains comfortably above regulatory minimums. The regulatory capital buffer allows expanding the credit supply in a sustainable way.

Results from various risk analyses and stress tests continue to demonstrate the resilience of the banking system's capital base and liquidity. Even in simulations with more adverse macroeconomic scenarios, there would be no relevant non-compliances. Tests conducted by the largest FIs corroborate this conclusion. The sensitivity analyses also indicate good resistance to the risk factors simulated separately. The liquidity stress test indicates a comfortable amount of liquid assets in case of cash outflows under adverse conditions or a shock to market parameters.

Systemically important financial market infrastructures (FMIs) operated efficiently and safely throughout the first half of 2022. The financial system maintained sufficient intraday liquidity to ensure the smoothness of transactions in the Brazilian Payment System (SPB). The settlements in the interbank market took place without any significant occurrences.

Regarding climate risk, 8% of the SFN's credit portfolio is sensitive to transition risk. This percentage has varied little over time and refers to borrowers who may be affected by transition risk. This risk is concentrated in smaller FIs. The "Beef Cattle", "Cargo Transport" and "Soybean" segments account for more than 70% of the exposure to the transition risk.

Simulation indicates that the share of the credit portfolio granted to borrowers located in municipalities with higher risk of drought would increase. Currently, 16% of the credit stock is with water-intensive activities borrowers, located in municipalities with medium or high drought risk. This percentage increases to 19%, considering the projected drought scenario for 2030 and 2050. The Southeast region, which concentrates about half of the Brazilian GDP, would be more exposed to the drought risk, due both to the large volume of credit and the number of municipalities vulnerable to extreme drought in the projected horizons. Rural credit for households and credit to the energy sector concentrate almost half of the exposures considered medium and high risk.

New liquidity facility lines (LFLs) allow timely liquidity provision to the financial system. Two new LFLs, backed by private bonds, came into effect in November 2021. The Immediate Liquidity Line (LLI) aims to meet liquidity demands of up to five working days. The Forward Liquidity Line (LLT) is accessible on demand and depends on specific authorization from the BCB. The effectiveness of the new LFLs enables a structural reduction in reserve requirements, without weakening the financial system stability. Another relevant benefit of LFLs is the promotion of liquidity in the private credit secondary market.

The BCB improved the prudential regulation to avoid systemic risk arising from the growth and diversification of payment institutions (PIs) operations. The new regulation extends to PIs and their prudential conglomerates the proportionality of the regulatory requirements applied to conglomerates led by FIs. Thus, the non-payment financial activities of PIs will be subjected to the same calculation of risk-weighted assets for credit, market, and operational risks as other institutions. The capital requirement methodology for payment activities applies to electronic money issuing, accreditation, and payment transaction initiation services.

The digital currency initiative is a response to the rapid progress of digital transformation. The BCB seeks, with the digital currency, to respond to society's demands for customized financial products and services at an affordable cost, as well as offering a secure transition path to the information economy. Since 2020, conditions ripen for important efficiency gains to be realized. This process is evolutionary so risks and opportunities must be constantly evaluated. There is still a long way to go. The BCB is confident that, despite relevant challenges, solutions that will benefit all Brazilian society will be reached.

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Decisions of the Financial Stability Committee on the Countercyclical Capital Buffer

At its regular meetings on May 26 and September 1, 2022, the Financial Stability Committee (Comef) decided to hold the Countercyclical Capital Buffer for Brazil ($ACCP_{Brasil}$) at 0% (zero percent).[2]

The Committee deems the financial system is prepared to face the materialization of potential risks. The credit portfolio continues to perform well, and the provisions for credit losses, the liquidity, and the capital levels are adequate. Given reduced exchange rate exposure and little dependence on external funding, the SFN's exposure to financial fluctuations originating abroad is low.

The Comef found that credit continues to grow across all modalities and asset prices have been behaving in line with economic fundamentals. Given the risks related to economic activity and to the reduction of households' income available to repay debt, it is important that banks continue to uphold their grantings' quality. Generally, banks voluntarily keep capital and liquidity at levels above prudential requirements. Capital and liquidity adequacy is asserted by analyses and stress tests. Tests are evaluated at the Comef meetings and disclosed on its Minutes and on the Financial Stability Report (FSR).

Thus, observing the tighter financial conditions, asset prices and expectations regarding the behavior of the credit market, the Comef considers it appropriate to maintain the $ACCP_{Brasil}$ at 0% (zero percent) in the coming meetings. This decision was made by the Comef in the exercise of its duties provided for in the Regulation attached to BCB Resolution 173, of December 9, 2021, and followed the principles and objectives described in Communiqué 30,371, of January 30, 2017.

2 Communiqués 38,702, of May 26, 2022 (available, in Portuguese, on https://www.bcb.gov.br/estabilidadefinanceira/exibenormativo?tipo=Comunicado&numero=38702), and 39,096, of September 1, 2022 (available, in Portuguese, on https://www.bcb.gov.br/estabilidadefinanceira/exibenormativo?tipo=Comunicado&numero=39096).

I

Assessment of National and International Financial Systems

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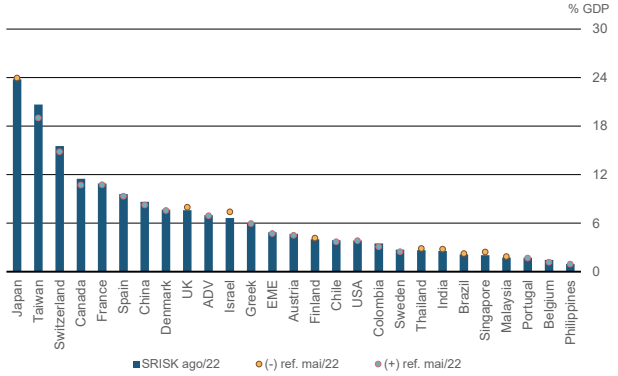
1.1 International financial markets

The financial system of the main economies remains resilient. Their banking institutions hold robust capital and liquidity levels. Simulations carried out by the BCB and stress tests performed by different jurisdictions indicate that the global banking sector remains prepared to withstand additional shocks.

Between the last two Comef meetings, the aggregate systemic risk (SRisk)[3] of advanced and emerging economies has increased slightly, albeit the change has been more pronounced in some countries. In Taiwan, China, Belgium, Canada, and Colombia, for instance, the systemic risk has increased, mainly due to market cap losses in financials. Specific factors in each jurisdiction have combined with deteriorating perspectives for the sector globally, affecting market capitalization, which is a proxy for banking capital in the SRisk model. Conversely, financials market value rose in India and Israel, leading to a decline in systemic risk. The SRisk is estimated at 7.0% of GDP for advanced economies (AE) and 4.9% of GDP for emerging market economies (EMEs, Chart 1.1.1).

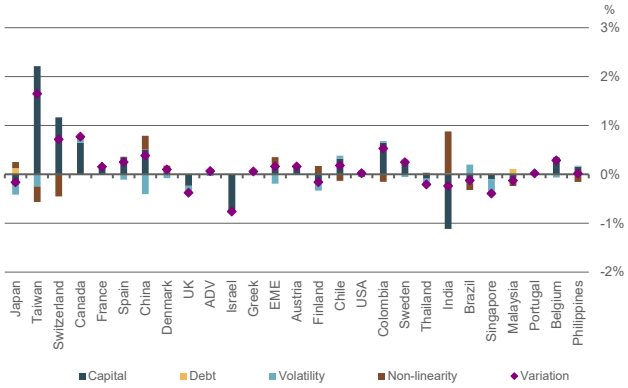
3 Systemic risk indicator that measures financial institutions' capital needs in a global stress event. The concept was presented in the April 2021 issue of the Financial Stability Report.

Chart 1.1.1a – Systemic Risk Analysis (SRisk)
SRisk/GDP (%)



Source: Bloomberg
Calculation: Banco Central do Brasil

Chart 1.1.1b – Systemic Risk Analysis (SRisk)
Change in SRisk/GDP since last Comef



Source: Bloomberg
Calculation: Banco Central do Brasil

The global macroeconomic scenario continues to deteriorate, increasing financial stability risks. Inflation remains high, leading most central banks, including the Federal Reserve (Fed), to accelerate monetary tightening (Chart 1.1.2). As a result, global financial conditions have become more restrictive, triggering an increase in market volatility and financing costs, and a repricing of financial assets. In China, the extension of the zero-Covid policy, coupled with the downturn in the housing market, continues to negatively affect economic activity and local asset prices, hindering the economic recovery process. In Europe, the Russian-Ukraine war continues to spark disruptions in the supply of gas and other energy products, affecting inflation and economic activity, and raising regional recession risks.

Taking those factors into account, perspectives for global growth have worsened while risk aversion increased, including for emerging market economies (Charts 1.1.3 and 1.1.4). Foreign portfolio capital flows into EMEs have been impacted by the adverse global scenario, showing net outflows more recently, especially from stock markets (Charts 1.1.5 and 1.1.5a). Notwithstanding outflows from all regions, China outflows have been substantially larger than other EMEs due to the deterioration of the domestic economy and of the perspectives for short-term recovery, given the strong restrictions to mobility imposed by the zero-covid policy, the widening of interest rate differentials in favor of advanced economies, and the real estate sector crisis.

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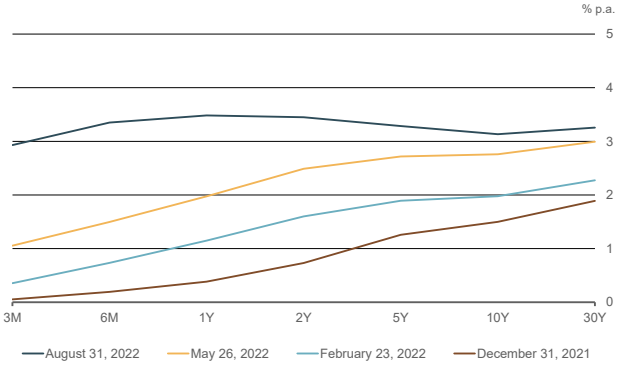
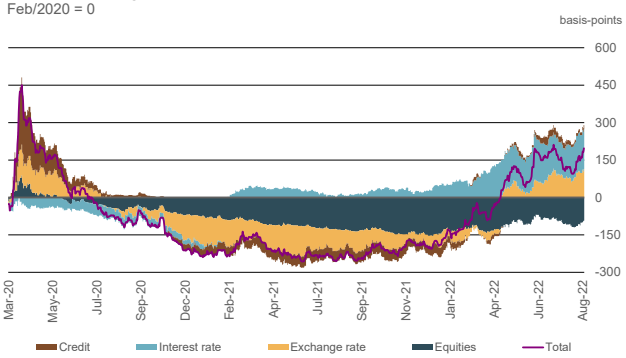
Chart 1.1.2 – USA: Yield Curve



Source: Refinitiv

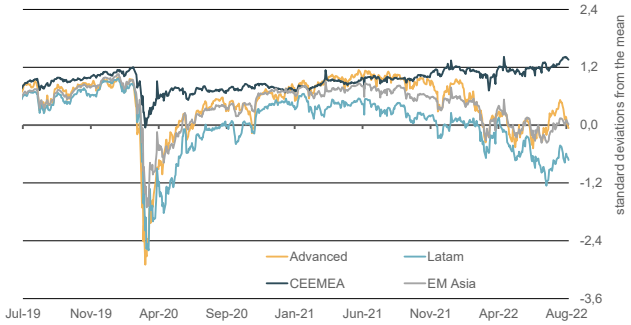
Chart 1.1.3 – USA: financial conditions

Cummulative change
Feb/2020 = 0



Obs.:The higher the value of the indicator, the more restrictive the financial conditions.
The metric reflects the change in financial conditions in terms of fed funds equivalence, in basis points.
Sources: Refinitiv, Fed St Louis. Calculation: Banco Central do Brasil

Chart 1.1.4 – Risk appetite indicator (up to Aug, 30th)



Asia: China, Korea, India, Indonesia, Philipines, Malaysia;
Latam: Brazil, Chile, Colombia, Mexico, Peru;
CEEMEA: Slovenia, Hungary, Poland, Qatar, Czech Republic, Russia, Turkey;

Sources: Bloomberg, Reuters and Fed St Louis. Calculation: Banco Central do Brasil.

Chart 1.1.5 – Portfolio flows to emerging economies

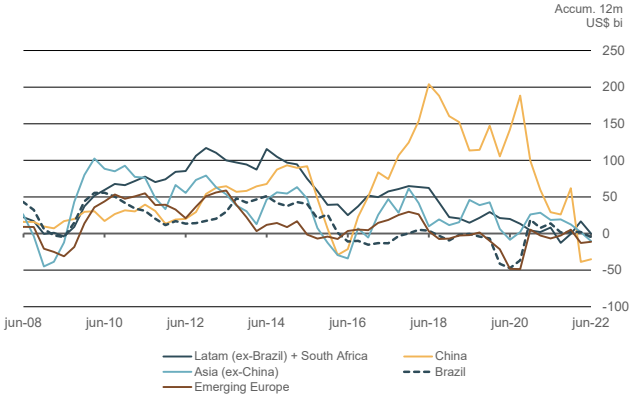
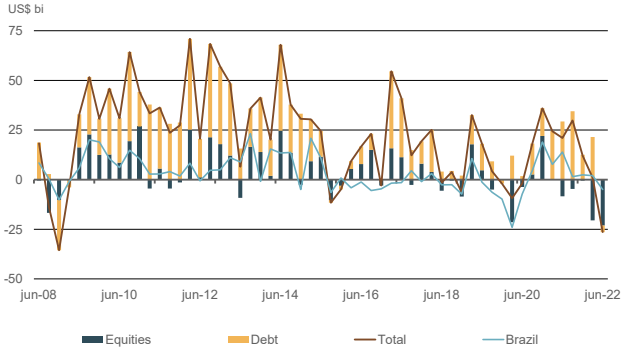


Chart 1.1.5a – Portfolio flows to emerging economies



The tightening of global financial conditions has negatively impacted the main asset classes, with declines in share prices, affected by the rise in long-term interest rates, and increases in credit spreads, especially in Europe due to the worsening of the region's economic outlook. Hence, between the last two Comef meetings, both corporate credit ratings and insolvencies have moderately deteriorated. Another consequence of the weakening of corporate financing conditions has been a substantial reduction in the debt issuance of higher-credit risk corporates in the U.S. (Charts 1.1.6 to 1.1.8).

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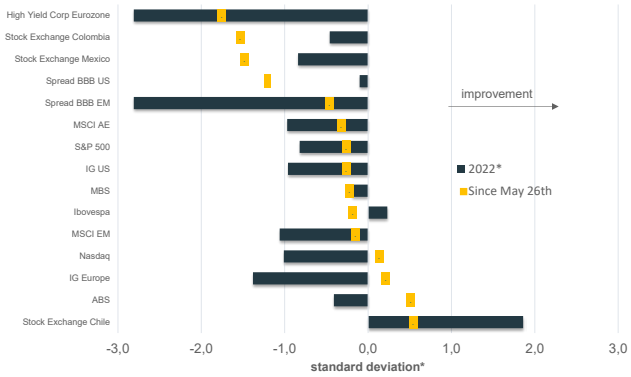
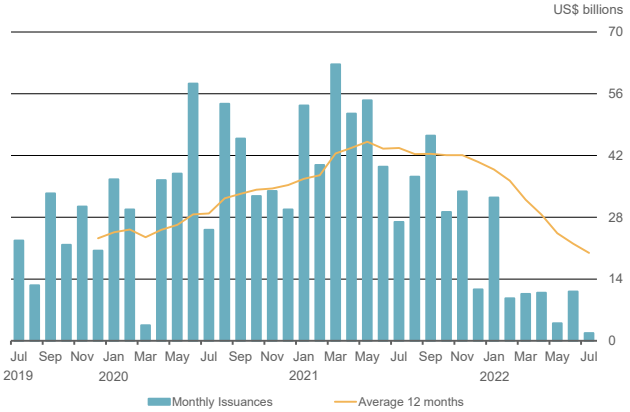
Chart 1.1.6 – Assets Performance (up to Aug, 30th)



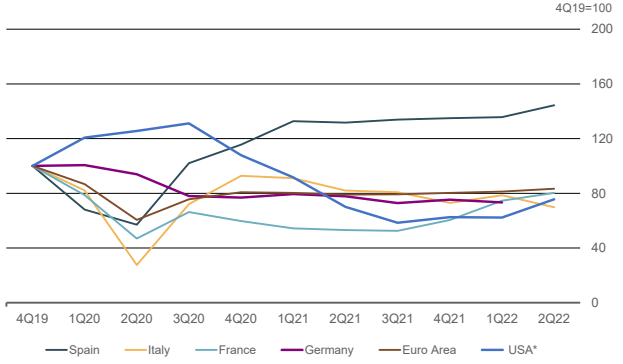
* normalized to the days range in each analysis window
Sources: Bloomberg, Refinitiv, Fed. St Louis

Chart 1.1.8 – USA: *high-yield issuances*



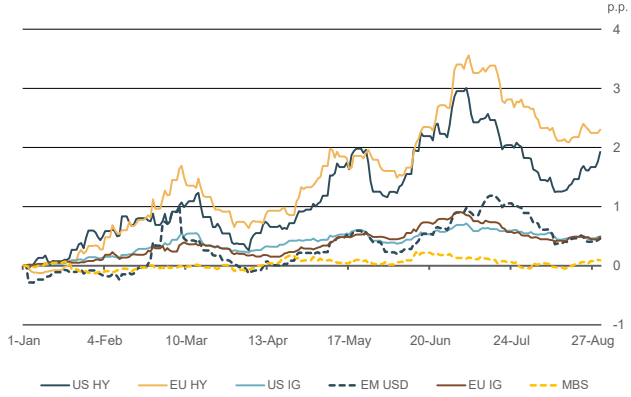
Source: SIFMA

Chart 1.1.9 – Insolvencies



*Chapter 11
Sources: Eurostat, Refinitiv

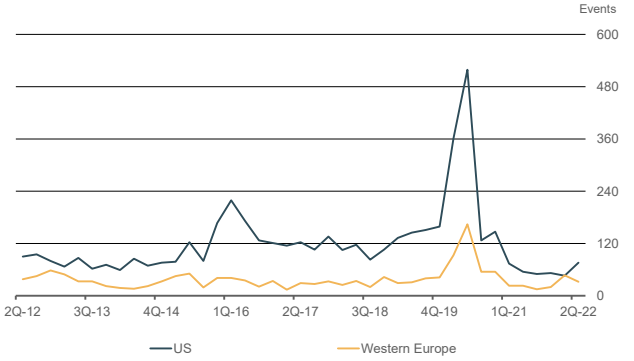
Chart 1.1.7 – Change of credit spreads in 2022



Source: Bloomberg

Comparatively to the pre-pandemic period (December 2019), banks' non-performing loans remain low, with sufficient provisioning to face current macroeconomic risks. However, the decline in household's purchasing power in a high-inflation environment, in addition to the impact of cost pressures on debt repayment capacity and on the demand for goods and services, increases both households and firms' vulnerabilities in the current scenario of higher inflation and interest rates (Charts 1.1.9 and 1.1.10). This has led Global Systemically Important Banks (GSIBs) to preemptively increase provisions.

Chart 1.1.10 – *Downgrades within the high-yield risk ranges*



Source: Bloomberg

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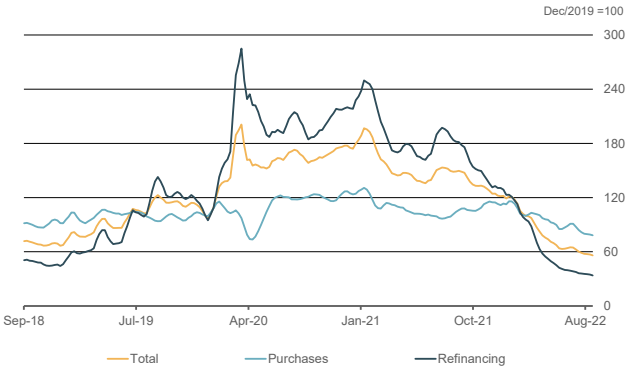
With the rise in long-term interest rates, the U.S. real estate sector is decelerating, with a recent sharp decline in demand for financing for both new mortgages and refinancing operations (Chart 1.1.11).

Chart 1.1.11 – Mortgages applications – USA



Source: Bloomberg

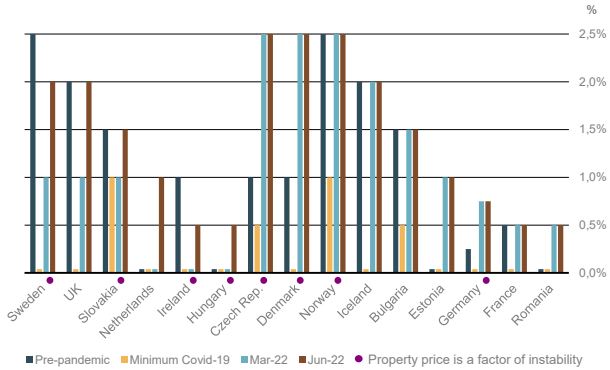
In China, the real estate sector continues to deteriorate. The stress events experienced by property developers has led to a strong downturn of the sector, which had been highly leveraged to sustain the solid growth of recent years. Sectorial confidence remains a drag to the sector's recovery. In fact, real estate credit deceleration signals a negative outlook for mortgage demand and developers' investment. Hence, concerns about the soundness of the financial sector have increased amidst the economic deceleration and the housing sector crisis (Chart 1.1.12).

Chart 1.1.12 – Real estate credit in China
Balance growth

Source: Bloomberg

Faced with a more challenging macroeconomic outlook coupled with increasing risks in the real estate market, several jurisdictions have maintained or increased their countercyclical capital buffers to strengthen banks' resilience. In Europe, the surge in risks due to the Russian-Ukraine war and its economic impacts, including regional energy security, has led the European Systemic Risk Board (ESRB) to issue its first general warning since its establishment in 2010, recommending regulators to require supervised financial institutions to strengthen capital buffers.[4] The ESRB also warned authorities to address the buildup of financial stability risks in the nonbanking financial sector, by establishing prudential instruments that strengthen the resilience of investment funds and insurers (Chart 1.1.13).

Chart 1.1.13 – Countercyclical Capital Buffer (CCyB)



Sources: BCE, BIS, central banks

Although current conditions remain stable in the main markets and relevant international financial systems continue to operate without major disruptions, the BCB continues to monitor their risks. The tightening of global financial conditions and the increase in volatility can lead to sharp asset price losses, especially for riskier assets. At the same time, the deterioration of global growth perspectives translates into additional risks to asset and commodities prices and to capital flows to EMEs. Additionally, the BCB also continues to monitor the volatility of the global crypto asset markets, their correlation with traditional financial markets, and potential impacts caused by the introduction of new decentralized finance (DeFi) tools.

4 ESRB warning is available at: https://www.esrb.europa.eu/pub/pdf/warnings/esrb.warning220929_on_vulnerabilities_union_financial_system~6ae5572939.en.pdf.

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1.2 Financial system overview[5]

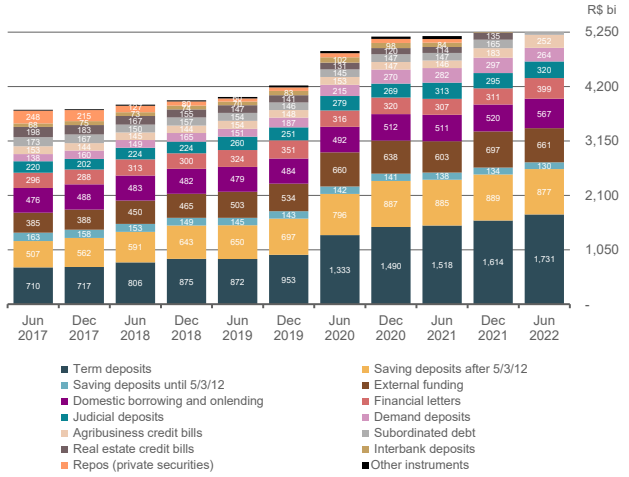
1.2.1 Liquidity

Liquidity levels exhibit resilience throughout the banking system, compatible with the balance of risks. **The banking system remains with an adequate level of liquidity to maintain financial stability and the regular functioning of the intermediation system.** Banks continue streamlining their liquidity management aiming to eliminate excesses and adjust to current market conditions and funding competition. The system holds enough liquid assets to absorb potential losses in stressed scenarios and comply with regulations. Finally, the BCB successfully implemented, as of November 2021, a new Liquidity Facility Line (LFL) backed by private securities, generating a new source of liquidity and additional support for financial stability.

Funding grew again for the second consecutive semester. The period was characterized by an increase in demand for assets with higher return and longer maturity, by maintenance of the convergence of rates practiced by various segments and by stability in the funding coming from foreign markets (graphs 1.2.1.1 to 1.2.1.8).

Funding followed the growth trend observed in the previous semester, influenced by the economic recovery and the monetary policy tightening cycle. In absolute terms, we highlight the growth of the term deposits portfolio. In relative terms, we underscore the evolution of Agribusiness Credit Bills (LCA) (38%), Real Estate Credit Bills (LCI) (25%) and Financial Letter (28%), instruments that offer good return for customers, and lower financial costs for banks (LCA and LCI). Certificate of deposit (CD) funding identified as coming from auto-sweep accounts grew in the quarter, along with net outflows from funds that serve similar purpose. The balance of savings accounts fell by 2%, due to negative net inflow recorded in the period, not offset by credited earnings. As in the previous semester, the downward trend in savings stock continues, due to loss of competitiveness vis-à-vis other investment options. The funding profile by investor type remained practically stable. The trend towards a reduction in concentration in the National Financial System persists. The volume raised by banks in the S1 segment represented 72% of the total in June 2022. (Graphs 1.2.1.1 to 1.2.1.4).

Chart 1.2.1.1 – Funding profile by instrument
Banking system



Sources: BCB, [B][3], CRT4, CERC

Term deposits: certificates of deposit, receipts of deposit, time deposits with special guarantee by the Credit Guarantee Fund (Fundo Garantidor de Crédito – FGC). Subordinated debts: subordinated certificates of deposit, subordinated financial letters and other capital instruments. Other instruments: structured notes, bills of exchange, mortgage notes, box spread strategies with options. Repurchase agreements (repo): refers only to repo collateralized by private-issued securities.

5 In section 1.2.1 Liquidity, the scope of the analyses is the banking system, comprised by commercial, multi-purpose, savings, foreign exchange, and investment banks, and by financial conglomerates including at least one of these types of institutions. Within sections 1.2.3 Profitability and 1.2.4 Solvency, the scope of the analyses is the prudential conglomerates related to the banking system, as defined by Resolution 4,280, of October 31st, 2013, to which the minimal capital requirements, as stated by Resolution 4,193, of March 1st, 2013, are applied since January 1st, 2015. In section 1.2.5 Stress tests, the scope is also the prudential conglomerates, including development banks. In section 1.2.2 Credit, the scope is the whole National Financial System (SFN).

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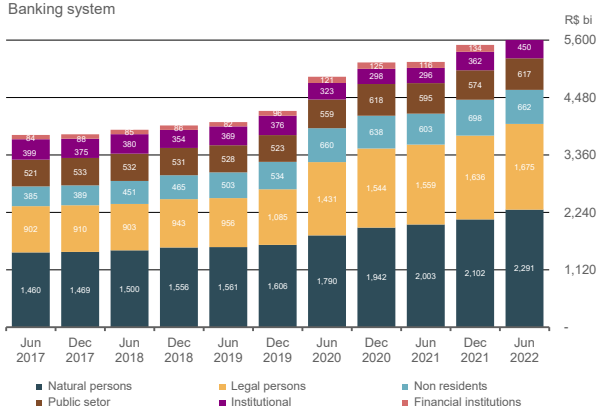
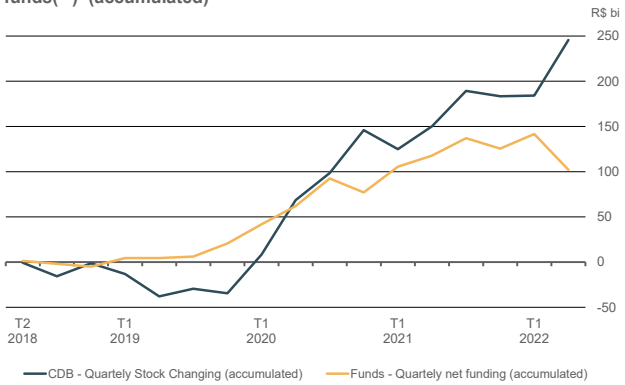
Chart 1.2.1.2 – Funding profile by type of investor
Banking system



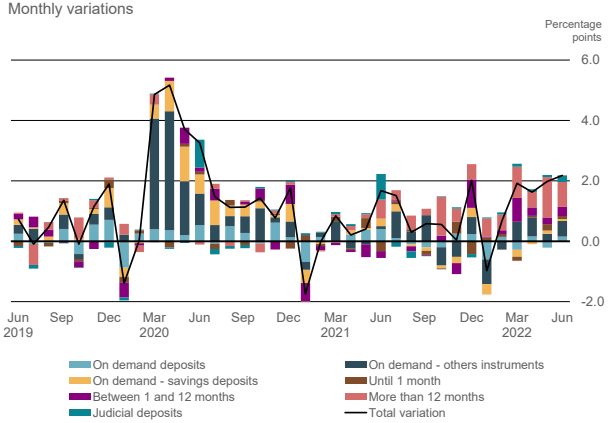
Sources: BCB, [B]³, CRT4, CERC

Chart 1.2.1.4 – Change in CDB stock(*) and net inflows of funds(**) (accumulated)



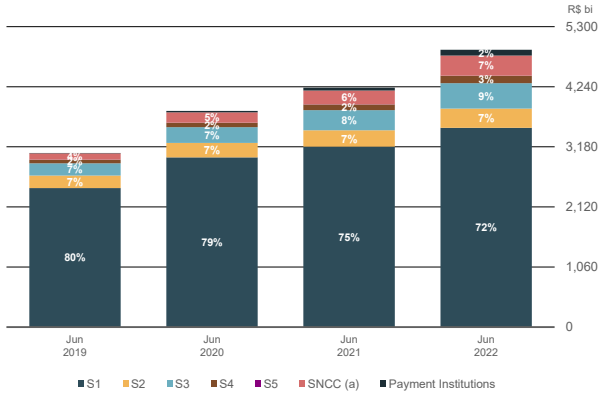
(*) and (**) - Both coming from auto-sweep accounts

Chart 1.2.1.5 – Domestic funding by maturity range
Monthly variations



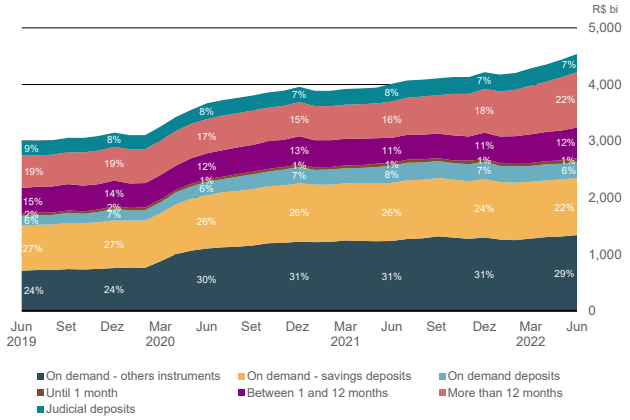
Sources: BCB, [B]³, CRT4, CERC

Chart 1.2.1.3 – Funding profile by type of segment
Banking system



The upward trend in the share of long-term funding in the aggregate portfolio continues in the first half of 2022. The monthly variations in inventories by maturity point to the growth in the portfolio of long-term assets (over twelve months). The search for more profitable assets, in a scenario of a higher Selic rate, indicates that investors remained willing to exchange liquidity and lower remuneration for longer and higher return investments, continuing the trend observed in the previous semester (charts 1.2.1.5 and 1.2.1.6).

Chart 1.2.1.6 – Domestic funding by maturity range



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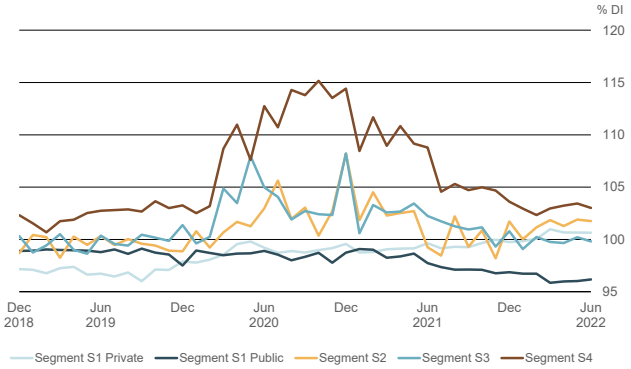
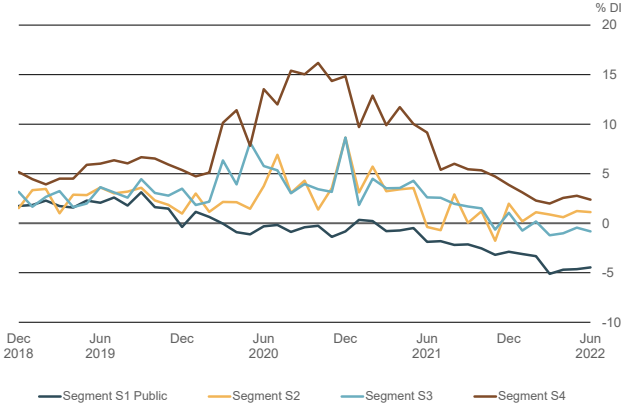
Funding rate spreads in relation to the interbank deposit rate remained stable throughout the first half of the year, with a slight increase in the S1 segment. Thus, the trend observed in the last semester of convergence of the rates practiced by the different segments, mainly between S2 to S4 and the private S1, remains. This reflects greater competition for funding, including via platforms (charts 1.2.1.7 and 1.2.1.8).

Chart 1.2.1.7 – Monthly average funding rates (*)



(*) Weighted average rate of these instruments: bank deposit certificates, bank deposit receipts, time deposits with special guarantee from the Credit Guarantee Fund (FGC), interbank deposits, agribusiness credit bills, real estate credit bills, financial letters (including with subordination clause), guaranteed real estate bills

Chart 1.2.1.8 – Difference in monthly average funding rates compared to the private S1 segment



The supply of external funding remains at a suitable level for the needs of the financial institutions. The stock of external borrowing by financial institutions totaled USD212.6 billion, an increase of 5.2% in the semester, concentrated in funding held abroad carried out by their overseas branches and subsidiaries. External funding reduced its share of total funding due to the devaluation of the US Dollar against the Brazilian Real in the period by 6.1% (charts 1.2.1.9 and 1.2.1.10). The cost of external export credit lines is on an upward trend, but with a constant spread, following the international reference rates (Chart 1.2.1.11).

Chart 1.2.1.9 – Profile of external funding
As a percentage of total funding

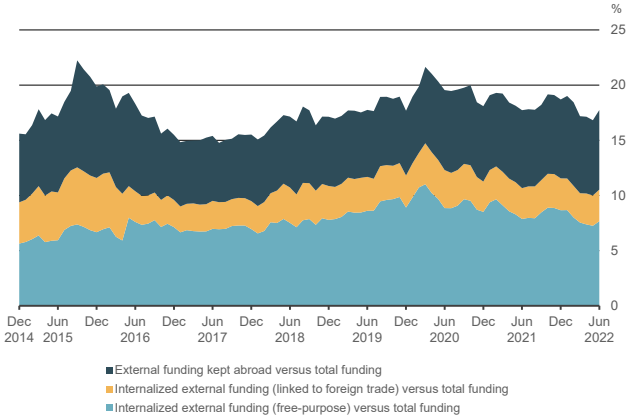


Chart 1.2.1.10 – Profile of external funding
Absolute amounts in dollars

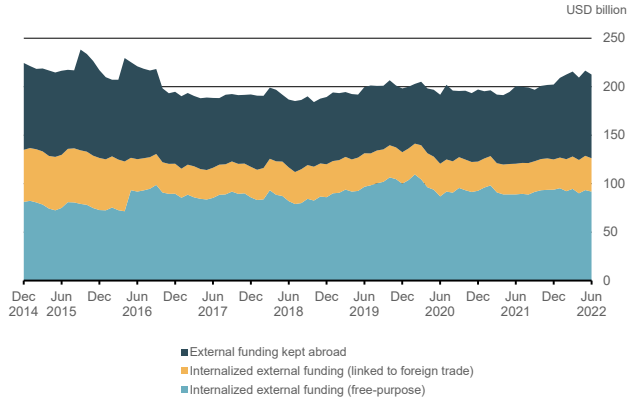


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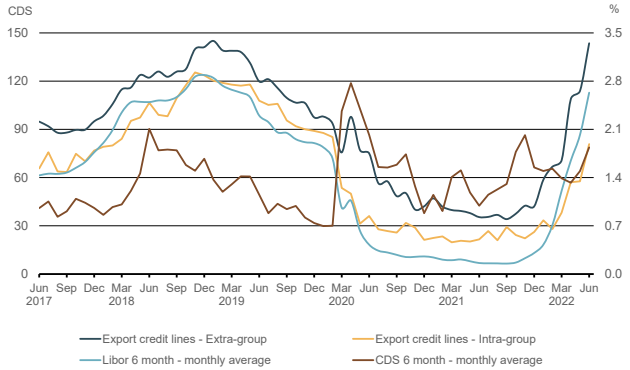
Chart 1.2.1.11 – External export credit lines
Interest rates

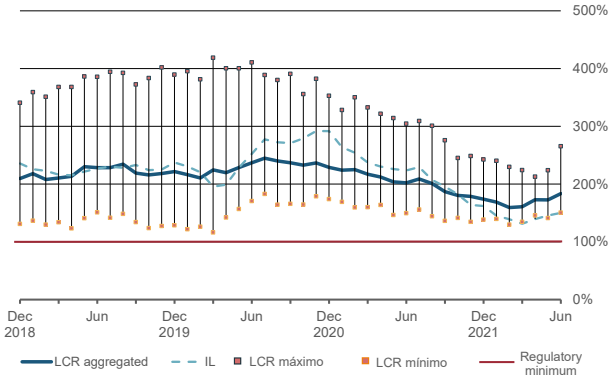


Short-Term Liquidity

The aggregated short-term liquidity in the banking system reverts its previous downward trend, with FIs adjusting to market conditions and competition for funding. Markedly in the second quarter of 2022, there was a significant shift in economic agents' expectations for domestic and global inflation. Future interest rates increased rapidly in the main international markets as well as in Brazil, while the International Monetary Fund (IMF) has warned about a predominantly negative global balance of risks[6]. The main FIs adjusted to this scenario adopting a mora conservative position, reflected in funding increase. Another driver for liquidity management was the inversion in the curve for the liquidity carrying cost, given by the proportion between the Selic base rate and funding costs, particularly in the S1 Segment. The increase in yields for treasury operations relative to funding costs provides additional flexibility for FIs to increase their funding without compromising earnings (charts 1.2.1.12, 1.2.1.13, 1.2.1.14 and 1.2.1.15). Smaller FIs continued their trend of reducing liquidity, trimming excesses to streamline management (Chart 1.2.1.16).

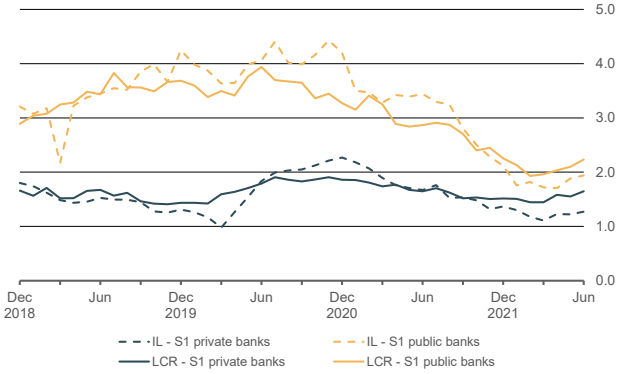
6 International Monetary Fund Global Financial Stability Report, April 19, 2022 – Global Financial Stability Report | April 2022 (imf.org).

Chart 1.2.1.12 – Liquidity Coverage Ratio (LCR)
High, low and aggregated[1/]



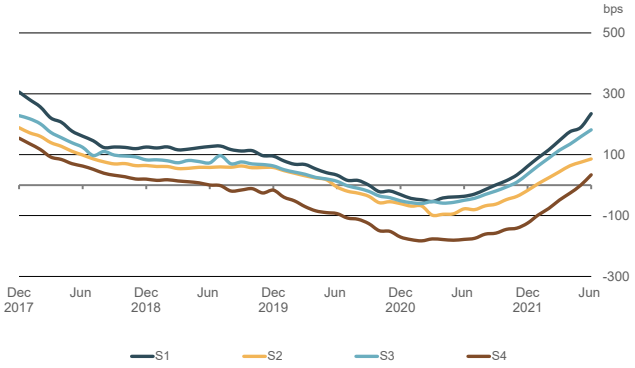
1/ Aggregated data for 6 FIs belonging to prudential segment S1.

Chart 1.2.1.13 – Short-term Liquidity Ratio (IL) and Liquidity Coverage Ratio (LCR)[1/]
Public vs. private banks



1/ Aggregated data for 6 FIs belonging to prudencial segmento S1 .

Chart 1.2.1.14 – Spread – Selic over funding cost[1/]
Banking System



1/ funding cost measured using accounting data - trailling twelve months (TTMs)

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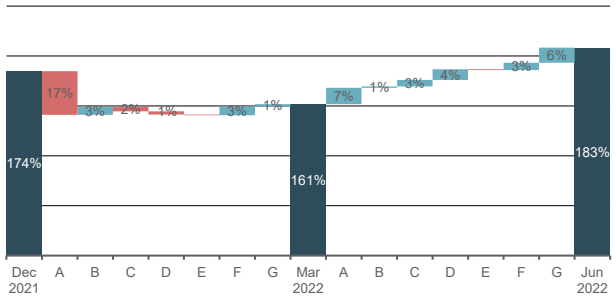
The S1 Segment's aggregated Liquidity Coverage Ratio (LCR) recovered, reflecting the new balance of risks. The indicator's behavior was marked by two distinct moments during the first semester of 2022: in the first quarter, the downward trend continued, while in the second, the scenario of increased uncertainty encouraged FIs to adjust their liquidity buffers by increasing funding (Chart 1.2.1.15).

Chart 1.2.1.15 – LCR changes in the 1° Semester 2022
Banking System, breakdown of changes between dates[1/]

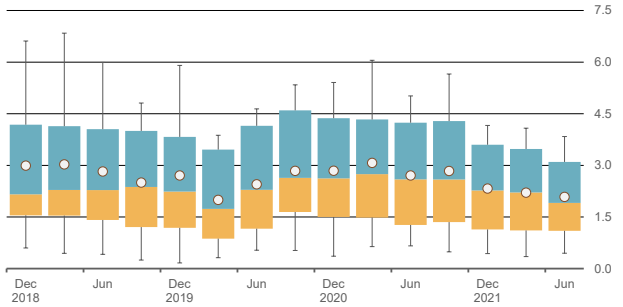


A – HQLA
B – Inflows from loans
C – Inflows from deposits in other FIs or Central Banks
D – Other inflows
E – Retail outflows
F – Wholesale outflows
G – Other outflows

1/ Percentage values in the red and blue bars indicate each component´s contribution to the change in LCR.

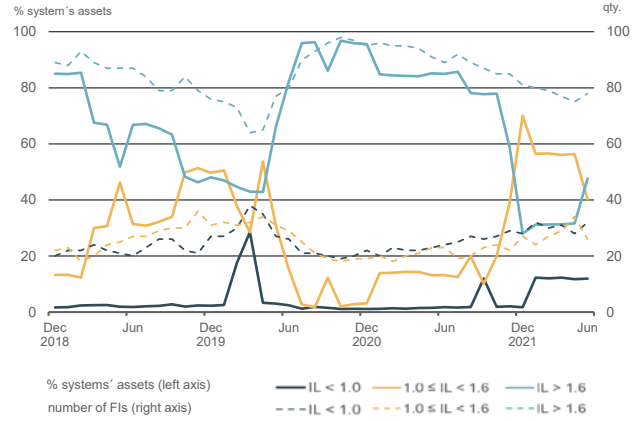
For the individual FIs, the Liquidity Ratio[7] (IL, in its Portuguese acronym) – which considers the effects of applying stressed scenarios – continued its downward trend, nevertheless liquidity levels remain adequate. The reduction is a consequence of lending growth, in addition to two factors that build a larger safety margin for FIs: increased access to funding throughout investment platforms and the establishment of Liquidity Facility Lines[8] (LFL) by the BCB in November 2021 (see chapter 2 of the Financial Stability Report, section 2.3 (Charts 1.2.1.16 e 1.2.1.17). These factors supported the reduction in liquidity carrying costs against higher profitability and operational efficiency, while also establishing structural conditions for reduction of credit spreads over time.

Chart 1.2.1.16 – Short-term Liquidity Ratio
Banking system, statistic data from individual institutions[1/]



1/The Short-term Liquidity Index of each FI is capped at the level of the 80th percetile. The values along the box and whiskers refer to the percentiles 10%, 25%, 50%, 75% and 90% respectively. The mean is represented by the circles.

Chart 1.2.1.17 – Short-term Liquidity Index Banking
Banking System – individual FIs by frequency bins[1/]



7 The IL – which covers the entire national banking system - measures whether banks have enough liquid assets to support their short-term cash-flow needs in a hypothetical stress scenario calibrated by the BCB for the next 30 days. The cash outflows arise from the run-off of maturing or redeemable liabilities, losses from market risk exposures, for instance, margin calls and settlements of derivatives, and other contractual payables over the next month. Institutions with IL above 1 have enough liquid assets to face those projected cash outflows. For further details about this indicator, please refer to Stress Test Section of the April 2020 edition of the Financial Stability Report.

8 The BCB instituted and regulated, through Resolution BCB 110, of July 1st, 2021, two new liquidity lines: one meant for the management of temporary short-term cash flow mismatches (Immediate Liquidity Line – LLI, as abbreviated in Portuguese) and the other for tending to liquidity needs stemming from mismatches between FIs' assets and liabilities, encompassing operations up to 359 days long (Forward Liquidity Line – LLT, as abbreviated in Portuguese). The implementation of LFLs enables IFs to access previously untapped liquidity using the stockpile of private securities in their portfolios. These lines generate value added in FIs' business models, creating positive externalities for the securities markets, enabling potential structural reduction of required reserves without compromising the stability of the financial system.

Long-term Liquidity

The funding structure remains adequate to finance long-term assets. The FIs belonging to Segment S1 exhibit loan portfolio growth, supported by the increase in retail funding, wholesale stable funding and regulatory capital, resulting in stability for the regulatory Net Stable Funding Ratio[9] (NSFR) (charts 1.2.1.18 and 1.2.1.19). The Structural Liquidity Ratio[10] (ILE, in its Portuguese acronym) – BCB's own managerial ratio similar to the NSFR and calculated for all FIs – indicates that the wide majority of FIs hold adequate levels of stable sources of funding in their balance sheets (Chart 1.2.1.20)

Chart 1.2.1.18 – Net Stable Funding Ratio breakdown (NSFR)
Available Sources of Funding (ASF) and Required Sources (RSF)

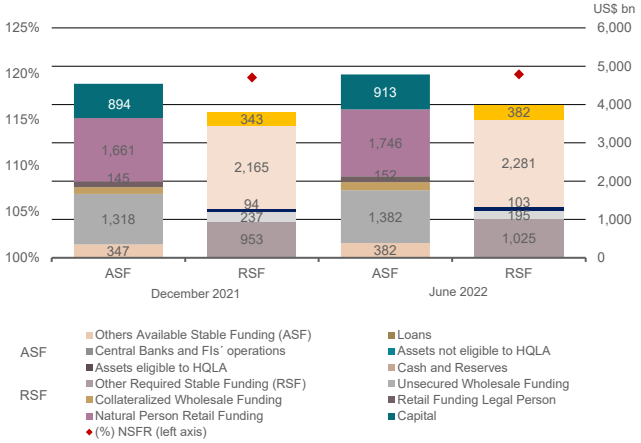
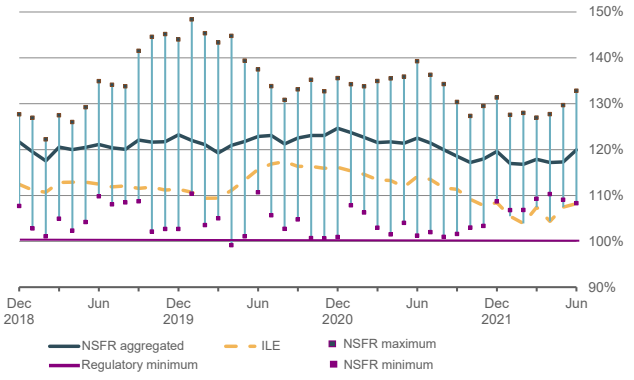
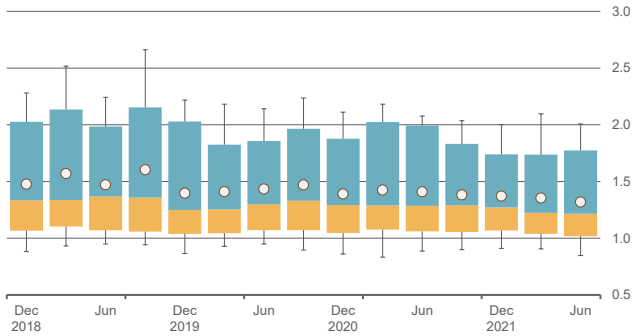


Chart 1.2.1.19 – Net Stable Funding Ratio (NSFR)
High, low and aggregated[1/]



1/ NSFR and ILE data series comprise institutions classified in the prudential segment S1 (currently 6 banks).

Chart 1.2.1.20 – Structural Liquidity Index[1/]
Banking System, statistic data from individual FIs



1/ The Structural Liquidity Index of each FI is capped at the level of the 80th percentile in each month, after capping the each index the statistics are calculated. The values along the box and whiskers refer to the ,percentiles 10%, 25%, 50%. 75% and 90% respectively. The mean is represented by the circles.

1.2.2 Credit

The growth of broad credit continued consistent with economic fundamentals. Bank credit for individuals continued to grow at a high pace, while credit for MSMEs continued to expand at levels above those of the pre-pandemic period. Larger companies, in turn, continued to access mainly the capital markets, but have recently started to increase their operations with the banking system. The values, in dollars, of internalized external funding remain practically stable, with no relevant changes since the end of 2018.

9 The NSFR was introduced in Brazil by CMN Resolution 4,616, of November 30, 2017, with the methodology given by Circular 3,869, of December 19, 2017, with effects from October 1, 2018. It is the quotient between Available Stable Funding (ASF) and Required Stable Funding (RSF). The numerator is composed mainly by loans, while the denominator mostly corresponds to regulatory capital and stable funding. All financial institutions in the S1 Segment must comply with the ratio above 100%, according to art. 2 of Resolution 4,553, of January 30, 2017.

10 The ILE aims to measure whether banks have enough stable funding resources (numerator) to finance their long-term activities (denominator). Therefore, institutions with ILE equal to or greater than 1 exhibit smaller liquidity mismatches and are less susceptible to future liquidity problems. For details, see the appendix Concepts and Methodologies.

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FIs risk appetite continued to increase, especially in some credit facilities for households with higher risk and return, and in operations linked to payment transactions. Credit card operations and non-payroll deducted credit continue to grow at a fast pace. There are uncertainties to be monitored, such as the levels of the household debt service-to-income and an eventual substantial frustration of economic activity, which could result in an increase of the credit risk materialization. In this scenario, it is important that the FIs continue to preserve the quality of the concessions.

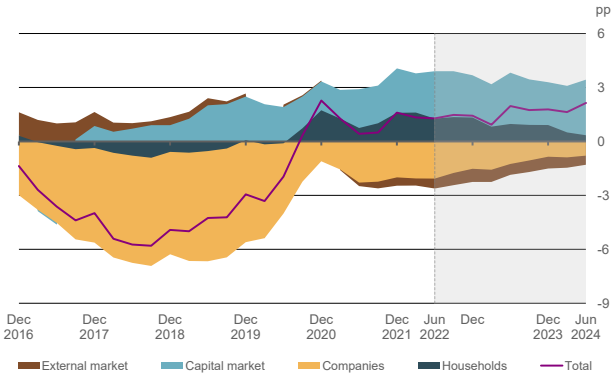
The risk materialization grew in the semester, but the movement was not uniform amongst the different portfolios. The percentage of problem assets for companies showed stability, but there was an increase for micro sized-companies, even with the strong expansion of the credit portfolio. For households, the increase in problem assets (PAs) has exceeded the growth of the credit portfolio. This trend should remain if the riskier operations recently granted have their risk materialized and, also, if the strategy of growth in riskier facilities is maintained throughout the second semester.

Provisions remained adequate, above the expected credit losses estimated for the credit portfolio. The provisions constituted by the FIs for the credit portfolio remained stable in the semester (6.6% of the credit outstanding). These provisions stayed at adequate levels to support the expected losses in the credit portfolio, estimated by the BCB based on proprietary models of probability of default (PD) and loss given default (LGD), applied to the SCR data. This level of provisions is an important buffer to deal with the uncertainties regarding the evolution of macroeconomic conditions and losses in the credit portfolio.

Broad credit and long run trend

Broad credit maintained growth in line with the stimulus and the economic environment in the first half of 2022. The capital market continued to strengthen, being the main contribution for the broad credit-to-GDP gap to remain positive. In the case of bank credit, the evolution of credit to households also makes a positive contribution with the continuity of its high growth rate; that of companies remained with a negative contribution, although stable, given that the general growth did not change significantly (despite the one-off increase in the last month of the semester). The external market remained with a negative contribution, but of lower impact, with no relevant changes in relation to its previous trend. Considering projections for GDP and broad credit, a broad credit-to-GDP gap around 2.0 p.p. is expected for the upcoming years (Chart 1.2.2.1)[11].

Chart 1.2.2.1 – Broad credit-to-GDP gap – Without FX variation
Shaded area: forecast



11 Broad credit-to-GDP gap is the benchmark indicator proposed by the BCBS to support CCyB decisions. Broad credit-to-GDP gap could signal excessive credit growth, which in turn could result in sudden corrections with detrimental effects on financial stability. According to the BCBS, should the gap exceed 2% of GDP, the country should consider increasing the CCyB. The BCBS, however, does not advocate the mechanical use of this indicator, because although there is empirical evidence of its predictive power, the metric has limitations, which are particularly important in the case of emerging economies and in times of crisis, such as the current one. Drehmann, M., Borio, C., and K. Tsatsaronis (2011). Anchoring countercyclical capital buffers: the role of credit aggregates, BIS Working Papers 355. Drehmann, M., and Juselius, M. (2011). Evaluating early warning indicators of banking crises: Satisfying policy requirements, BIS Working Papers 421. BCBS (2010). Guidance for national authorities operating the countercyclical capital buffer.

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Companies

The financial situation of the companies remained positive, despite some signs of worsening. On the one hand, payment capacity of companies benefited from the positive performance of economic activity: in a broader view, considering all companies, inflows[12] recorded growth in real levels (Chart 1.2.2.2) in the great majority of productive sectors. Additionally, applications for judicial recovery remained below of that observed in previous years, close to the minimum levels of the series (Chart 1.2.2.3). On the other hand, publicly traded companies were negatively impacted by the rise in production costs and financial expenses. These factors have influenced the declines in the interest coverage ratio and profitability levels of the companies, leading the former to fall below the pre-pandemic level, while the latter remains at a higher level (Chart 1.2.2.4). The still positive balance should be viewed with caution, since uncertainties regarding the economic scenario may eventually lead to a reduction in the companies payment capacity.

Chart 1.2.2.2 – Companies' inflows (deflated by IPCA)
All enterprises

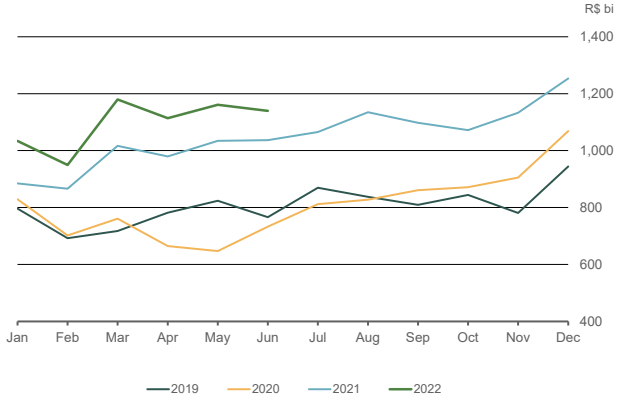
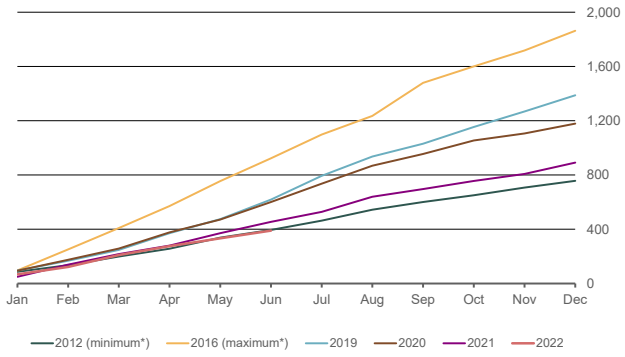


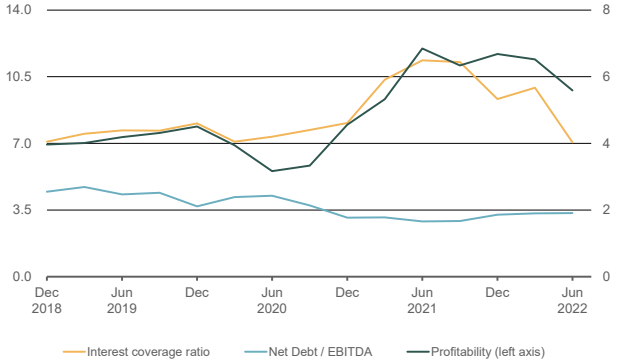
Chart 1.2.2.3 – Corporations in judicial recovery
Cumulative requests by year



Souce: Serasa Experian

* Minimums and maximums for the period between 2012 e 2022

Chart 1.2.2.4 – Financial-economic indicators
Publicly traded companies



The capital market remained in strong expansion, standing out as an important source of financing, especially for large companies. Even in an environment of rising interest rates, capital market debt instruments once again showed an important advance in the universe of broad credit to companies. The largest growth in nominal values came from debentures, whose main destinations were working capital, investment in infrastructure and refinancing of companies' liabilities[13]. FIDCs were also a highlight, with growth being more decentralized throughout the

12 Flows of receivables by means of payment documents ('boletos'), bank transfers ('TEDs'), debit and credit cards, instant payments ('Pix') and exports, according to the methodology used in section 2.2 – Covid-19 stress test, found in the REF published in October/2020, available at https:// www.bcb.gov.br/content/publicacoes/ref/202010/RELESTAB202010-secao2_2.pdf.

13 See https://www.anbima.com.br/pt_br/informar/relatorios/mercado-de-capitais/boletim-de-mercado-de-capitais/volume-de-emissoes-alcanca-r-233-bilhoes-no-primeiro-semestre.htm, Anexo_BoletimMK_0622, tab "Pág. 8 – Debêntures 2".

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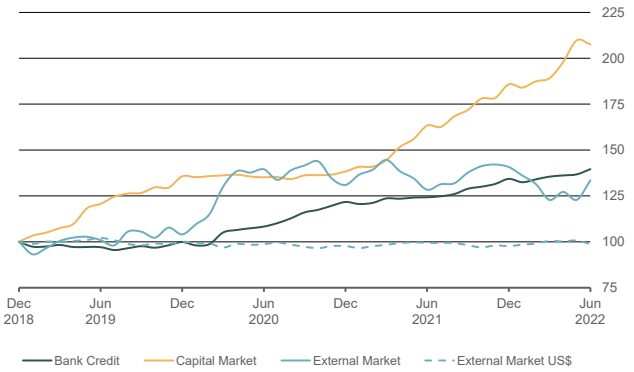
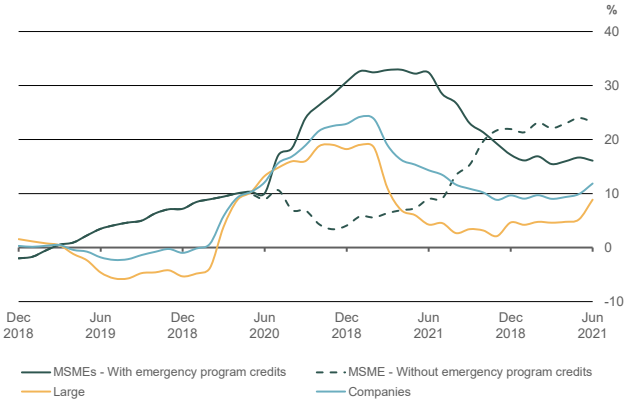
semester. Regarding internalized external funding, values in dollar have not changed significantly since December 2018 (Chart 1.2.2.5).

Chart 1.2.2.5 – Corporate Indebtedness
Dec/2018 = 100



Regarding bank credit, the highlight was the financing to MSMEs, which continued to grow strongly. The segments that most contributed to this increase were micro sized-companies (the largest percentage increase), especially in the working capital facility, and medium sized-companies (in nominal terms), especially in investment[14]. Even after the increase in credit to MSMEs in recent years, under the strong influence of emergency credit programs, credit granting for this segment of companies continues to rise at annual rates higher than the pre-pandemic period. Looking ahead, credit to MSME is expected to maintain its level of growth in the second half of 2022, also supported by the resumption of granting within the scope of such programs[15]. Large companies also registered credit expansion in the first semester (Chart 1.2.2.6), under the strong influence of external trade operations, mainly from the "Agriculture" and "Food" sectors[16]. Specifically, in the last month of the first semester, there was a relevant increase in transactions with acquired receivables[17] and infrastructure and projects financing operations for larger companies – in the latter case, mainly in the "Energy" and "Transport" sectors.

Chart 1.2.2.6 – Bank credit
Annual Growth



Risk appetite of FIs continued in a higher level for smaller companies. This could be noted by the maintenance of the granting average score[18,19] at a higher level for micro sized-companies, in line with the movements that occurred in the household facilities (the business of smaller companies is often linked to the

14 Mainly financing for the acquisition of motor vehicles.

15 Specifically, the Credit Stimulus Program (PEC), the Emergency Credit Access Program (Peac), and the National Program to Support Micro and Small Enterprises (Pronampe).

16 The "Agriculture" sector includes primary extraction activities, while "Food" encompasses processed products (flour, refined sugar, among others).

17 Operations with receivables, in which the supplier anticipates the receivables of a company ("drawee") with an FI, which then receives the funds from the "drawee" on the original maturity dates. These are operations in which there is no co-obligation on the part of the supplier ("grantor" or "assignor") in relation to the receivables. Such operations are a low-cost option for companies and low risk for FIs.

18 The credit granting average score is a measure that quantifies the credit risk of new granting in the reference month becoming problem assets in a 12-month window, determined by a proprietary statistical BCB model. The higher the score, the riskier the operations.

19 For companies, the model is based on borrowers' variables. The scores of micro, small and medium sized-companies cannot be directly compared, given that different models were used to generate them. For large companies, the variable is the percentage of the credit granting for companies that either are already deteriorated or with a high chance of deteriorate within a period of three months.

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individual that runs the company; therefore, the risk of micro sized-companies in many cases resembles the individual risk). On the other hand, for small, medium and large sized-companies, the average granting score was at the same or better levels when compared with the period at the beginning of the pandemic (Chart 1.2.2.7), which could lead to stabilization or reduction of risk materialization.

The risk materialization showed stability, but with different behaviors amongst different companies' sizes. In line with the recent increase in the FIs' risk appetite for credit to micro sized-companies, the percentage of PAs in this segment rose in the semester (Chart 1.2.2.8), despite the strong growth of the outstanding portfolio (denominator effect). In the case of small sized-companies, the PA recorded a slight percentage increase, despite the increase in the portfolio (Chart 1.2.2.9) and in the case of medium and large sized-companies, there was a reduction in the PAs in the semester (charts 1.2.2.10 and 1.2.2.11), with some contribution from the outstanding credit increase (denominator effect), but to a lesser extent. The risk materialization of the companies as a whole is at a favorable level (Chart 1.2.2.12), a fact that can also be observed by the percentage of PAs in each portfolio. The highlight comes from the portfolio of micro sized-companies, which, although it still has a percentage of PAs below the pre-pandemic level, undergoes a deterioration movement similar to that observed for the credit portfolio to households. The continued strong expansion in this segment, with an increase in the share of riskier operations, should be factors that can pressure the percentage of PAs of the companies' in the second half of the year.

Chart 1.2.2.7 – Credit granting average score
By company size

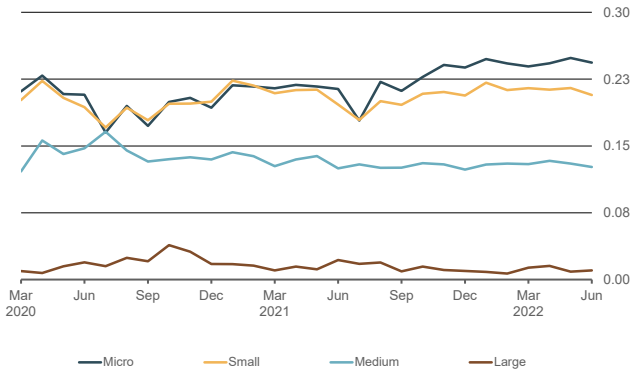
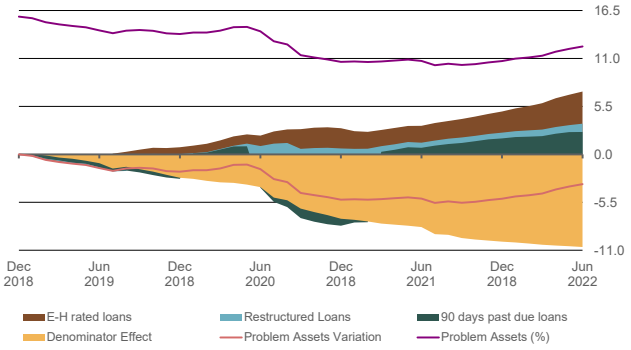
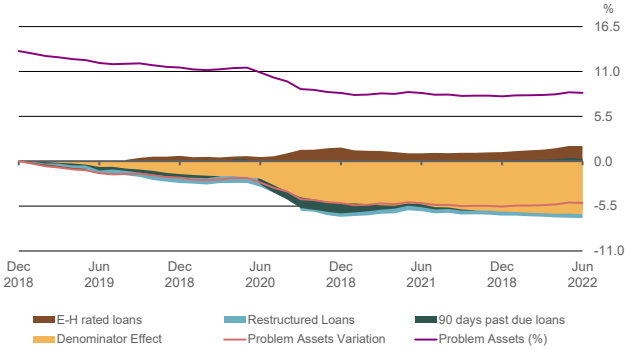


Chart 1.2.2.8 – Problem Assets – Micro companies
Cumulative monthly variation[1/]



1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2018, on the evolution of problematic assets percentage

Chart 1.2.2.9 – Problem Assets – Small companies
Cumulative monthly variation[1/]



1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2018, on the evolution of problematic assets percentage

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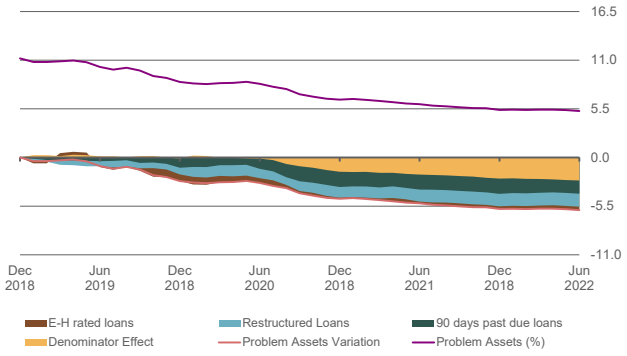
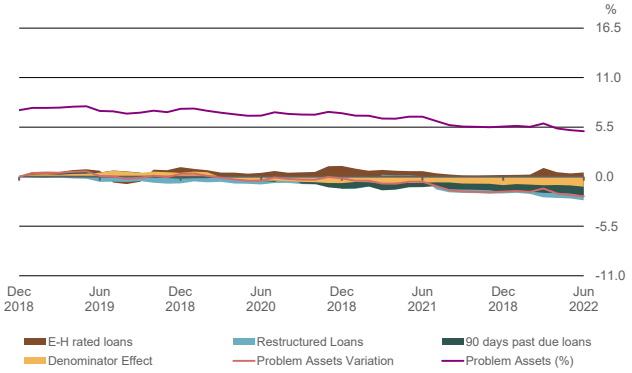
Chart 1.2.2.10 – Problem Assets – Medium companies
Cumulative monthly variation[1/]



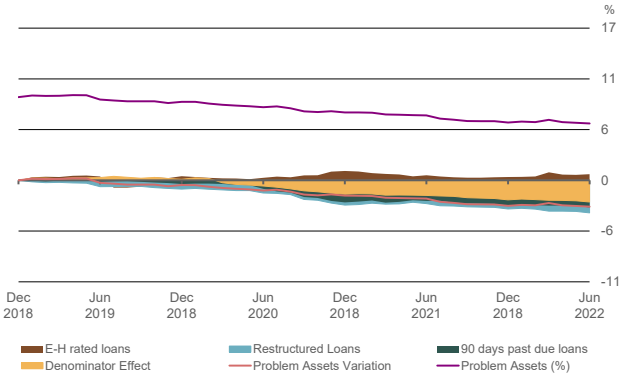
1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2018, on the evolution of problematic assets percentage

Chart 1.2.2.11 – Problem Assets – Large companies
Cumulative monthly variation[1/]



1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2018, on the evolution of problematic assets percentage

Chart 1.2.2.12 – Problem Assets – Companies
Cumulative monthly variation[1/]



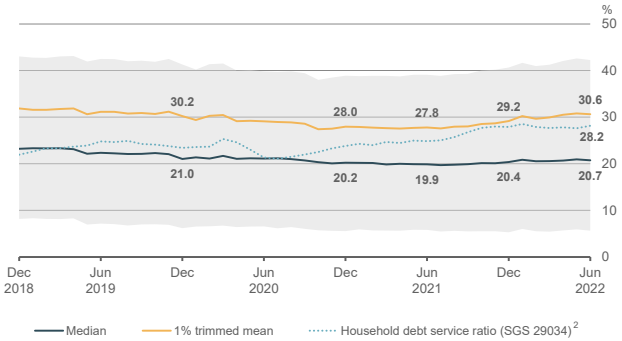
1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2018, on the evolution of problematic assets percentage

Households

The payment capacity of borrowers in banks' portfolios worsened, returning to pre-pandemic levels[20]. Despite the economic recovery and the drop in the unemployment level, the debt service-to-income ratio (DSIR) granular distribution of the SFN borrowers showed an upward trend in the first half of 2022, at values close to or exceeding those of the pre-pandemic period (Chart 1.2.2.13). This behavior can be explained by the breakdown of DSIR by facility: income is increasingly committed to riskier and more expensive facilities such as credit cards (here considered only the revolving credit or the installments financed purchases) and non-payroll deducted credit (Chart 1.2.2.14). In another approach to the subject – the debt service-to-income ratio calculated from a macroeconomic perspective (SGS 29034, dashed line in Chart 1.2.2.13) –, there was relative stability throughout the first half of 2022, despite the increase that occurred between mid-2020 and the end of 2021; its current values are higher than the pre-pandemic ones. Even with different dynamics at specific moments in time, both approaches to debt service-to-income ratio indicate recent deterioration in the households' payment capacity.

20 As explained in Selected Issue 2.2, "Household debt-to-income and debt service-to-income ratios", from the October 2021 Financial Stability Report, such metrics can be calculated for all households, either in aggregate or individually, i.e., considering data for individual debtors, as calculated here. For more information, see "Concepts and Methodologies" at the end of this report, items "g", "h" and "i". The aggregate calculation compares, respectively, total debts and its service with the restricted Gross Disposable National Income of households (see Time Series 29037 and 29034). For further understanding of the difference between the metrics, see Footnotes 1 and 2 in Chart 1.2.2.13.

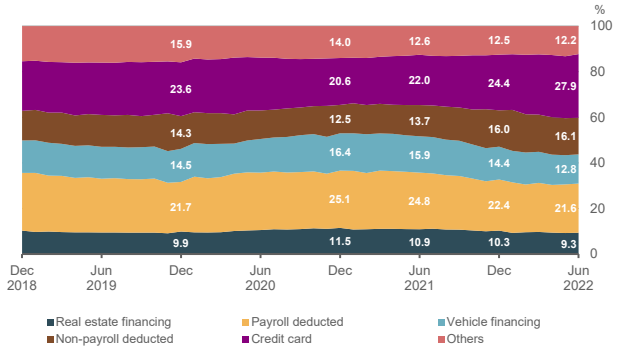
Chart 1.2.2.13 – Individual debt service-to-income ratio[1]
Interquartile range



[1] The interquartile range, the median and the 1% trimmed mean refer to the distribution of the individual debt service-to-income ratio of SFN borrowers. For this calculation, borrowers with credit outstanding lower than BRL200 or with debt service only in credit card purchases were excluded. For the calculation of debt service, credit card installments financed by merchants were not included.

[2] The household debt service-to-income ratio, SGS time series 29034 of BCB, is an aggregate measure that compares the debt service of SFN borrowers to the restricted households gross disposable national income. For this measure, credit card installments financed by merchants are included in the debt service.

Chart 1.2.2.14 – Individual debt service-to-income ratio[1]
By share of credit facility

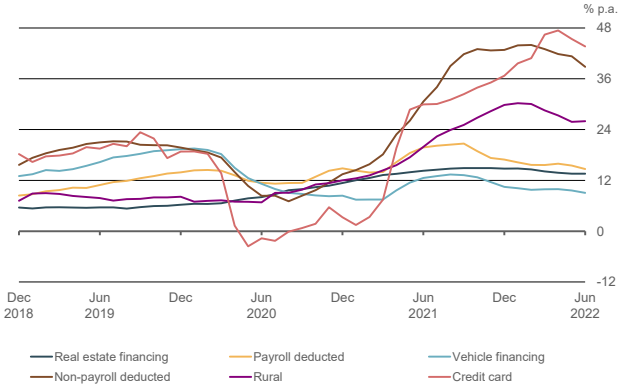


[1] The breakdown above shows the share of each credit facility in the 1% trimmed mean of the individual debt service-to-income ratio of SFN borrowers. For this calculation, borrowers with credit outstanding lower than BRL200 or with debt service only in credit card purchases were excluded. For the calculation of debt service, credit card installments financed by merchants were not included.

Credit continued to grow at high rates, especially in facilities of higher risk and return and in operations linked to payment transactions. Despite some reduction in the growth rates of credit facilities to households in recent months, high historical values can be observed for facilities with higher returns and, consequently, higher risks, such as non-payroll deducted credit and credit card. The growth of these facilities caused the general growth rate of loans to households to end the semester at a level similar to that of December 2021, reaching its peak in April 2022. Currently, the riskier facilities have the largest share in the household credit portfolio since the beginning of the series[21]. Also noteworthy is rural credit, which does not have such risk profile but also maintained its growth rates at a high level.

21 Data available since 2012, when the limit for identifying individualized operations of the SCR was reduced from BRL5,000 to BRL1,000. Between December 2012 and June 2021, the share of riskier facilities in the household portfolio reached a maximum of 26.8%, with an average of 25% in the period. Since June 2021, the share of these facilities has been increasing continuously, reaching 29.5% in June 2022.

Chart 1.2.2.15 – Credit outstanding – Year over year growth
By credit facility

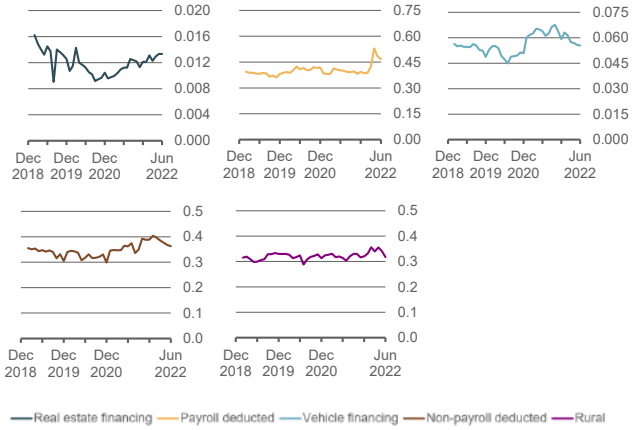


Overall, the risk appetite of FIs continued at a relatively higher level at the beginning of 2022. This can be verified not only by the maintenance of high growth rates in the facilities of higher risk and return, but also by the behavior of the average credit granting scores[22] (Chart 1.2.2.16): (i) in non-payroll deducted credit, despite the recent drop, the level is higher than those seen before 2021; (ii) there is a consolidated growth trend in real estate credit, at values that have not yet reached the peak of the historical

22 For credit to households, the models were based on borrowers' information and on specific features of the operations. The scores of different facilities cannot be directly compared, since different models were used to generate them; therefore, the most appropriate comparison of the current score of a facility is with its own historical levels.

series; and (iii) for vehicle financing, after the drop observed since the last quarter of 2021, the current scores are higher than those of 2020, but at levels compatible with some of the highest values observed in 2019. In the case of payroll deducted credit, there was an increase in recent values, still without an established trend.

Chart 1.2.2.16 – Average credit granting score
By credit facility



Characteristics of vehicle financing and non-payroll deducted credit granting reinforce the maintenance of risk appetite at a higher level. In the first case, credit granting for vehicles with ages superior to three years are still prevailing, with maintenance of comparatively longer maturities (Charts 1.2.2.17 and 1.2.2.18). Regarding non-payroll deducted credit, credit granting remained at a high level, especially in operations with fidejussory guarantees or without collateral (Chart 1.2.2.19). Considering all the portfolio's highlights (increase in the credit card portfolio, credit granting scores at comparatively higher levels, characteristics of vehicle financing and non-payroll deducted credit granting), one can see that the FIs' level of risk appetite remained higher in the first half of 2022.

Chart 1.2.2.17 – Vehicle financing – Credit granting
By age of vehicle

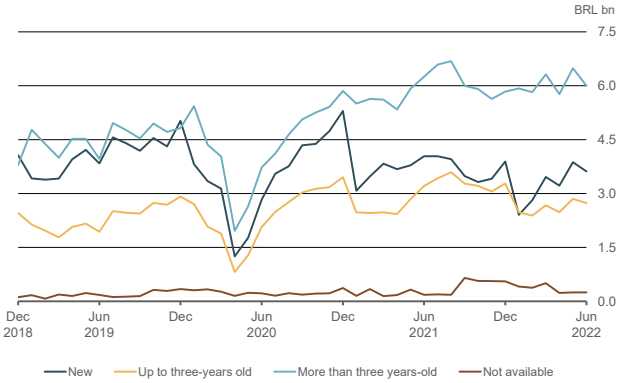


Chart 1.2.2.18 – Vehicle financing – Average credit granting operation term
By age of vehicle

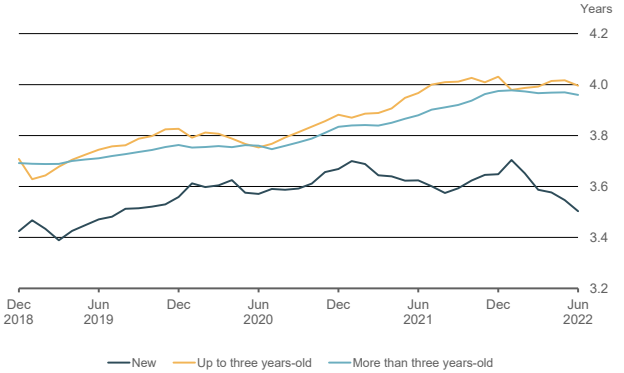
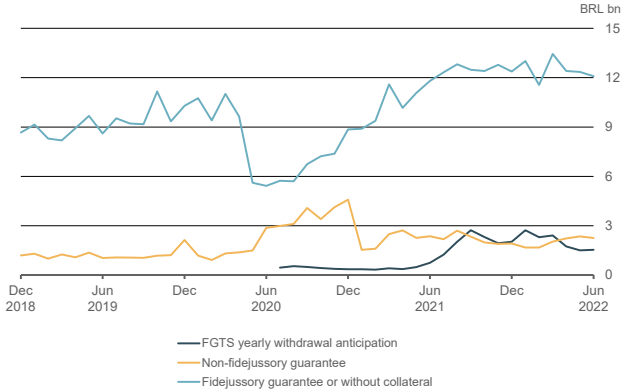


Chart 1.2.2.19 – Non-payroll deducted credit – Credit granting
By type of guarantee



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The risk materialization has increased, despite the large expansion of the credit portfolio. The growth that has been observed in recent times in higher risk and return loans is beginning to alter the performance of the portfolio as a whole. This movement has resulted in the growth of the problem assets portfolio at a faster pace than the growth of the portfolio (Chart 1.2.2.20), which has caused the percentage of PAs to rise almost across the board, especially in lower income brackets (Chart 1.2.2.21). The materialization is also visible in specific portfolios: (i) in vehicle financing, the PAs continue to accelerate, causing the percentage to continue to rise, at a level that is already higher than that seen during the pandemic (Chart 1.2.2.22); (ii) in the cases of non-payroll deducted credit and credit card, despite the fact that the percentages of PAs are below the peaks verified during the pandemic, the problem assets portfolio presents relevant growth in 2022, at rates higher than the portfolio's growth (Charts 1.2.2.23 and 1.2.2.24). Regarding real estate credit, despite the general stability, the portfolio funded by the FGTS maintained its percentage of problem assets at a higher level (Chart 1.2.2.25). Considering the lower volume of debt renegotiations, the uncertain economic scenario, and the difficulty of households to manage their budgets (which should lead them to demand more credit, in short-term and more expensive facilities), the process of risk materialization of the credit to households portfolio is expected to continue in the upcoming months, still within historical standards.

Chart 1.2.2.20 – Problem assets
Cumulative monthly variation

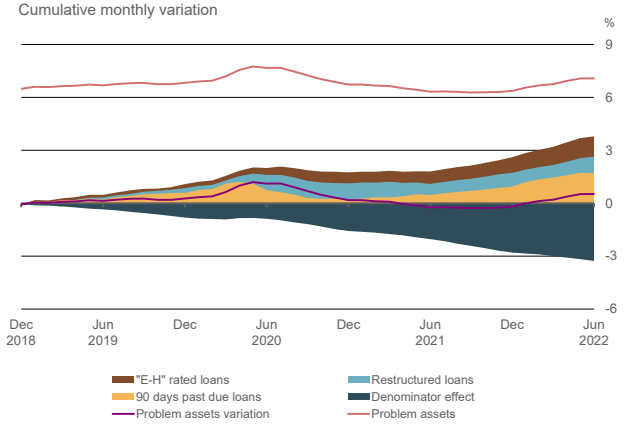

Chart 1.2.2.21 – Problem assets
By income bracket

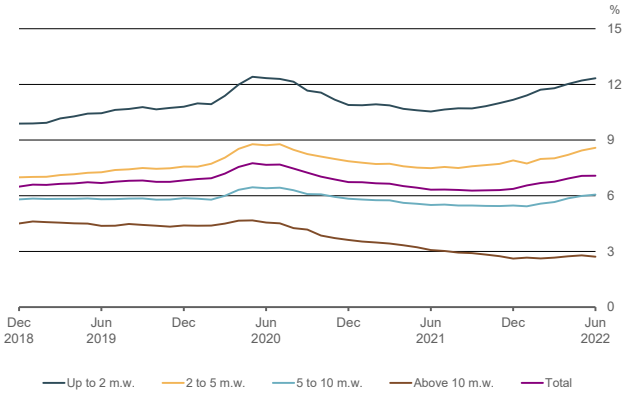

Chart 1.2.2.22 – Problem assets
By credit facility

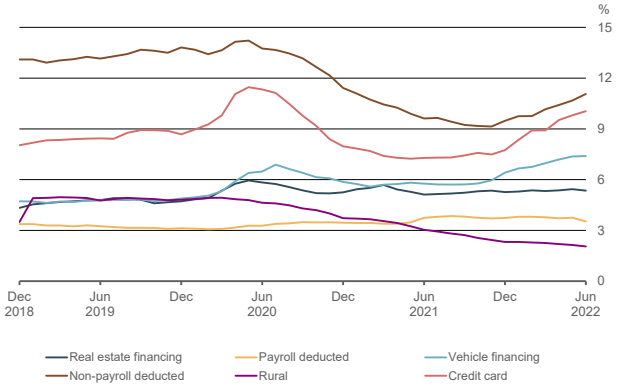

Chart 1.2.2.23 – Non-payroll deducted credit – Problem assets
Dec/2018 = 100

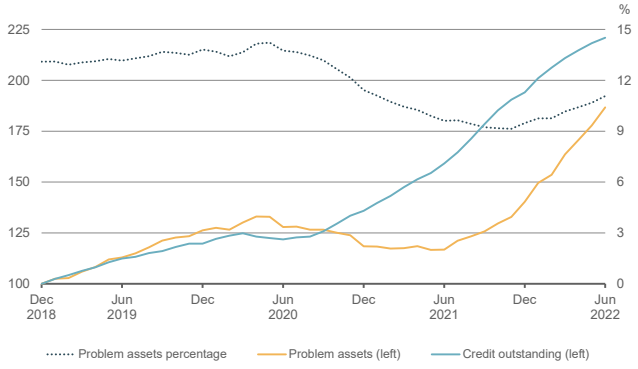

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Chart 1.2.2.24 – Credit card – Problem assets
Dec/2018 = 100

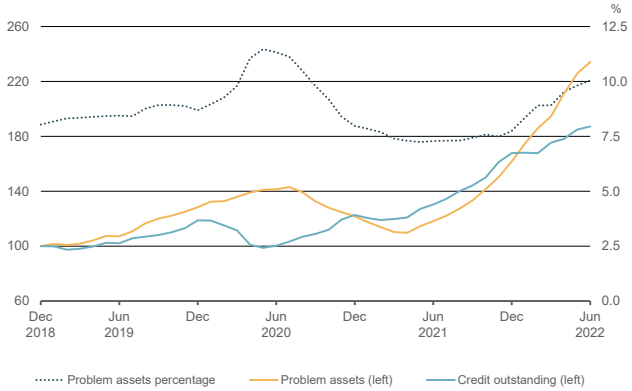
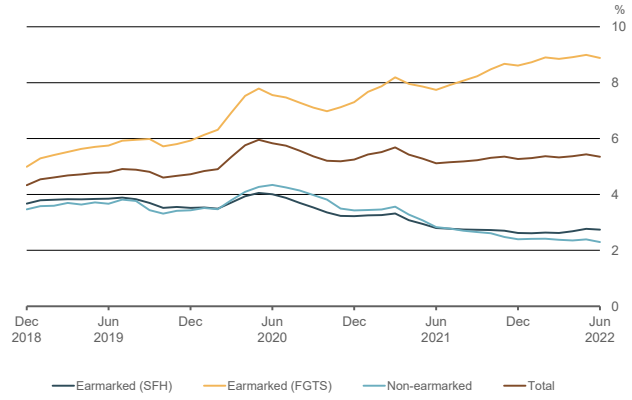


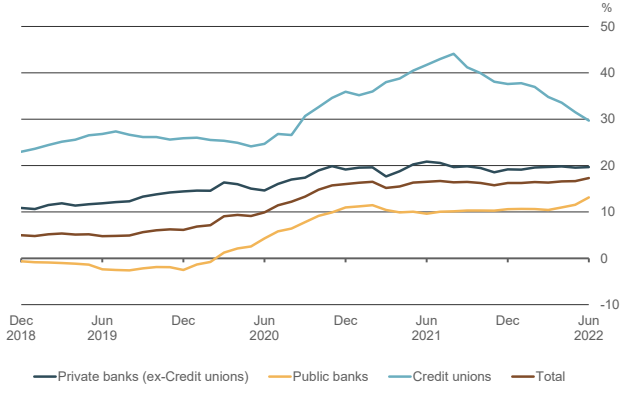
Chart 1.2.2.25 – Real estate financing – Problem assets
By line of funding



Domestic banking credit – By ownership and credit unions

The risk appetite of private banks remained higher than that of public banks in the first half of 2022. The growth of the loan portfolio remained stable in the segments, except for credit unions that presented higher rates but slowed its growth in the period (Chart 1.2.2.26). Private banks presented a higher risk appetite than public banks, not only because of the higher growth rate of the portfolio, but also for taking higher risk in credit lending household portfolios, especially in payroll-deducted, non-payroll- deducted loans, and vehicle financing.

Chart 1.2.2.26 – Year over year credit growth
By segment



Risks and provisioning

The materialization of credit risk grew in the semester. As expected, the materialization of credit risk in the portfolio increased in the first half, mainly due to the increase in the delinquency rate (Chart 1.2.2.27). This effect is more present in transactional credit lines and household consumer credit portfolios, such as non-payroll loans, credit cards and vehicle financing. Private banks were the most affected, and the percentage level of PA in the portfolio exceeded the level of public banks in June (Chart 1.2.2.28). Credit unions also showed a worsening in the portfolio credit quality in the semester, although at lower levels than the other segments. The increased materialization of credit risk is expected to continue in the next semester, especially in the household and small size companies' portfolio, due to the worsening in the credit lending quality and the growth of the higher risk and return credit lines.

Provisions remained higher than the expected credit losses. Provisions in the financial system remained at a similar level to that at the end of 2021. Considering the estimates of expected credit losses, provisions are adequate for the segments of public banks, private banks, and credit unions (Table 1.2.2.1). The financial system, for banking credit, presents an expected credit loss coverage ratio of 1.35 in June 2022.

Chart 1.2.2.27 – Problem assets
By component

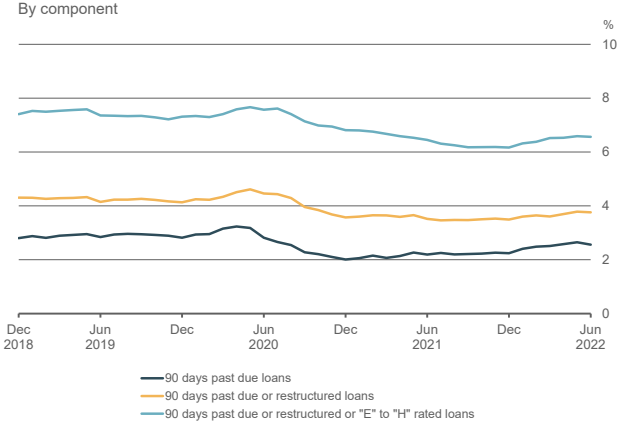


Chart 1.2.2.28 – Problem assets
By segment

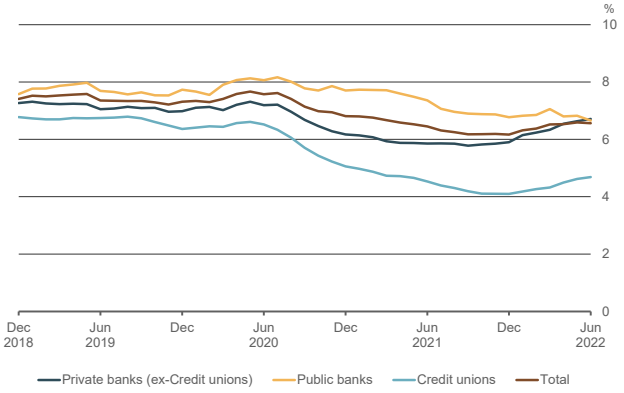


Table 1.2.2.1 – Expected loss and provisioning

Credit portfolio	Expected loss	Provision	Coverage
Private banks (ex-Credit unions)	4.8%	6.2%	1.30
Public banks	3.4%	5.1%	1.48
Credit unions	3.4%	4.0%	1.19
Total	4.1%	5.6%	1.35

1.2.3 Profitability

The profitability[23]of the banking system remained stable in the first half of 2022. After a recovery in 2021, the profitability of the system stabilized close to pre-pandemic levels. Loan loss provisions[24] (LLPs) increased due to the growth in credit (especially in higher risk lines) and in PAs. Net Interest Income (NII)[25] rose, influenced by the expansion in the loan portfolio and higher treasury results. Interest margin[26] was under pressure by the increase in the funding rate but tends to benefit from the gradual renewal of the loan portfolio at higher rates and from the treasury margin. The growth rate of service revenues reduced, and administrative expenses remain under control, despite inflationary pressures.

Banks' profitability should remain resilient, although there are uncertainties regarding the economic scenario in the medium term. The banking system net income was R$138 billion in the twelve-month period ended in June 2022, 5% higher than in 2021 and 20% higher than that observed in the twelve-month period ended in June 2021. Return on equity (ROE) was 15%, stable when compared to the level observed at the end of 2021 (Chart 1.2.3.1). NII growth (especially the NII from treasury) and efficiency gains explain the stability of the results. Banks' profitability should remain resilient, but the economic scenario marked by restrictive financial conditions and high inflation requires institutions to be vigilant. A slowdown in economic activity and a deterioration in credit quality could affect banks' profitability ahead.

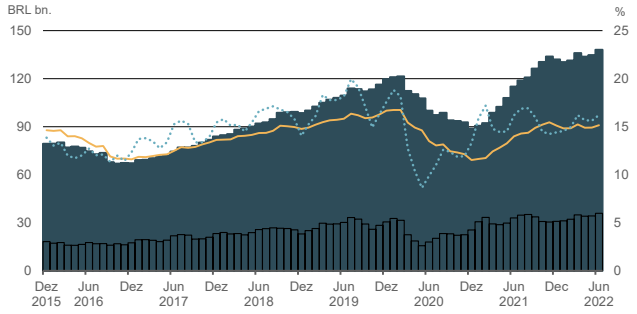
23 Profitability affects bank resilience. Banking systems with low profitability need more time to build their capital and liquidity ratios. This can restrict the availability of credit to the real economy and/or the ability of institutions to absorb shocks, such as losses in the credit and/or securities portfolios. Consistent low profitability also makes it difficult to obtain funds via capital markets, which can increase risks to financial stability.

24 In this section of the Report, we use the term "loan loss provision" to refer to the expenses recorded on FI's income statement.

25 Refers to the difference between interest income and interest expenses, without considering the effects of loan loss provision expenses. Interest income derives from interest-earning assets (mainly treasury and credit assets) and interest expenses derives from interest-bearing liabilities (mainly funding).

26 Refers to the difference between the interest return (income from credit and securities accumulated in twelve months divided by the average credit portfolio in the period) and the funding cost (funding expenses accumulated in twelve months divided by the average stock of funding in the period).

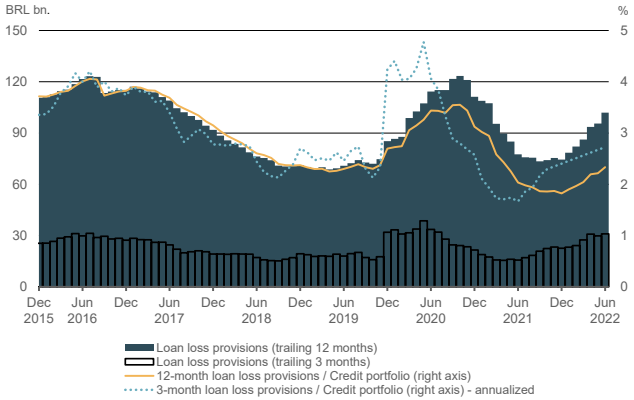
Chart 1.2.3.1 – Net income and ROE[1/]
Banking system



Source: Cosif - BCB staff calculations.
1/ Adjusted by non-recurrent results identified.

LLP increased, following the growth in credit and in PAs. LLP rose again in the first half of 2022, after falling consistently since mid-2020[27] (Chart 1.2.3.2). The increase is mainly due to the growth in credit (especially in higher risk lines) and in PAs.[28] The banking system, however, remains with an adequate coverage level of provisions considering the estimates for expected losses.[29] Although the higher risk lines also offer higher returns, institutions must remain vigilant regarding the quality of their lending criteria, as they may need to increase provisions to ensure adequate coverage for credit losses.

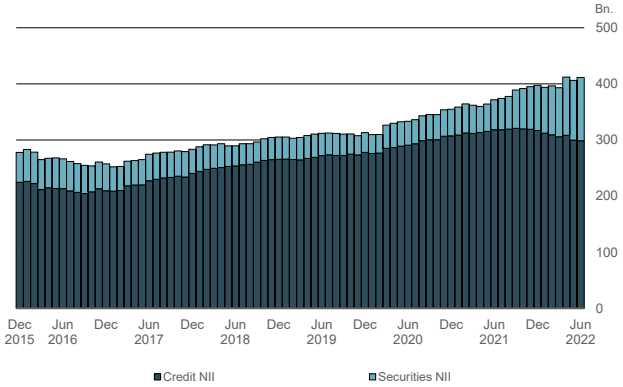
Chart 1.2.3.2 – Loan loss provisions
Banking system



Source: Cosif - BCB staff calculations.

The banking system NII continues trending higher, influenced by an increase in the loan portfolio and in the NII from treasury. NII continues to grow due to the increase in the treasury NII, which is more than offsetting the drop in the credit NII (Chart 1.2.3.3). Although credit NII is benefiting from the loan portfolio growth, interest expenses grow faster than income, leading to a reduction in credit NII. Treasury NII should continue in a favorable trend, given the current interest rate level. Credit NII, in turn, may take longer to recover if there is a reduction in the pace of credit granting or an increase in preference towards less risky lines, in a scenario of higher risk aversion.

Chart 1.2.3.3 – Net interest income
Trailing 12 months



Source: Cosif – BCB staff calculation.

Interest margin has remained stable. Since the beginning of the Selic hiking cycle, the increase in treasury margin has offset the reduction in credit margin, thus keeping the interest margin stable (Chart 1.2.3.4). On the one hand, the Selic rate rise increased funding costs, reducing the credit margin.[30] On the other hand, a higher Selic rate contributes positively to the treasury margin, given the sensitivity of treasury assets to changes in the Selic rate. After recovering since the end of 2020, the interest margin after

27 The reduction in expenses was due to the good behaviour of delinquency in the period.

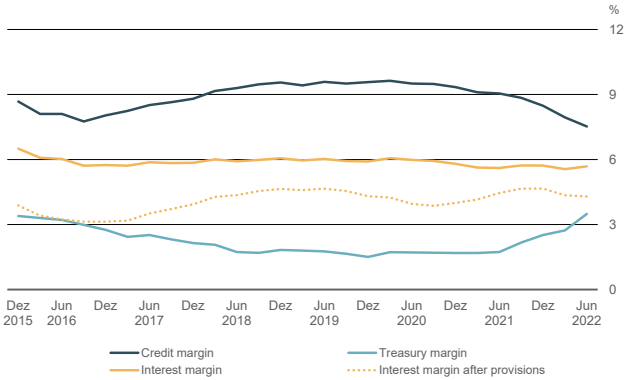
28 For more information, see Section 1.2.2 of this Report.

29 Provisions remain at adequate levels, above the estimates of expected losses. For more information, see Section 1.2.2 of this Report.

30 Due to the greater concentration on floating rate instruments and the shorter average term of funding, funding costs tend to respond faster to changes in the Selic rate than the return on credit. Thus, cycles of monetary tightening tend to reduce credit margin.

provisions fell again in the first half of 2022.[31] Despite the drop, the margin remains at levels close to those observed in the pre-pandemic period.

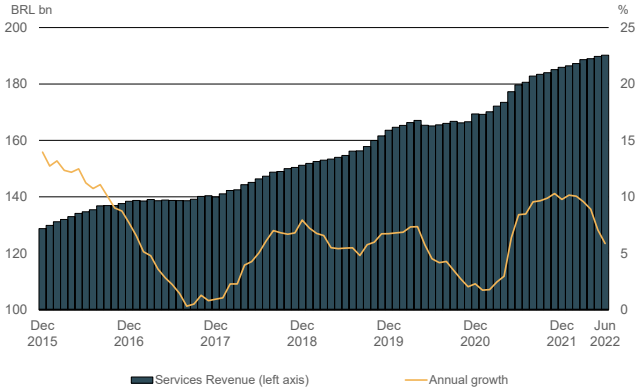
Chart 1.2.3.4 – Interest margin
Trailing 12 months



Source: Cosif – BCB staff calculation.

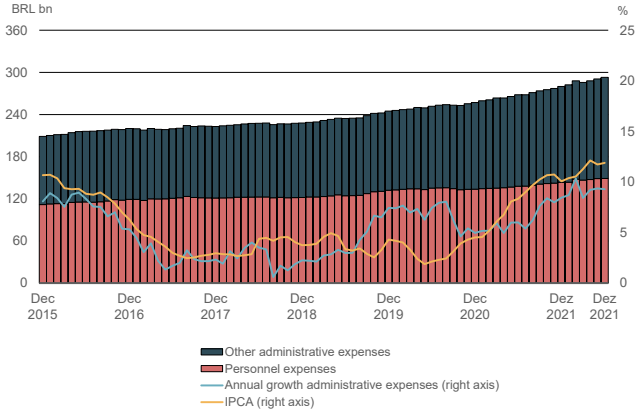
The growth rate of service revenues reduced, and costs remained under control despite inflationary pressures. After recovering in 2021, driven by improved economic activity, service revenues grew at a slower pace in the first half of 2022 (Chart 1.2.3.5). The outlook for service revenues in the second half of the year is favorable, given the positive performance of the economy recently. Despite rising inflation in 2022, banks have been able to maintain costs under control. Administrative expenses grew by 9.3% in the last twelve months,[32] while the Extended National Consumer Price Index (IPCA) accumulated in the period was 11.9% (Chart 1.2.3.6). Inflation should continue pressuring bank costs in the short term.

Chart 1.2.3.5 – Services Revenue
Trailing twelve months



Source: Cosif - BCB staff calculations.

Chart 1.2.3.6 – Administrative expenses
Trailing twelve months



Sources: IBGE and Cosif - BCB staff calculations.

1.2.4 Solvency

The banking system remains solid and apt to sustain regular market functioning. The capitalization ratios remain comfortably above the minimum requirements and pre-pandemic levels, despite the slight retraction occurred during the semester due to higher growth of risk-weighted assets (Charts 1.2.4.1 and 1.2.4.2). Of the institutions, 98.5% fulfill[33]

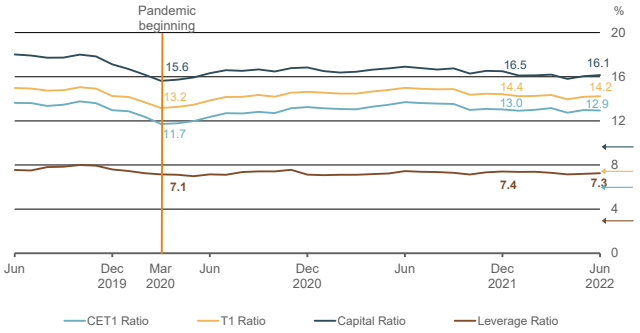
31 The decrease was due to the increase in LLP expenses, according to the reasons discussed in the paragraph of this Section that refers to this subject.

32 Excluding the effect of the exchange rate variation on the expenses of subsidiaries and branches of banks abroad, administrative expenses would have grown by 8.6% instead of 9.3%. This highlights the effective cost control of FIs, despite inflationary pressures.

33 Considering the minimum prudential requirements, the system needs 0.002% of the current regulatory capital to solve temporary shortfall. Situation resolved in August 2022.

the minimum prudential requirements using only Common Equity Tier 1 (CET1), considered the best quality capital (Chart 1.2.4.3).

Chart 1.2.4.1 – Capital ratios and regulatory requirements[1]



[1] Leverage ratio considers only institutions belonging to S1 and S2 segments, according to Resolution 4,615/17.

Chart 1.2.4.2 – Capital ratio variation

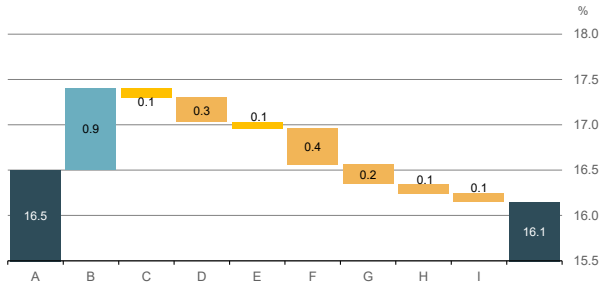
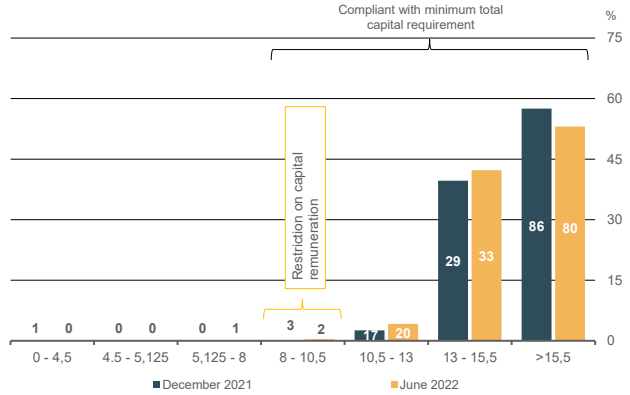


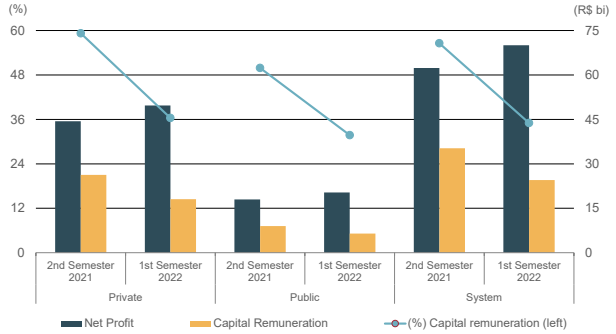
Chart 1.2.4.3 – Total Capital Ratio
Frequency distribution weighted by assets[1]



1 Inside the bars are the numbers of financial institutions in the correspondent CET1 ratio range.
2 The institution in the 5.125 - 8 range solved its situation in August 2022.

The growth in regulatory capital was sustained by higher retained earnings and offset by increased prudential adjustments related to tax credits from tax losses and derecognition of capital instruments. The system presented higher profits and, as usual, higher retention of earnings compared to the second half of 2021 (Chart 1.2.4.4). However, CET1 was impacted by prudential adjustments and accumulated other comprehensive income, especially tax credits from tax losses[34] and losses on securities available for sale, respectively. New emissions of instruments eligible for Additional Tier 1 and Tier 2 capital were outweighed by the phase-out of instruments issued prior to the Basel III framework[35] and constitutional funds[36] (Chart 1.2.4.5).

Chart 1.2.4.4 – Capital remuneration[1]



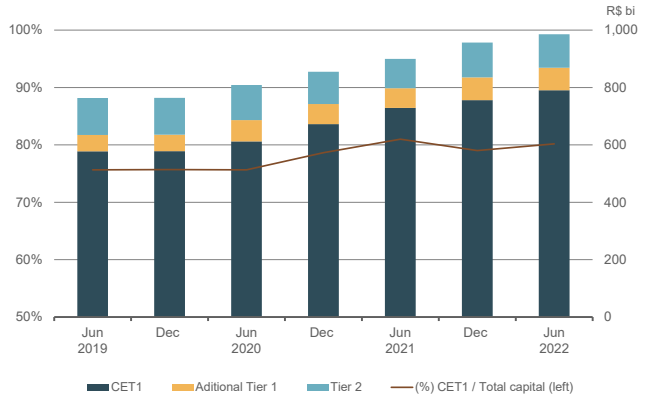
1 Capital remuneration values refer to the semester of the distribution, not the period in which the profits were earned.

34 Article 5, § 10 of CMN Resolution 4,955, of October 21, established that at least 50% of tax credits from tax losses and negative basis of Social Contribution on Net Profits (CTPF) constituted between 2018 and 2020, arising from overhedge of investments abroad must be subject to prudential adjustment until 30 June 2022. Until December 2022, the remaining CTPF stock should be subject to prudential adjustment, which will not generate a relevant impact on the total capital ratio.

35 As established in article 30 of CMN Resolution 4,955, of 2021, capital instruments issued before October 1st, 2013 should not be considered in the regulatory capital from 2022 on.

36 According to the schedule established by article 31 of CMN Resolution 4,955.

Chart 1.2.4.5 – Capital structure



The system's regulatory capital margin is not a restriction to expansion of credit supply. The risk-weighted assets (RWA) expanded more than capital essentially due to the growth of exposures in credit operations and securities (Table 1.2.4.1). With the greater expansion of RWA, the regulatory capital surplus fell[37] from R$22 billion to R$245 billion. The excess capital is equivalent to 24.8% of the system's regulatory capital, which would allow significant expansion of exposures to credit operations without any capital input due to regulatory issues.

37 As established by article 8, §4 of CMN Resolution 4,958 of 21 October 2021, the percentage of RWA required by the capital conservation buffer returned in April 2022 to 2.5%, value in force in the pre-pandemic period. Only this 0.5 p.p. increase resulted in R$30.5 billion rise on the required capital.

Table 1.2.4.1 – RWA Composition

	System			Var. (%) Dec/Jun	
R$ billions	dez/21	jun/22	Var. (%)	Públicos	Privados
Total RWA	**5,321**	**5,792**	**8.9%**	**5.0%**	**5.5%**
Credit RWA	**4,523**	**4,986**	**10.2%**	**6.7%**	**4.7%**
Credit operations	2,205	2,436	10.5%	8.0%	4.8%
Mortgages	348	378	8.6%	6.6%	3.9%
Leasing	18	20	11.4%	10.6%	-1.8%
Interbank investments	149	167	12.2%	-17.5%	-1.9%
Securities	309	353	14.0%	24.2%	21.2%
Derivatives	185	219	18.3%	-27.0%	6.9%
Fixed Assets	205	204	-0.4%	7.2%	3.2%
Non-cancellable credit commitments	162	173	6.7%	8.6%	4.1%
Guarantees provided	261	309	18.4%	1.8%	5.7%
Tax assets	409	409	0.0%	1.6%	-11.1%
Other	620	695	12.2%	8.9%	4.8%
Market RWA	**260**	**243**	**-6.6%**	**-42.2%**	**14.5%**
Operational RWA	**537**	**563**	**4.9%**	**4.0%**	**8.7%**

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1.2.5 Stress tests

Capital stress tests

Capital stress tests results reiterated an adequate resilience in the banking. There are no relevant non-compliances in adverse macroeconomic scenarios. Stress tests conducted by the biggest banks corroborate these findings. Sensitivity analyses also show good resistance to isolated simulated factors, in addition to the stability of results compared to previously performed tests. The liquidity stress test indicates a comfortable amount of liquid assets in the event of cash outflows in adverse conditions or shocks to market parameters in the short term.

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Box – Macroeconomic stress test scenarios

Stress scenarios, called Acute Recession and Confidence/Fiscal, described below, seek to describe an environment or context of stress through the state of the macroeconomic variables used (Charts 1.2.5.1 to 1.2.5.5).

Scenario "Acute Recession" assumes a significant drop in domestic demand, together with an acute GDP decline of the global economy from Q4 2022 onwards. The magnitude of the external economic activity resembles that observed during the Covid-19 pandemic, combined with a stronger US dollar and lower commodities prices. As to Brazil's economy, both household consumption and gross fixed capital formation would drop significantly, with a slow recovery in the aftermath so that 2022 GDP levels would only be recovered by the beginning of 2025. The reduction in economic activity would generate a significant increase in the unemployment rate. The increase in the idle capacity of the economy would lead to a reduction in inflation, despite a currency depreciation. In line with the Taylor rule, falling inflation would lead the BCB to reduce interest rates. Therefore, the scenario is characterized by a fall in economic activity, inflation, and interest rates.

Scenario Confidence/Fiscal is characterized by a significant increase in uncertainty in the economy starting in 2022 Q4 due to fiscal deterioration, leading to increased risk premiums, sharp exchange rate depreciation, an increase in the economy's neutral interest rate, and a contraction in economic activity. To build this scenario of a confidence crisis, we used as reference the past episode of fiscal deterioration and economic uncertainty that took place from mid-2014 to early 2016. Despite the fall in domestic GDP and the increase in the unemployment rate, here the inflationary effect of currency depreciation would prevail. The US dollar exchange rate reaches a peak in Q3 2023 and would than retract, aligned with an increase of the domestic interest rates differential to international rates. In line with the Taylor rule, in order to promote inflation convergence to the target, increasing inflation would lead the BCB to hike interest rates. Hence, this scenario features a drop in economic activity and both higher inflation and interest rates.

It is important to note that the interest rates (Selic) path assumed in both scenarios serves the only purpose of providing macroeconomic consistency to the scenarios and by no means indicates nor suggests any compromise of the BCB should any of these scenarios materialize.

Chart 1.2.5.1 – Inflation

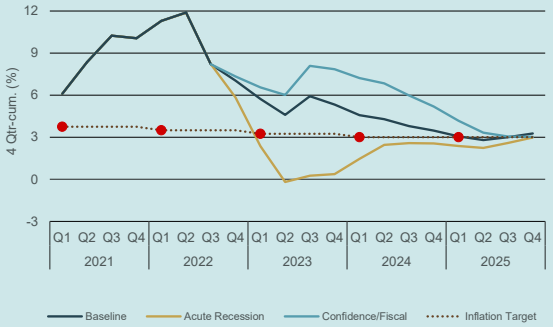


Chart 1.2.5.2 – FX

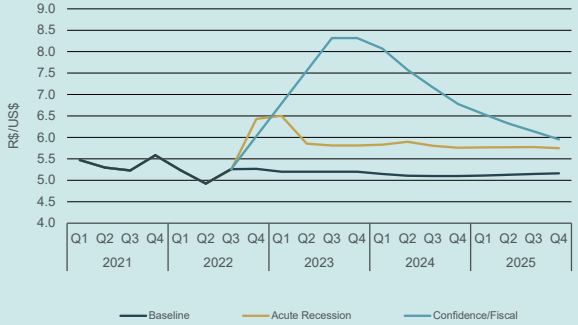


Chart 1.2.5.3 – GDP % variation

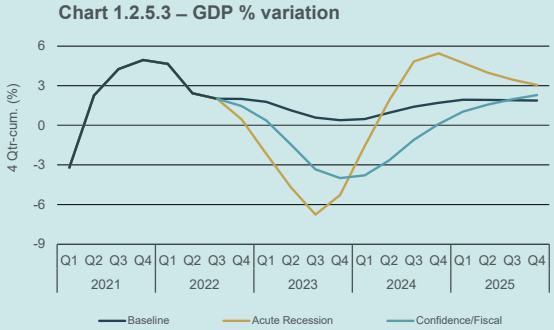


Chart 1.2.5.4 – Unemployment

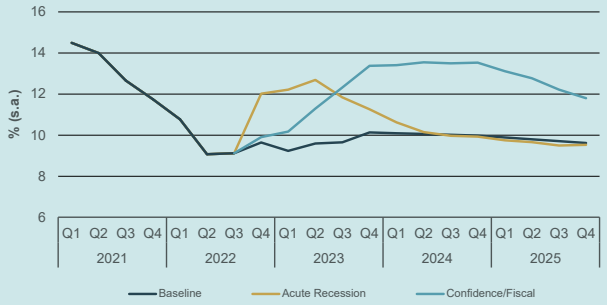
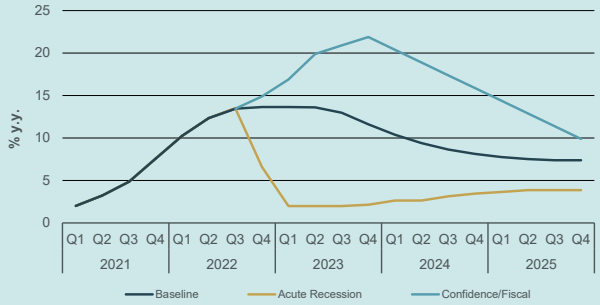


Chart 1.2.5.5 – Selic



The estimated need for capitalization of the system is low in both simulated scenarios, confirming the adequate capacity of the system for loss absorption. The largest capital need would be 6.8% of the current regulatory capital of the system at the 12th quarter of the simulation of the Confidence/Fiscal scenario (Chart 1.2.5.6). For the Acute Recession scenario, capital need reaches 2.5% of the current regulatory capital of the system, also at the 12th quarter (the last one) of the simulation. PAs, on the other hand, would reach 7.8% of total loans (Chart 1.2.5.7) in the Confidence/Fiscal scenario. Institutions that together account for 83% of the total assets of the system would continue to show capitalization rates above the regulatory minimum (10.5%) (Chart 1.2.5.8).

Chart 1.2.5.6 – Capital gap

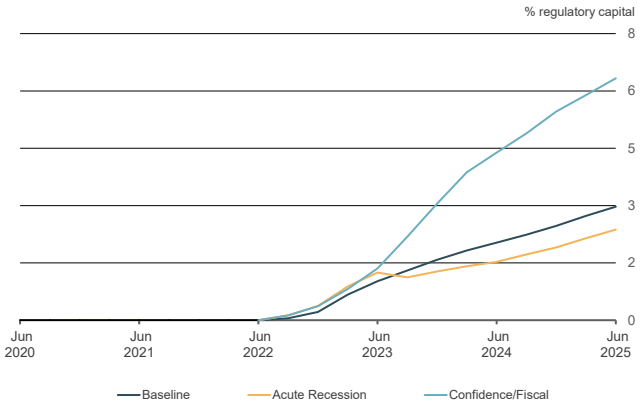


Chart 1.2.5.7 – Problem Assets

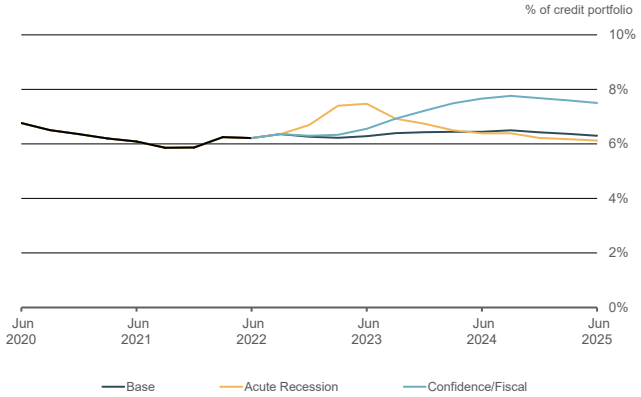
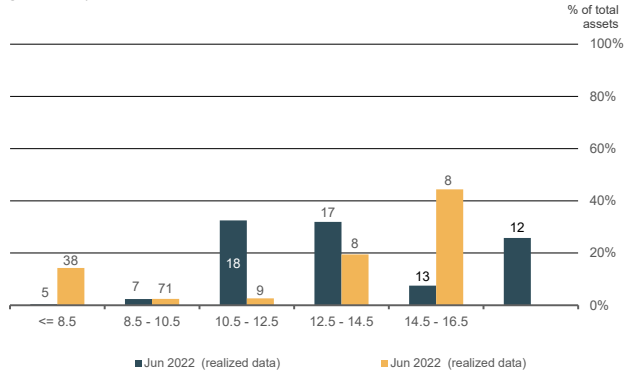


Chart 1.2.5.8 – Frequency Distribution of Assets By Capital Ratio Range
Confidence/Fiscal Scenario[1/]



1/ Values indicate the number of banks in each range.

The stress tests conducted during the Internal Capital Adequacy Assessment Process (Icaap) reinforce the capital adequacy evaluation of the most important financial system institutions. The Icaap exercise, conducted on an annually basis for segments S1 and S2 institutions, comprise a capital adequacy assessment based on prospective and stress scenarios. In any event an assessment deems the capital basis is inadequate, banks must describe in their Icaap report measures and action plans to be taken for adjustment. The tests apply scenarios defined by the financial institutions, as well as scenarios defined by the BCB. Throughout this process, banks apply their own models. Results reported by the institutions showed similar results obtained by BCB's proprietary model. No potential non-compliances have been identified in any of the scenarios defined by the BCB. This restates the perception of resilience of the banking system to adverse shocks in the stressed macroeconomic variables.

Sensitivity analysis

The system has low sensitivity to shocks in the exchange rate. For an exchange rate equivalent to twice the rate observed in June 2022, non-compliances amount to 2.8% of total system assets. The low observed net exposure resulting from regulatory restrictions and hedge policies, inhibits adverse effects resulting from drastic fluctuations in the exchange rate.

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Only very large positive shocks in the interest rate could generate some capital need. A shock equivalent to the greater variation observed would result in a need for capital of 3.4% of the regulatory capital. Hedge policies, current interest rates and the low exposure to assets that are sensitive to fixed-rates reduce the sensitivity to shocks in the interest rate.

There is no need for capital even with the PAs reaching their highest historical mark. Capital needs would be 0.5% of the system's regulatory capital, in case problem assets reaches 8.6%, the historical maximum level observed in May 2017 (Chart 1.2.5.9). In an extreme situation, if the proportion of problem assets reaches 16.8% of the credit portfolio there would be a need for capital equivalent to 7% of the system's regulatory capital. These institutions would represent 75.3% of the system's assets.

Simulations of reductions in residential property prices show a small possibility of non-compliance. There would only be a need for capital in the event of a nominal drop of at least 45% in the collateral price of real estate credit operations, updated by the IVG-R. This shock is superior to the 33% drop observed in the S&P Case-Shiller during the subprime crisis. Only a reduction of 50% or more in nominal prices would lead to insolvency, characterized by negative principal capital. In June, 2022, the stock of the residential real estate loan portfolio had an average LTV of 54%, considering collateral prices updated by IVG-R. The concession criteria with low LTVs and the use of the Constant Amortization System (SAC) are healthy characteristics for real estate credit and contribute to the system's ability to absorb price shocks in extreme scenarios (Chart 1.2.5.10).

Simulation of direct interbank contagion

The simulation suggests a low need for resources to recapitalize the system due to contagion caused by the bankruptcy of each financial institution individually. In the worst case, the need for capital resulting from contagion would be below 1% of the system's regulatory capital. This low impact is explained by the good level of capitalization of the system and the existence of an exposure limit per client, which restricts this type of exposure. In addition, most interbank transactions are carried out through repurchase agreements backed by TPFs, thus not propagating contagion due to the type of collateral. The remaining transactions have low volume in the aggregate of the financial system but are relevant in some particular cases, which explains the identified need for capital.

Chart 1.2.5.9 – Sensitivity analysis
Credit Risk

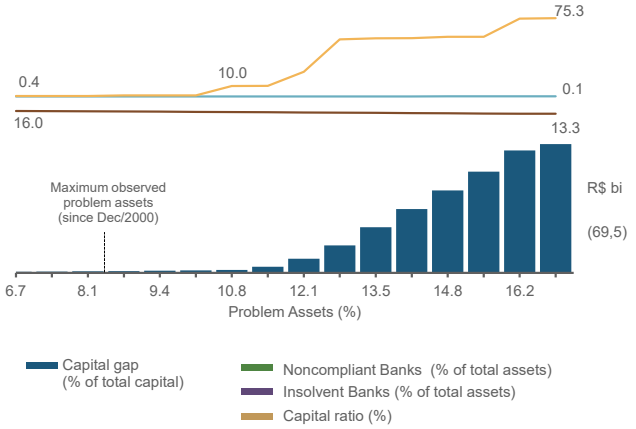
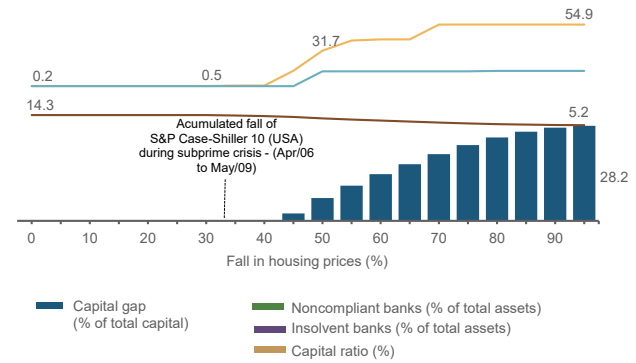


Chart 1.2.5.10 – Sensitivity analysis
Housing prices risk



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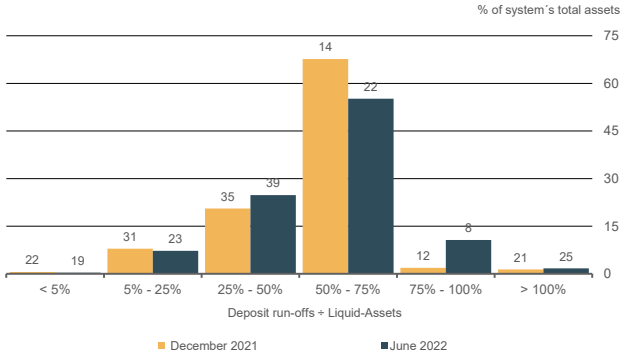
Liquidity Stress Test

The stress test featuring early withdrawal of deposits[38] suggests that the system's liquidity buffer is sufficiently large to safeguard financial stability and the regular functioning of the intermediation system, even under adverse scenarios. The scenario for outflows over a 30-day horizon encompasses outflows from the largest institutional depositors and a portion of the other clients. The shock applied to the outflow for the remaining clients considers the historical behavior for depositor's daily balance, as well as an additional loss, according to the depositor's type and the funding category. The vast majority of FIs, including the largest ones, have liquidity buffers large enough to withstand depositors' outflow[39] in potential stress scenarios. Only a group of institutions jointly representing 1.7% of the system's assets have deposit run-offs representing more than 100% of their liquid assets (Chart 1.2.5.11).

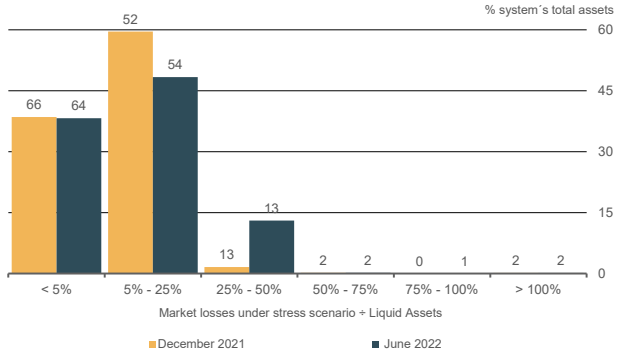
Chart 1.2.5.11 – Frequency distribution off deposits run-offs[/1]



1/ The values on the top of the bars refer to the number of financial institutions with the value of the expected earlier redemptions for next 30 days (run-offs) as a share of its liquid assets beloging to the corresponding interval.

The result of shocks applied to market parameters demonstrates that banking institutions remain sufficiently resilient to face eventual cash outflows to honor margin calls and guarantees as well as withstand potential devaluations in liquid assets in the short-term horizon. The market stress simulation is based on projections of different scenarios for the yield curve, exchange rate and currency and inflation coupons. [40] These simulations consist of estimating the amount necessary to cover losses arising from fluctuations in the prices of liquid assets, combined with other cash outflows of the institutions' resources due to positions in derivatives and other instruments.[41] The average increase in foreign exchange and inflation-linked exposures combined with the reduction in liquid assets contributed to a rise in the ratio between market stress and the institutions' liquid assets compared to December 2021, but at non-relevant levels (Charts 1.2.5.12 and 1.2.5.13).

Chart 1.2.5.12 – Frequency distribution for market losses under a stress scenario[1/]



1/ The values on top of the bars refer to the number of institutions with estimated market losses under stress scenario as a share of liquid assets belonging to the corresponding interval.

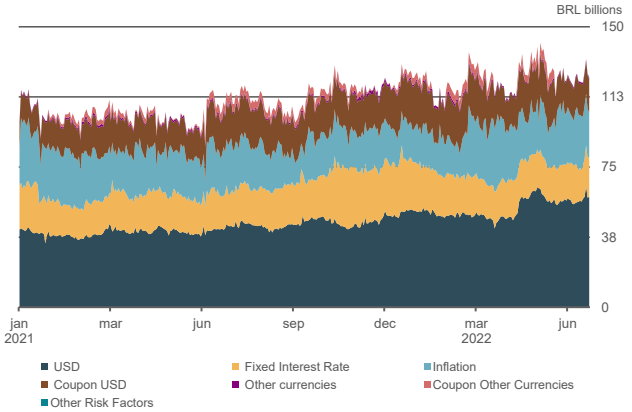
38 The early withdrawal of depositors' stress test aggregates a subset of components of the Short-Term Liquidity Ratio methodology (IL) associated with unexpected deposits outflows: deposit profile, early redemption and brokered deposits. For further details about the IL´s methodology, please refer to the April 2020 edition of the Financial Stability Report.

39 The scenario calibrated for the 30-day horizon encompasses redemptions from the largest institutional depositors and other clients The shock applied to the withdrawal of other customers considers historical behavior for daily depositor balances with a 99% confidence interval applied to a series encompassing 100 business days. Additionally, there is a third category of investors considered in the stress scenario: those who have brokered deposits, for which specific shocks are applied.

40 The stress tests consider the worst impact of a high/low shock scenario for the different market risk factors, independently, for each institution; i.e. that might be two independent scenarios: one shock estimating an increase for a certain risk factor for an institution A while another shock a decrease for the same risk factor for an institution B.

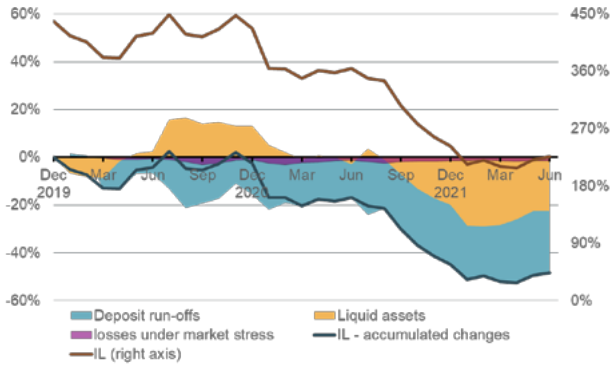
41 The resource losses/outflows include: (i) additional margin calls deposited in clearing houses; (ii) disbursements in positions of derivative markets; (iii) loss of value of liquid assets on repo agreements or given as a guarantee in clearing houses and the BCB.

Chart 1.2.5.13 – Impact of market stress by risk factors



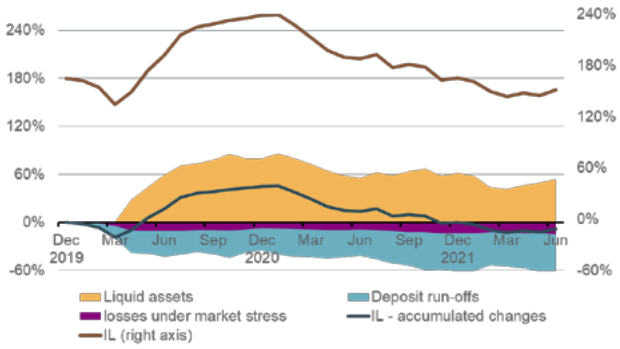
The liquidity ratio (IL), computed under stressed parameters for depositors' outflows and market losses, stops its downward trend in the second trimester of 2022 and maintains resilience. While the first trimester was marked by the continuation of the ratio's downward trajectory, as of March 2022, the main public and private FIs increased their efforts to increase funding, adjusting to a scenario of rapid interest rates raises in the main international markets and, consequently, greater risk aversion. Therefore, the increase in estimated depositor' outflows under stress scenarios – consequence of increased volatility during that period – has been off-set by the recovery in liquid assets. Losses arising from the market stress scenario were not significant across the system as a whole (Charts 1.2.5.14 and 1.2.5.15).

Chart 1.2.5.14 – Short-term Liquidity Ratio[1/]
Public banks, monthly accumulated changes



1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2019, on the evolution of the Short-term Liquidity Ratio

Chart 1.2.5.15 – Short-term Liquidity Ratio[1/]
Private banks, accumulated monthly changes



1/ The accumulated area shows how much each component has impacted, in percentage points, since December 2019, on the evolution of the Short-term Liquidity Ratio

The estimated impact of potential liquidity support to investment funds[42] managed by bank-linked managers on the banking system participants is not a relevant matter of concern. The step-in risk is the ratio between the potential liquidity support to investment funds provided by their bank-linked managers – estimated in a scenario of strong withdrawals in investment funds – and the excess liquidity of their linked FIs – estimated from the liquidity stress tests performed by the BCB. This risk is assessed along with the other stress tests carried out by the BCB. At the end of the first semester of 2022, this risk represented 14% of the excess liquidity of the linked FIs. The indicator has been showing a reduction mainly due to the recovery of liquidity of the linked FIs and the step-in risk does not represent a relevant point of attention (Chart 1.2.5.16).

42 The concept and methodology for assessing potential liquidity support to investment funds were presented in the October 2017 edition of the Financial Stability Report, available at https://www.bcb.gov.br/publications/financialstabilityreport/201710.Investmentfunds considered in the estimation of the potential support are those under CVM Instruction 555/2014, managed by entities belonging to the banking system, open-end and non-exclusive, not fund of funds, having a redemption no longer than thirty days and whose financial statements are not consolidated into prudential conglomerates.

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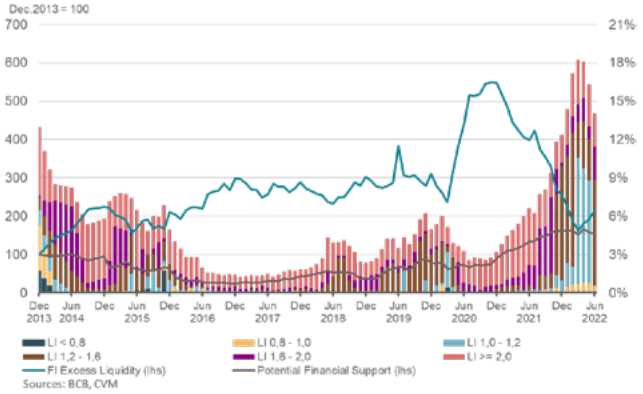
Chart 1.2.5.16 – Investment funds' step-in risk

Potential support as a proportion of excess of liquidity of bank-linked managers, segregated by Liquidity Index range



1.3 Financial Stability Survey[43]

Confidence in the stability of the National Financial System (SFN) increased and reached a new all-time high. However, fiscal risks have remained important and concerns about the risk of the global scenario have been raised. The risk of the international scenario has been boosted, with higher inflation in central economies, the need for further tightening of monetary policy, and the possibility of a global recession and escalating geopolitical conflicts. According to the respondents, fiscal concerns stem from recent fiscal measures and uncertainties related to the next presidential term. In turn, the positive perception of economic activity has strengthened. Most respondents expect and suggest that the value of the $ACCP_{Brasil}$ is kept at 0%.

Risks to financial stability[44]

There is a growing concern about the risk of the international scenario, especially those related to the tightening of monetary policies in advanced economies and the deceleration, or even recession, in the global economy. Considering the main risk pointed out by each financial institution, the risks arising from the international scenario appeared in 40% of the answers in August 2022, compared with 13% in February 2022 (Table 1.3.1). If all three risks pointed out by each respondent are considered, the average number of citations per financial institution increased from 0.74 to 1.13 (Table 1.3.2).[45] The persistence of global inflation has engendered a tightening of the monetary policy in advanced economies that may affect the Brazilian economy mainly through two channels: by generating pressure on domestic asset prices, with inflationary impacts; and by causing a slowdown or even a recession in the world economy, which would negatively affect domestic activity. Moreover, global economic activity could still be affected by a further economic slowdown in China and by escalating geopolitical tensions, particularly between China and Taiwan and Russia and Ukraine. In the respondents' opinion, these tensions may destabilize markets through disruption in the production chains, increasing commodity prices, increasing risk aversion, and capital flight in emerging markets.

Financial institutions assess that fiscal risks remain relevant, reflecting concerns about recent measures and uncertainties related to the next presidential term. The percentage of financial

43 The BCB conducts a quarterly survey to identify and monitor risks to financial stability according to the perception of regulated entities. Opinions reported here are those of the responding financial institutions. In the last edition of the Financial Stability Survey (FSS), the sample was composed of 52 financial institutions, corresponding to 90.4% of the banking system's assets in December 2021. Since the previous edition of the Financial Stability Report (REF), two FSS have been carried out, on April 25-29, 2022, and on August 1-9, 2022, both with 100% of response rates.

44 Questions: "In the next three years, which risks to financial stability does your institution deem as most relevant, considering the probability of occurrence and their impact on the SFN?" and: "For each of the three mentioned risks, indicate the probability and the impact, considering the following classes: i) probability: low (<1%); medium-low (1%-10%); medium-high (10%-30%); high (>30%); ii) impact (total SFN assets): very low (<0.1%); low (0.1%-1%); medium (1%-5%); high (5%-10%); very high (>10%)".

45 A number greater than 1 indicates that each financial institution, on average, cited risks classifiable as international risks out of the three risks indicated more than once.

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institutions citing fiscal risks as the most important reduced from 33% in February 2022 to 17% in May, reflecting improved fiscal results. However, this value rose to 23% in the August survey.

Delinquency and economic activity risks lose importance, reflecting the favorable evolution of activity and the labor market. Domestic inflation risks decline, while political risks show an upward trend. The GDP growth and the unemployment rate reduction have acted as limiting factors for increasing concerns about delinquency. However, respondents believe the scenario requires caution since credit growth and a potential reversal of economic conditions could impact delinquency. The number of citations indicating inflation as a risk increased in the May FSS, probably related to the inflationary peak in April, but decreased in the August survey, due to the ensuing inflationary slowdown. In contrast, the number of citations of exclusively political risks increased, related to the respondents' concerns about the upcoming elections (Tables 1.3.1 and 1.3.2).

Table 1.3.1 – FSS – Citation frequency of the most important risk

Risk	Frequency (%)			Probability	Impact
	Feb 2022	May 2022	Aug 2022	Aug 2022	
Global scenario	13	44	40	Mid-High	High
Fiscal risks	33	17	23	Mid-High	High
Delinquency and economic activity	31	13	13	Mid-High	Medium
Domestic inflation	15	17	12	Mid-High	High
Exclusively political risks	6	8	12	Mid-High	High

Table 1.3.2 – FSS – Average frequency of the three most cited risks

Risk	Average frequency (citations/financial institution)			Probability	Impact
	Feb 2022	May 2022	Aug 2022	Aug 2022	
Global scenario	0.74	1.13	1.13	Mid-High	High
Fiscal risks	0.67	0.58	0.67	Mid-High	High
Delinquency and economic activity	0.70	0.46	0.42	Mid-High	High
Exclusively political risks	0.26	0.31	0.33	Mid-High	Medium
Domestic inflation	0.31	0.35	0.25	Mid-High	Medium

Note: Financial institutions answer the following question: "In the next three years, which risks to financial stability does your institution deem as most relevant, considering the probability of occurrence and their impact on the SFN? Describe the three risks in order of importance (the most important first, considering the product between the probability of the event occurring and the magnitude of losses as a fraction of the total SFN assets)". The BCB then classifies these descriptions into different risk categories for analysis. Table 1.3.1 presents information referring only to the risk considered the most important by each institution, while Table 1.3.2 refers to the three risks listed by each of them.

The textual analysis of the survey shows concern about global inflation, tighter monetary policies, credit risk, and uncertainties related to the presidential election in Brazil. The word cloud based on the description of the most important risk pointed out by each respondent highlights expressions related to domestic and international macroeconomic conditions and with the political context, such as "inflation", "interest", "price", "delinquency", "uncertainty", and "elections" (Chart 1.3.1). Comparing the last three surveys, the increase in the occurrence of terms related to the domestic fiscal issue, monetary policies, and risks of global deceleration or recession, such as "fiscal risk", "interest rate", "central banks", "recession", "risk premium", and "volatility" stand out

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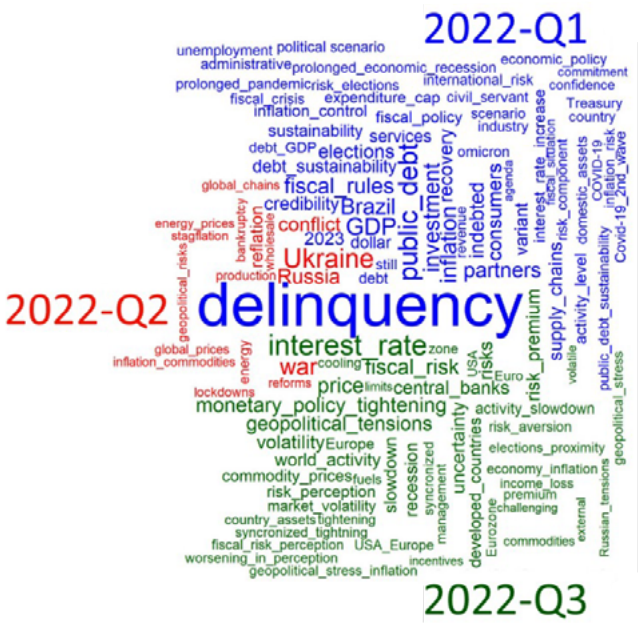
(Figure 1.3.2).[46] In turn, the number of terms related to the war in Ukraine was greatly reduced.

Chart 1.3.1 – FSS – Word cloud describing the most important risk

Note: The word cloud is compiled from the textual analysis of the most important risk described by each respondent. The size of the word is proportional to its frequency.

Chart 1.3.2 – FSS – Evolution of risk perceptions



Note: The comparative word cloud is compiled from the textual analysis of the most important risk described by each respondent. The color of the word indicates the FSS in which the word frequency was predominant. The size of the word is proportional to the difference between the word frequency in the corresponding FSS and the average frequency of the same word in the three surveys depicted in the figure.

Respondents assess that the risk of the international scenario and fiscal risks have the highest average expected impact on the SFN. The sum of the average expected impact of all the different risks has been reduced from the survey reported in the last edition of this REF. The risk of the international scenario has risen, signing the highest average expected impact on the SFN, followed by fiscal risks. In contrast, there was an equivalent decrease in the risks related to delinquency and activity. The variations in the average expected impact of the other risks were smaller, generally decreasing over the period (Chart 1.3.3 and 1.3.4). As for the shock transmission channels in the SFN, the probability assigned to "Credit rating downgrade, including sovereign rating, broadly and widespread" has reduced compared to February 2022.

46 In many cases, the word cloud does not allow one to distinguish whether the variable refers to Brazil or abroad. However, the assessment is complemented with a more granular analysis.

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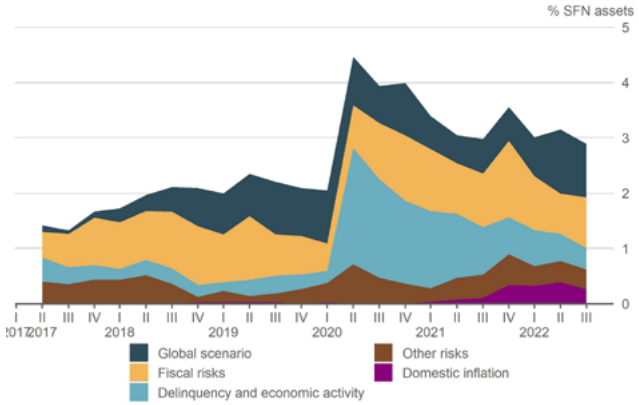
Chart 1.3.3 – FSS – Average expected impact



Note: The average expected impact of risk *r* is computed as $I_r = \frac{1}{n}\sum_b probabilidade_{br} * impacto_{br}$, where *n* is the number of financial institutions; and probability and impact are values assigned by the respondents to the *r* risk cited in the FSS. Risks are assumed to be independent so they can be aggregated into a single indicator. Hence, $I = \sum_r I_r$. All three risks pointed out by the financial institutions are considered. The measure I_r refers to the expected impact of a risk type from the point of view of the group of respondents. It is not a feature of the *r* risk class itself, but of the group's expectation about the materialization of that risk. For example, there could be a risk class with a very high expected impact mentioned by only one respondent. In this case, the average expected impact of the risk from the respondents' point of view would be low.

Chart 1.3.4.a – FSS – Global scenario: probability, impact and frequency

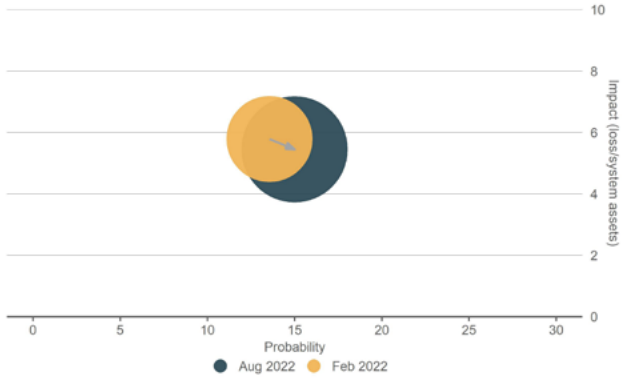


Chart 1.3.4.b – FSS – Fiscal risks: probability, impact and frequency

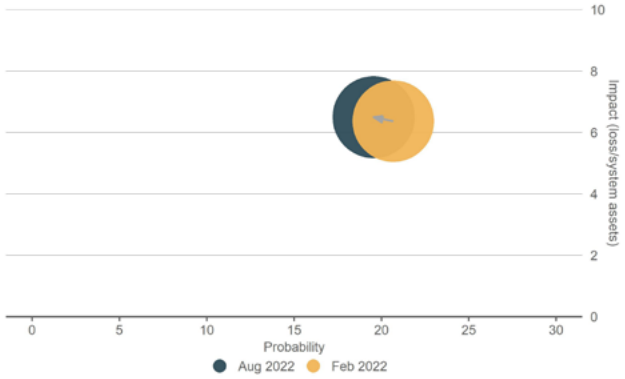


Chart 1.3.4.c – FSS – Delinquency and economic activity: probability, impact and frequency

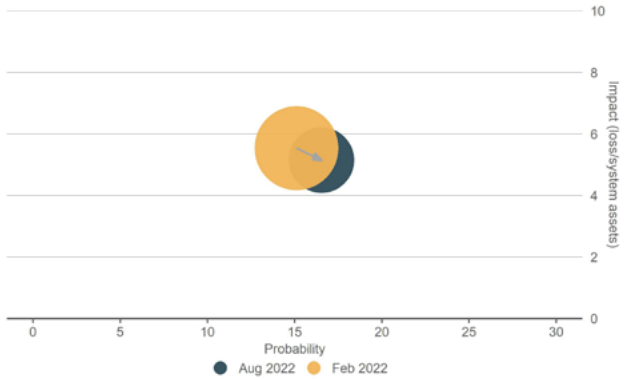


Chart 1.3.4.d – FSS – Exclusively political risks: probability, impact and frequency

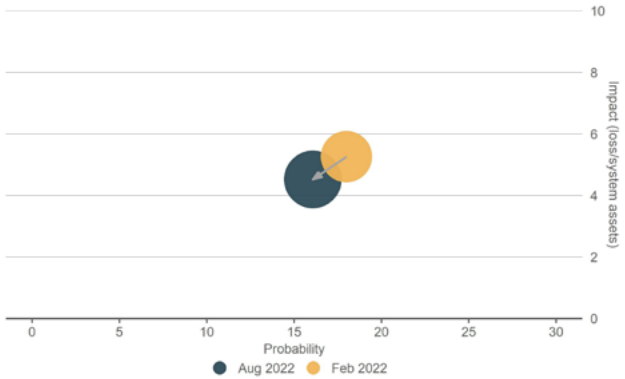
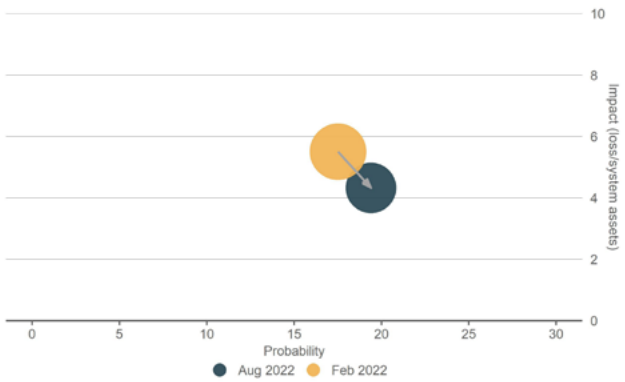


Chart 1.3.4.e – FSS – Domestic inflation: probability, impact and frequency



Note: The size of the circle represents the frequency of the risk. The x and y coordinates represent the midpoint of the probability and the impact classes, respectively.

Table 1.3.3 – FSS – Transmission channels of high-impact events

Transmission channel	Feb 2022 (median)	May 2022 (median)	Aug 2022 (median)	Distribution (last survey)
Contagion between markets and domestic institutions	4	4	4	1 2 3 4 5 6
Liquidity freeze, including interbank markets and foreign credit	3	3	3	1 2 3 4 5 6
Sharp decline in domestic financial asset prices, including collateral prices	4	4	4	1 2 3 4 5 6
Increase in risk aversion and uncertainty, affecting consumption and investment decisions	4	5	4	1 2 3 4 5 6
Decline in depositors confidence, including flight-to-safety	3	3	3	1 2 3 4 5 6
Capital flight and/or relevant exchange rate depreciation	4	4	4	1 2 3 4 5 6
Widespread credit rating downgrade, including sovereign ratings	4	3	3	1 2 3 4 5 6

Probability

Very low 1 2 3 4 5 6 Very high

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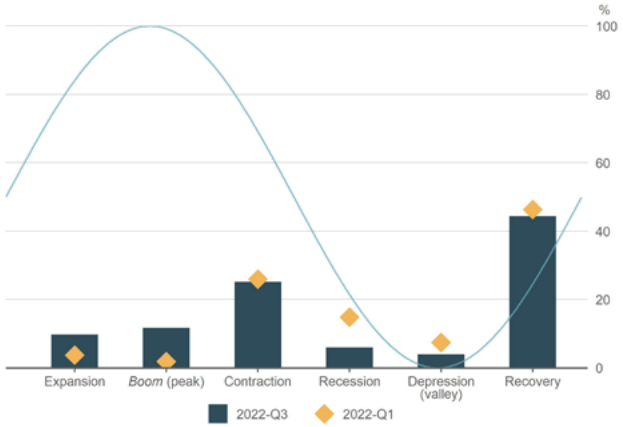
Economic and financial cycles

There was a significant increase in the positive perception of the business cycle. The perception of recovery in economic activity remains predominant, and the share of financial institutions that consider that the economic cycle is in a more negative phase (recession or depression) decreased to 10% in August 2022, from 22% in February 2022. Comparing the two most recent surveys, there was a migration of responses from recovery to expansion (three respondents) and from expansion to peak (four respondents). The portion of respondents that classified the business cycle in the "Expansion" and "Boom/Peak" phases was 21% in August 2022, up from 6% in February 2022.

Chart 1.3.5 – FSS – Economic cycle



The credit/GDP gap continues to be perceived heterogeneously, although with a predominant view of stability. Despite the predominating perception of a low-level willingness of financial institutions to take risks, this willingness has increased. The share of respondents who believe that the credit/GDP gap is stable is 40%, with a drop in the upward trend from 26% in February to 23% in August (Chart 1.3.6.a). In August 2022, about 62% of the respondents consider their willingness to take risk low, compared to 70% in February 2022, pointing to an increase in the financial institutions' risk appetite in that period. The biggest reduction occurs in the "Low and stable" class, which reduced to 21% in August 2022, down from 30% in February 2022 (Chart 1.3.6.b).

The degree of corporate and household leverage is still perceived as high. That the degree of household leverage is high is almost a consensus,[47] and just over 40% assess that the trend is upward. However, the perception of "high with a downward trend" increased from February to August, in contrast to the decrease in "high and stable", suggesting a softening of the trend (Chart 1.3.6.c). As for corporate leverage, 67% of the respondents assess that it is high, although with a reduction concerning the February survey, and most of them see it as being stable or with a tendency to decrease (Chart 1.3.6.d).

The level of asset prices continues to be perceived heterogeneously, but with a preponderance of a low price level perception. Access to funding and liquidity continues to be perceived as high, although with a moderately increasing downward trend. The share of financial institutions assessing that asset prices are low increased to 58% in August 2022, up from 54% in February 2022 (Chart 1.3.6.f). The share of financial institutions that consider that access to "funding and liquidity" is high increased to 79% in August 2022, up from 74% in February 2022. However, the percentage of respondents pointing to a downward trend increased to 42% in August 2022, from 31% in February 2022 (Chart 1.3.6.e). Many respondents warn that the persistence of the global inflationary process, combined with the risk of recession in the main economies, may impact asset prices and reduce liquidity volume for emerging economies, via funding interest rate rise and a degree of risk aversion increase.

47 Only one respondent considers the degree of household leverage low.

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Chart 1.3.6.a – FSS – Financial cycles
Credit-to-GDP gap

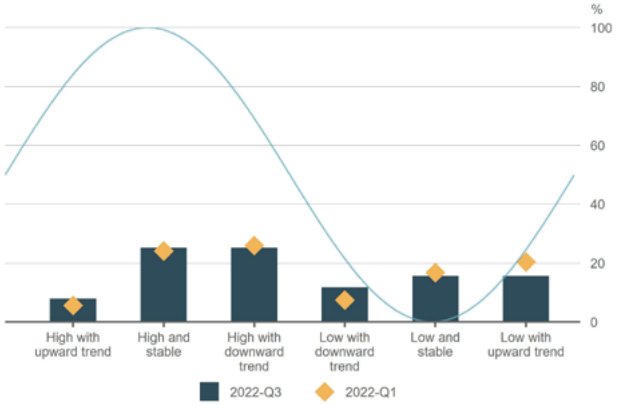


Chart 1.3.6.c – FSS – Financial cycles
Households leverage

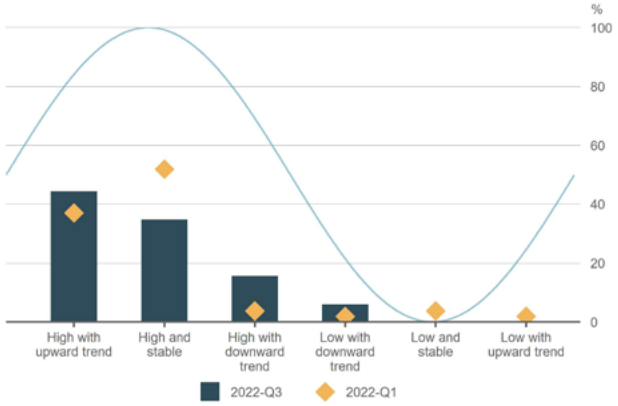


Chart 1.3.6.e – FSS – Financial cycles
Funding and liquidity

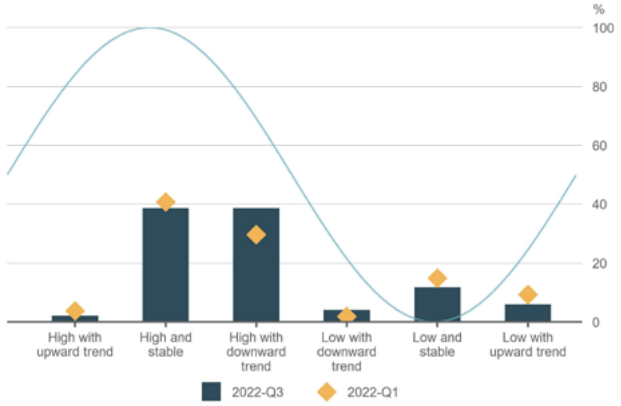


Chart 1.3.6.b – FSS – Financial cycles
Risk appetite

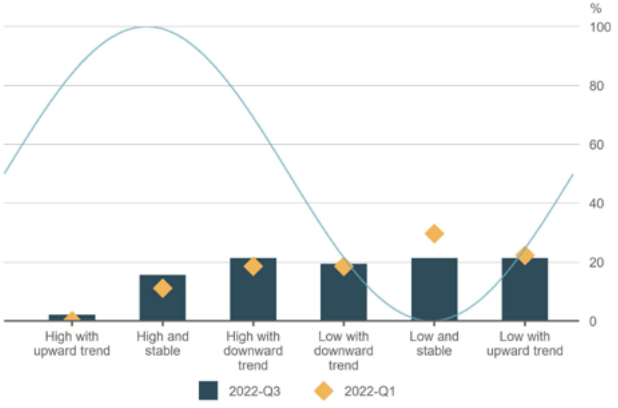


Chart 1.3.6.d – FSS – Financial cycles
Companies leverage

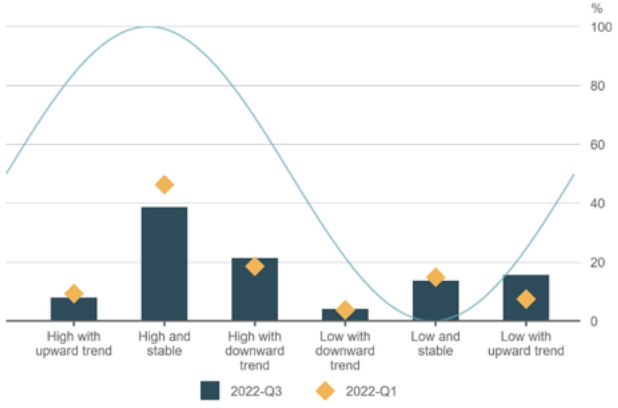
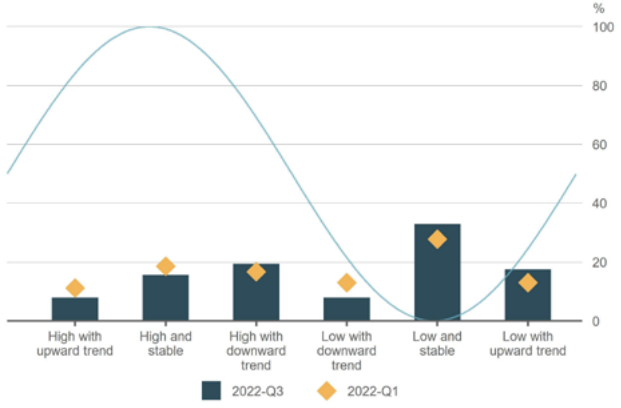


Chart 1.3.6.f – FSS – Financial cycles
Asset prices with respect to the fundamentals of the economy



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Resilience and confidence in financial system stability

Confidence in the SFN stability remains high, having reached a new all-time high in the last survey. Most financial institutions have full or high confidence in SFN resilience. The classes "full confidence" and "high confidence" represent 81%, while "mid confidence" represents 19% of citations in August 2022 (Chart 1.3.7.a and 1.3.7.b).

Expectations for the Countercyclical Additional Buffer

Financial institutions expect and suggest ACCPBrasil at 0%. About 94% of the respondents believe that the ACCPBrasil shall remain at 0% and recommend maintaining it at this level (Chart 1.3.8.a and 1.3.8.b). This result has remained relatively constant during all surveys.

Chart 1.3.7.a – FSS – Index of confidence in the stability of the financial system
Evolution of confidence indexes

Chart 1.3.7.b – FSS – Index of confidence in the stability of the financial system
Relative distribution of confidence perceptions

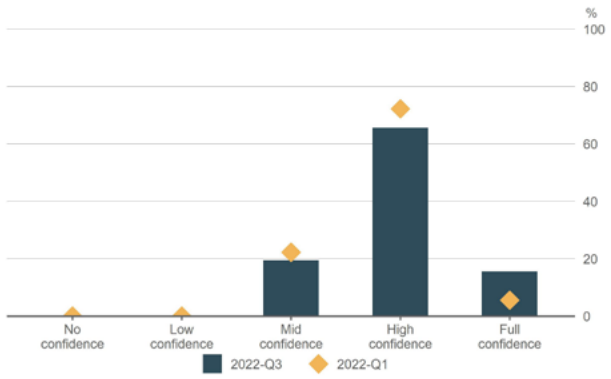


Chart 1.3.8.a – FSS – Expectations and suggestions for the Countercyclical Additional Buffer (Brazil)
Expectations

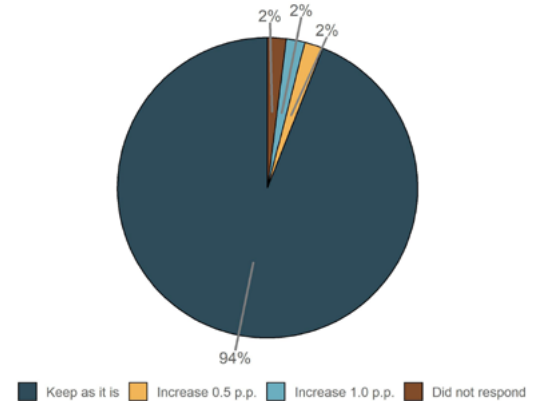
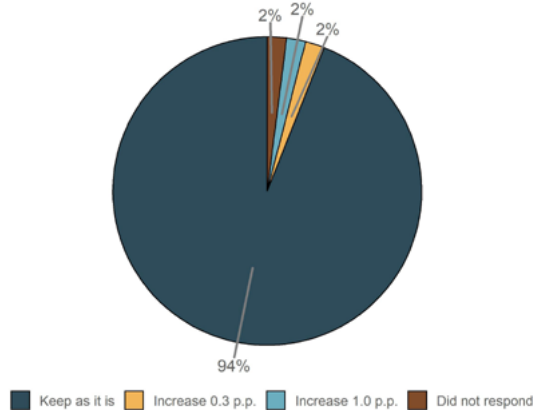


Chart 1.3.8.b – FSS – Expectations and suggestions for the Countercyclical Additional Buffer (Brazil)
Suggestions



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1.4 Financial market infrastructures

In the first half of 2022, FMIs contributed to safe and efficient functioning of markets. The systems were compliant to regulatory requirements and to applicable international principles. These are necessary conditions for the stability of the SFN.

The financial system held enough intraday liquidity[48] to ensure smooth flow of payments in the Brazilian Payment System (SPB)[49]. Interbank market transactions were settled without any relevant issues and under low risk of intraday insufficient funds throughout the semester (Chart 1.4.1)[50]. Every two days the STR managed a turnover that nearly equals the Brazilian GDP. During the semester, the average need for funds for daily payments (NEL) was 3.3% of the total available liquidity, with a peak of 6.3%. The SPI reached 73 million transactions on a single day. In more than 95% of time, institutions demanded no more than 25% of their liquidity to settle payments out of STR's operating schedule (Chart 1.4.2).

48 Aggregate balance of funds available for interbank payments and transfers.

49 Real-time gross settlement systems: Reserves Transfer System (STR), Instant Payment System (SPI) and Funds Transfer System (CIP-Sitraf).

50 Financial Institutions can transfer required reserve balances to the Reserves Account and convert Brazilian Government Bonds into Central Bank money by doing repo operations, both without intraday financial costs.

Chart 1.4.1 – Liquidity Potential and Effective Liquidity Needs

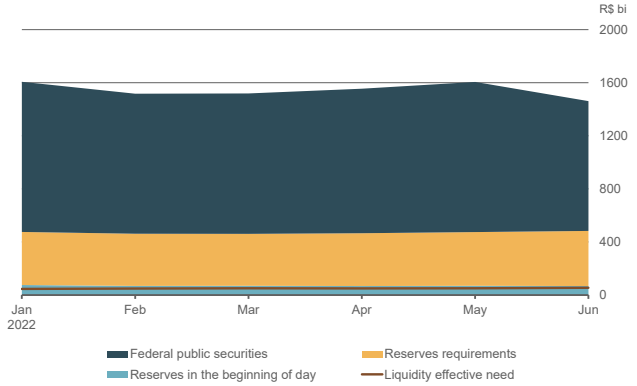
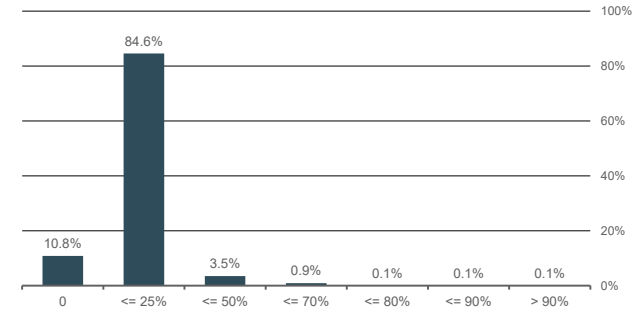


Chart 1.4.2 – After-Hours Liquidity Needs



Pix has considerably increased its relevance in the SFN and the SPB. The average monthly growth in transaction volume (Chart 1.4.3) was around 5%. Most transactions continue to be between persons (P2P), as shown in Chart 1.4.4, with potential for expansion in other use cases. The SPI maintained availability above 99.9% throughout the period and 99% of transactions were settled in less than one second.

Chart 1.4.3 – Interbank Pix (settled by SPI) and Intrabank Pix

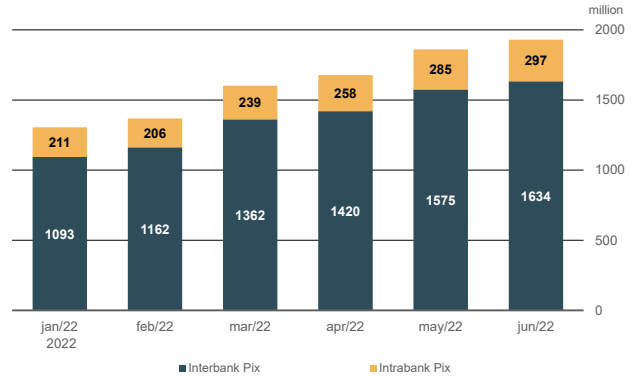
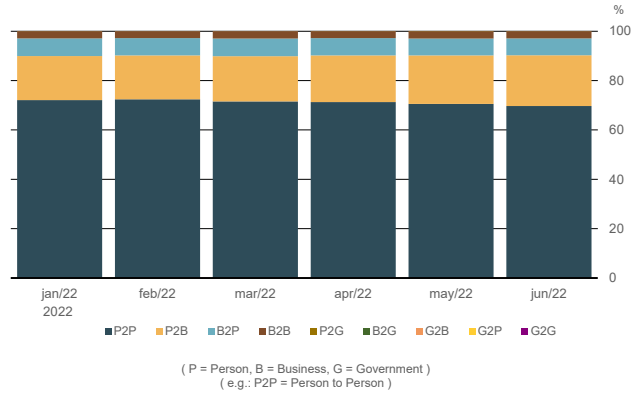


Chart 1.4.4 – Pix transactions types (interbank pix)
Transaction percentage



(P = Person, B = Business, G = Government)
(e.g.: P2P = Person to Person)

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Financial risks in financial assets, securities and foreign currencies markets were properly managed by the FMIs. B3 S.A. acts as CCP in two systems: B3 Clearinghouse and B3 FX Clearinghouse. In both, the confidence level of the initial margin model is over 99%, compliant with the Principles for Financial Market Infrastructures (PFMI)[51]. The stress scenarios employed by B3 were more severe than the observed variations of the main Primitive Risk Factors (FPRs)[52] in the period (Table 1.4.1). The margins required by B3 Clearinghouse were sufficient to cover the risk of a high percentage of investors' portfolios, as determined by the BCB (Chart 1.4.5).

Credit and liquidity exposures were adequately managed by CCP throughout the whole period.[53] For B3 Clearinghouse, individual margins and prefunded additional resources would be sufficient to cover B3's credit exposure against the two participants whose joint default would result in the highest aggregate credit exposure (Chart 1.4.6). The liquid resources maintained by the B3 Clearinghouse would be sufficient to ensure the timely settlement of obligations coming from the two participants with the largest debt net positions. For the B3 FX Clearinghouse, required collateral would be sufficient to cover credit exposures against each of the participants. Liquid resources held by the B3 FX Clearinghouse would be sufficient to cover the default of the participant with the largest obligation in Brazilian real (Chart 1.4.7) and in U.S. dollar (Chart 1.4.8).[54]

51 This confidence level relates to the estimated distribution of future exposure to settled financial instruments.

52 The primitive risk factor associated with a derivative contract is the name given to the financial variables that are relevant to the formation of the contract price.

53 The backtestings indicate that the B3 Clearinghouse and the Foreign Exchange Clearinghouse are complying with SPB legislation and PFMI objectives.

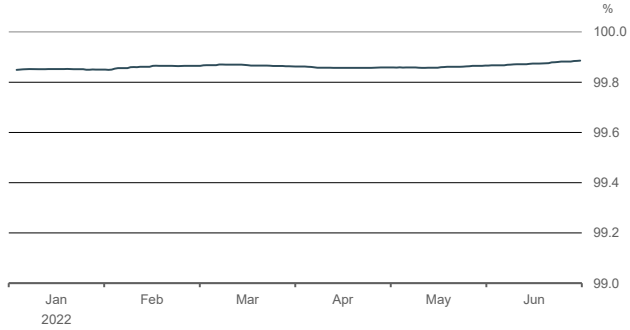
54 Principle 7 of the PFMI determines: a) maintenance of sufficient liquid resources to timely settle the obligations arising from the default of the two participants, including companies controlled by them, which would generate the largest aggregate payment obligation for the CCP, in the case of CCPs that are considered systemically important in more than one jurisdiction, or that have a complex risk profile; or b) maintenance of sufficient liquid resources to timely settle the obligations arising from the default of the participant and its affiliates, which would generate the largest aggregate payment obligation for the CCP, in the case of the other CCPs. As the B3 FX Clearinghouse is systemically important only in Brazil, does not have a complex risk profile and only settles contracts for the purchase and sale of dollars in cash, the events represented in graphs 1.4.7 and 1.4.8 are compatible with international recommendations.

Table 1.4.1 – B3 Clearinghouse
Primitive Risk Factors (PRF)

Discrimination	Low[1/]	High[1/]
Ibovespa spot	23%	21%
USD spot	23%	44%
Fixed rate 42	4%	17%
Fixed rate 126	11%	18%
Fixed rate 252	17%	23%
Fxed rate 756	30%	22%
DDI[2/] 180	62%	41%
DDI 360	12%	25%
DDI 1080	26%	37%

Sources: [B]³ and BCB
Own methodology
1/ Highest percentage of accumulated variation in 2 days in in relation to the low and high scenarios in the 1st semester of 2022
2/ Foreign exchange coupon.

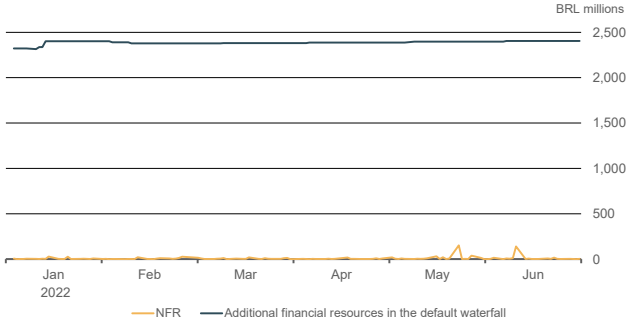
Chart 1.4.5 – B3 Clearinghouse
Statistics of accuracy of the model for individual margin [1/]



1/ Simply put, the statistic corresponds to an average, over a moving period of 63 working days, of the ratio between (i) the number of portfolios that would not have suffered losses greater than those calculated by the individual margin model used by the CCP; and (ii) the total number of portfolios.

Sources: [B]³ and BCB
Own methodology

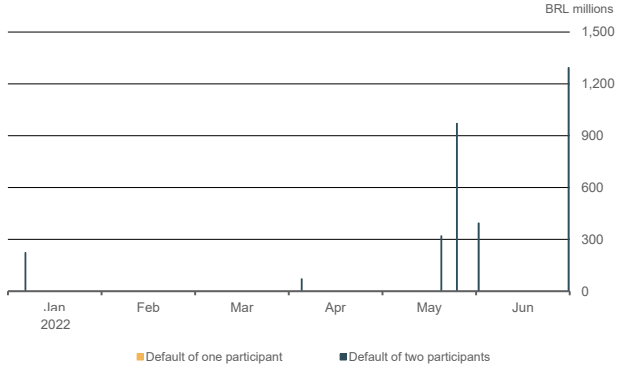
Chart 1.4.6 – B3 Clearinghouse
Credit risk backtesting



The NFR is calculated by comparing the financial result of the simulation of the closeout of the participant's positions and the value of the participant's collateral, in case the participant was declared defaulter. The closeout of the participant's positions is calculated by the CCP based on the closeout strategy calculated by the initial margin model and the real variations in the prices of the assets, calculated in the following days.

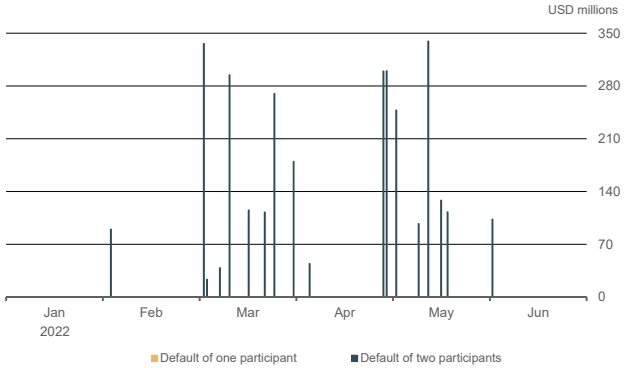
Sources: [B]³ and BCB
Own methodology

Chart 1.4.7 – B3 FX Clearinghouse
Liquidity shortage in BRL



Sources: [B]³ and BCB
Own methodology

Chart 1.4.8 – B3 FX Clearinghouse
Liquidity shortage in USD



Sources: [B]³ and BCB
Own methodology

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2.1 Climate transition risk

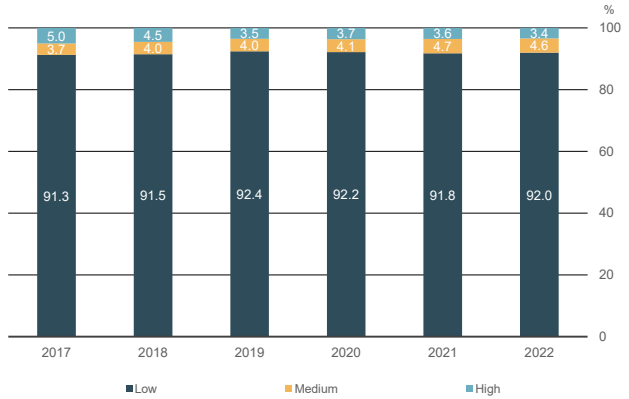
The BC's commitment to the sustainability agenda has resulted in several actions that seek to reduce the possible impacts of events associated with social, environmental and climate risks. Prominent in the external scope was BC's participation in forums and working groups *of the Network for Greening the Financial System* (NGFS), *the Financial Stability Board* (FSB) and BCBS. Within the internal scope, the BCB has continuously improved the regulation of these aspects, having improved, for example, the procedures to be observed in operations related to rural credit as well as included social, environmental and climate risks among those subject to integrated risk management and the assessment of capital sufficiency.[54]

The assessment of climate risk impact on the SFN is among BC's commitments. In addition to regulatory and supervisory measures, the BCB incorporated into its agenda the assessment of physical climate risk and climate transition risk impacts within the SFN. This is a trend followed by several central banks that, through different methodologies, seek to evaluate the effects of climate change on their financial systems. Given the complexity of the theme, the heterogeneity of knowledge and associated databases, the expectation is that new studies of this nature will be carried out and presented in the future, incorporating new methodologies and addressing different aspects of climate risk.[55, 56]

This section presents the mapping of the exposure of the SFN credit portfolio to the transition risk. At this stage, the objective is to evaluate the relevance of the credit portfolio granted to sectors that are most exposed to possible regulatory, technological or behavior changes that may stem from the transition to a low-carbon economy. According to the methodology described in the following boxing, each economic activity sector was associated with the respective potential for exposure to the transition risk. From the identification of the economic activity of each borrower, the risk of the sector was extended to the credit operations of the SFN.[57]

About 8% of the SFN's credit portfolio is intended for borrowers who may be affected by the transition risk. Transactions whose clients were classified as with medium or high transition risk accounted for 8.0% of the total credit portfolio in June 2022. This proportion shows little variation over time (Chart 2.1.1).

Chart 2.1.1 – Climate transition risk: history
Credit distribution by risk level



54 These actions and the edited standards are detailed in the October 2021 REF (https://www.bcb.gov.br/content/publicacoes/ref/202110/RELESTAB202110-refPub.pdf).

55 Physical climate risk addresses the possibility of frequent and severe weather losses or long-term environmental changes that may be related to changing weather patterns.

56 Climate transition risk refers to the possibility of losses arising from the transition to a low-carbon economy, where greenhouse gas emissions are reduced or compensated.

57 For rural credit operations, the association of exposure to activity risk was based, for both legal entities and natural persons, on the specification of the type of product, according to the data reported in the Rural Credit Operations System and the Proagro (Sicor). In the other credit types for businesses, the relationship was carried out based on the economic activity of the borrower, determined by the National Classification of Economic Activity (CNAE).

***Beef Cattle Breeding, Cargo Transportation* and *Soybean* account for more than 70% of the exposure to transition risk.** *Road Transportation* (R$100.2 billion), especially cargo (R$81.4 billion), alongside *Beef Cattle Breeding* (R$28.6 billion) and *Pig Iron and Steel industry* (R$22.1 billion) are the largest sources of exposure to business credit. For personal credit, the exposure focuses on beef cattle breeding (R$ 98.6 billion) and soybean production (R$75.6 billion). Considering personal and business exposures, the resources allocated to beef cattle breeding total R$127 billion (Chart 2.1.2). This volume corresponds to 32% of medium and high risk exposures.[58]

Smaller institutions have proportionally greater exposure to the transition risk. Compared to the 8% of mean exposure in the SFN, the institutions of the Segment S4 (14.6%) and the S5 (14.3%) account for the highest percentages of risk, as a proportion of the respective total portfolio (Chart 2.1.3). The institutions with the highest percentage of exposure is basically formed by smaller entities specialized in financing heavy vehicle fleets or rural credit financing. Among cooperatives, for example, agricultural financing accounts for about 23% of the total portfolio. Among the other institutions, this percentage is less than 9%. In any case, in more than 60% of institutions, which account for 70% of total credit, exposure does not reach 8% of their portfolios (Chart 2.1.4).

58 For the "Power Generation" segment, a specific methodology was used to approximate the level of transition risk. In this sector, the company's risk depends on the percentage of each energy source used in the electric power generation process, according to data released by National Electric Energy Agency (ANEEL). Processes using fossil fuels (except natural gas) or burning waste in generation have been classified as highly exposed to the transition risk; those based on forests (cultivated for this purpose) or natural gas would have medium exposure; other energy sources have a low or zero risk. For this reason, in the segment "Power Generation" there are legal entities associated with the three levels of risk: low, medium and high. This situation is reflected in Chart 2.1.2.

Chart 2.1.2 – Transition risk by sector

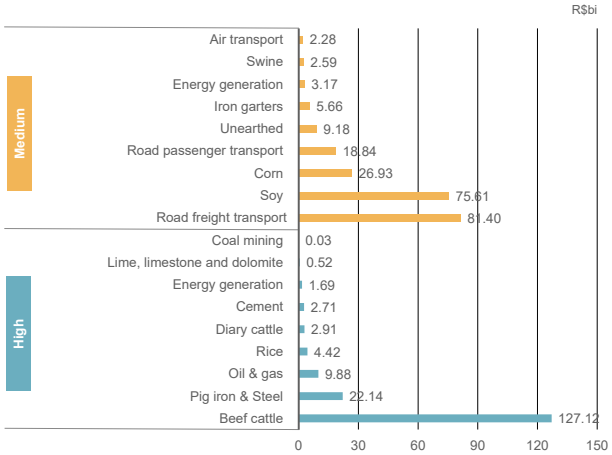
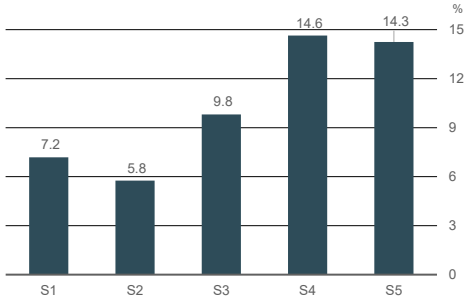


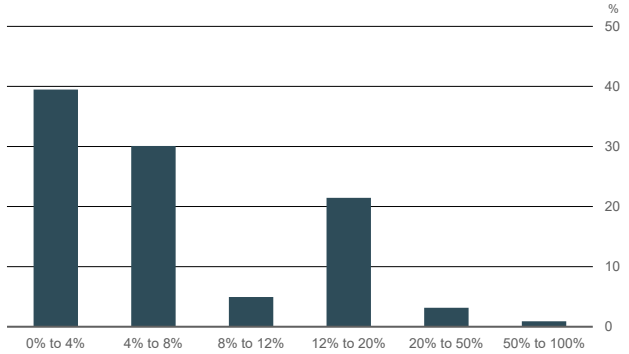
Chart 2.1.3 – Exposure by Segment S
to transition risk



Percentage of Segment S on total credit	68.5%	10.6%	10.7%	6.9%	3.2%
Percentage of Segment S on portfolio with transition risk.	61.0%	7.6%	13.1%	12.6%	5.7%

■ Percentage of high and medium exposures on the segments portfolio

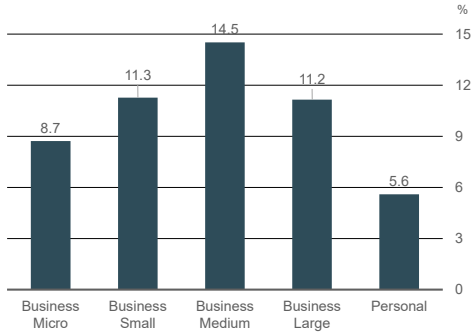
Chart 2.1.4 – Frequency distribution
Percentage high and medium risk exposure on institutions portfolio



- The values above the bars represent the number of institutions in each range.

In business credit, 84% of exposures subject to transition risk are in medium and large companies. [59] Proportionally, medium-sized enterprises are the ones with the highest risk (Chart 2.1.5). Large companies account for 54% of exposures to medium or high transition risk. In credit for individuals, the risk (given by rural credit operations) is about 6% of the total personal credit portfolio. Considering that the weighted average maturity of operations with medium or high exposure was about 20 months in June 2022, and assuming the company size approximates its management capacity, the risk currently seems to be fully manageable by the SFN.

Chart 2.1.5 – Exposure to transition risk by client type



	Business Micro	Business Small	Business Medium	Business Large	Personal
Percentage of client type on total credit	4.4%	3.3%	9.7%	23.0%	59.7%
Percentage of client type on portfolio with transition risk.	4.7%	4.6%	17.5%	31.8%	41.4%

■ Percentage of high and medium exposures on client type portfolio

59 In the size analysis (Graph 2.1.5), only business credits are considered.

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Methodology

This section presents the methodology used to identify the sectors of economic activity that have the greatest potential for exposure to the climate transition risk. Since it is a risk arising from structural changes that may result from the transition to a low-carbon economy, the model assumes as a basic premise that the risk is proportional to the greenhouse gas (GHG) emissions of the sector.[60]

This box is divided into three stages. The first details the source and allocation of emissions data to the various sectors of economic activity. The second describes how production and export data were used to relativize emissions. The third presents the risk metrics used and how they are incorporated into the transition risk measure for the sectors, which are classified as **low**, **medium,** and **high** risk. At the end of the text, an infographic is presented that summarizes the methodology used.

Sector emissions mapping

Sector emissions mapping considers scope 1 and 2 emissions. The scope 1 emission data were obtained from the "Annual Estimates of Greenhouse Gas Emissions - 5th Edition" of the Ministry of Science, Technology and Innovations (MCTI). The participation in electricity consumption, to determine scope 2, and the origin of the classification of the sectors of activity follow the National Energy Balance (BEN), of the Energy Research Company (EPE).[61, 62, 63]

The MCTI inventory, published in 2020 (for 2016 emissions), is the basis for mapping sectoral GHG emissions. In the inventory, emissions in tonnes are organized into five large groups, described briefly below:

1. **industrial processes**: emissions generated in the production processes of industries;
2. **agriculture**: emissions from livestock (enteric fermentation and animal waste management) and agriculture (burning of waste and agricultural soils);
3. **energy**: emissions from the direct burning of fossil fuels – Industry, Agriculture, Transport, Public Sector, Residences, Trade and Energy Sector (electricity generation) – and fugitive emissions;
4. **waste treatment**: emissions generated by the disposal of solid waste, the treatment of domestic and industrial effluents, and the incineration of waste;
5. **land use changes**: emissions originated mostly from deforestation and, to a lesser extent, from the liming, in addition to the removal of CO_2 from the atmosphere by forests.

60 The methodology detailed here was developed internally with the collaboration of external consultancies and is in line with the literature on the subject, keeping fundamental similarities with other methodologies in development, which associate risk with the agent's economic activity sector. The primary difference in relation to other methodologies is that this approach takes into account the national emissions matrix, not directly following the standardized classification of sector risk disclosed by Task Force on Climate Related Financial Disclosures (TCFD). In this sense, the methodology applied here seeks to be more aligned with the characteristics of local emissions and the particularities of the country's activity sectors. Another aspect is that BCB is developing specific approaches to physical and transition risks, instead of addressing climate risks in aggregate. Finally, the customer's credit risk is not taken into account in the initial measurement of the transition risk by the BCB, although it may be used as an aggravating or mitigating factor.

61 In scope 1, emissions resulting directly from the operations or production processes controlled by the issuer are accounted for. In scope 2, indirect emissions generated by the use of electricity acquired for use in operations and processes are also considered.

62 livro_digital_5ed_estimativas_anuais.pdf (www.gov.br).

63 https://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/balanco-energetico-nacional-2020.

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The emissions of the *Industry* and *Agriculture* groups and those related to *Transport* in the *Energy* group were detailed and alllocated by sector of activity. The emissions of *Trade, Families (Households)* and *Public Sector* come mainly from the burning of fossil fuels and can be obtained from the respective participations in the constant electricity consumption in BEN. However, given the low volume of emissions and the high complexity to obtain other metrics used in the methodology, these segments were not considered. *Energy* sector emissions were considered according to the consumption of each sector (scope 2), as described below. In *Waste Treatments* and *Land Use Changes,* emissions (and removals) were not assigned for specific economic activities, due to lack of adequate parameters for an unequivocal association.

Emissions in *Land Use Changes* are significant, accounting for nearly half of the country's total emissions. However, assuming that deforestation is associated with the predominant activities at agricultural borders, and that the objective of this methodology is only to define a method to establish an order to the sectors exposure risk levels "low", "medium" and "high", the incorporation of these emissions would not significantly alter the level of transition risk attributed to most activities.

The emissions of scope 1 of *Industry, Agriculture and Transportation* consider the emissions of their production processes and those originated by the respective direct burning of fuels[64]. The emissions of scope 2 were considered only for *Industry,* from the distribution of the value of emissions originated by electricity generation by the various sectors of activity according to the participation in electricity consumption, following the data from BEN. In *Agriculture,* scope 2 emissions were not calculated, since there is no complete sector opening in BEN. The consumption of electricity in *Transportation,* according to BEN, is negligible and therefore there is no significant difference between scopes 1 and 2.

Production and export values

The production data were obtained from the following IBGE economic surveys:

- Annual Industrial Survey (PIA-Product);
- Municipal Agricultural Production (WFP);
- Annual Service Survey (PAS); and
- Quarterly Milk Survey.

The calculation of the value of milk production uses the average prices offered by the Center for Advanced Studies in Applied Economics Luiz de Queiroz School of Agriculture (Cepea/Esalq). The export data were obtained from the Ministry of Industry, Foreign Trade and Services (MDIC).

64 Emissions for Animal husbandry are obtained by the values of emissions from enteric fermentation and direct management of residues for beef cattle and dairy cattle. For soil residue emissions, where there is no separation between beef and dairy cattle, enteric fermentation emission values (which is a direct function of the number of animals) are used as a parameter to disaggregate emissions between the two activities.
For Agriculture, the MCTI inventory lists the values of emissions from waste (either by deposition or burning) of the main crops in the country, as well as the specific emission values of irrigated rice. However, there is no distinction by crop of emissions from the addition of synthetic fertilizers to the soil, or by the mineralization of nitrogen associated with the cultivation of organic soils. In these cases, crop breakdown was obtained as a function of the planted area, according to the research data Municipal Agricultural Production (WFP), of the Brazilian Institute of Geography and Statistics (IBGE).
In Transportation, the MCTI inventory relates emissions by burning fossil fuels in the modalities Air, Rail, Road and Waterway. To disaggregate the Road transportation between Cargo, Passengers and Private Vehicles, the participation of emissions by type of vehicle was used according to the calculations carried out by the Climate Observatory, according to the following grouping: Cargo Transportation (trucks and light commercial vehicles); Commercial Passenger Transportation (bus); and Private Transportation (cars and motorcycles).

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Industry risk and transition risk metrics

From the emissions, production and export data, three indicators are generated for each sector of activity: Emissions per Product (EP); Gross Emissions (EB); and Export Participation (PE), according to the following formulas:

$$EP_s = \frac{Emissions_s}{Production\ Value_s};$$

$$EB_s = \frac{Emissions_s}{Total\ Emissions};\ and$$

$$PE_s = \frac{Exported\ Production_s}{Production\ Value_s},$$

where *s* represents the sector of economic activity.

Each of these three indicators brings a distinct purpose for estimating exposure to the transition risk. Emissions are used as a fundamental premise of the model; relativization by product seeks to incorporate an efficiency perspective, while gross emissions are used to balance any asymmetric effects caused by the production value of each market. The incorporation of export data aims to consider a relevant aspect not directly approximated by emissions, related to the risk of changing perception of external agents.

Then, linearly normalized indices between the values 0 and 1 for each of these three indicators are calculated: the Product Emissions Index (IEP), the Gross Emissions Index (IEB) and the Exported Production Index (IPE). The respective sector indices are obtained from the sector's position in the sampling distribution in each of the metrics, calculated by the five-year moving average, as follows:

- sectors whose metrics are below the sample median are assigned a risk level between 0 and 0.3;
- sectors whose metrics are above the sample median and below the third quartile are assigned a risk level between 0.3 and 0.7; and
- sectors whose metrics are above the third quartile are assigned a risk level between 0.7 and 1.0.

Finally, the value of the transition risk for each sector is given by the weighted sum of the three indices. Emissions per product represent the index with the highest weight (0.7); gross emissions and exposure to the external sector are assigned the same relevance (0.15).[65]

$$Transition\ Risk_s = 0{,}70 * IEP_s + 0{,}15 * IEB_s + 0{,}15 * IPE_s$$

where *s* represents the sector of economic activity.

The final classification of **high**, **medium,** or **low** risk levels for the sectors are defined from the results of the formula above, using the same cutoff points of the IEP, IEB and IPE indices. The sectors that obtained transition risk between 0 and 0.3 are classified as **low**; those classified between 0.3 and 0.7 as **medium**; and those classified between 0.7 and 1.0 as **high.**

The results obtained are in accordance with the expectation determined by the characteristics of the industries and the literature on the subject. The final distribution of the activity sectors by risk level is presented in the table below.

65 Exceptionally, the industry Extraction and transportation of oil and natural gas, given its characteristics, was considered as high risk of transition, regardless of the result obtained.

Table 2.1.1 – Transition risk by economic sector
Risk by sector

Sector	Risk level
Textile	Low
Cassava	
Food and beverage	
Rail transport	
Ceramics	
Other agricultural	
Waterway transport	
Other industries	
Chemical industry	
Beans	
Pulp and paper	
Poultry	
Mining	
Cane	
Air transport	Medium
Swine	
Iron garters	
Soy	
Road passenger transport	
Corn	
Unearthed	
Road freight transport	
Coal mining	High
Rice	
Pig iron & Steel	
Lime, limestone and dolomite	
Diary cattle	
Cement	
Oil & natural gas extraction and transport	
Beef cattle	

Synthesis of methodology

1 Sector emissions mapping

Scope 1
- Production processes
- Direct fuel burning

Source: Estimativas Anuais de Emissões de Gases de Efeito Estufa - 5ª Edição - Ministério da Ciência, Tecnologia e Inovações (MCTI) - 2020

Scope 2
- Originated by electricity generation

Source: data from Balanço Energético Nacional (BEN)

2 Production value and export value

Economic research of IBGE:
- Annual Industrial Survey (PIA-Produto)
- Municipal Agriculture Research (PAM)
- Annual Service Survey (PAS)
- Quarterly Milk Survey

Exports value obtained from the MDIC

Industry | **Agricultural** | **Transport**

3 Sector transition risk

1. **IEP = Product Emissions Index (relative)**
2. **IEB = Gross Emissions Index (absolute)**
3. **IPE = Exported Production Index**

Sector transition risk = 0.7 x IEP + 0.15 x IEB + 0.15 x IEP

Risk <= Median	Median < Risk <= 3rd Quartile	Risk > 3rd Quartile
Low	Medium	High
[0.0 , 0.3]	(0.3 , 0.7]	(0.7 , 1.0]

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2.2 Physical Climatic Risk – Extreme Drought

In continuation to the previous section, a sensitivity analysis of physical climate risk is hereby presented to the extreme droughts risk. The simulation evaluates institutions' credit exposures to eventual episodes of extreme drought nationally. The analysis measured the proportion of current credit books are loans granted to debtors located in municipalities and economic sectors which will be significantly affected in a scenario of extreme drought projected to occur between 2030 and 2050. These loans' contribution to banks' credit revenues has also been evaluated. Other aspects, such as impacts on solvency and liquidity risks have not been assessed.

One of the main goals of current study is to disseminate the subject and promote a better understanding of climatic risks in the financial system. Although the methodologies for quantifying potential impacts of the climatic risks are still in an early stage of development, simulations like this one are able to serve the goals of promoting and stimulating a better understanding of the transmission channels and potential exposures to this risk.

However, climatic risk impacts analyses in financial systems present limitations. The traditional methodology used in macroeconomic stress tests assumes static or passive balance sheets, a reasonable assumption for shorter time horizons such as 3 to 5 years, typical time frames on this type of studies. This assumption is questionable for time horizons more suitable for climatic analyses, typically of longer term. Additionally, historic data for such evaluations may not be good parameters to estimate future behavior of climatic risks, as per the high uncertainty and non-linearity of impacts, also because climatic changes may be above all a change of patterns, therefore making eventually existing historic data less useful.

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Methodology

This box is divided into three steps:

i. projection of climatic changes effects;

ii. estimation of climatic impact risks in each municipality in the stressed scenario;

iii. identification of economic activities with most intense use of water in its production processes or services.

The meteorological projections and estimations of climatic impact risks (steps i and ii) are obtained from the *Sistema de Informações e Análises sobre Impactos das Mudanças Climáticas* (AdaptaBrasil MCTI portal),[66] whereas data needed for step iii, regarding credit books distributions are obtained from the BCB's credit bureau – *Sistema de Informações de Crédito* (SCR).

The AdaptaBrasil portal is aimed to consolidating, integrating and disseminating information that enable advances on analyses of impacts from climate changes, both observed or projected in national territory, providing key insights to competent authorities responsible for adaptation actions. Data currently available include the extreme drought event, although projections of other extreme climatic events are under development by the Ministry of Science, Technology, and Innovation (MCTI). The estimation of climatic impact risks provided by AdaptaBrasil has a socioeconomic bias not suitable for this study's goal, as our specific purpose is to quantify impacts on economic activity. Because of that, methodological adaptations were needed, which are described below.

Sistema de Informações e Análises sobre Impactos das Mudanças Climáticas (AdaptaBrasil) and methodological adaptations

Meteorological projections have focused on years 2030 and 2050, according to the emissions scenarios in the Fifth and Sixth *Relatório de Avaliação do Painel Intergovernamental sobre Mudanças Climáticas* (AR5/IPCC). There are two projections for each date: an optimistic (based on the RCP 4.5 scenario) and a pessimistic (scenario RCP 8.5), in which intensity and frequency of droughts are accentuated. In present study, only the pessimistic scenarios for 2030 and 2050 were used, as the goal is to evaluate the financial system's exposure to extreme droughts.

66 For further details, assess https://sistema.adaptabrasil.mcti.gov.br/.

Climatic Scenarios

Figures 2.1 to 2.3 display the climatic scenarios developed by AdaptaBrasil for the three dates used, showing drought severity in all of the national territory.

Figure 2.1.1 - Risk of impacts in water resources - Current

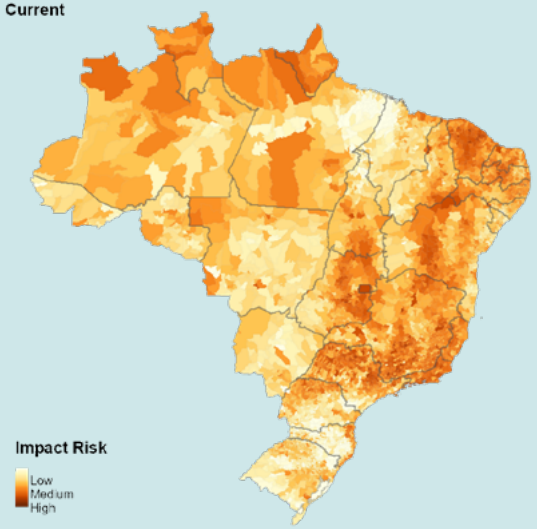


Figure 2.1.2 - Risk of impacts in water resources - 2030 Scenario (Pessimistic)

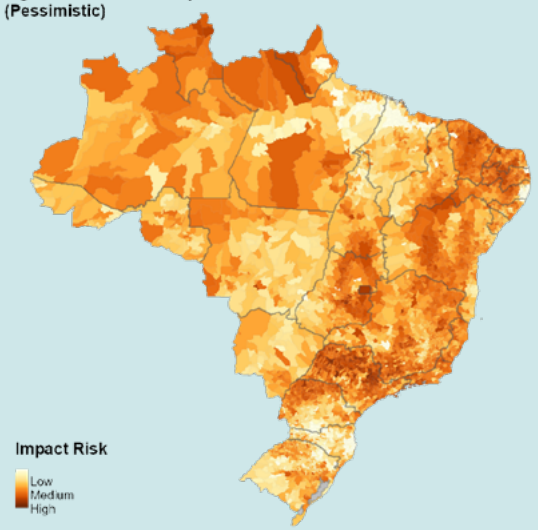
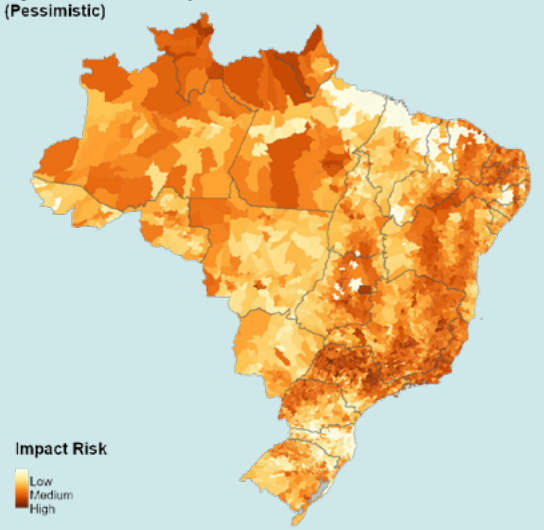


Figure 2.1.2 - Risk of impacts in water resources - 2050 Scenario (Pessimistic)



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Results

The percentage of loans in the credit book granted to debtors in municipalities with high risk of severe drought would increase in the time-frames projected. Currently, 16% of system's loans are located in municipalities with high or medium drought risks, to debtors in activities with intensive water usage. This exposure increases to 19% in 2030 and 2050 scenarios. Segment S2 presents the highest exposure to physic risk (Chart 2.2.1), with a 40% allocation of their credit books in municipalities and sectores deemed as high or medium risk. Geographic distribution indicates that the Southeast region is the most exposed to drought risk (Chart 2.2.2), both due to credit volumes allocated to the region, and the increase of municipalities with high risk of drought in the projected dates.

A portion of financial institutions could suffer increases in their exposures to physical risk. As droughts become more intense and frequent, more municipalities would migrate from low risk to medium or high risk tiers. Therefore, financial institution's credit book exposures would increase. As an example, only 43 institutions currently have more than 50% of their credit books exposed to risks medium or high. In scenarios projected for 2030 and 2050, this metric would increase to 56 and 64 institutions, respectively.

Chart 2.2.1 – Segments exposures to physical risks of extreme drought
Percentage of credit book in medium and high risk

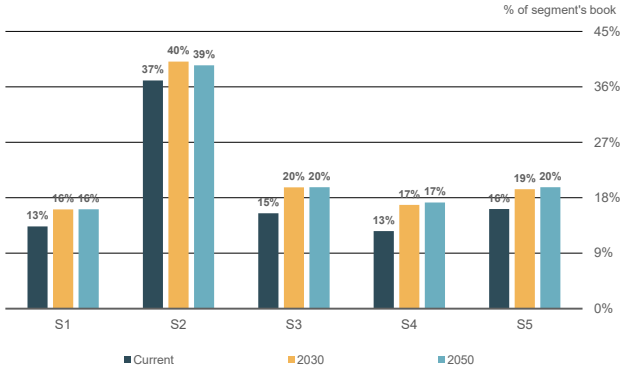


Chart 2.2.2 – Geographic regions exposures to physical risks of extreme drought

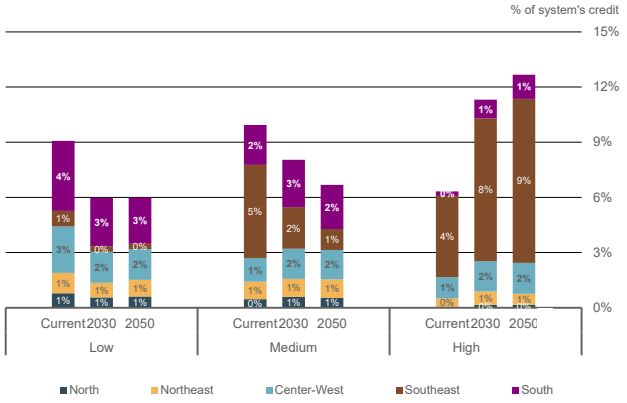
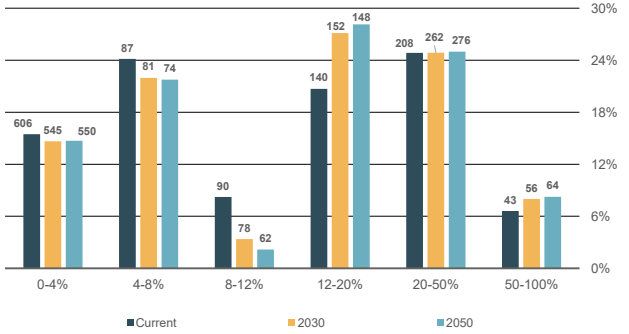


Chart 2.2.3 – Exposure to medium and high physical risk on credit books
Frequency distribution



Values above bars represent the number of institutions in each category

Among economic activities with intensive water usage, the financial system is more concentrated in sectors Agricultural and Energy, in considered scenarios. Agriculture credit to natural persons, and the Energy sector concentrate 48.5% of total exposures deemed as medium or high risk, suggesting that sectors are a dimension to deserve bigger attention (Chart 2.2.4). Other economic sectors also tied to rural sectors as Soy, Agriculture Inputs and Cattle Raising also figure on the list of most vulnerable to the drought scenarios, to which the financial system is largely exposed.

Chart 2.2.4 – Exposure to physical risk of extreme by activity with intensive water usage
Municipalities with medium and high risk

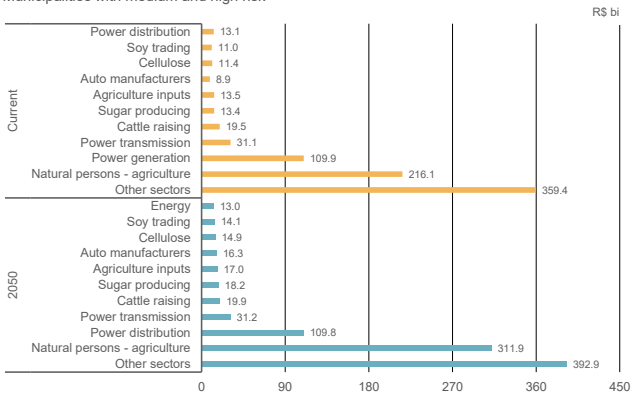
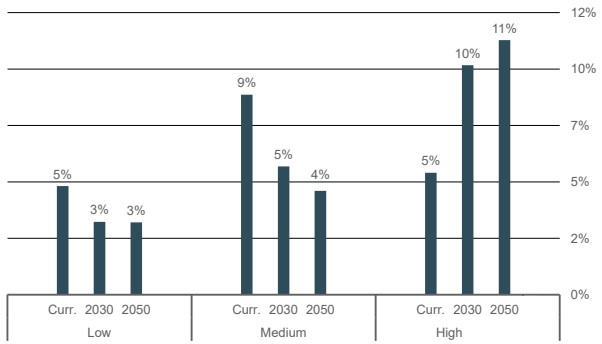


Chart 2.2.5 – Income share of operations exposed to physical risk
Risk related to municipality where the operation was granted



Interest income would be compromised by the evolution of the risk in municipalities to extreme drought. Interest income could also be impacted as a consequence of credit exposure to municipalities and sectors more exposed to drought, although the risk is low. Considering medium and high risks, up to 15% of the interest income of the system would be compromised in the drought scenario for 2050 (Chart 2.2.5). Although the relevance is still low, these numbers show that profitability drop can become another channel through which the FIs would be impacted by the physical risk.

2.3 Implementation of LFLs

The implementation of the new liquidity facilities (LFL) made the BC's essential lender-of-last-resort function more effective. The LFLs went into operation in November 2021 and have a robust regulatory and operational framework that allow for the effective provision of liquidity in a timely manner to the financial system, backed by private securities.

The first months of operation confirmed the effectiveness of the LFLs. Care must be taken not to measure the success of a central bank's instrument by its use. Without prejudice, one of the objectives of the LFLs was to ensure the existence of a normatively robust, operationally efficient instrument that could be accessed, without stigma. Moreover, the instrument was designed to be capable to allow the normal functioning of markets and the safety and efficiency of the National Financial System (SFN). At the end of August 2022, the main data related to the new facilities were as follows:

- 20 qualified participants;
- 1,456 debentures and commercial notes eligible as collateral;
- 222 different assets effectively positioned in the amount of R$65 billion, generating an available limit of R$48 billion; and
- R$42 billion in contracted operations.

LFL has two facilities that work, in an automated way, by means of a loan against a basket of guarantees. From the pre-positioning of collateral assets, a limit is automatically generated, considering criteria such as market price, haircut, and asset diversification. LLI is an available, fully automated line that aims to meet very short-term liquidity demands, up to five business days. The LLT is accessible by specific demand and depends on specific authorization from the BCB. LLT is a typical instrument of a lender of last resort, aimed at meeting liquidity mismatches of longer terms and can be contracted for up to 359 calendar

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days, and can also be used to address dysfunctional private securities and funding.

Considering the maturity concentration of liquidity operations offered in response to the crisis caused by Covid-19,[67] the BCB pre-approved the LLT limit for all eligible institutions. The decision, while trying to maintain the normal functioning of the private securities and bank funding markets, also aimed, together with other liquidity lines[68], to reduce the amount of liquidity offered by the BCB to the SFN compared to the end of 2020. The limit, of 25% of Tier I Capital, was available from the beginning of the operation of the new credit facilities (November 2021) until the end of March 2022. In addition to this pre-approved amount, the operations were conditioned by the value of the limit resulting from the pre-positioned guarantees.

LFL´s effectiveness increases efficiency and allows for the reduction of National Financial System (SFN) costs, with emphasis on the possibility of a structural reduction in reserve requirements. The absence of an effective and operational instrument to offer timely liquidity to the SFN was one of the historical causes of the high levels of reserve requirements in Brazil. One of its historical functions has been, therefore, the formation of a precautionary deposit of liquidity at the BCB for use in crisis situations.

Considering the opportunity to reduce reserve requirements and to encourage the SFN's operational readiness for LFL usage, the BCB allowed the deduction of up to three percentage points of reserve requirements on term fund deposits through the placement of LFL-eligible assets. This is a structural reduction that increases the efficiency of the SFN without harming its safety. From a potential deduction of R$48.7 billion, R$24.9 billion was deducted at the end of August 2022.

Another relevant benefit of the new facilities is the promotion of liquidity in the secondary private credit market. In recent years, the capital market has become increasingly important in financing the economy. By making privately issued securities eligible for its liquidity lines, the BCB contributes to the continued development of financing through the capital market in the country.

LFLs have an improvement agenda, which prioritizes, throughout 2023, the inclusion of assets representing bank credit as collateral. Debentures and commercial notes, the eligible collateral assets now, are still not very representative in the total credit of the economy. The inclusion of assets representing bank credit will increase the effectiveness of the lines as an instrument for offering liquidity. It will further increase the power of the instrument in the execution of monetary policy, in the promotion of financial stability, in the efficiency of the credit market and in the maintenance of the regular functioning of the markets.

In the future, we intend to study the differentiation of sustainable assets. Asset pricing and haircuts are based on market and credit risks, in addition to a component derived from the use of a pricing model. Currently, these criteria justify the differentiation of specific parameters for incentivized debentures. With the maturation of the market for sustainable assets, the BCB will assess the suitability of different treatment of parameters, also, for these assets. Furthermore, the incorporation of environmental risks into the risk rating of financial institutions will organically generate the differentiation of these assets.

2.4 Prudential Regulation for Payment Institutions (PI)

The thriving of Brazilian payment institutions (PI) generated innovation, increased competition and financial inclusion. The enactment of

67 As part of the orderly exit strategy of the Special Liquidity Temporary Facilities backed by Guaranteed Financial Letters (LTEL-LFG), an emergency line operated from the first half of 2020 in response to the effects on the markets caused by the Covid-19 pandemic.

68 New LTEL-LFG issue, limited, per institution, to 40% of the outstanding balance in effect on December 31, 2020.

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Law nº 12.865 in 2013 (the legal basis for PI regulation) allowed new incomers to operate in payment activities previously restricted to banks. As the PIs emerged offering new technological solutions with lower costs they attracted both financial institutions' customers and as well as those without access to the payment system. The natural consequence was the increase in competition and in cost reduction for payment clients and retailers.

The growth of PIs was followed by the offering of new products and services not directly related with payments, implying an increase in the risks these institutions incur. As they expanded their customer base, many IPs began offering other financial services, establishing financial subsidiaries or FIDCs in order to improve their market share.

However, the current prudential framework for PIs did not provide for such an expanded action or even for the establishment of financial subsidiaries. In the business model of these groups, their subsidiary FIs or FIDCs raise funds and carry out operations that involve some form of granting credit. Through mechanisms such as the acquisition of subordinated fund shares or bank credit notes, the credit risk could be transferred back to the PI. Nevertheless, the PI is not required to hold capital for this risk, enabling the development of a shadow banking.

The growth, diversification of operations and integration of PIs into the financial system represented a potential increase in systemic risk through contagion channels between FIs, FIDCs and the PI itself. Through this channel, shocks can propagate to the entire group, even in the absence of a contractual or a legal obligation for one institution to provide financial assistance to the other (step in risk). The leading PI may find itself compelled to financially assist its subsidiary FIs and FIDCs, due to reputation risk. As the prudential rules in place did not address the evolution of the PIs business model, the improvement of the prudential framework is necessary.

The new framework is guided by the principles of regulation by activity, proportionality, security, promotion of innovation and competition. Aiming at a balance between regulation by activity and by entity, identical prudential treatment is applied to the same activity, regardless of the type of entity that performs it, except when considerations of size, systemic relevance or complexity justify a different treatment. Another objective of the new framework was to preserve the attractiveness of PIs as an entry option for newcomers to the financial system.

The new regulation extends to PIs and to prudential conglomerates led by them the proportionality already applied for conglomerates led by FIs. With the new rules, conglomerates led by PIs will have a prudential regulation proportional to the risks of their activities, taking into account whether there are FIs in the conglomerate. Those conglomerates led by PIs and integrated by FIs are subject to the segmentation of Brazilian financial system as established by Resolution 4,553, of January 30, 2017. Conglomerates led by PIs and without FIs are subject to a simplified regulation aimed at maintaining the incentive for innovation and competition.

Main characteristics of the new framework

The new prudential requirements for PIs will be applied in a consolidated form to the entire prudential conglomerate, as already established for FIs. The solo basis approach for members of conglomerates led by PIs in the case of prudential rules created incentives for excessive risk-taking by such PIs.

In order to address this, the conglomerates integrated by at least one PI were segregated into three types:

I. type 1: prudential conglomerate led by a FI;

II. type 2: prudential conglomerate led by a PI and not integrated by a FI; and

III. type 3: prudential conglomerate led by a PI and integrated by at least one FI.

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The regulatory capital required of PIs and their conglomerates is enhanced to ensure higher quality. The concept of regulatory capital applicable to PIs is redefined. Thus, the accounting concept of adjusted net worth is replaced by the concept of prudential capital (PR), in which assets that are unable to absorb losses are deducted. In order to ensure easiness of entry for new PIs, deduction rules involving intangible assets are waived for two years after operating license is granted by the BCB.

Capital requirement for payment activities, except credit cards, is calculated using the amount of payment transactions. The capital requirement for payment activities is calculated using the total amount of payment transactions in the preceding year. This methodology is applied to electronic money issuance, acquiring of payment transactions and payment initiation services that are considered in the calculation of risk-weighted assets related to payment services (RWA_{SP}).

The capital requirement for credit card exposures by conglomerates of types 1 and 3 is identical, following the Basel standard, while type 2 follows a specific and simplified methodology. The BCBS has established in its credit risk framework a specific treatment for credit card exposures. For type 2 conglomerates, a simpler treatment is justified, and the capital requirement is calculated using a percentage of transactions volume.

Standardization of capital requirement rules for financial exposures incurred by PIs. The coverage of the financial risks incurred by PIs, previously without a specific prudential treatment, follows the same rules applicable to FIs, in line with recommendations by BCBS, observing criteria of proportionality, covering credit risk, market risk and operational risk.

Regulatory improvements aim to maintain prudence while encouraging competition. The new requirements will be gradually enforced with effects starting in January 2023[69] and achieving full implementation in January 2025. This schedule ensures sufficient time for institutions to adjust their internal controls and their capital structure.

2.5 The impact of CBDCs on financial intermediation – GT CBDC

The BCB's infrastructure for smart payments

The development of central bank digital currencies (CBDC) has been receiving growing attention around the world. A survey of the Bank of International Settlements (BIS)[70], conducted in 2019, has confirmed the growing interest of central banks on the topic: around 100 countries – responsible for more than 90% of the world's GDP – are engaged in research or tests related to the development of a sovereign digital currency.[71]

The strengthening of the digital economy and the impacts of the Covid-19 pandemic have been essential factors driving the engagement of monetary authorities in CBDC projects. In the late years, central banks, including the Banco Central do Brasil (BCB)[72], have been following up the evolution of technologies that support digital currencies. A plan to launch a global stablecoin[73] to operate into Meta Inc. platforms (former Facebook) was announced in 2019, signaling that the demand for this kind of means of

69 The effects of the new framework were postponed to July 1st 2023, by Resolution BCB nº 258, of November 18, 2022. The full implementation was maintained in January 2025.

70 See BIS 2021, "Ready, steady, go? - Results of the third BIS survey on central bank digital currency"; https://www.bis.org/publ/bppdf/bispap114.pdf.

71 CBDC tracker; https://cbdctracker.org/

72 An example is the 'Information Integration Platform for Regulators' (Pier), through which BCB and other financial regulators, by using a blockchain-based technology, exchange information for licensing entities; https://www.bcb.gov.br/en/pressdetail/2249/nota.

73 To mitigate the high volatility inherent in the values of "traditional" cryptocurrencies, the so-called stablecoins are private cryptoassets whose value is linked to one or more assets (such as sovereign currencies or another asset that is not traded in a cryptocurrency trading environment). Further information, see https://www.fsb.org/wp-content/uploads/P131020-3.pdf.

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payment was already approaching a degree of maturity that could make them applicable on a large scale. In addition, the Covid-19 pandemic itself highlighted the need for more efficient digital payment instruments. The combination of these factors contributed to central banks turning their attention to CBDCs.

Countries seek to use a CBDC to address their own domestic issues. Not one size fits all. In general, the projects of CBDC can be divided into three broad categories:

i. wholesale payment projects, which include projects for cross-border payments;

ii. retail payment projects, mainly focusing on instant payments arrangements; and

iii. projects that seek to foster financial innovation, recognizing the capacity of CBDCs to generate new business models. The "Real Digital Initiative", the Brazilian Digital Real (DBRL) project, is included in this last category.

A platform for smart payments anchored on the future DBRL

The natural path for Brazil is to develop the Real Digital to be the basis of a smart payment platform. The Brazilian Payment System (SPB) provides solutions that are international benchmarks regarding wholesale transactions, the Reserve Transfer System (STR); as well as for retail payment industry, the Brazilian instant payment ecosystem (Pix)[74]. The STR and Pix are both managed and operated by the BCB. To take advantage of a CBDC framework, the natural path for the BCB is to provide the Brazilian population with a smart payment platform based on programmability, such as programmable money and smart contracts. In addition to offering a safe transition path to the information economy, the BCB has been pursuing the goal of fulfilling society's demands for custom-fitted financial products and services with affordable costs.

Domestic liquidity conditions and concerns regarding the design of a CBDC[75]

The money market in Brazil operates with high liquidity, which is a favorable initial condition for the transition to a CBDC environment.[76] To control the liquidity of the interbank market, in addition to conducting open market operations, the BCB regulates the levels of reserve requirements on demand, savings or term deposits held by depositary financial entities. In the international comparison, Brazil has a high reserve requirement level,[77] so a reduction in the level of reserve requirements can be used as an adjustment tool in the transition to the new balance within a CBDC framework. In practice, the reduction in compulsory requirements could counterbalance the demand for the DBRL to keep the aggregate liquidity of the economy unchanged.

The issuance of a CBDC could impact the activities of taking deposits and providing credit. Both central banks and banks provide liquidity to the economy. Central banks do this directly by controlling the amount of money in the economy through managing the cost of money[78] (repo operations). Banks, in turn, manage liquidity by raising funds and extending credit to the economy – an arrangement that establishes a strong connection between the activities of taking deposits and providing credit.

74 Further information on BIS Bulletin nº 52: "Central banks, the monetary system and public payment infrastructures: lessons from Brazil's Pix", March 2022.

75 This section addresses commonly raised concerns about the potential effects of a CBDC on the credit provision and liquidity conditions of the economy. The "Real Digital Initiative" considers the creation of liquidity by banks and Ips through the tokenization of deposits, mitigating bank disintermediation risk. In connection to this issue, see the "Private Digital Currencies" topic in this very section.

76 This high amount reflects the monetary sterilization associated with the policy of accumulation of international reserves in the period 2006/2012.

77 With an average reserve requirement ratio close to 20%, Brazil has a remarkably elevated level when compared to the average of 6% of the countries of the Advisory Task Force on the OECD Codes of Liberalisation, of which Brazil is a member.

78 In fact, the BCB controls the basic interest rate, the Selic rate.

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An "excessive" conversion of conventional liquidity to the CBDC could impact the distribution of credit in the economy. In the extreme case, where total bank deposits were converted into CBDC, the linkage between deposit taking and credit supply can be impaired. Such a condition will entail the need for the central bank to provide liquidity to money market by, for instance, acquiring assets from depositary entities, so that banks can continue its credit activities. In practical terms, if the demand for a CBDC exceeded the total liquidity related to the sum of reserve requirements and repo operations balances, the absorption of this excess liquidity would cause the expansion of the central bank's liabilities.

The creation of a DBRL shall not affect the composition of the BCB's assets, minimizing thus impacts on the allocation of credit. Given the high liquidity of the Brazilian economy – represented by the BCB's liabilities – it would be possible to absorb a markedly higher demand for the Digital Real than those balances considered in baseline scenarios presented in the international literature. Such a condition would prevail even without the planned strategy of allowing the issuance of regulated private digital currencies, as already announced by the BCB, as the way to fulfill the demand for digital currency retail services. Therefore, avoiding any the relevant impacts on credit allocation in the economy.

The risk of a sovereign digital currency accelerating bank runs can be mitigated with careful design of its framework. In addition to the potential impact on the credit market, the convenience and security offered by a CBDC could drive its demand. Given a basic design of a CBCD, it be possible that depositary entities would face episodes of fast or massive conversion of their deposits to the CBDC format during periods of financial distress. This scenario could be mitigated by imposing limits on the speed of conversion without prior notice between digital currency balances, analogous to protocols already in place for transfer and withdrawal operations. In addition, it would become imperative reassessing liquidity stress parameters to adapt them to the dynamics of the funding market.

Private digital currencies

The BCB will maintain the current partnership with the private sector for the provision of liquidity. Notwithstanding its structural capability to mitigate potential adverse impacts arising from the issuance of a CBDC on the liquidity of the Brazilian economy, the BCB foresees the coexistence of the 'Real Digital' with private digital currencies – to be issued exclusively by regulated institutions on a smart-payments' platform. Specifically, new digital financial services will be based on these private digital currencies, fulfilling, throughout the Real Digital network, the same role that stablecoins have been already playing within unregulated environments.

This strategy will give rise to two types of private sources of regulated digital liquidity. Other sources can be added to the portfolio if necessary. Both traditional depositary institutions and payment institutions (IPs) will be able to offer liquidity in the form of tokens based on deposits of their clients, the so-called tokenized deposits:

- IPs – tokens will be backed by their deposits, fitting the basic concept of a stablecoin, since Ips' deposits are fully backed (100%) by compulsory reserves, held at the BCB in the form of Brazilian reais or federal government bonds. Fintechs willing to provide new products could benefit from simplified regulation and opt to use IP tokens to reach their public, making it easier to focus efforts on developing their business models.

- Banking institutions – their tokens would be backed by demand deposits balances. Unlike the case of IPs, these deposits do not count on 100% requirement reserves. However, prudential regulation on liquidity and portfolio risk, as well as the compulsory fractional reserves and deposit insurance would effectively make these tokens stable, similarly to the stabilization of the parity between bank deposits and the Brazilian sovereign currency promoted by analogous regulation.

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Potential for financial inclusion through the use of programmability

Once implemented within the Real Digital ecosystem, technological resources and programmability features – available on the cryptocurrency ecosystem and on Web3 – have great potential to deepen financial inclusion. Standardization and interoperability can foster the dissemination of developments undertaken in any part of the DBRL's network, thus benefiting the entire environment. Alongside that, the reuse of protocols and composability of financial services[79] can reduce cost of and timeframe for developing new financial products, enabling entrepreneur to focus on specific aspects of their business model.

The possibility of embedding compliance within the CBDC's applications and a low transaction cost can both lessen the burden of developing new financial products and business models. Moreover, programmability features and DLT (Distributed Ledger Technology) networks[80] enable a high degree of auditability, traceability, and transparency, potentially meeting all the supervision criteria. Additionally, with adequate models for validating transactions and identities – using permissioned networks, for example – it seems possible to reconcile transaction costs of CBDC environment with those prevailing in instant payment systems.

With proper regulation and governance, the potential for deepening financial inclusion of the smart payment technologies becomes clear. The evolving technology alone will not solve the problems arising from this moment of transition to the information economy. Nevertheless, these technological resources, if well employed and subjected to adequate regulation and governance, can result in new products and services that are more accessible and, thus, reach their target audience in a shorter period. In addition to allowing transactions with average values lower than the current ones, the new solutions could be better customized to end-users' needs.

Smart payment technologies make it easier for new entrepreneurs to enter the financial markets. The challenge is broadening the access to these tools – currently used to self-replicate their ecosystem – in order to reach a wider audience, facilitating the entry of new fintechs focused on business niches that cannot currently be operationalized with traditional financial tools. Thus, it will be possible to effectively expand the financial inclusion of population by means of continuous availability of new investment, credit, and insurance tools, among others.

Conclusion

The BCB's 'Real Digital Initiative' seeks, in new a financial framework, to respond to the fast progress of the digital transformation of the economy, as well as society's demand for natively digital settlement functionalities. The conditions for its implementation have been maturing and enabling important efficiency gains, since the creation of the internal "Working group on digital currencies" in 2020. We must emphasize that the digital transformation of the economy is an evolutionary process where risks and opportunities must be constantly evaluated. Therefore, there is still a long way to go and the BCB is confident that the reached solutions will benefit the entire Brazilian society. Even with relevant challenges on the horizon, in each related step taken, the BCB is always open to dialogue.

79 Provided with native composability in open-source ecosystems, developers can build new functionality on top of existing applications. Thus, protocols, applications, and decentralized finance platforms (DeFi – financial applications that use blockchain technology) work in an interconnected way, with interoperability.

80 DLT is a decentralized data framework, where records are maintained, updated, and validated, simultaneously and collectively. Given the permissionless blockchain format, all platform participants carry out these tasks by consensus, without a main administrator.

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Banco Central do Brasil Management

Acronyms

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Banco Central do Brasil Management

Board of Governors

Roberto de Oliveira Campos Neto
Governor

Bruno Serra Fernandes
Deputy Governor

Carolina de Assis Barros
Deputy Governor

Diogo Abry Guillen
Deputy Governor

Fernanda Magalhães Rumenos Guardado
Deputy Governor

Maurício Costa de Moura
Deputy Governor

Otávio Ribeiro Damaso
Deputy Governor

Paulo Sérgio Neves de Souza
Deputy Governor

Renato Dias de Brito Gomes
Deputy Governor

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Acronyms

ACCP
Countercyclical Capital Buffer

ACCP$_{Brasil}$
Countercyclical Capital Buffer for Brazil

AE
Advanced Economies

BCB
Banco Central do Brasil

BCBS
Basel Committee on Banking Supervision

CCP
Central Counterparty

CDB
Bank Deposit Certificate

CET1
Common Equity Tier 1

CI
Brokered Deposits

CMN
National Monetary Council

Comef
Financial Stability Committee

CVM
Brazilian Security and Exchange Commission

DI
Interbank Deposit Rate

EME
Emerging Economies

FGTS
Length-of-Service Guarantee Fund

FIDC
Receivables Investment Funds

FMI
Financial Market Infrastructure

FPR
Primitive Risk Factors

FSR
Financial Stability Report

FSS
Financial Stability Survey

GDP
Gross Domestic Product

G-SIB
Globally Systemic Banks

HQLA
High Quality Liquid Assets

IBC-Br
Economic Activity Index measured by the BCB

IBGE
Brazilian Institute of Geography and Statistics

ILE
Structural Liquidity Indicator

IPCA
Extended National Consumer Price Index

IVG-R
Residential Mortgage Collateral Value Index

LCA
Agribusiness Credit Bills

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LCI
Real Estate Credit Bills

LCR
Liquidity Coverage Ratio

LFL
Liquidity Facility Lines

LIG
Real State Secured Bill

LLI
Immediate Liquidity Line

LLT
Forward Liquidity Line

LR
Leverage ratio

LTV
Loan-to-value

MSME
Micro, Small and Medium-sized Enterprises

NII
Net Interest Income

NSFR
Net Stable Funding Ratio

PEC
Credit Stimulus Program

PFMI
Principles for Financial Market Infrastructures

PNADC
Continuous National Household Sample Survey

Pronampe
National Program to Support Micro and Small Companies

RDB
Bank Deposit Receipt

ROE
Return on Equity

RWA
Risk-Weighted Assets

SAC
Constant Amortization System

SCR
BCB's Credit Information System

SFN
National Financial System

SGS
Time Series Management System

SPB
Brazilian Payment System

SPI
Instant Payment System

SRisk
Systemic Risk Analysis

STR
Reserves Transfer System

TED
Bank Transfer

TPF
Federal Public Security

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Concepts and Methodologies

Concepts and Methodologies – Capital Stress

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Concepts and Methodologies

a) **Short-term Liquidity Ratio (IL)** – Conceptually like the Liquidity Coverage Ratio (LCR), it is the ratio between the stock of liquid assets held by the institution and the net stressed cash flows (estimated disbursements in the next 21 business days under a stress scenario). Therefore, institutions with IL above one (100%) have enough liquid assets to withstand this stress scenario.

i. Liquid assets – liquid resources available for each conglomerate/institution to honor its stressed cash flows for the next 21 business days. It is the sum of highly liquid assets, release of required reserves (due to deposits run-off) and supplemental resources.

a. Highly liquid assets – These include: i) unencumbered Brazilian sovereign bonds held by the institution or received as a collateral in reverse repurchase agreement operations (reverse repos); ii) stocks listed in Ibovespa index; iii) liquid quotas of investment funds; iv) cash; and (v) free central bank reserves.

b. Release of required reserves – amount of the required reserves that would be released to the institution due to the deposit run-off estimated in the stressed cash flows calculation.

c. Supplemental resources – other options for monetization in the scenario's time-horizon, such as: Bank Deposit Certificate (CDB), Bank Deposit Receipt (RDB), Interbank Deposit (DI), long positions in box strategies (options), reverse repurchase agreements (reverse repos) backed by private securities.

ii. Stressed cash flows – an estimate of the amount of cash that the institution needs within the scenario's timeframe (21 business days) under a stress scenario. The analyses take into account retail deposits run-off, wholesale funding run-off, market stress and net contractual cash flows.

a. Retail deposits run-off – estimate of the necessary amount to cover the retail-customers withdrawals in demand deposits, term deposits, savings accounts, box strategies, securities issued by the bank, and repurchase agreements (repos) backed by private securities.

b. Wholesale funding run-off – estimate of the necessary amount to cover the possibility of early redemption of the liability positions from the three largest market counterparties.

c. Market stress – estimate of the necessary amount to cover losses arising from market movements affecting the liquid assets or others positions that may cause a cash outflow of the institutions in the stress scenario. The losses comprise: i) margin calls; ii) pre-settlements of derivatives contracts; iii) losses on the marked-to-market values of the liquid assets.

d. Net contractual cash flow – payments due in derivatives positions and in contractual cash flows (assets and liabilities positions) with market agents, maturing within the horizon of the scenario.

b) **Structural Liquidity Ratio (ILE)** – It is the ratio between the available stable funding (part of the equity and liabilities on which the institution can rely for a one-year horizon) and the required stable funding (part of the assets, including off-balance-sheet assets, which must be financed by stable funding because they have long maturities and/or low liquidity). Institutions with ILE equal or above one (100%) are less susceptible to future liquidity problems. The calculation methodology is based on the final version of the Net Stable Funding Ratio (NSFR), which was introduced as a minimum mandatory compliance in October 2018.

i. Available stable funding – the funding that shall remain in the institution for at least a year. The main sources of banks' stable funding are the capital; non-redeemable liabilities with residual maturities above one year regardless of counterparty; and funding with no maturity or with a maturity of less than a year coming from retail customers.

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ii. Required stable funding – the amount of stable funding needed to finance the long-term activities of financial institutions. Therefore, it takes into account the liquidity and the maturity of the assets of the institution. The long-term assets are mainly the credit portfolio maturing in over a year; non-performing assets; less liquid or encumbered securities (i.e. margin requirement in clearings); fixed assets; and the items deducted from the regulatory capital.

c) **Total Capital Ratio** – Basel Committee on Banking Supervision international concept, consisting of the system regulatory capital (RC) divided by the system RWA. In Brazil, until September 2013, the minimum required ratio was the factor "F", according to Resolution CMN 3,490, of 29 August 2007, and Circular BCB 3,360, of September 12, 2007. Until October 2013, financial institutions and other institutions authorized to operate should observe the 11% limit established by the BCB, except for individual credit unions not affiliated to central units. From October 2013 on, the minimum required ratio has been disciplined by the Resolution 4,193, of March 1, 2013, which defines a convergent calendar, requiring 11% of RWA from October 2013 to December 2015; 9.875% in 2016; 9.25% in 2017; 8.625% in 2018; and 8% from 2019 on. On top of this requirement must be added a capital buffer, as mentioned in the Common Equity Tier 1 (CET1) Ratio topic.

d) **Tier 1 Capital Ratio** – According the Resolution 4,193, of 2013, a Tier 1 Capital requirement became effective from October 2013 on, corresponding to 5.5% of RWA, from October 2013 to December 014, and 6% from January 2015 on. On top of this requirement must be added a capital buffer, as mentioned in the Common Equity Tier 1 (CET1) Ratio topic.

e) **Common Equity Tier I Ratio (CET1)** – According the Resolution 4,193, 2013, a CET1 capital requirement became effective from October 2013 on, corresponding to 4.5% of RWA. In addition to this requirement, the Resolution established a capital buffer, composed by the following items: conservation, countercyclical and systemic. The conservation buffer requirement corresponds to the following RWA percentages: zero, until December 31, 2015; 0.625%, from January to December 2016; 1.25%, from January to December 2017; 1.875%, from January to December 2018; and 2.5% from January 2019 on. The countercyclical buffer requirement is limited to the following maximum RWA percentage: zero, until December 31, 2015; 0.625%, from January to December 2016; 1.25%, from January to December 2017; 1.875%, from January to December 2018; and 2.5% from January 2019 on. The systemic buffer requirement is limited to the maximum RWA percentage: zero until December 31, 2016; 0.5%, from January to December 2017; 1.0%, from January to December 2018; and 2.0% from January 2019 on.

f) **Leverage ratio (LR)** – Basel Committee on Banking Supervision international concept, consisting of Tier I Capital to Total Exposure ratio. In Brazil, the BCB Circular 3,748, of February 27, 2015, established the LR methodology. This index intends to complement the current prudential requirements, through a simple, transparent and non-sensitive risk metric. The leverage ratio minimum requirement of 3.0% was established by the Resolution CMN 4,615, of November 30th, 2017, which is effective from January 2018 on, applicable for institutions classified as S1 or S2, accordingly to the Resolution CMN 4,553, of January 1st, 2017.

g) **Household debt service-to-income ratio (DSTI)** – Defined as the ratio between monthly debt service and monthly income. A methodological review of the measure presented in the FSR issues of September 2014, March 2015 and October 2015, this measure uses data from BCB's Credit Information System (SCR) to calculate the ratio for each debtor in the SFN and, from individual data, calculates measures of central tendency for the SFN and other aggregation levels.

h) **Monthly debt service** – Credit outstanding due in 30 days, except for: a) real estate financing, whose 30-day due amount is estimated by a constant amortization system; b) overdraft, whose debt service is defined as its monthly interest; and c) other revolving facilities, whose 30-day due amount is estimated by a Price amortization system. It considers all household loan facilities, except for rural and business facilities, even when loaned by an individual. Even though it is calculated, 30-day due amount in credit card

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purchases are not considered in the DSTI base measure, being included only in alternate measures of the indicator.

i) **Monthly income** – As a customer's income may vary when informed by different financial institutions, the following procedure applies: i) in case of more than one income bracket, the mode is used to select a single income bracket for the customer – if there is a tie among income brackets, the one with the largest amount of credit outstanding is chosen; ii) among the FIs which informed the selected income bracket, the largest informed income is chosen, capped by the lower and upper bounds of the income bracket; and iii) an estimate of income tax and social security contribution is deducted from the selected income.

j) **Companies' size** – Defined by an intern algorithm, which considers three sources of information: i) size of micro and small enterprises set by Federal Revenue of Brazil; ii) size mode informed by financial institutions in the Credit Information System (in case of tie, it is considered information of the financial institution in which the company has the greatest volume of debt); (iii) corporate indebtedness amount (bank credit, capital market, internalized external debt) to enclose size's boundaries. The criteria (i) and (ii) take into consideration annual gross revenue standards of Complementary Laws 123/2006 and 11,638/2007. The criteria (iii) is residual and classifies companies' sizes not set by criteria (i) or (iii).

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Annex

Concepts and Methodologies – Capital Stress

1.1 Stress test – Introduction

The stress tests executed in BCB comprise a macroeconomic stress test as well as sensitivity analysis to relevant risk factors. These exercises are simulations executed by the BCB to estimate potential losses and capital shortfalls in the banking system stemming from extreme adverse, but plausible, scenarios. It also provides assessment of the resiliency of either an individual institution or the banking system. Hence, it is possible to determine the impact on the capital of institutions taking into consideration unexpected, and thus, not provisioned losses caused by changes in macroeconomic variables.

For each stressed scenario new capital ratios (Basel Ratio, Tier 1 and CET1) are calculated. A financial institution is considered as non-compliant whether any of its capital ratios is below the minimum required and classified as insolvent in the case of total depletion of the CET1. The relevance of non-compliant and/or technically insolvent institutions is assessed and the additional capital required in order that no other bank could get non-compliant is calculated. The relevance of and individual entity is determined based on the representativeness of its Adjusted Assets with respect to the assets of the whole banking system.

The positive effects of the activation of the triggers related to Tier 2 and Additional Tier 1 capitals, in which values are converted into CET1 capital, are classified as income. Furthermore, the requirement of additional capital buffers, according to the Resolution 4,193 with the redaction given by the Resolution 4,443 from Oct. 29th, 2015, is taken into account in the calculation of capital shortfalls. And finally, the framework also considers the potential changes of registration and uses of deferred taxes and its implications on regulatory capital calculations, according to the Resolution 4,192, from Mar 1st, 2013, and posterior modifications.

1.2 Macroeconomic stress test

The macroeconomic stress test framework is an exercise that consists of the application of adverse macroeconomic scenarios and the simulation of how the balance sheet of each financial institution individually would behave under such scenarios. With that information in hands, capital shortfall of the whole system is calculated.

1.2.1 Scenario design

Three macroeconomic scenarios are designed, all of them with time horizon of twelve quarters, based on market information, having the following macroeconomic variables: 1) economic activity (Economic Activity Index measured by the BCB – IBC-Br); 2) exchange rate (Brazilian Real vs US Dollar parity); 3) Brazilian Benchmark Interest Rate (measured by the Selic rate); 4) inflation rate (measured by the Extended National Consumer Price Index – IPCA – accumulated in twelve months) and 5) unemployment rate (calculated by the IBGE based upon the Continuous National Household Sample Survey – PNADC.

The baseline scenario is built using the median of the market expectations (Focus report) for the following variables: economic activity, interest rates, FX (foreign exchange) rates and inflation. The GDP – Focus expectation – and the IBC-Br (VAR variable) are perfectly correlated. The Brazil's country risk premium, unemployment rate and commodity index are kept constant over the forecast horizon.

The other scenarios are described in core text of the FSR.

1.2.2 Stress simulation

The stress simulation is done by projecting six basic groups of the income statement, trying to represent

the operational performance of banks presented in the last income statement (net non-operational income is not considered in the test):

1. Net interest income: comprises net credit income, accrued income from bonds and securities and funding costs;

2. Non-interest income: mark-to-market effects, hedges and exchange rates variations;

3. Fees & commissions;

4. Non-consolidated companies; 5. Administrative expenses and;

5. Provisions expenses.

In the "net interest income", credit and bonds/securities income as well as funding costs are modeled based on the Selic rate. The total funding is adjusted according to their credit portfolio volume, in the proportion of 1:1. Provision expenses are estimated based on the problem assets evolution, resulting from the macroeconomic scenario.

The non-interest group is modeled by applying a shock on market risk sensible positions observed in the starting date of the test. The stressed market risk factors are obtained out of the macroeconomic scenario and positions are then recalculated. The result is the difference between the stressed and the initial values. This amount is applied on the first quarter of projection and incorporated into the result.

The BCB changed the methodology used to capture the interest risk exposures. Hence, from the second semester of 2018 onwards this method will be different. Until recently the shocks were applied only on the trading book positions, all of them informed by banks, according to the Circular 3,354, from June 25th of 2007. However, this criterion is no longer in place and now the framework will encompass all the liquid positions, notably both government and corporate bonds as well as derivatives. The effect of this change is that the number of exposures subjected to these shocks have increased, which make the "non-interest" group more significant in the stress test.

The "Fees & Commissions", "Non-consolidated companies" and "Administrative Expenses" groups are modeled by making use of dynamic panel data models, obtained with the same macroeconomic variables employed in the scenarios.

Besides the performance simulation, verified through the income statement, the Banco Central do Brasil has incorporated the inter-financial contagion into the macroeconomic stress test framework from the first semester of 2019 onwards. In each quarter of the stress test time horizon, there is a verification whether any institution falls below the minimum threshold of 4% of the Core Tier 1 capital ratio. If this is the case, the inter-financial contagion is estimated. The uncollateralized interbank exposures issued by that institution are assumed as losses in the creditors´ balance sheet, and then capital is recalculated. If any financial firm also falls below that threshold, the process is repeated iteratively until there is no more institution below the threshold. The stress test continues with new affected capital levels and the process is repeated in all quarters of the projection, until the end of the time horizon.

1.3 Sensitivity analysis – Introduction

Sensitivity analysis complements the macroeconomic stress test framework. Its objective is to assess the individual effects of credit or market risk factors that might affect the regulatory capital of institutions, causing eventual capital shortfalls. Those analyses are conducted by applying incremental variations in such risk factors, keeping the other factors fixed.

1.3.1 Sensitivity analysis – Changes in market risk factors

The exposures subjected to interest rate changes (e.g. fixed rates, currency coupons, price indexes and

interest rates) listed in the trading book are stressed. The positions at all vertices (from 21 to 2,520 days) are recalculated after the application of shocks as well as the financial impact on banks' capital positions. Stressed exposures also affect risk weighted assets (RWA) components. In the case of fixed rates, new regulatory parameters of capital requirements are recalculated based on every new yield curve generated by a shock.

Exposures in foreign currency, gold and other instruments subject to changes in the exchange rates are also stressed, and their impacts on capital and RWA estimated. Here we assume that all exposures are revalued following the percentage points projected for the stressed USD/exchange rate.

We apply shocks individually in each factor, the interest rate and the exchange rate, starting at their current values, in steps of 10% in both directions, until it reaches 200% and 10% of its current value, on the upside and on the downside, respectively. After recalculating capital ratios, we evaluate both the regulatory capital adequacy ratios and the solvency of banks.

The calculation of interest rate shocks follows the same methodology as for the "non-interest" items of the macroeconomic stress test. For the other risk factors all the balance sheet positions are considered.

1.3.2 Sensitivity analysis – Increases in problem assets

This analysis tries to measure the effect of problem assets increases over the regulatory capital of institutions. We increase problem assets up to 150% of its current level and compute the additional provision required. These additional provisions affect both banks' capital positions and the RWA component of the required capital. After recalculating capital ratios, regulatory capital adequacy and the solvency of banks are evaluated.

1.3.3 Sensitivity analysis – Fall in housing prices

The objective of this exercise is to estimate the impacts of fall in housing prices over the capital of financial institutions with outstanding mortgages. Prior to the simulations we proxy housing prices with the value of the updated collateral provided for the loan using the IVG-R index, adding the variations measured by the index since the date that the loan was generated until the date f simulation.

The analysis consists of reducing house prices, simulating a sequence of decreases in steps of 5 pp. In each step collaterals that become lower than 90% of the remaining loan are considered delinquent.

The loss of each delinquent loan is equal to the difference between the outstanding balance and the present value of the amount recovered from the foreclosure process. To calculate the recovered amount, we calculate new housing prices after shocks, net of taxes, maintenance fees and costs related to the foreclosure process. In addition, we consider that the sale in the foreclosure process is done with a discount proportional to the reduction of price due to the shock. The present value is obtained by discounting that sale amount by the 1-year future rate negotiated in the BM&FBovespa. New regulatory capital ratios of each institution are calculated considering the estimated losses to the related decline in housing price.

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